codling wind park

EIAR Addendum

Appendix 16-A IRCG Safety Justification

Codling Wind Park Search and Rescue Safety Justification

Prepared by	Anatec Limited
Presented to	Codling Wind Park Ltd
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Revision Number	Date	Summary of Change
00	18th November 2025	Initial Draft
01	25th November 2025	Initial Review
02	27th November 2025	For Submission

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Abbreviations Table

Abbreviation	Definition
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ALB	All-Weather Lifeboat
BBC	British Broadcasting Corporation
COLREGs	Convention on International Regulations for Preventing Collisions at Sea
CRBI	Community Rescue Boats Ireland
CTV	Crew Transfer Vessel
CWP	Codling Wind Park
CWPL	Codling Wind Park Limited
DMR	Digital Mobile Radio
DoT	Department of Transport
DVE	Degraded Visual Environment
EASA	European Aviation Safety Agency
EEZ	Exclusive Economic Zone
EO	Electro-optical
ERCoP	Emergency Response Cooperation Plan
ERP	Emergency Response Plan
FSA	Formal Safety Assessment
ft	Feet
HMCG	His Majesty's Coastguard
HTAWS	Helicopter Terrain Awareness and Warning System
ID	Identification
IFR	Instrument Flight Rules
ILB	Inshore Lifeboat
IMO	International Maritime Organization
IRCG	Irish Coast Guard
LoD	Limit of Deviation
m	Metre

Abbreviation	Definition
MCA	Maritime and Coastguard Agency
MCC	Marine Coordination Centre
MRC	Marine Rescue Centre
nm	Nautical mile
NMOC	National Maritime Operations Centre
NRA	Navigational Risk Assessment
NVG	Night Vision Goggles
OMB	Operations and Maintenance Base
OREI	Offshore Renewable Energy Installation
OSS	Offshore Substation
OWF	Offshore Wind Farm
PLB	Personal Locator Beacon
PoD	Probability of Detection
RNLI	Royal National Lifeboat Institution
SAR	Search and Rescue
SLoO	Single Line of Orientation
SOLAS	International Convention for the Safety of Life at Sea
SOV	Service Operation Vessel
TC	Technical Crew
UHF	Ultra High Frequency
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
VFR	Visual Flight Rules
VHF	Very High Frequency
VTS	Vessel Traffic Service
WTG	Wind Turbine Generator

1 Introduction

Codling Wind Park Limited (CWPL) (hereafter 'the Applicant') is the developer of the Codling Wind Park (CWP) Project, a planned Offshore Wind Farm (OWF) located in Irish waters off the coast of County Wicklow. The planning permission application seeks consent for two different Wind Turbine Generator (WTG) rotor diameters ('WTG Layout Option A' and 'WTG Layout Option B').

The Department of Transport (DoT) Guidance on Safety of Navigation & Emergency Response: Offshore Renewable Energy Installations (OREI) (DoT, 2025a) states that *"In compliance with safety of navigation and search and rescue requirements developers of every offshore renewable energy project with floating and/or surface piercing devices should undertake a thorough appraisal of the safety benefits afforded by two consistent lines of orientation and based on this, either implement such layouts or, where appropriate, consider alternatives".*

The Applicant undertook detailed consideration of multiple constraints as part of the layout design, including consideration of lines of orientation. The proposed layouts following this process form grids with multiple lines of orientation if only the WTGs are accounted for. However, the Offshore Substation (OSS) positions for each layout result in only a Single Line of Orientation (SLoO) being available as they are offset from the WTGs.

Therefore, in line with the DoT Guidance (DoT, 2025a) a Safety Justification is required to support the planning application given the guidance states "*The DoT will not consider any layout proposals with just one line of orientation, without supporting documentation which fully justifies the proposed layout to the satisfaction of the DoT".*

In order to align with above guidance, and following consultation with the Irish Coast Guard (IRCG), the Applicant has committed to set certain limitations on its Limits of Deviation (LoDs) to ensure that a SLoO will always be maintained i.e., LoD will be applied in such a way so as to maintain a minimum of a full SLoO with lanes of at least 500 metres (m).

This Search and Rescue (SAR) Safety Justification has therefore been prepared by the Applicant for the IRCG to demonstrate that hazards associated with emergency response for a SLoO layout in the case of the CWP Project are As Low As Reasonably Practicable (ALARP). The SAR Safety Justification builds on work conducted as part of the Navigational Risk Assessment (NRA) and the mitigations identified as part of that process.

This SAR Safety Justification will consider risk relating to the IRCG remit of emergency response and not general navigation safety.

The SAR Safety Justification structure and key aims and objectives are as follows:

- Explanation as to why a SLoO is required (Section 1.1).
- Description of the SAR Safety Justification process (Section 1.2).
- Profiles of key authors (Section 1.3).
- Overview of the relevant guidance and risk assessment methodology (Section 2).

- Project description (Section 3).
- Identification of likely users of the array site i.e., potential casualties that may require emergency response (Section 4).
- Risk assessment (Section 5):
  - Identification of potential scenarios resulting in a need for emergency response.
  - Mitigations.
  - Formal Safety Assessment (FSA).
- Conclusion and ALARP statement (Section 6).

The following supporting appendices are also included:

- Appendix A: SAR Lane coverage and Operations.
- Appendix B: Precedent examples of OWF vessels assisting in emergency response incidents.

1.1 Overview of Need for a Single Line of Orientation

The proposed layouts have been developed through consideration of various constraints, including ecological habitats, water depths, unsuitable ground conditions and archaeological exclusion zones. The siting of the OSS in particular (and the cause of the SLoO) has been based upon consideration of:

- Physical considerations:
  - Similar water depths – common design.
  - Seabed features – sand waves, gradients and surface boulders avoided.
  - Subsurface hazards – faulting and weak ground.
- Technical considerations:
  - Electrical performance – proximity to WTG's, export cable lengths and system losses.
  - Shallow water depths.
  - Monopile foundation suitability.
- Environmental considerations:
  - Minimising impact to ecological receptors.
  - Minimising impact to fishing activities.
- Archaeological exclusion zones, and features anticipated to be Protected Wrecks.

1.2 Layout Process – Now and Post Consent

The Applicant has sought in its planning application the ability to move each WTG/OSS position by up to 100 m through use of a LoD i.e., a radius within which the Applicant can move a structure from its intended position. A LoD is necessary due to the possibility of additional site investigation work pre-construction or issues encountered during construction identifying additional site constraints.

For this reason, the SAR Safety Justification is considered a live document that may require updates should layout positions change. Further details of LoD are provided in Section 3.1.2.

1.3 Profiles of Authors

1.3.1 Adam Foster

Adam is Head of Renewables and a Principal Risk Analyst at Anatec Ltd and has over a decade of experience in offshore marine risk. His speciality is in OWFs, and he has led on numerous layout approval processes including SLoO layouts. This includes working with developers to achieve safe layouts and liaising with relevant regulators to agree suitable mitigation such that associated hazards are ALARP.

1.3.2 Sam Westwood

Sam is a Director of Anatec and has over 28 years' experience within the marine industry including in the Merchant Navy, as a Vessel Traffic Service (VTS) operator and at the Maritime and Coastguard Agency (MCA) before moving into offshore renewables consulting 15 years ago. Sam specialises in offshore renewables including navigation risk assessments and post consent supporting including layout design.

1.3.3 Mark Prior

Mark is a highly experienced aviation professional with a wide range of expertise in certification, safety analysis, investigation, operations, technical issues and regulations. He has over 40 years' experience as a pilot, initially in the Royal Air Force then a civil pilot with SAR trials and certification experience. He was a licensed civil pilot with concurrently 20+ years of experience as a military and then civil experimental test pilot. Since 2003 he has been an industry representative on a number of rule-making, operational and research groups. He has been an independent consultant since 2016.

2 Guidance and Methodology

2.1 Guidance

The principal guidance documents that have been considered and applied in the drafting of the SAR Safety Justification are as follows:

- DoT Guidance on Safety of Navigation & Emergency Response: Offshore Renewable Energy Installations (OREI) (DoT, 2025a);
- Standard Operating Procedure 07-2025 Offshore Renewable Energy Installations (OREI): Guidance and Operational Considerations for SAR and Emergency Response (DoT, 2025b); and
- Revised Guidelines for Formal Safety Assessment (FSA) for Use in the International Maritime Organization (IMO) Rule-Making Process. MSC-MEPCC.2/Circ.12/Rev.2 (IMO, 2018)

The guidance on Safety of Navigation & Emergency Response (DoT, 2025a) references the IMO FSA (IMO, 2018) which is a marine standard for risk assessment. The FSA has therefore been applied within this SAR Safety Justification.

2.2 Risk Assessment Methodology

The FSA process considers five main steps:

1. **Identification of hazard** scenarios building on the work of the NRA and in relation to the proposed SLoO layouts.
2. **Risk analysis** including consideration of embedded mitigations. This will be identified as consequence versus frequency. Severity and frequency rankings are defined in Table 2-1 and Table 2-2 respectively. This will separately consider risks in relation to the proposed SLoO.
3. **Identification of further mitigations** required to reduce the risk to ALARP – if required.
4. **Cost benefit analysis** – if required.
5. **Statement of risk** and determination of ALARP status. Overall significance of each hazard is determined using a tolerability matrix as defined in Table 2-3. As per the FSA, the risk of a hazard is defined as Broadly Acceptable (low risk), Tolerable with Mitigation (intermediate risk) or Unacceptable (high risk). Unacceptable risks are not considered to be ALARP and will need additional mitigation.

Table 2-1 Severity of Consequence Ranking Definitions

Rank	Definition			
	Description	**People**	**Property**	**Environment**
1	Negligible	No adverse health effects	No perceptible impact	No perceptible impact
2	Minor	Minor injury / First-aid injury	Minor damage to property, for instance, superficial damage	Tier 1 local assistance required
3	Moderate	Medical treatment injury	Damage not critical to operations	Tier 2 limited external assistance required
4	Serious	Lost time injury	Damage resulting in critical impact on operations	Tier 2 regional assistance required
5	Major	Permanent injury, disability, fatality	Total loss of property	Tier 3 national assistance required

Table 2-2 Frequency of Occurrence Ranking Definitions

Rank	Description	Definition
1	Negligible	Highly unlikely to occur in the lifetime of the CWP Project
2	Extremely unlikely	Could happen in the lifetime of the CWP Project
3	Remote	May occur once within each phase
4	Reasonably probable	Likely to happen on annual basis
5	Frequent	Likely to happen more than once a year

Table 2-3 Tolerability Matrix and Risk Rankings

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

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

2.3 Existing Assessment Summary

The assessment within this Safety Justification is considered standalone, and considers the specific issues of relevance to emergency response. However, it is noted that an NRA has been undertaken for the CWP Project (Anatec, 2024) which found that all relevant hazards to shipping and navigation users within the NRA remit were ALARP assuming the identified mitigation was applied, both for the CWP Project in isolation, and cumulatively with other possible developments. This includes the nearby proposed Dublin Array and Arklow Bank Wind Park 2 developments.

The hazards determined to be ALARP through the NRA process include:

- Vessel displacement leading to increased encounters and collision risk;
- Increased collision risk between third-party vessels and project vessels;
- Increased allision risk; and
- Reduction in emergency response capability.

3 Project Description

3.1 Layout Options

The array site is located within the Irish Sea approximately 7 nautical miles (nm) from the coast of County Wicklow, on the east coast of Ireland. The northern extent of the array site is located on the Codling Bank, with the southern extent of the array site located east of the India Bank.

Figure 3.1 and Figure 3.2 present WTG Layout Option A (75 WTGs) and WTG Layout Option B (60 WTGs) respectively. Both WTG Layout Options include three OSSs which are also shown.

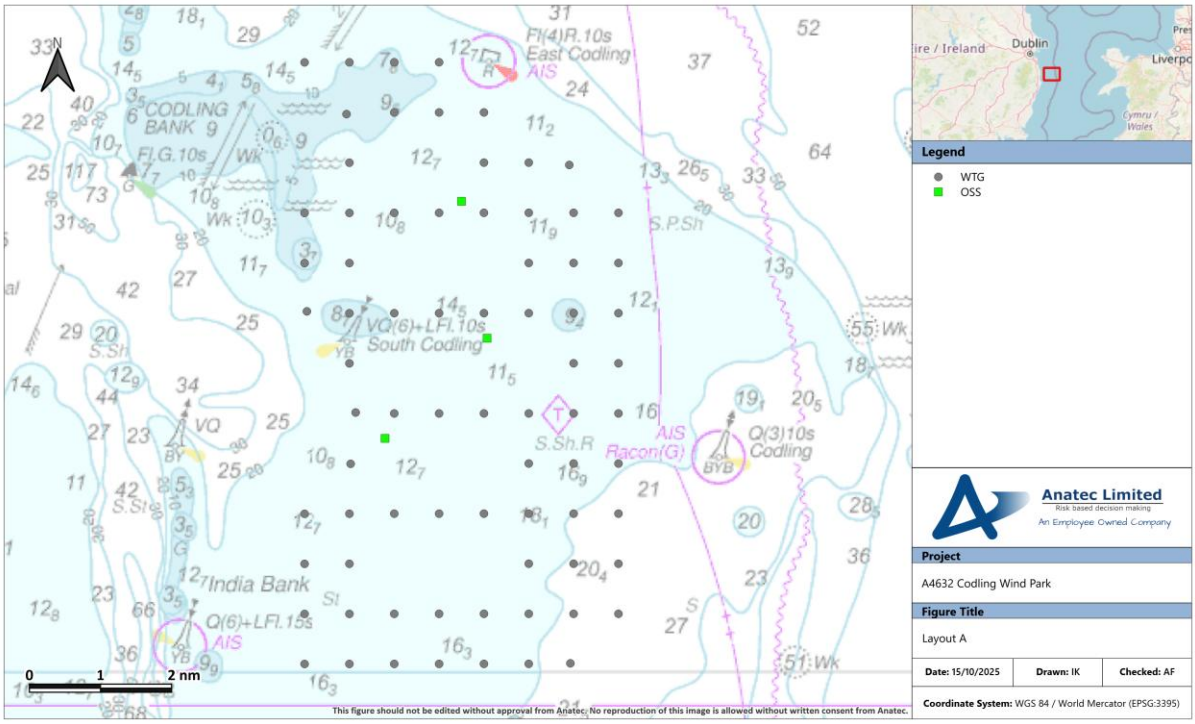

Figure 3.1 WTG Layout Option A (75 WTGs)

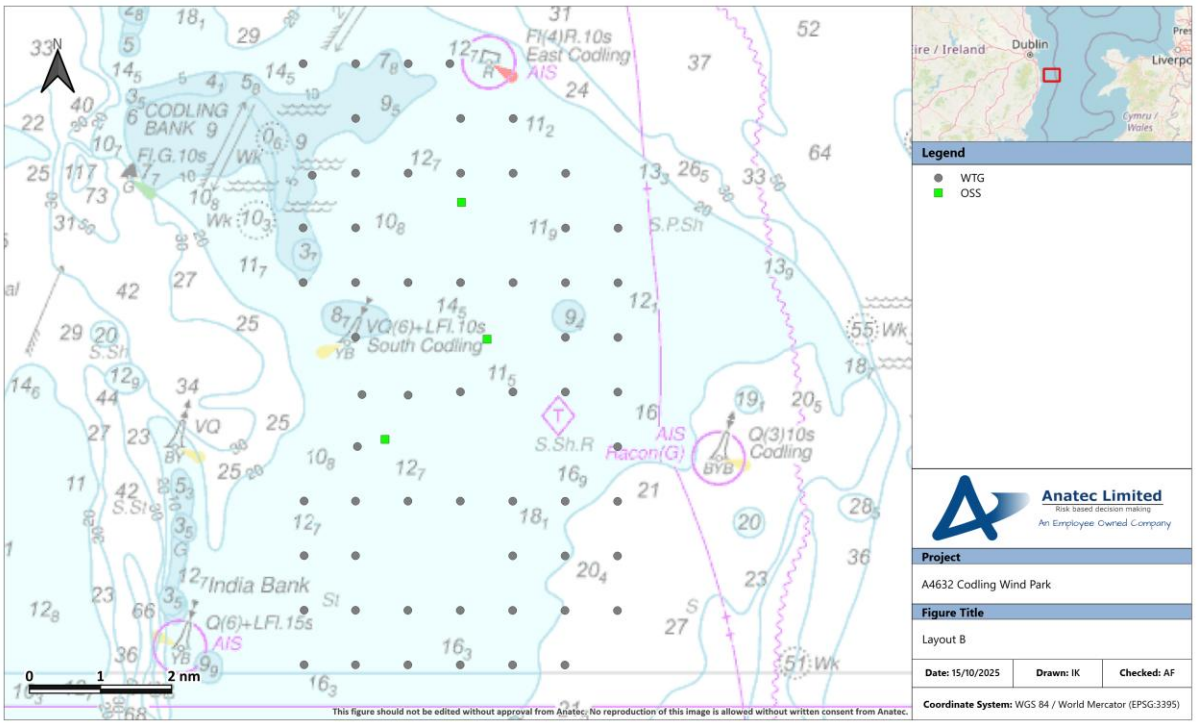

Figure 3.2 WTG Layout Option B (60 WTGs)

3.1.1 SAR Lanes for the CWP Project

As per Section 1.1, each WTG Layout Option has multiple lines of orientation through the WTGs and a minimum of a SLoO if the OSS are accounted for. The associated SAR lanes are presented for the two WTG Layout Options in Section A.1. As per the methodology described in the SOP 07 2025 OREI Guidance and Operational Considerations for SAR and Emergency Response (DoT, 2025b), all are at least 500 m in width tip-to-tip (between WTGs) or tip-to-topside (between WTGs and OSSs).

In addition, as required[1] under the Guidance on Safety of Navigation & Emergency Response: Offshore Renewable Energy Installations (OREI) (DoT, 2025a), available secondary lines of orientation have also been identified. These are presented for each WTG Layout Option in Section A.2. It is noted that these secondary lanes are only deemed "secondary" as the OSS result in a minority of lanes of being less than 500 m. Good coverage is still available overall.

See Appendix A for further details and illustration of these SAR lanes, as well as (in Section A.3) a summary of how helicopter operations could be undertaken relative to the array site considering the SAR lanes available.

[1] "*Where a project proposes just one line of orientation, this discussion should include any potential secondary lines*".

3.1.2 Limits of Deviation

Although one of the two layouts presented will be used as a final layout, the individual structures within each layout could be sited in a position up to 100 m from that presented (termed the LoD). A 100 m LoD is sought to accommodate for the results of further pre-construction surveys on ground conditions and unexploded ordnance (UXO) and will mitigate the consequences of unforeseen circumstances during active construction. The approach in gaining limited design flexibility is supported by the relevant planning authorities and subject to a request for flexibility under Section 287 of the Planning and Development Act 2000.

Following consultation with IRCG, the Applicant has committed to set certain limitations on its LoD to ensure that a SLoO will always be maintained i.e., LoD will be applied in such a way so as to maintain a minimum of a full SLoO with lanes of at least 500 m.

The details of the as-built structures will be promulgated to all relevant bodies including the IRCG and the United Kingdom Hydrographic Office (UKHO) to allow marking on appropriately scaled Admiralty charts.

3.2 Project Vessels

During each phase of the CWP Project, various project vessels will transit to and from the CWP Project and undertake numerous activities within the array site.

During the construction phase, the following vessel types are expected to be on-site during certain periods:

- Seabed preparation vessels;
- WTG and OSS installation vessels;
- Scour protection installation vessels;
- Cable installation vessels;
- Commissioning vessels; and
- Support vessels.

During the operation and maintenance phase, the following vessel types are expected to be on-site where required:

- Jackup vessels;
- SOVs (Service Operation Vessels);
- Operation support vessels;
- Cable maintenance vessel;
- Auxiliary vessel[2].

[2] Includes survey vessels, remotely operated vessels, autonomous underwater vehicles, tug operations, cargo vessels, passenger vessels, and scour replacement vessels.

All project vessels will broadcast positions via Automatic Identification System (AIS) data, and project personnel will wear Personal Locator Beacons (PLBs) at all times.

Project vessel(s) may be able to respond or react to maritime emergencies (e.g. pollution or a drifting vessel) which present an actual or possible threat to the safety of life or property. Project vessels will be well-equipped and crewed by well-trained professional mariners, and therefore are likely to be well-placed to assist in SAR operations if requested by IRCG. Appendix B provides a list of instances of wind farm vessels responding to emergency incidents.

3.3 Construction Phase

During the construction phase, the Applicant will establish a Marine Coordination Centre (MCC) which will be used during the construction phase. This will represent a central control base with overarching responsibility for managing and monitoring all project vessels and all project personnel.

Marine coordination will be in place 24/7 during the construction phase. The key responsibilities will include tracking all vessel movements within the array site (both project vessel and third-party), in addition to tracking project personnel locations. The MCC will also be the central internal contact point for contractors or other relevant parties in case of an emergency, noting IRCG would always also be contacted where appropriate.

3.4 Operation and Maintenance

The Applicant's preference for the Operations and Maintenance Base (OMB) is Wicklow, 7 nm west of the array site. An actual location has yet to be confirmed or consented.

3.5 CWP Project Location Relative to Existing SAR Resources

Figure 3.3 shows the locations of the IRCG SAR helicopter bases and Marine Rescue Centres (MRCs) in Ireland relative to the array site.

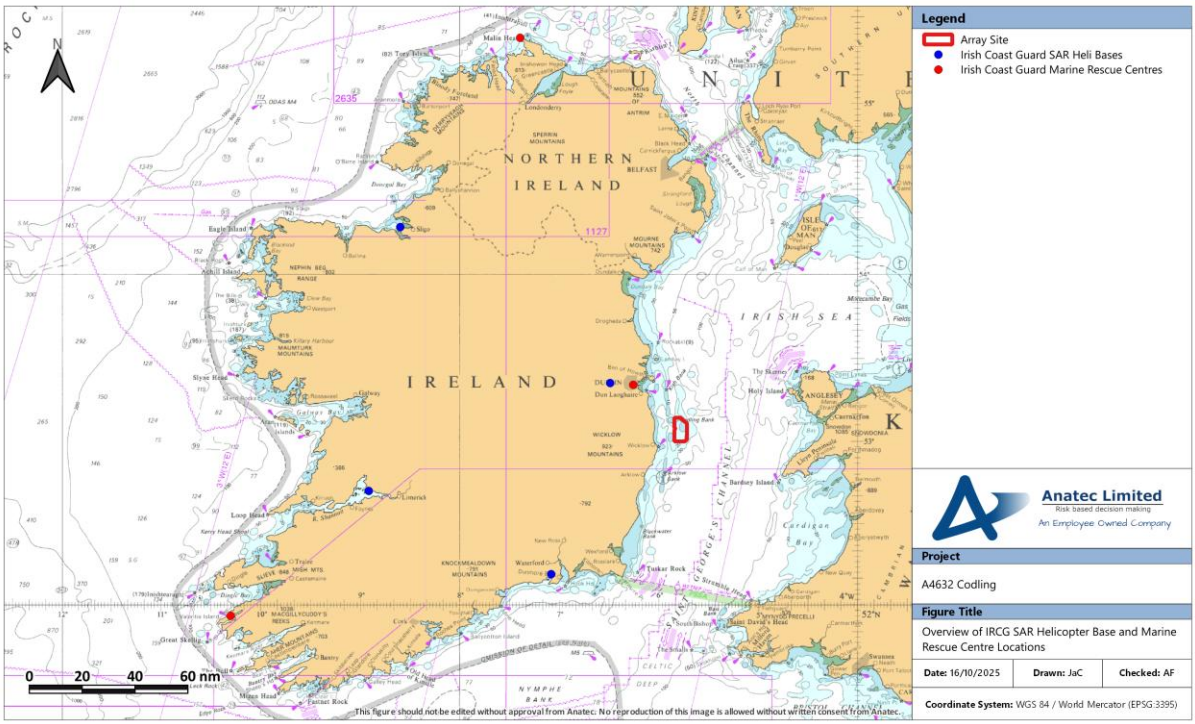

Figure 3.3 IRCG SAR Helicopter Base and Marine Rescue Centre Locations

The IRCG has four SAR helicopter bases around the country located at Weston, Waterford, Sligo, and Shannon. The closest of these to the array site is at Weston, approximately 26 nm northwest. The operator of services at these bases is transitioning from CHC to Bristow, with the transition expected to be complete in 2026 (The Clare Herald, 2025). This involves upgrading to AW189 helicopters from the Sikorsky S-92s.

The IRCG operates three MRCs around Irish waters, based in Dublin, Malin Head, and Valentia Island. The closest of these centres to the array site is Dublin, located approximately 19 nm northwest. Dublin MRC is a National Maritime Operations Centre (NMOC) which provides marine SAR response services and co-ordinates the response to marine casualty incidents within the Irish Exclusive Economic Zone (EEZ).

The IRCG manages 44 Coast Guard Units throughout Ireland. These are volunteer cells which provide a localised focus for coastal search operations, with some units also capable of providing cliff rescues, boat rescues, and unmanned aerial vehicles searches. The closest to the array site are at Wicklow and Greystones, which are situated approximately 7 nm and 8 nm from the array site respectively.

Figure 3.4 presents the locations of Royal National Lifeboat Institution (RNLI) stations in proximity to the array site. Following this, Table 3-1 summarises the types of lifeboat operated by the RNLI out of these stations and the minimum distance from each station to the array site. Although a helicopter may be used for SAR operations within the array site, it is noted that surface assets are located nearby (notably at Wicklow) and Annex I to DoT Guidance on Safety of Navigation & Emergency Response: OREI (DoT, 2025a) states that "*Surface vessels,*

in most circumstances, will be the most appropriate means of rescue from within wind farms or close to other OREI".

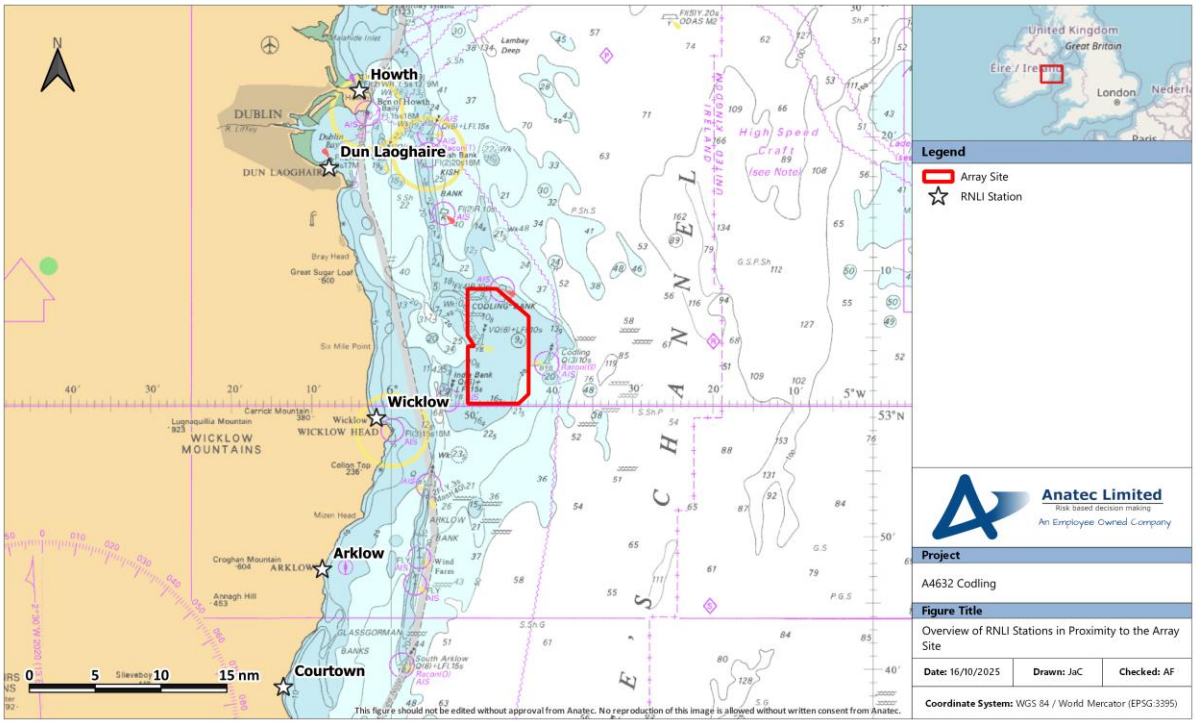

Figure 3.4 Overview of RNLI Stations in Proximity to the Array Site

Table 3-1 Types of Lifeboat Held at RNLI Stations in Proximity to the Array Site

Station	Lifeboat(s)	All-Weather Lifeboat (ALB) Class	Inshore Lifeboat (ILB) Class	Minimum Distance to Array Site (nm)
Wicklow	ALB and ILB	Shannon	D Class	7
Dun Laoghaire	ALB and ILB	Trent	D Class	14
Arklow	ALB	Trent	–	17
Howth	ALB and ILB	Trent	D Class	17
Courtown	ILB	–	D Class	26

Also available to IRCG are Community Rescue Boats Ireland (CRBI), a group of independent volunteer rescue craft able to respond to emergencies in their vicinity. At present CRBI boats are based at:

- Banna, County Kerry
- Bantry, Country Cork
- Ballinskelligs, Country Kerry
- Ballybunnion, Country Kerry

- Boyne Fishermans Rescue & Recovery
- Bunmahon, Country Waterford
- Cahore, Country Wexford
- Corrib/Mask Lakes, Country Galway
- Derrynane, Country Kerry
- Limerick City (River Shannon)
- Mallow River Rescue, Country Cork
- Tramore, Country Waterford
- Waterford City River Rescue
- Waterford Marine Search & Rescue

Based on location it is considered that an RNLI asset would be more likely to respond to an incident in the array site than a CRBI asset.

4 Users of the Array Site

This section assesses 12 months of AIS data (2021) and ten years of RNLI incident data (2015-2024) to identify likely users of the array site i.e., parties which may require an emergency response. These datasets have been assessed within a 10 nm buffer of the array site (the 'study area'), and have been validated through reference to recent datasets which demonstrate this to be appropriate and representative for this purpose (noting the original timing of the AIS data which coincided with the period of the COVID19 pandemic).

4.1 Third-Party Vessels

Figure 4.1 presents 12 months of AIS data[3] recorded during 2021 within the array site.

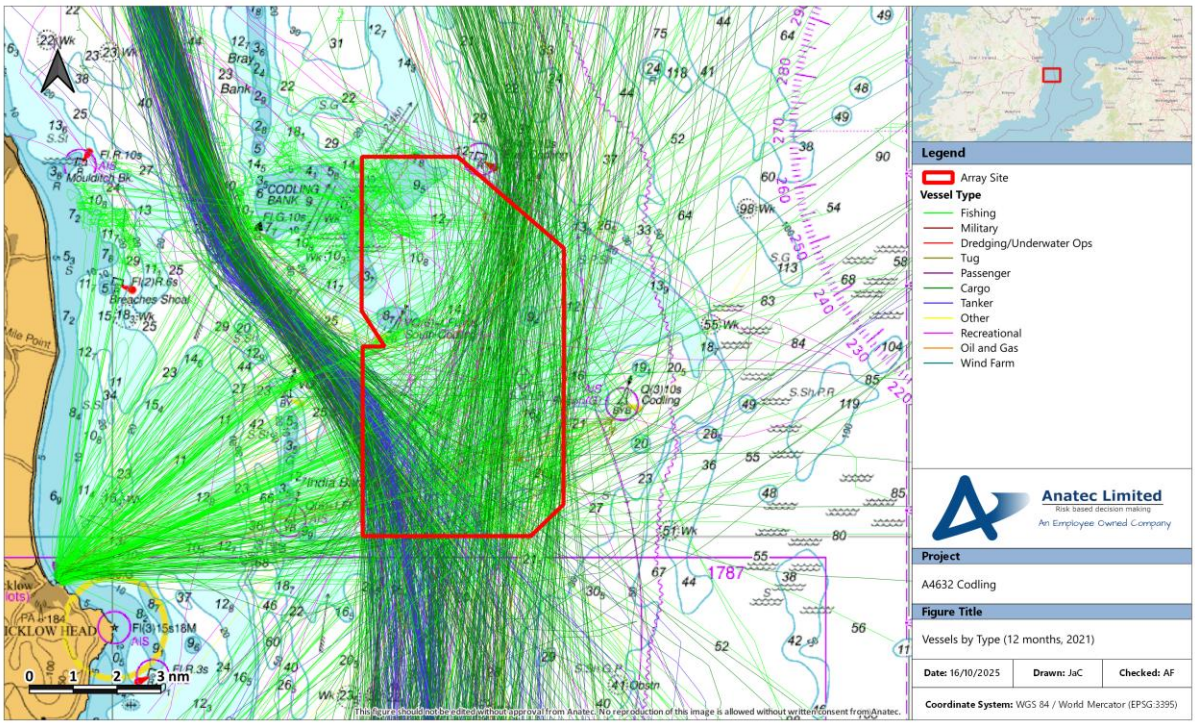

Figure 4.1 Vessels Intersecting Array Site by Type (12 Months, 2021)

The most common vessel types seen intersecting the array site were cargo vessels (one per day), fishing vessels (one per day), tankers (one every two days) and recreational (one every ten days).

As per the NRA (Anatec, 2024), commercial vessels are expected to deviate to avoid the array site once construction begins and will continue to avoid the array site during the lifetime of the CWP Project. The commercial vessels that intersect the southwestern portion of the array site are expected to deviate inshore of the India Bank, which will act as a natural buffer due to its shallow waters, while those commercial vessels that intersect the array site further east

[3] AIS data may under-represent certain vessel types, notably fishing vessels less than 15 m and recreational vessels.

are anticipated to deviate to offshore of the Codling buoy (an east cardinal). Therefore, commercial vessels are considered unlikely to require emergency response within the array site.

Fishing vessels and recreational vessels are considered more likely than other vessel types to transit through the array site during and/or post construction, and therefore these vessel types are considered the most likely to require emergency response within the array site. A dedicated overview of fishing and recreational vessels which intersected the array site is presented in Figure 4.2.

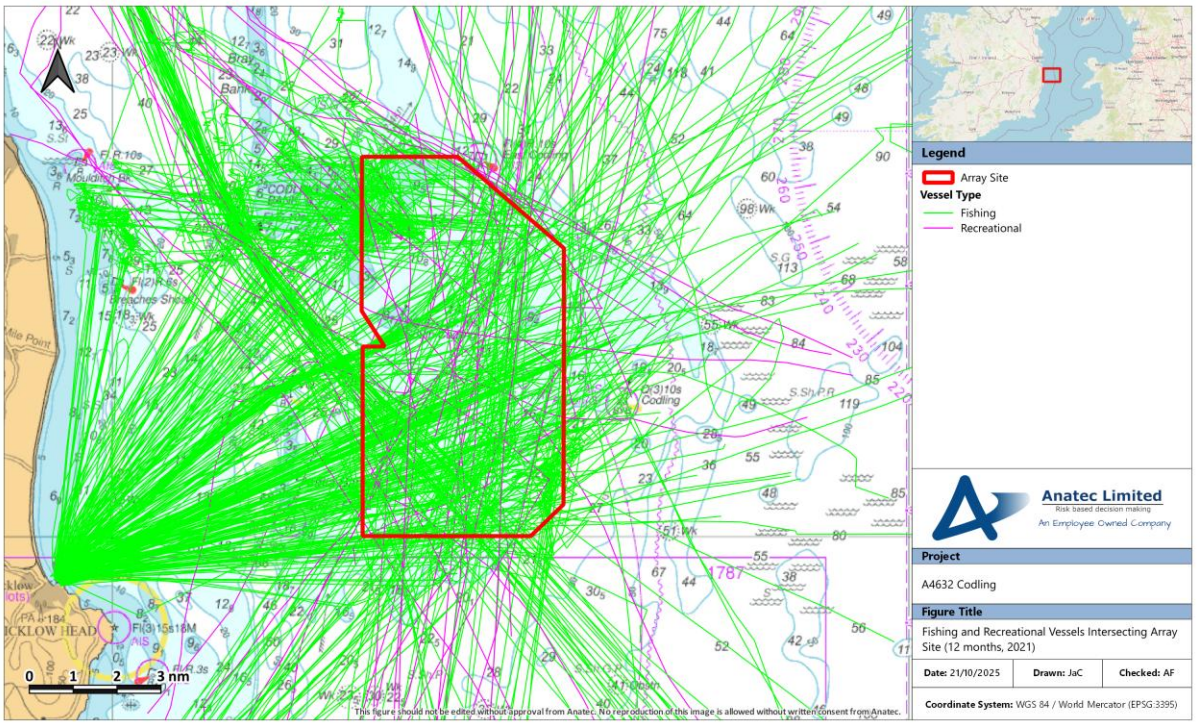

Figure 4.2 Fishing and Recreational Vessels Intersecting Array Site (12 Months, 2021)

Figure 4.3 presents the lifeboat responses to maritime incidents involving vessels that occurred in the vicinity of the array site during the 10-year period between 2015 and 2024 as documented by the RNLI, colour-coded by casualty type.

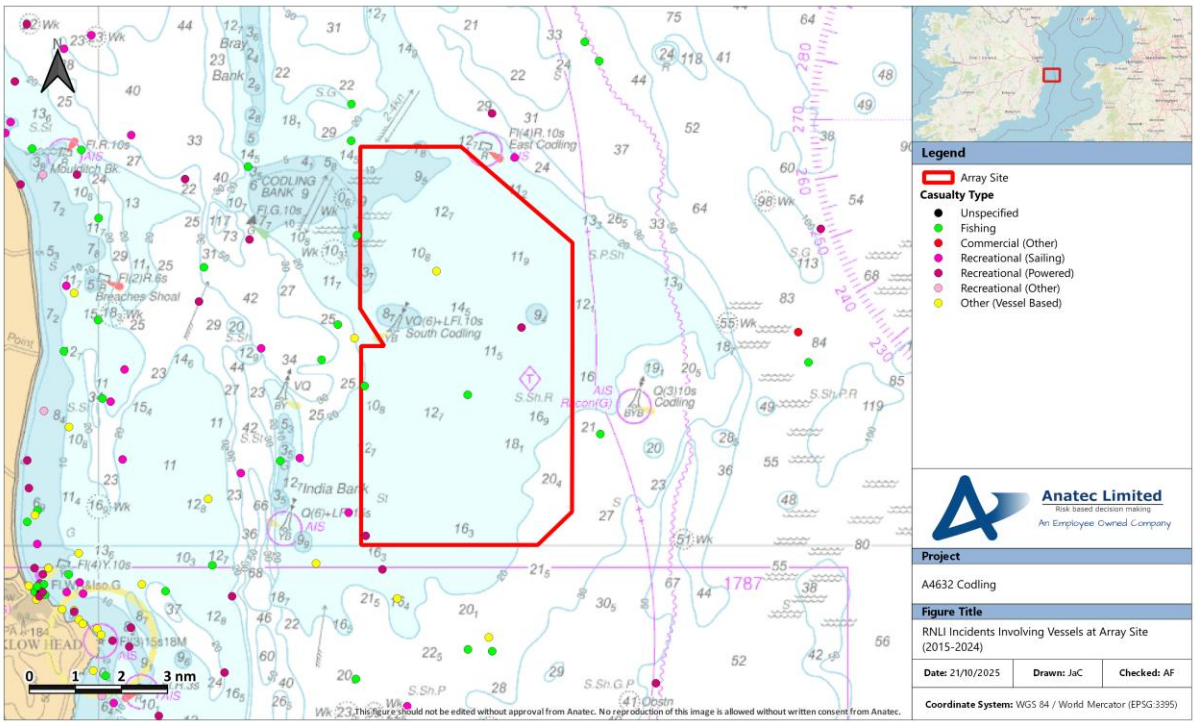

Figure 4.3 RNLI Incidents Involving Vessels within Proximity of Array Site (2015-2024)

There was a total of five RNLI lifeboat responses documented as occurring within the array site, corresponding to a frequency of one every two years. Two of the incidents involved fishing vessels and two involved recreational vessels. One involved a vessel classed as "motorboat", however desktop research indicates this may have actually been a lifeboat response to a fishing vessel closer to shore based on the provided date of the response[4]. Each casualty vessel had experienced machinery failure and was responded to by Wicklow station.

The overall findings from the AIS and incident data is that fishing vessels and recreational vessels are the most likely third-party vessels to require assistance within the array site, given that they will be the most common third-party user of the array site during/post construction and they have also historically been the most common vessel types to require emergency response within the array site (noting such instances were still infrequent).

4.2 Project Vessels

As per Section 3.2, there will be various project vessels on-site during all phases of the CWP Project. These vessels will need to be within the array site to undertake the necessary works and therefore may require an emergency response within the array site in the event of an incident.

[4] Wicklow RNLI bring three fishermen to safety | RNLI

4.3 Water Sports

In addition to vessels in transit, any users engaged in water sports within the array site could require SAR assistance. Figure 4.4 presents the locations of lifeboat responses to incidents documented by the RNLI as involving activities classed as water sports (e.g., jet skiing, kayak/canoeing, kitesurfing, paddleboarding, use of an inflatable, surfboarding) within proximity of the array site during a ten-year period from 2015 to 2024.

Incidents that were documented by the RNLI as "person on craft" have been assumed to involve a water sports related craft.

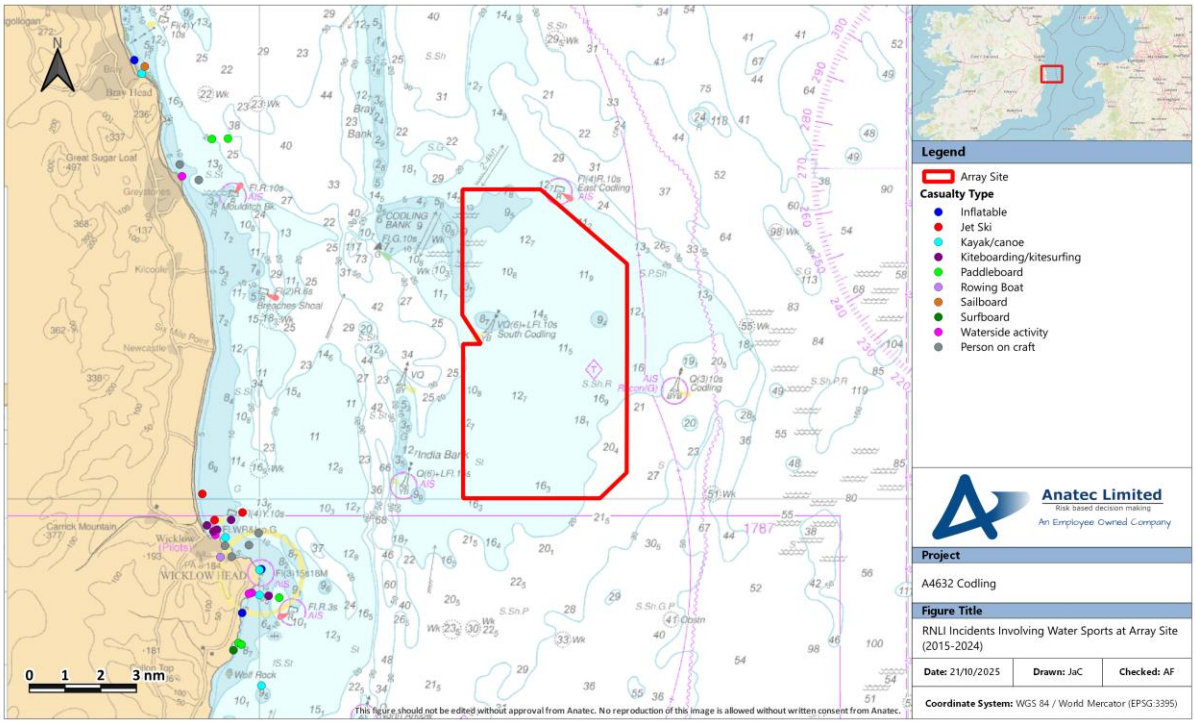

Figure 4.4 RNLI Incidents Involving Water Sports within Proximity of Array Site (2015-2024)

There were no incidents involving water sports within the array site over the 10-year period, with such incidents remaining close to the coast (within 2 nm).

The presence of the CWP Project (in particular the associated surface piercing infrastructure or associated construction works) may represent an interest or attraction to third party individuals participating in water sports, however given the distance offshore it is still considered unlikely that this will lead to notable increases of individual presence on site over baseline rates.

Given that the array site is at a minimum of 7 nm from the coast, it is considered unlikely that water sports activities would be seen within the array site and therefore unlikely that people undertaking water sports would require an emergency response within the array site.

It is also noted that any water sports are likely to be undertaken when conditions, including visibility conditions, are good. This aligns with the RNLI data which detailed that the majority (78%) of the water sports incidents in the study area occurred in either "excellent" (19%) or "good" (59%) visibility (with "fair" accounting for 14% and "unknown" accounting for 8%).

4.4 Individuals

The RNLI data in proximity to the array site during the ten-year period from 2015 to 2024 was reviewed for any incidents where the stated casualty was an individual. Figure 4.5 presents the locations of these incidents. Any lifeboat responses to animals are excluded[5].

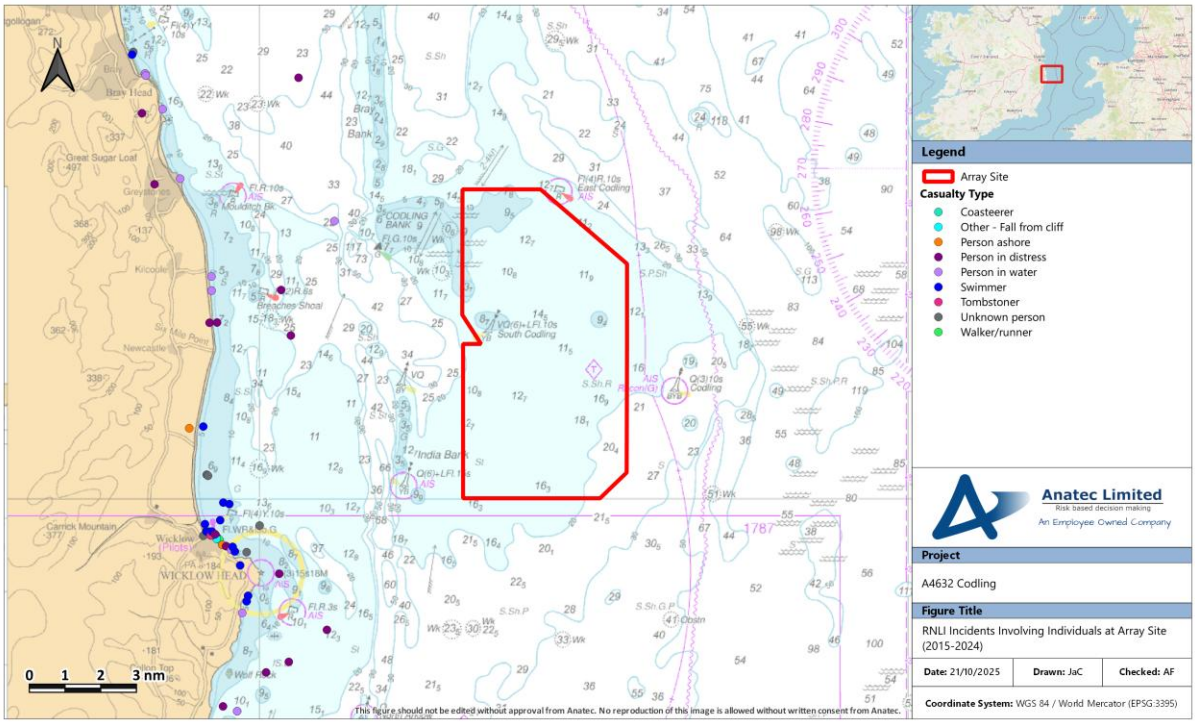

Figure 4.5 RNLI Incidents Involving Individuals in Proximity to Array Site (2015-2024)

The incidents shown in Figure 4.5 that were the furthest offshore were documented as "Person in distress" or "Person in water". All other incident types were very close to the coast (within 1 nm).

The presence of the CWP Project (in particular the associated surface piercing infrastructure or associated construction works) may represent an interest or attraction to third party individuals, however given the distance offshore it is still considered unlikely that this will lead to notable increases of individual presence on site over baseline rates.

[5] The scenario of an animal (on its own) requiring emergency response within the array site is considered very unlikely due to the distance offshore (the furthest offshore was approximately 560 m from the coast).

Based on the distance offshore of the array site, and the review of historical incident data, it is considered highly unlikely that an emergency response to an individual (without any vessel being involved) within the array site would be required.

5 Risk Assessment

This section provides a risk assessment as per the FSA approach outlined in Section 2.2.

5.1 Hazard Identification

Based on the findings of Section 4, the following hazards have been identified as potentially occurring in or near the array site and therefore requiring an emergency response that may be impacted by a SLoO layout:

- **Person in the water**
  - Project personnel or crew member;
  - from third-party vessel; or
  - third-party water sports, swimmer or diver.
- **Vessel capsize in array site**
  - Project vessel; or
  - third-party vessel.
- **Oil spill**
  - Project vessel; or
  - third-party vessel.
- **Vessel grounding**
  - Project vessel; or
  - third-party vessel.
- **Injured person requiring extraction from array site**
  - Project personnel.
- **Drifting vessel**
  - Project vessel; or
  - third-party vessel.
- **Fire**
  - WTG or OSS; or
  - On vessel.
- **Salvage operation**

5.2 Embedded Mitigation

This section summarises the mitigation in place deemed of clear relevance to the SAR Safety Justification. It is noted that other mitigations will be in place to reduce the frequency of an on-site incident occurring (e.g., charting of infrastructure, marine Aids to Navigation), however this section focuses on the mitigations in place deemed to be of direct relevance to assisting an emergency response scenario i.e., assuming an incident has already occurred.

The CWP Project will have capability of responding to Tier 1 incidents, Tier 2 and Tier 3 incidents which may require support in line with the National Maritime Oil / HNS Spill Contingency Plan (DoT, 2020a).

The mitigations are detailed in Table 5-1. The mitigations shown are not intended to replace the SAR checklist process which will be undertaken at the appropriate time post consent.

Table 5-1 Embedded Mitigations

Embedded Mitigation Measure	Description
Application of LoD Commitments	▪ LoD will be applied in such a way that a minimum of a consistent SLoO comprising 500 m SAR lanes will be maintained.
Emergency Response Cooperation Plan (ERCoP)	▪ An ERCoP in IRCG template will be produced pre-construction that details the communication and cooperation procedures that will be in place between the Applicant and IRCG. ▪ The ERCoP will include a 24/7 emergency contact list.
Emergency Response Plan (ERP) and Self Help	The Applicant will have its own internal response procedures in place via its ERP that will include: ▪ Roles and responsibilities; ▪ Facilities; ▪ Medical needs assessment and equipment; ▪ Reporting and Investigation; ▪ Media contacts; ▪ Next of Kin procedure; ▪ Procedures by incident type including escape and evacuation; and ▪ Flow diagram for when an incident exceeds Tier One capability.
Fire Fighting Equipment	▪ Project vessels, WTGs and OSSs will be equipped with firefighting equipment.
Lighting and Marking	▪ All WTGs will be fitted with SAR lights that emit in the infra-red. The lighting will be visible to a SAR helicopter's infra-red camera and the crew's Night Vision Goggles (NVG). ▪ All structures will have lit Identification (ID) boards. ▪ Select peripheral structures will have additional navigational aids. ▪ Selected structures will broadcast AIS positions.
Medical Advice	▪ The Applicant will undertake a medical needs assessment and ensure that relevant first aid resources are in place. This may include the need for offshore medics.
PLBs	▪ All project personnel will be required to be fitted with PLB.
Pollution Contingency Planning	▪ CWP Project Oil/HNS Spill Contingency Plan.

Embedded Mitigation Measure	Description
	▪ National Maritime Oil/HNS Spill Contingency Plan (DoT, 2020a). ▪ SOP 01-202 - Assessment and notification of a pollution incident (DoT, 2020b).
Pollution Kits on Vessels	▪ All project vessels will be equipped with pollution kits. Pollution kits also available on structures.
Vessel and Personnel Location Monitoring	▪ All project vessels will broadcast positions via AIS and be monitored via MCC / OMB. Personnel locations will also be monitored. Third-party vessels will also be monitored via AIS.
Project vessel compliance with international marine regulations	▪ Compliance from all project vessels with Irish Law, international maritime regulations as adopted by the relevant flag state including the Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/77) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974). ▪ Assistance under SOLAS undertaken in liaison with IRCG. ▪ Appendix B provides a list of instances of wind farm vessels responding to emergency incidents.
Remote WTG Control	▪ WTGs remotely controllable (i.e., on a full windfarm basis, individually, or predefined routes).
Security Plan	▪ Will include details of how security will be maintained throughout all phases of the development.
Self Help Capability	▪ Provision of project vessel(s) and other assets to respond or react to maritime emergencies associated with the CWP Project.
Weather Data	▪ CWP will collect live on-site weather data which can be provided to IRCG if requested.
On site Communications and Marine Services	▪ The following systems shall, as infrastructure becomes available during the construction phase, reside on the OSS topside (details to be confirmed post consent): ▪ Meteorological monitoring and Oceanographical monitoring. ▪ Marine surveillance systems including Marine Navigation Radar and AIS. ▪ Marine VHF and Aeronautical VHF base stations.

Embedded Mitigation Measure	Description
	▪ VHF / Ultra High Frequency (UHF) radio communication i.e., Digital Mobile Radio (DMR); ▪ Mobile data system i.e. 4G/5G infrastructure. ▪ A Closed Circuit Television (CCTV) system comprising cameras installed on several WTG foundation external platforms, CCTV recorder and monitors shall perform the surveillance of the navigation inside offshore site and the access to the offshore assets. ▪ Adherence to relevant EirGrid requirements, as appropriate. This equipment will primarily be for CWP use, but discussions around the coverage available and how they could also be used in a SAR operation by IRCG will be held with IRCG as part of the post consent SAR checklist process.

5.3 Formal Safety Assessment

The risk assessment undertaken via the FSA is presented in Table 5-2.

Table 5-2 Risk Assessment

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
Person in the water – project personnel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Fire Fighting Equipment. ▪ Lighting and Marking. ▪ Medical Advice. ▪ PLBs. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Project Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Security Plan. ▪ Self Help Capability. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	Project personnel will have PLBs reducing the likelihood of a search being required. In the case of SAR lanes being required (due to the need for a search in bad visibility), Probability of Detection (PoD) is high given that (as per Appendix A) the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore, all parts of the array site can be accessed using at least a SLoO. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation.	Extremely Unlikely *In the event that a project personnel member is in the water, the PLB will mean it is likely they are retrieved quickly.*	Minor	Broadly acceptable	N/A

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
Person in the water – third-party overboard from vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Project / third-party vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	As per Section 4.1, the most likely third-party vessel users in the array site are expected to be smaller fishing or recreational vessels. Recreational vessels in particular are more likely to be out in good visibility meaning 500 m SAR lanes may not be required. In the case of SAR lanes being required, PoD is high given that (as per Appendix A) the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation.	Extremely unlikely	Major	Tolerable	Increasing conspicuousness of OSS to SAR helicopters (e.g., added to the Helicopter's Helicopter Terrain Awareness and Warning System (HTAWS), discussion on AIS broadcasts from the OSS with Irish Lights).

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
Person in the water – third-party water sports, swimmer or diver	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Medical Advice. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	As per Section 4.3 and Section 4.4, individuals such as swimmers/divers and receptors undertaking water sports are considered highly unlikely to be seen within the array site due to the distance offshore of the array site and this was validated with a review of historical maritime incident data and consideration of reasonably foreseeable future baseline scenarios. In the case of such receptors being within the array site and then requiring emergency response, it is likely that this would take place during favourable visibility (which was also indicated by the review of historical maritime incident data). Therefore the 500 m SAR lanes may not be required. In the unlikely scenario of the SAR lanes being required to attend to such an incident, PoD is high given that (as per Appendix A) the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs.	Negligible *RNLI data reviewed indicated no records requiring emergency response in or near the array site*	Major	Tolerable	Increasing conspicuousness of OSS to SAR helicopters (e.g., added to the Helicopter's HTAWS, discussion on AIS broadcasts from the OSS with Irish Lights).

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
		Therefore all parts of the array site can be accessed using at least a SLoO. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation.				
Vessel capsize in array site – project vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Medical Advice. ▪ PLBs. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data.	Project vessels will have AIS and personnel will have PLBs reducing the likelihood of a search being required (Section 3.2). In the case of SAR lanes being required, PoD is high given that (as per Appendix A) the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO in the event of a vessel capsize.	Extremely Unlikely	Major	Tolerable	Increasing conspicuousness of OSS to SAR helicopters (e.g., added to the Helicopter's HTAWS, discussion on AIS broadcasts from the OSS with Irish Lights).

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
	▪ On site Communications and marine services, subject to availability of necessary infrastructure.	The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation.				
Vessel capsize in array site – third-party vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Lighting and Marking. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	In the case of SAR lanes being required, PoD is high given that (as per Appendix A) the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO in the event of a vessel capsize. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation.	Extremely Unlikely	Major	Tolerable	Increasing conspicuousness of OSS to SAR helicopters (e.g., added to the Helicopter's HTAWS, discussion on AIS broadcasts from the OSS with Irish Lights).

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
Oil spill – project vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	As per Appendix A, the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed by air and surface assets to reach the oil spill using at least a SLoO. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation. A search operation would not be required in the case of an oil spill and therefore additional mitigation for a SLoO is not necessary.	Remote	Minor	Broadly Acceptable	N/A
Oil spill – third-party vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Lighting and Marking. ▪ Pollution Contingency Planning.	As per Appendix A, the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can	Remote	Minor	Broadly Acceptable	N/A

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
	▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	be accessed by air and surface assets to reach the oil spill using at least a SLoO. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation. A search operation would not be required in the case of an oil spill and therefore additional mitigation for a SLoO is not necessary.				
Vessel grounding – project vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Lighting and Marking. ▪ PLBs. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring.	Project vessels will have AIS and personnel will have PLBs reducing the likelihood of a search being required (Section 3.2). In the case of SAR lanes being required, PoD is high given that (as per Appendix A) the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if	Extremely unlikely	Minor	Broadly acceptable	N/A

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
	▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO should a vessel ground. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation.				
Vessel grounding – third-party vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Lighting and Marking. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Weather Data.	There were no documented grounding incidents in the reviewed RNLI data that occurred in open waters. In addition, as per Section 4.1, third-party vessels within the array site are most likely to be smaller fishing and recreational vessels which are less likely to ground. In the case of SAR lanes being required, PoD is high given that (as per Appendix A) the layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if	Remote	Moderate	Tolerable	Increasing conspicuousness of OSS to SAR helicopters (e.g., added to the Helicopter's HTAWS, discussion on AIS broadcasts from the OSS with Irish Lights).

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
	▪ On site Communications and marine services, subject to availability of necessary infrastructure.	accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO should a vessel ground. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation.				
Injured person requiring extraction – project personnel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Medical Advice. ▪ PLBs. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data.	The layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO in the event that an extraction is required. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that	Reasonably probable	Moderate	Tolerable	N/A

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
	▪ On site Communications and marine services, subject to availability of necessary infrastructure.	prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation. This hazard assumes that the location of the personnel is known and therefore search operations would not be required and additional mitigation for a SLoO is not necessary.				
Drifting vessel – project vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Medical Advice. ▪ PLBs. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data. ▪ On site Communications and marine services, subject to	Project vessels will have AIS and personnel will have PLBs reducing the likelihood of a search being required (Section 3.2). The layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO regardless of the vessel location. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR	Remote	Minor	Broadly acceptable	N/A

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
	availability of necessary infrastructure.	lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation. Search operations would not be required and additional mitigation for a SLoO is not necessary.				
Drifting vessel – third-party vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Lighting and Marking. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	The layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO regardless of the position of the vessel. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation.	Extremely unlikely	Major	Tolerable	N/A

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
		Search operations would not be required and additional mitigation for a SLoO is not necessary.				
Fire on WTG or OSS	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Fire Fighting Equipment. ▪ Medical Advice. ▪ PLBs. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	The layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO in the event that there is a fire on a structure. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation. Search operations would not be required and additional mitigation for a SLoO is not necessary.	Remote	Minor	Broadly acceptable	N/A
Fire on project vessel	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help.	The layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if	Extremely Unlikely	Serious	Tolerable	N/A

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
	▪ Fire Fighting Equipment. ▪ Lighting and Marking. ▪ Medical Advice. ▪ PLBs. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations. ▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO in the event that a response to a vessel on fire is required. The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation. Search operations would not be required and additional mitigation for a SLoO is not necessary.				
Salvage operations	▪ Application of LoD Commitments. ▪ ERCoP. ▪ ERP and Self Help. ▪ Pollution Contingency Planning. ▪ Pollution Kits on Vessels. ▪ Vessel and Personnel Location Monitoring. ▪ Project vessel compliance with international marine regulations.	The layouts have been designed to yield multiple lines of orientation through the WTGs and at least a SLoO if accounting for the OSSs. Therefore all parts of the array site can be accessed using at least a SLoO in the event that a salvage operation is required.	Negligible	Major	Tolerable	N/A

Hazard Scenario	Embedded Mitigation	Does a SLoO Mean Additional Mitigation is Required	Likely Frequency	Likely Consequence	Significance of Risk	Is Additional Mitigation Required for ALARP as a result of SLoO
	▪ Remote WTG Control. ▪ Self Help Capability. ▪ Weather Data. ▪ On site Communications and marine services, subject to availability of necessary infrastructure.	The majority of the array site can be easily accessed using both the primary and secondary SAR lanes, as (in both layouts) it is only the widths of the SAR lanes adjacent to one of the OSSs that prevents the secondary SAR coverage from strictly fulfilling the definition of being a second line of orientation. Search operations would not be required and additional mitigation for a SLoO is not necessary.				

6 Summary and Conclusion

The array site maintains a high level of SAR coverage, achieving one full line of orientation and a good second line of orientation on a perpendicular bearing. This Safety Justification has therefore been prepared by the Applicant to demonstrate that hazards associated with a SLoO are ALARP.

Details of the SAR coverage i.e., available SAR lanes are provided in Appendix A. The risk assessment on hazards associated with a SLoO is provided in Section 5.3.

The risk assessment was supported by analysis of AIS and RNLI incident data undertaken in Section 4. This analysis was used to assist an assessment of likely users of the array site and therefore the potential casualties that may require an emergency response. An FSA has then been applied to show that all identified hazards are ALARP assuming the additional mitigation of increasing conspicuousness of the OSS to SAR helicopters (e.g., added to the Helicopter's HTAWS, discussion on AIS broadcasts from the OSS with Irish Lights[6]).

[6] Should Irish Lights deem that AIS broadcasts from the OSS were not appropriate from a navigational safety perspective it is still considered that the risk can be ALARP with the other mitigations in place in particular the input of the OSS positions into the HTAWS database. This will be discussed and agreed as part of the Lighting and Marking Plan discussions with both Irish Lights and IRCG.

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Appendix A SAR Access Lanes and SAR Operations

This appendix provides the SAR access lanes that have been identified based on the current layouts. The SAR lanes have been defined using the methodology described in the SOP 07 2025 OREI Guidance and Operational Considerations for SAR and Emergency Response (DoT, 2025b) i.e., defined to be at least 500 m in width tip to tip.

Primary SAR lanes are shown in Section A.1 and secondary lanes are shown in Section A.2.

A.1 Primary SAR Lanes

Figure A.1 and Figure A.2 present the lines of orientation for WTG Layout Option A and WTG Layout Option B, respectively. Both layouts have a line of orientation with a bearing of 90°/270°.

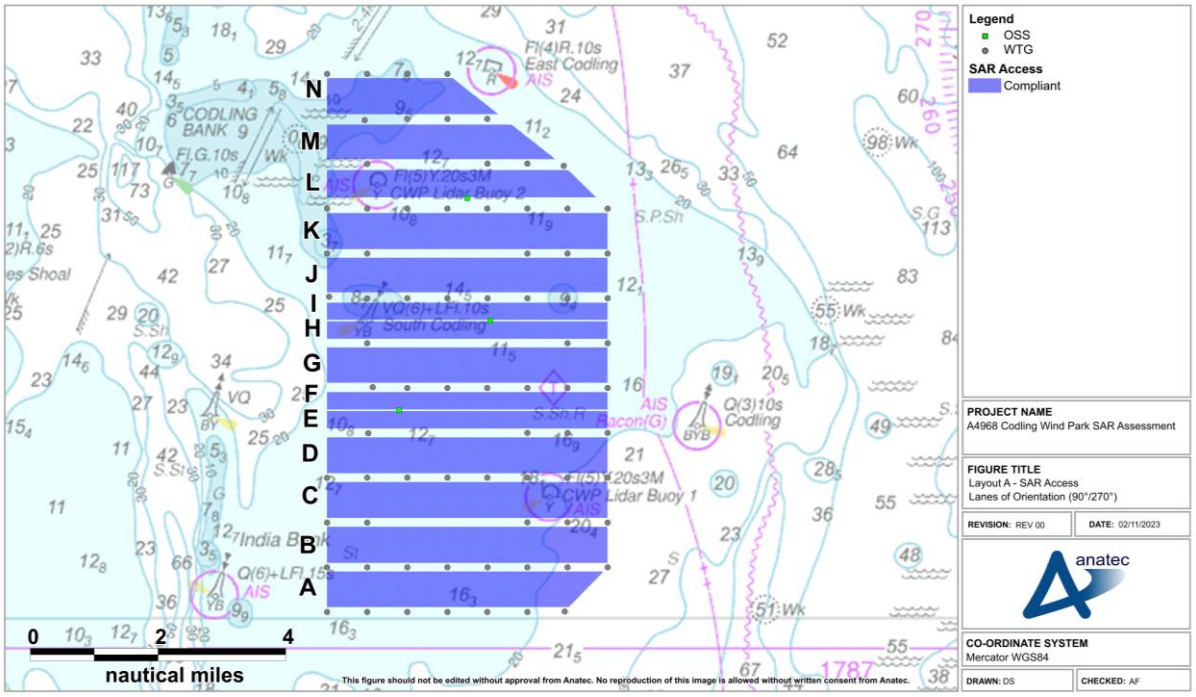

Figure A.1 WTG Layout Option A – Line of Orientation

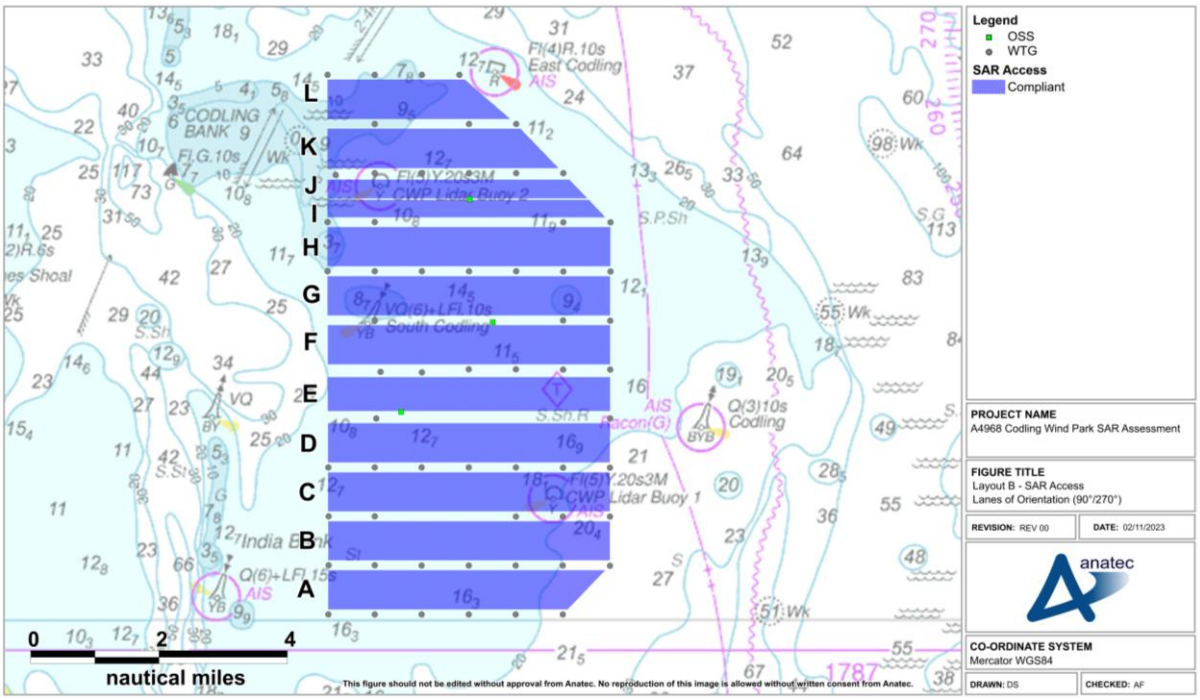

Figure A.2 WTG Layout Option B – Line of Orientation

A.2 Secondary Coverage

Figure A.3 and Figure A.4 present the secondary SAR coverage for WTG Layout Option A and WTG Layout Option B, respectively. Both layouts have secondary SAR lanes at a bearing of 0°/180°.

It is noted that, for each layout, the secondary SAR lanes provide a high level of coverage. In particular, each secondary SAR lane has a compliant width with the exception of two lanes per layout separated only by an OSS. The SAR lanes would otherwise fulfill the definition of being a full line of orientation.

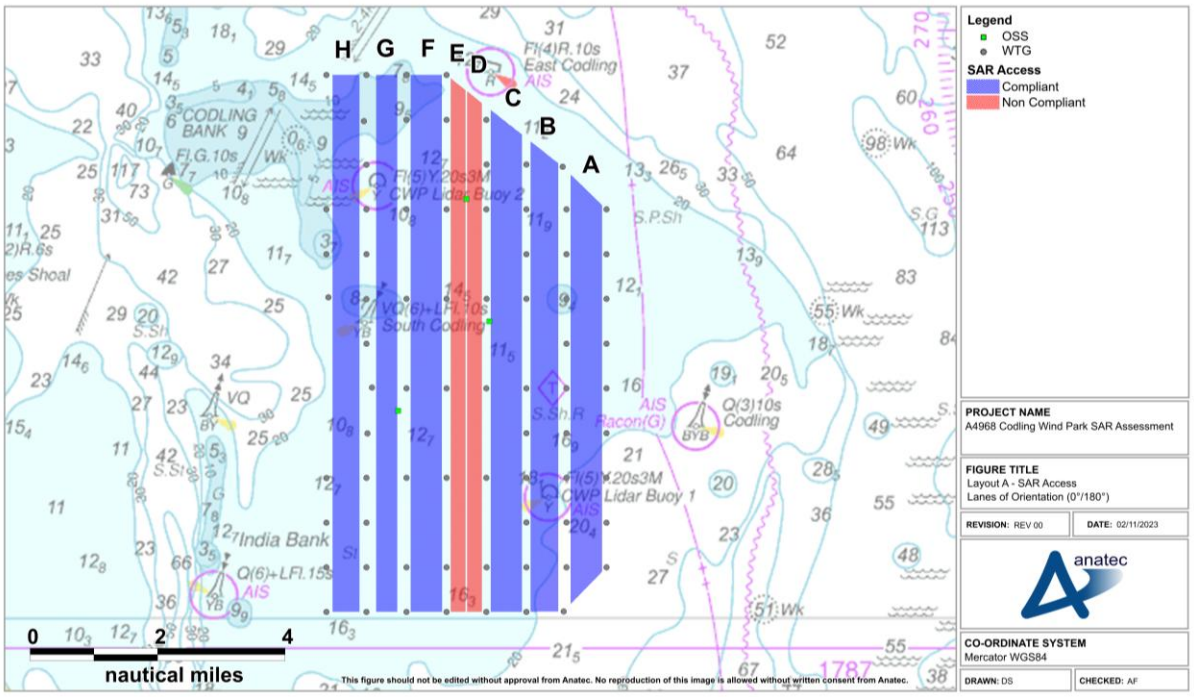

Figure A.3 WTG Layout Option A – Secondary SAR Coverage

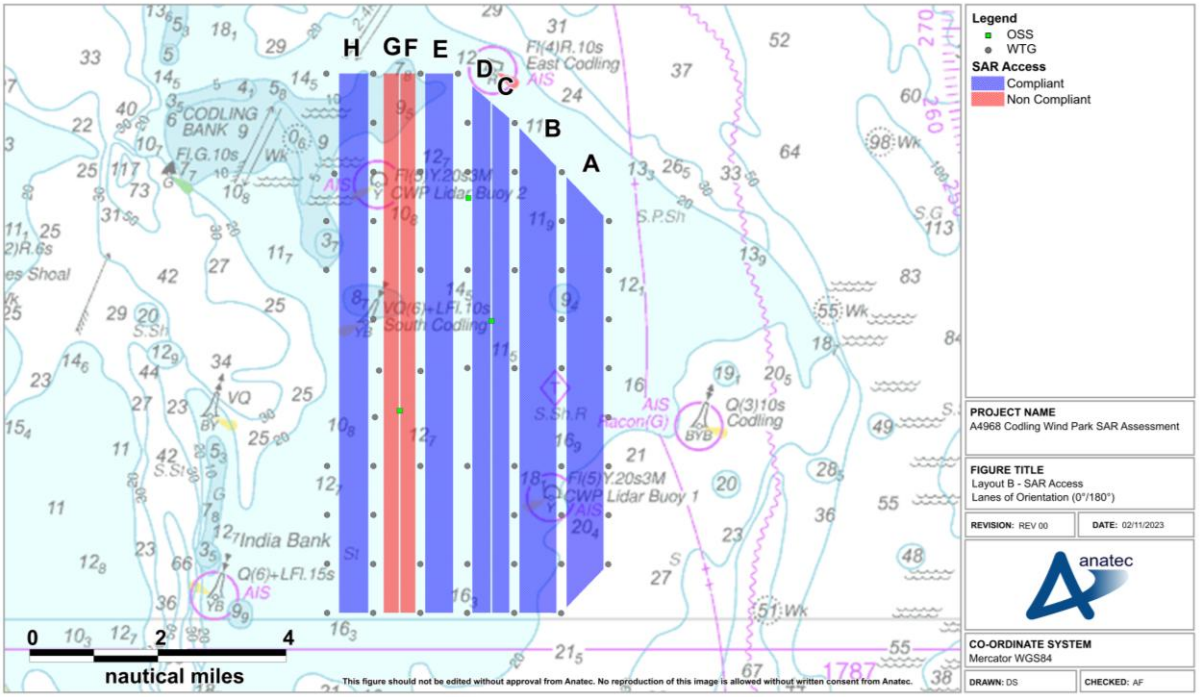

Figure A.4 WTG Layout Option B – Secondary SAR Coverage

A.3 SAR Operation Overview

A.3.1 SAR Aviation Assets

The primary SAR aviation assets will be the SAR helicopters located at the four bases identified in Figure 3.3. When project construction commences, it is anticipated that all four bases will have transitioned to using the AW189 helicopter. In addition to helicopters, the IRCG can task their King Air 200 fixed wing to assist in searching, environmental monitoring, or to coordinate more complex rescues.

A.3.2 SAR Lanes

Section 1.1 identifies why a SLoO is required for this project. The primary SAR lanes are shown in Figure A.1 and Figure A.2, and secondary SAR lanes shown in Figure A.3 and Figure A.4. The SAR lanes provide a passageway that is a minimum of 500 m wide between WTG blade tips at their worst-case orientation, or between blade tips and the edge of an OSS. The SAR lanes will provide access on a minimum of one line of orientation, with most of the array site being accessible via two lines of orientation. Where the north-south SAR lanes are obstructed (lanes E-D in WTG Layout Option A and G-F in WTG Layout Option B), this is due to the location of an OSS reducing the lane width below 500 m. Each OSS will extend up to 60 m (197 feet (ft)) and so will present a significant obstacle to a helicopter flying a low-level search pattern in poor visibility.

A.3.3 Rescue Scenarios

Incidents that occur to the east of the array site can be accessed by overflying the WTGs. In good weather, the transit could be flown 500 ft above the WTGs under Visual Flight Rules (VFR). In poor weather, the transit over the array site would be made at a minimum of 1,000 ft above the WTGs under Instrument Flight Rules (IFR). As the SAR helicopters are equipped for flight in Full Icing Conditions, the WTGs would not impose any additional restrictions on an IFR transit to an incident. Under either VFR or IFR a transit over the WTGs would not require a deviation from a direct track, and so the array site would have no impact on SAR operations to the east of the CWP Project.

Section 4 identifies previous incidents in the array site, using historical evidence. Section 5 identifies likely rescue scenarios inside the array site during construction and operation of the CWP Project, as well as incidents to third-party users of the area. Historically, all incidents in the array site have occurred in excellent, good or fair visibility, where a SAR helicopter could enter the array site under day VFR.

A.3.3.1 Night and Poor Weather Operations

Using historical evidence, it is Extremely Unlikely that a SAR helicopter will be required to conduct a rescue from the array site in a Degraded Visual Environment (DVE), such as at night or in poor visibility. However unlikely, a rescue in DVE is considered below.

Section 5 identifies that for most rescue scenarios, the location of the incident would be known due to an emergency call or personnel wearing PLBs. Therefore, the search element of a SAR mission would be minimal, with the helicopter transiting direct to the survivor's location and so reducing their exposure to the WTGs. This lessens the requirement for the helicopter to fly search patterns inside the array site and allows them to pre-plan their entry and exit routes. If the location of a survivor is not known, for example a fishing boat is reported overdue, then in addition to using the SAR lanes, the array site could be searched from the overhead using the IRCG King Air aeroplane, which is equipped with radar and electro-optical sensors.

When entry into the array site is required under DVE the following mitigations are available:

- The SAR lighting will emit in the infra-red and so will be visible to the electro-optical (EO) turret fitted to the SAR helicopter. In particular, the European Aviation Safety Agency (EASA) regulations[7] require the lighting to emit at the 850 nanometres wavelength, which is also visible to the crew's NVG. Imagery from the EO turret is available to the Technical Crew (TC) in the cabin and may be displayed to the pilots in the cockpit. EO and NVG vision may be degraded in rain or with visible moisture in the air.
- The location of WTGs, OSS and any other obstacles will be made available to the IRCG during construction of the CWP Project. The location of each WTG can be added to the obstacle database installed on the AW189's Mission Management System. This will permit the Technical Crew to correlate the position of the WTGs with other sensor data and so ensure that situational awareness is maintained during flight inside and adjacent to the array site. In addition, the position of the WTGs may be added to the HTAWS, providing a study confirms this will not result in a high Nuisance Alert[8] rate. HTAWS can be displayed in the cockpit and provides an aural and visual alert of an impending collision to all crew members.
- In DVE it is anticipated that the SAR crew will make optimum use of the AW189's autopilot upper modes in order to maintain a track along a SAR lane.
- In the unlikely event of a helicopter malfunction, including an engine failure, the SAR lanes provide an obstacle-free escape route.

A.3.3.2 Additional OSS Mitigation

Although an OSS will be a significant obstruction to low-level helicopter operations, its location will be known to the AW189 helicopter crew through the onboard systems shown in Section A.3.3.1. As an OSS will impact both WTG Layout Option A and WTG Layout Option B north-south SAR Lanes, the following additional mitigations are identified:

[7] EASA Safety Information Bulletin 2019-04

[8] In aviation, a Nuisance Alert refers to an alert generated by a system that is functioning correctly but is inappropriate or unnecessary for the specific situation. These alerts can be distracting and reduce a crew's confidence in the alerting system, potentially delaying responses to legitimate alerts.

- The location of an OSS can be added to the Helicopter's HTAWS. That will generate an aural and visual caution approximately 20 seconds ahead of an obstacle conflict, which is upgraded to a warning 10 seconds before the obstacle. Inserting three OSSs into the HTAWS Database is highly unlikely to increase the system's Nuisance Alert rate. The WTGs can also be included in the HTAWS database, but this might result in a high Nuisance Alert rate during operations.
- An OSS will be detectable by the helicopter's radar, although inside the array site the radar picture might be cluttered and not result in the OSS being readily identified under all conditions. Therefore, an additional mitigation would be to fit AIS to the OSS. The helicopter has an AIS receiver that can display AIS data to the pilots in the cockpit and TC on the cabin Mission Management System. This will enable the crew to verify the location of an OSS amongst a cluttered radar picture. Equipping the OSS with AIS will be especially beneficial when NVG and EO imagery is degraded due to rain and visible moisture. This would be subject to agreement with Irish Lights.

A.3.4 Summary

The following points were considered:

- the low probability of an incident occurring in DVE;
- two consistent lines of orientation will be available for most of the array site;
- the equipment installed on the AW189 SAR helicopters, including a SAR autopilot, EO sensors, NVG, radar and navigation systems;
- the position of each WTG being made available to a SAR crew inflight, on their moving maps, via their obstacle and terrain database(s);
- the integrated sensor data available to the crew, permitting them to correlate WTG positions with other sensor data;
- infra-red emitting SAR lighting installed on each WTG and the OSS;
- additional mitigations for the three OSSs, including inserting their positions into the HTAWS database and equipping the OSS with AIS (subject to agreement with Irish Lights[9]).

When the combination of factors is taken into account, it is considered that the risk to SAR helicopters operating inside the array site has been reduced to ALARP.

[9] Should Irish Lights deem that AIS broadcasts from the OSS were not appropriate from a navigational safety perspective it is still considered that the risk can be ALARP with the other mitigations in place in particular the input of the OSS positions into the HTAWS database. This will be discussed and agreed as part of the Lighting and Marking Plan discussions with both Irish Lights and IRCG.

Appendix B Project Vessel Response Precedent

Companies operating offshore typically have resources including vessels, helicopters, and other equipment available for normal operations that can assist with emergencies offshore. All vessels under IMO obligations set out in SOLAS (IMO, 1974) as amended, are required to render assistance to any person or vessel in distress if safely able to do so.

Table B.1 presents details of incidents which have occurred within the United Kingdom (UK) where a vessel associated with a nearby OWF has rendered assistance. It is noted that the initial cause of these incidents is not related to the OWF in question.

Table B.1 Incidents Responded to by Vessels Associated with UK OWFs

Incident Type	Date	Related Development	Description of Incident	Source
Capsize	21 June 2018	Walney	His Majesty's Coastguard (HMCG) issued mayday relay broadcast following trimaran capsize. Support vessel for Walney arrived and recovered two persons from the water who were then winched onboard a Coastguard helicopter.	Web search (4C Offshore, 2018)
Capsize	5 November 2018	Race Bank	Fishing vessel capsized resulting in two persons in the water. Vessel operating at the nearby Race Bank reported to have assisted with the rescue which also involved a Belgian military helicopter and the RNLI.	Web search (British Broadcasting Corporation (BBC), 2018)
Vessel in distress	15 May 2019	London Array	Yacht in difficulty sought shelter by tying up to a WTG but suffered damage and a person in the water. Support vessel for London Array identified and secured the casualty vessel and recovered the person in the water. The support vessel raised the alarm to the Coastguard. The Coastguard later instructed the support vessel to return to port and seek medical assistance for the casualty vessel's occupant.	Web search (The Isle of Thanet News, 2019)
Drifting	7 July 2019	Gwynt y Môr	Speedboat suffered mechanical failure stranding four persons. Support vessel for Gwynt y Môr responded to an 'all-ships' broadcast from the Coastguard and prevented the casualty vessel drifting into the Gwynt y Môr array. The support vessel later towed the casualty vessel back towards port.	Web search (Renews, 2019)

Incident Type	Date	Related Development	Description of Incident	Source
Machinery failure	28 September 2019	Race Bank	Fishing vessel suffered mechanical failure and launched flares. Guard vessel and SOV for Race Bank both immediately offered assistance until the MCA's arrival on-scene.	Internal daily progress report received by Anatec
Vessel in distress	13 December 2019	Race Bank	Passing vessel got into difficulty and guard vessel for Race Bank was requested to assist. The Coastguard later requested that the guard vessel tow the casualty vessel into port.	Internal daily progress report received by Anatec
Search	21 May 2020	Walney	Coastguard contacted guard vessel for Walney reporting red flare sighting at the OWF. Guard vessel proceeded to undertake search but did not find anything to report.	Internal daily progress report received by Anatec
Aircraft crash	15 June 2020	Hornsea Project One	United States jet crashed into sea during routine flight. Crew Transfer Vessels (CTVs) and SOVs for Hornsea Project One joined the search for the missing pilot.	Web search (4C Offshore, 2020)
Fire / explosion	15 December 2020	Dudgeon	Fishing vessel experienced explosions on board with crew injured. SOV for Dudgeon deployed its Fast Rescue Boat (FRB) and evacuated the casualty vessel.	Web search (Offshore WIND, 2020)
Persons in distress	10 July 2021	Unknown (East Irish Sea)	Two swimmers were in difficulty near to Talacre beach and raised the alarm. An RNLI lifeboat was launched from West Kirkby although the swimmers were recovered from the water by a commercial wind farm vessel.	Web search (RNLI, 2021)
Drifting	17 July 2021	Neart na Gaoithe	Small dinghy with two children aboard drifted offshore due to strong winds. A guard vessel associated with Neart na Gaoithe was able to retrieve the children.	Web search (Edinburgh Evening News, 2021)

Incident Type	Date	Related Development	Description of Incident	Source
Machinery failure	1 September 2022	Rampion	A recreational motorboat experienced power failure and anchored near to an OWF. The anchor could not then be recovered and assistance was requested from the Coastguard. A CTV for the OWF responded and towed the vessel back to port.	Marine Accident Investigation Branch (MAIB) (Case ID 9900)
Machinery failure	1 December 2022	Unknown	A survey vessel suffered an engine failure and was towed back to port by an OWF Rigid Inflatable Boat (RIB).	MAIB (Case ID 10215)
Persons in distress	12 July 2024	Stromar	A deckhand on a fishing vessel became entangled in a creel rope and was pulled overboard. The vessel's crew alerted HM Coastguard and manoeuvred to attempt a rescue. The deckhand was recovered on board and attempts to revive were supported by a paramedic from a HMCG helicopter, an RNLI lifeboat and crew from a nearby survey vessel for the Stromar OWF. The deckhand could not be revived and was declared deceased.	Web search (BBC, 2024)