



gwerth mewn gwahaniaeth
delivering on distinction

Marine Characterisation Research Project (MCRP)

MCRP-MARICO-DOC-0005

**Morlais_Demonstration_Zone_Navigation_Risk_Assessment_
Issue01**

Menter Môn

Marine Characterisation Research Project (MCRP)

MCRP-MARICO-DOC-0005

Morlais_Demonstration_Zone_Navigation_Risk_Assessment_Issue01

Author:



MCRP Document No.:
MCRP-MARICO-DOC-
0005

Status
FINAL

Version
No.:
Issue 01

Date:
01 July 2023

© 2024 Menter Môn

This document is issued and controlled by:

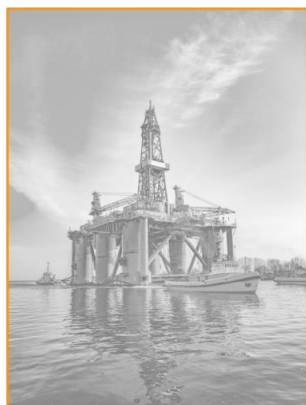
Morlais, Menter Môn. Registered Address: Llangefni Town Hall, Anglesey, Wales, LL77 7LR, UK

Unauthorised copies of this document are NOT to be made

Company registration No: 03160233 Requests for additional copies shall be made to Morlais Project

MENTER MÔN

**MDZ BIENNIAL SITEWIDE NAVIGATION RISK ASSESSMENT
2023**



Report Number: 22UK1877
Issue: 01
Date: 01 July 2023

Prepared for:

Menter Môn
Town Hall
Bulkley Square
Llangefni
LL77 7LR

Author(s): Ryan Horrocks; Lewis Seymour-Pugh; William Heaps

QC: André Cocuccio

Date	Release	Prepared	Authorised	Notes
11/12/2023	Draft A	RH, LSP, WH	AC	Draft A for client review
01/07/2024	Issue 01	RH	AC	Final Issue

Marine and Risk Consultants Ltd
Marico House
Bramshaw
Lyndhurst
Hampshire
SO43 7JB
United Kingdom

Telephone: + 44 (0) 2380 811133

Email: officeUK@maricogroup.com



EXECUTIVE SUMMARY

Following the consenting of the Morlais tidal demonstration zone in December 2021, Menter Môn has requested Marine and Risk Consultants Ltd complete an updated independent Navigation Risk Assessment in response to their marine licence (ORML 1938) conditions. This NRA is the first of the biennial NRA updates to be undertaken and will seek to review the updated risk profile for the full extent of the Morlais Demonstration Zone and determine the impacts that the site will have on local traffic.

The Navigation Risk Assessment methodology is based on the International Maritime Organisation's Formal Safety Assessment approach to risk management utilising a combination of data analysis and stakeholder/expert judgement to determine risk levels. Please note, the Navigation Risk Assessment considers safety of navigation and does not seek to address any possible loss of amenity.

The Navigation Risk Assessment was informed by stakeholder consultation, baseline marine environmental conditions and vessel traffic data collected by Marico Marine over two two-week periods which included Automatic Identification Systems data, RADAR data, and visual observations data. A variety of secondary sources including the Royal Yachting Association Coastal Atlas, the HR Wallingford Coastal Processes Modelling Report and navigational incident data were also utilised.

This Navigation Risk Assessment has assessed the baseline and residual navigation risk profiles of the consented MDZ and approaches, to fulfil the requirement set out within Menter Môn's marine licence to undertake a biennial sitewide navigation risk assessment. The assessment has:

- Established an updated baseline traffic profile including traffic densities, incident history, future developments and plans, and interactive boundaries;
- Confirmed the baseline marine environment including an assessment on metocean characteristics, proximities to sea-space uses, and offshore developments; and
- Reviewed and compared the changes from the previous navigation risk assessment undertaken in 2020 entitled 20UK1647_MM_Morlais NRAAddendum_20-issue02.

Compared with the conclusions of the previous Navigation Risk Assessment, no new hazard categories or risk scenarios were identified; the original 155 hazards were reviewed using the most recent data collected, but no changes made.

No additional/new embedded risk controls or suggested risk controls were identified or suggested during the assessment and stakeholder consultation.

Overall, no change in the overall risk profile was identified since the 2020 Navigation Risk Assessment and therefore the baseline and residual risk for the site, including the conclusions reached within the 2020 Navigation Risk Assessment remain unchanged.

It is recommended that the risk profile, baseline conditions and mitigations are all reviewed and reassessed within the next biennial Navigation Risk Assessment due in 2025.

The project is therefore assessed to be acceptable in terms of navigational risk assuming compliance with embedded, and implementation of, suggested additional mitigation measures where appropriate for hazards scoring as ALARP.

CONTENTS

1	Introduction.....	1
1.1	Guidance	2
1.2	Reference Documents.....	2
2	Description of the Site	3
2.1	Study Area.....	3
2.2	Background – Sitewide.....	3
2.3	Proposed Tidal Devices	5
3	Scope and Methodology	9
4	Overview of the Baseline Marine Environment.....	10
4.1	MetOcean Characteristics.....	10
4.1.1	Visibility.....	10
4.1.2	Wind, Wave and Swell.....	10
4.1.3	Tidal Conditions.....	10
4.2	Search and Rescue Resources	12
4.2.1	HM Coastguard SAR Helicopter Base	12
4.2.2	The Royal National Lifeboat Institution (RNLI)	12
4.3	Shelter	13
4.4	Traffic Separation Schemes (TSS)	13
4.5	Pilotage.....	13
4.6	Principal Marks.....	13
4.7	Anchorage.....	14
4.8	Offshore Renewable Infrastructure (OREI).....	14
4.9	Oil and Gas.....	15
4.10	Marine Aggregates.....	15
4.11	Dredge Disposal Sites.....	15
4.12	Diving Boats.....	15
4.13	Exercise Areas	16
4.14	Sub-Sea Cables.....	16
4.15	Pipelines.....	16
4.16	Explosive Dumping Grounds.....	16
5	Communication, Radar, and Positioning Systems	16
6	Vessel Traffic Analysis	17
6.1	Data Sources.....	17
6.2	Data Collection	17

6.2.1	Traffic Survey	18
6.2.2	Automatic Identification Systems	19
6.2.3	Stakeholder Consultation	21
6.3	Data Analysis	29
6.3.1	Vessel Classification	29
6.3.2	Vessel Track Analysis by Type.....	29
6.3.3	Vessel Track Analysis by Length	45
6.3.4	Density Analysis.....	46
6.3.5	Gate Analysis	47
6.3.6	Future Vessel Traffic Levels	50
6.3.7	Interactive Boundary Assessment	51
7	Historic Incidents Near Project Site.....	53
7.1	MAIB Accident Reports.....	53
7.1	RNLI Callouts	54
8	Met-Ocean Impacts	56
8.1	HR Wallingford Coastal Processes Modelling Report	56
8.1.1	Tidal Stream	56
8.1.2	Waves.....	56
9	Under Keel Clearance	61
9.1	Vessel Draughts	61
9.2	UKC Summary	62
10	Navigation Risk Assessment	63
10.1	Methodology	63
10.2	Hazard Identification	64
10.3	Assumptions	66
10.4	Embedded Mitigation Measures.....	67
11	Navigation Risk Assessment Results	69
12	Suggested Additional Risk Control Measures	70
13	Residual Risk Assessment	74
14	Cumulative Impacts.....	75
15	2023 Sitewide NRA Update Summary	76
16	Conclusions and Recommendations	77

FIGURES

Figure 1: MDZ layout as per the marine license.....	1
Figure 2: LiDAR Research Buoy Location.....	30
Figure 3: All Vessel Tracks	31
Figure 4: NCI Vessel Count by Type across Summer and Winter.....	32
Figure 5: Cargo Vessel Tracks	33
Figure 6: Tanker Vessel Tracks.....	33
Figure 7: Passenger Vessel Tracks.....	34
Figure 8: Ferry Poor Weather Routeing.....	35
Figure 9: Military Vessel Tracks.....	36
Figure 10: Other Vessel Tracks	37
Figure 11: Fishing Vessel Tracks	38
Figure 12: Fishing Intensity	39
Figure 13: Recreational Vessel Tracks.....	40
Figure 14: RYA Coastal Atlas AIS mean of summer 2014 and summer 2017. © Data reproduced under licence from the Royal Yachting Association.	41
Figure 15: Indicative Kayak GPX Tracks	42
Figure 16: Non-AIS Vessel Tracks	43
Figure 17: Non-AIS Vessels by Type within Summer Data	44
Figure 18: Non-AIS Vessels by Type within Winter Data	44
Figure 19: Vessel Tracks by Length	46
Figure 20: Density Analysis – Sitewide.....	47
Figure 21: Gate Analysis – Sitewide.....	48
Figure 22: Frequency of transits by vessel type	48
Figure 23: Vessel transits by LOA	49
Figure 24: Vessel transits by Draught	50
Figure 25: 90% Analysis	51
Figure 26: MAIB Incidents (1997– 2022)	53
Figure 27: MAIB Incidents by type within 5nm of MDZ	54
Figure 28: RNLI Callouts (2008 to 2020)	55
Figure 29: RNLI Callouts within 5nm of MDZ.....	55
Figure 30: Vessel Track by Draught (AIS only)	61
Figure 31: Indicative Kayak GPX Tracks	E-8

TABLES

Table 1: Examples of Tidal Energy Converters (TEC) that could be deployed in the MDZ	5
Table 2: Tidal Stream in the Vicinity of South Stack.....	11
Table 3: Tidal diamond for project site (Admiralty Total Tide: 53°05.52'N, 4°44.57'W Date: 14/11/2023).....	11
Table 4: RNLI Stations near to the MDZ	12
Table 5: Nearby Anchorages	14
Table 6: Nearby Offshore Renewable Energy Infrastructure	14
Table 7: Nearby Marine Aggregate Extraction.....	15
Table 8: Duration of Datasets.	18
Table 9: Class A shipborne mobile equipment reporting intervals	20
Table 10: NRA Stakeholder Consultation Meeting Key Comments and Concerns.	22
Table 11: Vessel Categories.....	29
Table 12: Recreational Vessel Transits from Visual Observations – Summer and Winter Surveys	45
Table 13: 90% Shipping Lane Analysis.....	52
Table 14: MGN 654 Section 4.9 – The effects of tides, tidal streams and weather	58
Table 15: Maximum draughts identified within MDZ.....	62
Table 16: Passenger Vessel Draughts and Required UKC.....	63
Table 17: Minimum Under Keel Clearance	63
Table 18: Hazard Categories	64
Table 19: Vessel Categories.....	65
Table 20: Device Categories.....	66
Table 21: Site-Wide NRA Assumptions	66
Table 22: Embedded Risk Controls –assumed to be in place for the risk assessment.....	67
Table 23: Baseline Risk Assessment Results Summary – Construction and Operational Phases - Sitewide	69
Table 24: Sitewide top hazards scoring ALARP - Construction Phase	69
Table 25: Sitewide top ten hazards - Operational Phase	70
Table 26: Suggested Additional Risk Control Measures.....	71
Table 27: Sitewide Residual Risk Assessment Results Summary – Construction and Operational Phases.....	74
Table 28: Sitewide top ten residual hazards – Construction Phase	74
Table 29: Sitewide top ten residual hazards – Operational Phase	75

ANNEXES

Annex A	Risk Assessment Methodology	A-1
Annex B	Hazard Log – Site-Wide Construction.....	B-1
Annex C	Hazard Log – Site-Wide Operational	C-1
Annex D	NRA Stakeholder Minutes.....	D-1
Annex E	Data Received from Recreational Stakeholders	E-1
Annex F	NCI Logbook Data	F-1

ABBREVIATIONS

Abbreviation	Detail
ACC	Anglesey County Council
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
ASD	Admiralty Sailing Directions
ATBA	Area To Be Avoided
AtNP	Aids to Navigation Plan
CA	RYA Coastal Atlas of Recreational Boating
CD	Chart Datum
CGOC	Coast Guard Operation Centre
CHA	Competent Harbour Authority
COLREGS	International Regulations for Preventing Collisions at Sea
CPMR	Coastal Processes Modelling Report (HR Wallingford)
CW	Canoe Wales
DfT	Department for Transport
DP	Dynamic Positioning
ERCoP	Emergency Response Co-operation Plan
ES	Environmental Statement
FLO	Fisheries Liaison Officer
FSA	Formal Safety Assessment
GIS	Geographic Information System
HA	Harbour Authority
HMCG	His Majesty's Coast Guard
HoSC	Holyhead Sailing Club
HSC	High Speed Craft
HSE	Health & Safety Executive
HW	High Water
IALA ASM	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICW	In Collision With
IMO	International Maritime Organisation
IMM	International Maritime Management
ISM	International Safety Management
kt	Knot (unit of speed equal to nautical mile per hour, approximately 1.15 mph)
kWh	Kilowatt-hour

Abbreviation	Detail
LAT	Lowest Astronomical Tide
LOA	Length-Over-All
LW	Low Water
m	Metre
MAIB	Maritime Accident Investigation Branch
Marico Marine	Marine and Risk Consultants Ltd
MCA	Maritime and Coastguard Agency
MDZ	Morlais Demonstration Zone
MGN	Marine Guidance Note
ML	Most Likely
MMO	Marine Management Organisation
MSI	Maritime Safety Information
MW	Megawatts
NCI	National Coastwatch Institution
nm	Nautical Mile
NMS	Navigation Monitoring Specification
NRA	Navigation Risk Assessment
NSMS	Navigational Safety Management System
NSTA	North Sea Transition Authority
NTM	Notice To Mariners
OREI	Offshore Renewable Energy Infrastructure
PA	Precautionary Area
PDE	Project Design Envelope
PEXA	Practise and Exercise Area
PHA	Preliminary Hazard Analysis
PPE	Personal Protective Equipment
RHIB	Rigid Hull Inflatable Boat
RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
SAR	Search and Rescue
SCC	Snowdonia Canoe Club
SHA	Statutory Harbour Authority
SKA	Sea Kayaking Alliance
SLF	Stena Line Ferries

Abbreviation	Detail
SLP	Stena Line Ports
SMS	Safety Management System
SOG	Speed Over Ground
SOLAS	Safety Of Life at Sea
SRR	Search and Rescue Region
SWAN	Simulating Waves Nearshore
TBSC	Trearddur Bay Sailing Club
TEC	Tidal Energy Converter
TH	Trinity House
THLS	Trinity House Lighthouse Service
TSS	Traffic Separation Schemes
UKC	Under Keel Clearance
UKCoS	UK Chamber of Shipping
UXO	Unexploded Ordnance
VHF	Very High Frequency (radio communication)
VMS	Vessel Monitoring System
WC	Worst Credible

1 INTRODUCTION

Following the successful consenting of the Morlais tidal demonstration zone in December 2021, Menter Môn has requested Marico and Risk Consultants Ltd (Marico Marine) complete an updated independent Navigation Risk Assessment (NRA) in response to their marine licence (ORML 1938) conditions. This NRA is the first of the biennial NRA updates to be undertaken and will seek to review the updated risk profile for the full extent of the Morlais Demonstration Zone (MDZ) and determine the impacts that the site will have on local traffic.

The NRA will consider and review the risk profile identified within the previous 2020 NRA addendum produced by Marico Marine. The document will assess both the construction and operation phases of the full site, which have been assessed independently. In conjunction with the NRA, and to satisfy the marine licence, Marico Marine have undertaken stakeholder consultation, and produced an Aids to Navigation Plan (AtNP) and a Navigation Monitoring Specification (NMS).

The MDZ layout has been visualised using the coordinates set out within the marine licence for each zone and can be seen in **Figure 1**.

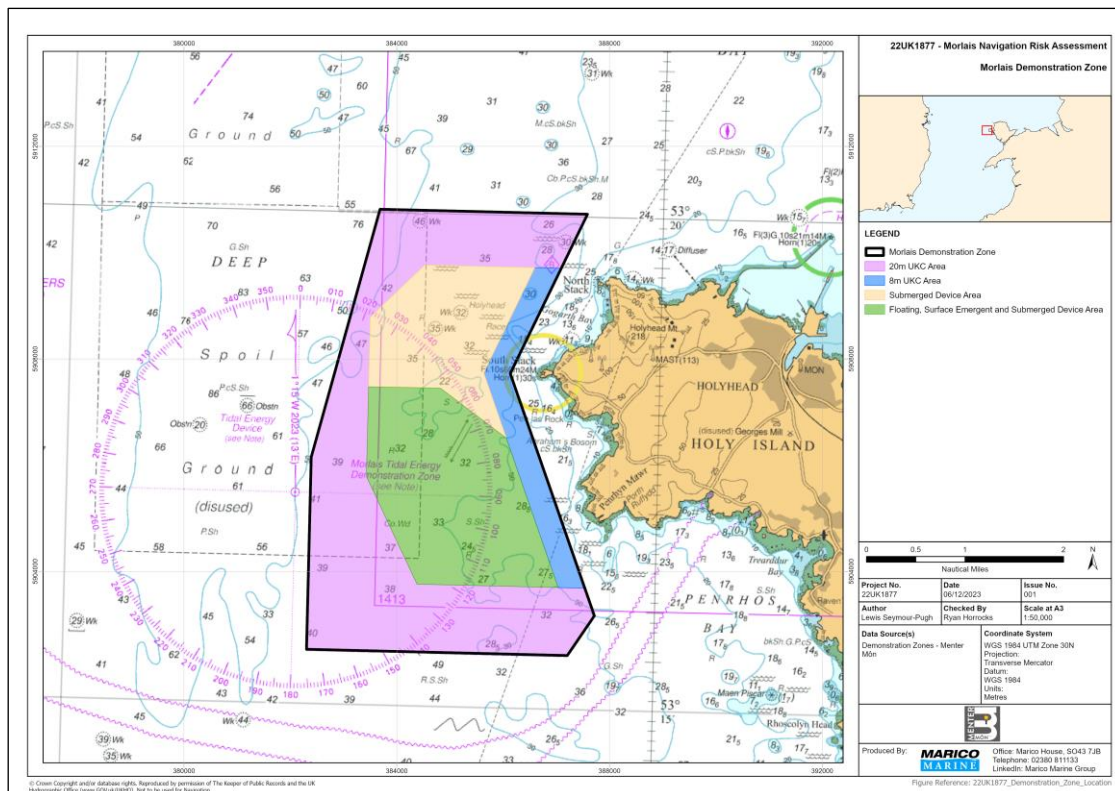


Figure 1: MDZ layout as per the marine license.

The NRA methodology is based on the International Maritime Organization's (IMO) Formal Safety Assessment (FSA) approach to risk management utilising a combination of data analysis and stakeholder/expert judgement to determine risk levels. It follows the navigation risk assessment guidelines stipulated by the UK's Maritime and Coastguard Agency in their role as Maritime Regulator under Marine Guidance Note (MGN) 654 (see next). Please note that this Navigation Risk Assessment considers safety of navigation and does not seek to address any possible loss of amenity.

1.1 GUIDANCE

The following assessment was conducted using the following guidance:

- MGN 654 Guidance on UK Navigational Practice, Safety and Emergency Response Issues (including Methodology for Assessing Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI));
- MGN 372 Amendment 1 Guidance to Mariners Operating in the Vicinity of UK OREIs;
- MGN 489 Pleasure Vessels - UK Regulations;
- MGN 610 (M+F) SOLAS Chapter V: Guidance on the Merchant Shipping (Safety of navigation) regulations 2020
- MCA - Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response (Nov 21);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA AISM) G1162 the Marking of Man-Made Offshore Structures;
- Royal Yachting Association (RYA) Position on Offshore Energy Developments;
- International Maritime Organisation (IMO) Formal Safety Assessment. Revised Guidelines for Formal Safety Assessment (FSA) MSC-MEPC.2/Circ.12/Rev.2;
- Regulatory expectations on moorings for floating wind and marine devices – HSE and MCA 2017;
- Cumulative Impact Assessment Guidelines issued by RenewableUK in June 2013; and
- International Regulations for Preventing Collisions at Sea 1972 (as amended) (ColRegs).

1.2 REFERENCE DOCUMENTS

Document Name	Description
ORML 1938	Menter Môn's Marine Licence issued by Natural Resources Wales (NRW)
20UK1647_MM_Morlais_NRAAddendum-20 Issue 02	2021 Navigation Risk Assessment Addendum to address sitewide changes and included additional data pertaining to the Morlais Development Zone.

20UK1619_RN_MM_VTS02-02	Interactive Boundary Assessment of the northern and eastern MDZ boundaries in accordance with MGN 543, Annex 3.
06_MOR-HRW-DOC-0001_HR Wallingford Coastal Processes Modelling Report	To assess the impact of the proposed MDZ development on coastal processes, including tidal currents, waves, and sediments.
United Kingdom Hydrographic Office (2022) Admiralty Sailing Directions West Coast of England and Wales Pilot; NP37, 21 st Edition	Outlines meteorological and metocean conditions and general guidance in navigation in the area.
Admiralty 1413 - Anglesey - Holyhead Bay	Specific passage guidance for navigation in vicinity of Holy Island.
02_MOR_RHDHV_DOC-0004ES Chapter Description (005)	Morlais Environmental Statement Project Description - Chapter 4, Volume I
RYA Passage Planning Guidance	Overall safety and passage planning for recreational craft.
Go Paddling Kayak guidance and safety checklist	Overall safety and planning for small recreational craft.

2 DESCRIPTION OF THE SITE

2.1 STUDY AREA

The location and layout of the proposed MDZ is shown within **Figure 1**. The MDZ is located to the west of Holy Island, Anglesey, approximately 520m off South Stack. The MDZ occupies a total area of 35km² and has been sub-divided in to four separate areas; two areas were defined based on visual characteristics, of which one is for all devices including surface emergent devices (green) and one for sub-surface devices (gold). The remaining two areas are based on minimum Under Keel Clearance (UKC) (blue and purple) which will support the installation and commercial demonstration of multiple arrays of tidal energy devices, to a maximum installed capacity of 240 Megawatts (MW).

2.2 BACKGROUND – SITEWIDE

The MDZ project aims to generate renewable energy from the strong tidal flows around Anglesey. The project has an aspirational maximum capacity of 240MW over a 20-hour a day operating window. The project has a

45-year lease which commenced in 2014 and will have a 37-year design life. Construction is to commence by 2023 and will likely take a phased deployment approach.

The project sought consent for a broad Project Design Envelope (PDE) to ensure flexibility in deployment of devices as the technology evolves over time. Subsequently, the location and routeing of inter-array and export cables (up to nine assumed), which are to make landfall at Abraham's Bosom, and associated electrical hubs which may extend up to 18m above the sea surface at LAT (up to nine assumed), and the specific types of turbines to be deployed have not yet been determined. The NRA therefore assumes the potential for utilisation of one of, or a combination of; seabed mounted, mid-water or surface devices in accordance with the zones outlined in **Figure 1**.

Consideration of a broad PDE is particularly important for the following areas relevant to the assessment of shipping and navigation risk, which will be further developed via detailed design work post consent:

- The total number of tidal devices deployed within the MDZ;
- Layout of tidal devices within the MDZ (location, density, array spacing);
- Device types;
- Foundation/mooring types;
- Location of electrical hubs and monitoring equipment;
- Number and routing of inter-array and export cables; and
- Location and lighting/marketing requirements of navigational aids.

Depending on the type of tidal device, full deployment to a worst-case of 240MW could comprise up to a maximum of 620 tidal devices, supporting up to 1,648 TECs and up to 740 inter-array cables within the MDZ. Up to 9 export cables will be installed between the MDZ and the landfall at Abraham's Bosom. Due to the hard and rocky nature of the seabed, it is expected that the majority of the cables will be free laid with protection such as rock bags, concrete mattresses or split-pipe at locations along the length. Installation of export and array cables could require a medium sized cable installation vessel (up to 140m long and 6m draught), plus barge (could be up to 130m long x 30m wide) for installation of rock bags / mattresses (30m long x 12m wide), with a small additional support vessel for each.

The device installation methodology to be adopted will depend on the device types to be installed. Example construction vessels may include:



- **Moored barges** - for example: 100m x 30m and have four to eight 100 tonne gravity blocks (5m by 5m) or drag anchors (3m x 5m) with some anchor chain catenary, estimated at 400m to 500m length on seabed and 1m diameter.
- **Support vessels** (30m x 22m) to assist with moored barge positioning and anchor deployment.
- **Dynamic Positioning (DP) vessel** (approximately 155m x 30m) with craneage (250t to 400t)
- **Multicat vessels**

During the operational phase developers are expected to visit each array/ tidal device up to 15 times annually for planned and unplanned maintenance. Vessels utilised for maintenance will typically be a workboat or multicat. In the event that the removal of a tidal device is required, such as retrieval and repair following structural failures for example, a large multicat or possibly offshore DP vessel may be required, dependent upon device type.




2.3 PROPOSED TIDAL DEVICES




A range of example devices that could be deployed within the MDZ are given within **Table 1**.

Table 1: Examples of Tidal Energy Converters (TEC) that could be deployed in the MDZ¹

Sub-Category	Exemplars (Developer or Device Names)	
Category 1 : Seabed Mounted Sub-Surface Devices		
Large rotor(s) (>10 m diameter)	<ul style="list-style-type: none"> • SIMEC Atlantis Energy • Andritz Hydro Hammerfest 	 <p>Developer: SIMEC Atlantis Energy Source: (https://twitter.com/simecatlantis/status/534996023178178560)</p>
Small (<10 m diameter) rotors	<ul style="list-style-type: none"> • Verdant Power • QED Naval SubHub • Nova Innovation • Sabella 	 <p>Device/Developer: Gen5Tidal/Verdant Power</p>

¹ 02_MOR_RHDHV_DOC-0004ES Chapter Description (005)

Sub-Category	Exemplars (Developer or Device Names)	
		<p>Source: Verdant Power</p>  <p>Device/Developer: D10-1000/Sabella</p> <p>Source: Sabella</p>
Vertical Axis Turbine	<ul style="list-style-type: none"> Repetitive Energy 	 <p>Developer: Repetitive Energy</p> <p>Source: http://www.repetitiveenergy.com/ourtechnology</p>
Category 2: Mid-water Column Devices		
Multiple small (<10 m diameter) rotor upon submerged buoyant platform	<ul style="list-style-type: none"> SME PLATO platform or similar with Tocardo or Schottel TECs Renewable Devices Marine Ltd. 	 <p>Developer: Renewable Devices Marine Ltd.</p> <p>Source: https://www.theenergytimes.com/distributedenergy-ecosystem/scots-push-new-tide-turbine-tech</p>

Sub-Category	Exemplars (Developer or Device Names)	
Category 3: Floating or Surface Emergent Devices		
Large rotor (>10 m diameter) floating or emergent devices	<ul style="list-style-type: none">Orbital Marine PowerMagallanes	<div></div> <div>Developer: Orbital Marine Power</div> <div>Source: https://marineenergy.biz/2018/11/16/orbitalmarine-unveils-o2-turbine-blueprints/</div>
Small rotor (<10 m diameter) floating devices	<ul style="list-style-type: none">Tocado TFS	<div></div> <div>Developer: Tocardo</div> <div>Source: https://marineenergy.biz/2018/06/06/-tocardo-strengthens-management-with-financeappointments/</div>
		<div></div> <div>Developer: Instream</div> <div>Source: https://www.marineenergywales.co.uk/-</div>

Sub-Category	Exemplars (Developer or Device Names)	
		instream-and-its-pennergised-full-scale-demonstrator/
Large rotor (>10 m diameter) surface emergent spar buoy	<ul style="list-style-type: none"> Aquantis 	 <p>Developer: Aquantis Source: https://www.f6s.com/aquantisinc</p>

3 SCOPE AND METHODOLOGY

The scope and objectives for the assessment are as follows:

1. Describe the project;
2. Provide an updated description of the existing baseline environment and activities in the project area, including but not limited to:
 - a. Local ports and harbours;
 - b. Tidal conditions;
 - c. Other users of the area such as aggregates, oil and gas, anchorages, military and renewable energy installations;
 - d. Existing vessel traffic patterns, including frequency and types; and
 - e. Existing risk profile for navigational incidents.
3. Identify and assess impacts of the development to shipping and navigation, including:
 - a. Traffic routing;
 - b. Collision, contact, grounding, breakout, swamping risk etc.;
 - c. Cable risk, including snagging;
 - d. Search and Rescue; and
 - e. Cumulative and In-Combination Effects.
4. Review the previous NRA and undertake an updated NRA that reviews the hazards during the construction and operation phases of the development. These hazards are then assessed, and risk controls identified to reduce the risk to an acceptable threshold; and
5. Make recommendations as to the safety of the development and what measures should be implemented to improve it.

4 OVERVIEW OF THE BASELINE MARINE ENVIRONMENT

4.1 METOCEAN CHARACTERISTICS

The following information has been extracted from the Admiralty Sailing Directions for the West Coasts of England and Wales, 2022.

4.1.1 Visibility

The study area is often cloudy in all seasons with the coast often obscured by low cloud and driving rain. Fog at sea is most common in June and less frequent from November to March.²

4.1.2 Wind, Wave and Swell

Generally, the region has a mild maritime climate with periods of strong winds and rough seas. Gales occur most frequently within the winter months. The prevailing winds in the MDZ are in the south-westerly quadrant with south-westerly gales considered the most severe resulting in a lee shore hazard.

The roughest seas are experienced with winds from the south-west with extreme waves most dominant from 210°N³. 60% of seas over 2m are recorded within winter. The calmest seas occur within July. The predominant swell is from south and south-west, however, north swells increase within spring and summer.

4.1.3 Tidal Conditions

The tidal stream is generally set N and S in the direction of the coast to the west of Anglesey and changes NNE SSW off the NW tip of Anglesey. The tide is strong around the promontories but is weaker within the bays. The NW coastal stream is joined by the N stream from Caernarfon Bay tending to set towards the land. The stream turns NNE around South Stack, whereas the SSW stream from North-Stack turns south across Caernarfon Bay and SE around South Stack.

A west-going eddy forms off the coast east of Penryhn Mawr during the SE going stream and there are eddies in Abraham's Bosom and in Gogarth Bay during both streams and in both directions.

It is noted within the Admiralty Sailing Directions (ASD) that there is a rocky islet known as South Stack (53° 18'.41N, 4° 41'.98W) which lies close off the western extremity of Holy Island and is connected to it by means of a bridge with dangerous tidal races to the west.

Tidal streams in the vicinity of South Stack begin as outlined within **Table 2**.

² United Kingdom Hydrographic Office (2022) Admiralty Sailing Directions West Coast of England and Wales Pilot; NP37, 21th Edition.

³ 06_MOR-HRW-DOC-0001_HR Wallingford Coastal Processes Modelling Report

Table 2: Tidal Stream in the Vicinity of South Stack

Interval from HW Holyhead	Direction
-0520	NNE
+0050	SSW

Table 3 gives the tidal diamond for an area within the proposed MDZ. Tidal flows reach maximum spring flow rates in both directions of over 2 knots.

Table 3: Tidal diamond for project site (Admiralty Total Tide: 53°05.52'N, 4°44.57'W Date: 14/11/2023)

HW Hour	Direction (°)	Spring Rate (kts)	Neap Rate (kts)
-6	182	0.5	0.3
-5	002	0.4	0.2
-4	002	1.5	0.9
-3	002	2.2	1.3
-2	002	2.2	1.3
-1	002	1.5	0.9
HW	002	0.6	0.4
+1	182	0.4	0.2
+2	182	1.2	0.7
+3	182	2.0	1.2
+4	182	2.1	1.2
+5	182	1.7	1.0
+6	182	1.0	0.6

4.2 SEARCH AND RESCUE RESOURCES

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

The MCA is responsible for requesting and tasking SAR resources made available by other authorities and co-ordinating the subsequent SAR operations. The MCA currently co-ordinates SAR operations through a network of 12 Coastguard Operations Centres (CGOCs).

The CGOCs maintain continuous watch on VHF Channel 16 and 70 for; distress, urgency and safety calls, covering UK waters.

SAR response can be drawn from three levels of responder:

- Dedicated (e.g. RNLI, SAR helicopter);
- Declared (e.g. coastguard vessels, port launches, police boats); and
- Merchant shipping (e.g. vessels transiting in the area).

HMCG provides declared SAR facilities to cover both civil and military operations, exercises and training within the UK SAR.

4.2.1 HM Coastguard SAR Helicopter Base

The closest HM Coastguard SAR station to the MDZ is situated at Caernarfon Airport. The base has been operated by Bristow Helicopters Ltd on behalf of HMCG since it opened in 2015.

4.2.2 The Royal National Lifeboat Institution (RNLI)

The RNLI provides all-weather and inshore lifeboats around the coast for saving life at sea. The RNLI stations near to the MDZ are given within **Table 4**. At each of these stations crew and lifeboats are available on a 24-hour basis throughout the year.

Table 4: RNLI Stations near to the MDZ

Station	Location
Holyhead New Harbour	53° 19'.17N 4° 38'.56W
Trearddur Bay	53°16'.57"N 4°37'.49"W

4.3 SHELTER

Shelter is listed within the ASD as available at all times in Holyhead Outer Port. Within the previous NRA was noted in by recreational stakeholders in consultation that '*Holyhead is the only nearby safe-haven for running for shelter. Caernarvon is not accessible during poor weather.*'

4.4 TRAFFIC SEPARATION SCHEMES (TSS)

The closest Traffic Separation Scheme (TSS) is the Off Skerries TSS (53° 22'.88N 4° 52'27W to 53° 32'18N 4° 31' 78W). Off Skerries was established for vessels rounding the NW coast of Anglesey. Rule 10 of The International Regulations for Preventing Collisions at Sea (COLREGS) applies. Laden tankers are to avoid the area between the SE boundary of the scheme and the coast.

An un-adopted TSS is located at the entrance to Holyhead Port.

4.5 PILOTAGE

The pilot boarding station for Holyhead Port Authority is located at 53° 20' 54.49"N 4° 38' 57.01"W. Within the ports general directions, compulsory pilotage applies to all vessels with the following exemptions:

- a. Vessels of less than 40 metres.
- b. HM Ships and foreign warships.
- c. GLA tenders.
- d. Vessels shifting in berth.
- e. Fishing vessels of less than 47.5 metres Length Over-all (LOA)

Exceptions do not apply to a vessel in (a) above:

- With a passenger certificate.
- Carrying a hazardous cargo or marine pollutants including vessels not gas free.
- When visibility is less than 2.5 cables.
- Vessels or tows with any defects.

4.6 PRINCIPAL MARKS

South Stack Lighthouse is located at 53° 18'41N 4° 41' 98W. The light is shown throughout 24 hours.

During consultation on the previous NRA, it was noted by Trinity House that once per year it has a vessel with a helipad located up to 1.5nm off South Stack in order to carry out routine maintenance. Additionally, approximately every 7 years the vessel would be present for an extended time to support major maintenance activities such as; painting, battery change or modernisation.

4.7 ANCHORAGES

Anchorage in the vicinity of the proposed MDZ are given within **Table 5**. It was noted within the previous NRA that *'recreational vessels anchor in Abraham's Bosom, however, it is not an overnight anchor'*.

Table 5: Nearby Anchorages

Anchorage	Description
Abraham's Bosom	53°17'.81N 4°40'.97W - Anchorage in offshore winds (marked as a reported anchorage with no defined limits) A below water rock lies below the water surface (Pen – las rock) close to the northern entrance to the bay with foul ground extending 1 cable southwest from the rock.
Trearddur Bay	53°16'.63N 4°37'.28W Temporary anchorage in offshore winds.

4.8 OFFSHORE RENEWABLE INFRASTRUCTURE (OREI)

OREI's within the vicinity of the MDZ are given within **Table 6**. The nearest OREI to the MDZ is the Minesto operated Holyhead Deep tidal demonstration site located 1km to the west of the proposed MDZ. It was noted during consultation that the Holyhead Deep project appears to have moved from Anglesey to the Faroe Islands. The Holyhead Deep's Marine License is due to expire prior to the installation of any devices. It should also be noted that the Réalt na Mara wind farm in Dublin is due to be consented in 2026 which is approximately 70km west of Morlais⁴.

Table 6: Nearby Offshore Renewable Energy Infrastructure

Development Type	Project	Approximate Distance from Morlais (km)	Status
Wind Farm Extension	Awel y Mor	48.37	In Planning
Tidal	Bardsey Sound	51.50	Pre-Planning
Wind Farm	Mona	53.68	Pre-Planning
Wind Farm	Rhyl Flats	66.49	Operational
Wind Farm	Gwynt y Mor	67.53	Operational
Wind Farm	Morgan	79.28	Pre-Planning
Wind Farm	North Hoyle	80.95	Operational

⁴ <https://www.realtnamaraoffshorewind.ie/wp-content/uploads/2022/07/mapa-big.jpeg>

Wind Farm	Morecambe	81.67	Pre-Planning
-----------	-----------	-------	--------------

4.9 OIL AND GAS

The nearest oil and gas infrastructure as per the North Sea Transition Authority (NSTA) data updated on the 21/09/2023 is the Conwy Platform, operated by ENI UK Limited and connected to the Liverpool Bay pipeline, approximately 74.83km from the MDZ. Oil and Gas infrastructure has therefore not been considered a present hazard within the assessment.

4.10 MARINE AGGREGATES

The closest marine aggregate extraction site is situated over 75km from the MDZ. Marine aggregate dredging activities are therefore not considered to present a hazard within this assessment.

Table 7: Nearby Marine Aggregate Extraction

Area Name	Area Number	Distance from Morlais (km)	Status	End Date
Liverpool Bay - Production Agreement Area	457	76.72	Operational	13/07/2025
Hilbre Swash - Production Agreement Area	393	79.21	Operational	31/12/2029
Liverpool Bay- Exploration and Option Area	1808	79.29	Operational	31/08/2024

4.11 DREDGE DISPOSAL SITES

Holyhead North spoil ground is located to the west of the MDZ near to Holyhead Deep. The southernmost portion of which overlaps with the western portion of the zone including the western sub-zone. Dredge material from the proposed Holyhead Port expansion is likely to be disposed of at Holyhead North disposal site to the west of the MDZ⁵. The spoil ground is marked by a lit buoy.

4.12 DIVING BOATS

There are several wreck features within and around the MDZ. No historic wrecks are present. It was identified within consultation that wreck diving occurs within the MDZ area and within close proximity to the site, with

⁵ MMO (2017) Scoping Opinion; Port of Holyhead – Holyhead Port Expansion: DC10119

118 wrecks registered within 15nm of the site. A collision involving a dive boat was identified from MAIB incident data within 1nm of the MDZ in 2015 (see **Section 7.1**).

4.13 EXERCISE AREAS

There are no active military exercise areas or firing zones in the vicinity of the site. The closest military practice area is located 15.71km to the west and south of the MDZ.

4.14 SUB-SEA CABLES

There are two sub-sea cables approximately 0.58km from the south-east corner of the MDZ. The cables, which include the Emerald Bridge cable and Celtic Connect cable, make landfall on the west coast of Holy Island near Porth Dafarch, north of Trearddur Bay.

4.15 PIPELINES

There is a pipeline 54.10km west of the MDZ which is the Interconnector between Scotland to Ireland. There are also multiple pipelines within the Holyhead Port and a pipeline located north of Holyhead which is connected to a Diffuser at 17m.

4.16 EXPLOSIVE DUMPING GROUNDS

There are no explosive dumping grounds in the vicinity of the site. No presence of Unexploded Ordnance (UXO) is indicated within the MDZ.

5 COMMUNICATION, RADAR, AND POSITIONING SYSTEMS

The tidal devices are not considered to present any hazard to communication, radar and positioning systems during installation, operations and decommissioning phases.

There would be no adverse or unusual effects on communications, radar and positioning systems caused by the vessels or equipment used during the construction phase except for the possibility of the use of inappropriate International Maritime Mobile (IMM) VHF channels. The use of IMM VHF during construction for communication between ship and shore or between vessels could interfere with other marine activities. The developer should liaise with local Harbour Authority (HA) areas to ensure that suitable working channels are selected to avoid compromising authorised local communications.

There are no known adverse effects on navigation systems from acoustic interference arising from the infrastructure or associated equipment likely to be employed at the site.

6 VESSEL TRAFFIC ANALYSIS

Analysis of the baseline vessel traffic data seeks to quantitatively determine the extent of navigation in the vicinity of the MDZ and the surrounding area and requires that data and statistics are available to ensure that the risk assessment is as robust and accurate as possible. An assessment of navigation regarding the MDZ has been made based on the following available data.

A full traffic resurvey was undertaken during 2023 to inform this updated NRA.

The principal data source used within this assessment is as follows:

- Automatic Identification System (AIS) data to determine:
 - Vessel types in the vicinity of the MDZ and their tracks;
 - Gate analysis to discover the frequency and distribution of vessels transiting the area; and
 - Vessel traffic density.

6.1 DATA SOURCES

Marico has undertaken the NRA utilising the following data sources:

- Automatic Identification System (AIS) data (collected by Marico Marine);
- Radar data (collected by Marico Marine);
- Visual Observations data (collected by Marico Marine and National Coastwatch Institution (NCI))
- GIS shapefiles (including recreational user data and GPX Track kayak positions);
- RYA Coastal Atlas of Recreational Boating (**Section 6.3.2.7**);
- MMO Fishing VMS data (**Section 6.3.2.6**);
- Maritime Incident Data (Maritime Accident Investigation Branch (MAIB) 1997-2021 and RNLI Callouts 2008 to 2020 (**Section 7**);
- Stakeholder Consultation (**Section 6.2.3** and **Annex D**);
- Admiralty Sailing Directions – West Coast of England and Wales Pilot, NP37, 21st Edition, 2022; and
- UK Admiralty Charts: 1977, 1413 (All cartography in this report, unless otherwise stated, is to WGS84 UTM Zone 30N standard. All marine charts are in a Mercator projection. Charts are not suitable for navigational purposes).

6.2 DATA COLLECTION

The MCA sets out the requirement for AIS, radar, and visual observations data collection in MGN 654 which advises:

“An up to date, traffic survey of the proposed development area concerned should be undertaken within 12 months prior to submission of the EIA Report. This should include all the vessel and craft types found in the area and total at least 28 days duration but also take account of seasonal variations and peak times in traffic patterns and fishing operations. AIS data alone will not constitute an appropriate traffic survey; radar, manual observations, other data sources (e.g. for fishing and recreation) and stakeholder consultation will ensure those vessels that are not required to carry and operate AIS are included, and it provides an appropriate representation of the base line marine traffic.”

“However, to cover seasonal variations, peak times or perceived future traffic trends, the survey period may be extended to a maximum of 24 months. For all OREI developments, subject to the planning process, the survey may be undertaken within 24 months prior to submission. If the EIA Report is not submitted within 24 months an additional 14 day continuation survey data may be required for each subsequent 12-month period. Should there be a break in the continuation surveys, a new full traffic survey may be required and the time period starts from the completion of the initial 28 day survey period.”

A desk-based study was undertaken to obtain other relevant data sources mentioned within **Section 6.1**.

6.2.1 Traffic Survey

To comply with MGN 654, a vessel traffic survey was undertaken by Marico Marine to collect AIS, radar, and visual observations data (using a CCTV Camera). The survey was conducted from South Stack lighthouse to the west of Holy Island. The location offered the best line of sight over the study area as well as an uninterrupted power supply and fog house building on which to deploy the equipment. Permission was provided by Trinity House for this purpose under a formal licence.

Two 2-week summer and winter surveys were undertaken, the data periods of which can be seen below in **Table 8**. The data periods were of sufficient length to capture 28 days within a 12-month period. A report of survey for both summer and winter periods were produced.

Table 8: Duration of Marico Marine Gathered Datasets.

Data Type and Period	Duration of Dataset
Summer AIS Data	23/08/2023 – 07/09/2023 (Missing two days (30/08 & 31/08) due to technical disruption)
Summer Radar Data	23/08/2023 – 07/09/2023 (Missing two days (30/08 & 31/08) due to technical disruption)
Summer Visual Observations	16/08/2023 – 29/08/2023
Winter AIS Data	27/10/2023 – 9/11/2023
Winter Radar Data	27/10/2023 – 9/11/2023

Winter Visual Observations

30/10/2023 – 12/11/2023

AIS, radar data and visual observations data were collected during a vessel traffic survey to better understand the traffic profile of vessels transiting the site-wide project areas and any potential impacts the development may have upon navigation.

The following were assessed through the analysis of data collected:

- Location of the MDZ relative to areas used by any type of marine craft;
- Numbers, types and sizes of vessels presently using the MDZ including: course, name, IMO Number and nationality where possible;
- Non-transit uses of the areas, e.g. fishing, recreation, racing or military purposes;
- Presence of transit routes used by coastal or deep-draught vessel on passage; and
- Alignment and proximity of the development site relative to adjacent shipping lanes.

6.2.2 Automatic Identification Systems

In 2000, the International Maritime Organization (IMO) adopted a new requirement as part of a revised Chapter V of Safety of Life at Sea (SOLAS) for ships to be fitted with an AIS receiver. The system aims to improve a mariner's awareness of other vessels by augmenting radar, visual and sound as collision avoidance tools. AIS broadcasts key information about a vessel (such as its identity, position, type, speed and course) at regular intervals through Very High Frequency (VHF) radio waves.

AIS exists in two forms: Class A and Class B; the former is fitted in all vessels required to carry AIS under SOLAS and the latter is on a voluntary basis by non-SOLAS vessels such as recreational craft and commercial fishing vessels less than 15m in length.

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

- All ships greater than or equal to 300 gross tonnage and engaged on international voyages;
- Cargo ships greater than or equal to 500 gross tonnage not engaged on international voyages; and
- All passenger ships irrespective of size.

AIS uses one of two VHF frequencies, namely:

- AIS 1: 161.975 MHz; and
- AIS 2: 162.025 MHz.

Vessels transmit packets of dynamic and static information in 26 millisecond timeslots of which there are 2,250 each minute. Static data, i.e., that defining the unchanging description of a vessel, e.g. its identity, type,

etc. is broadcast every 6 minutes. Dynamic information giving details of the vessels passage and actions, e.g. course, speed, heading, etc. is broadcast at intervals dependent on the speed and type of vessel. The normal reporting interval for dynamic Class A AIS information can be found below:

Table 9: Class A shipborne mobile equipment reporting intervals⁶

Ship's dynamic conditions	Nominal reporting interval
Ship at anchor or moored and not moving faster than 3 knots	3 min(1)
Ship at anchor or moored and moving faster than 3 knots	10 s(1)
Ship 0-14 knots	10 s(1)
Ship 0-14 knots and changing course	3 1/3 s(1)
Ship 14-23 knots	6 s(1)
Ship 14-23 knots and changing course	2 s
Ship > 23 knots	2 s
Ship > 23 knots and changing course	2 s

For AIS Class B installations, the reporting intervals are:

- 3 minutes for a vessel at anchor (speed of less than 2 knots); and
- 30 seconds for a vessel underway (speed greater than 2 knots).

6.2.2.1 AIS Limitations

It should be noted that there are limitations with AIS data. Class B transponders, of comparatively reduced range, are often used by recreational vessels, however, are not mandatory. Therefore, many small leisure and fishing vessels may not be equipped with AIS transmitters at all, with vessels under 10m less likely to carry AIS equipment than those over 10m. Additionally, if power saving is a concern, transponders may not be switched on.

While class A AIS is mandatory on most larger vessels, military or government vessels not wishing to reveal their locations may switch transmitters off.

⁶ ITU-R M.1371-5 - https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.1371-5-201402-!!!PDF-E.pdf

6.2.3 Stakeholder Consultation

For this NRA update, comprehensive stakeholder consultation was undertaken with local and national consultees in accordance with MGN 654. **Table 10** includes a summary of the consultation feedback relevant to shipping and navigation. The full meeting minutes for each consultation meeting are available within **Annex D**.

Stakeholder consultation has previously been undertaken as part of the Preliminary Hazard Analysis (PHA) initially (Phase 1 - National), the 2019 NRA (Phase 2 – Local and National) and the 2020 NRA Addendum in accordance with MGN 543.

While the opportunity was taken to consult as widely as possible to inform this sitewide update, the opportunity was also taken to consult local users on a possible initial device installation, to inform device specific assessments in due course.

Overall, the consultation process was positive and well supported, and highlighted the following key points:

- The traffic captured within the survey looks normal and as expected;
- The only noticeable change in traffic observed in recent years was when the Marina was closed in 2018, which saw a reduction in recreational users. A number of consultees also commented that the number of kayaks has increased in summer. Overall, the traffic has not had a noticeable change since the previous assessment;
- All ferries that transit to Holyhead may undertake weather routing more frequently in the winter;
- The traffic data representing summer may be higher than shown within data. The consultees suggested that this could be because of the slightly harsher weather than predicted and a shift in the regatta dates;
- The number of Stand-Up Paddleboards (SUPs) has slightly decreased but the number of experienced kayakers has increased. South Stack is regarded as an area for experienced kayakers;
- The main concerns for the sitewide were breakout moorings and the risks surrounding the “Gold Area”;
- Many stakeholders suggested that restrictions could be placed on navigation through the “Gold zone” to mitigate a contact with the device;
- Traffic is likely to increase over time with the Holyhead Port expansion (including a DW jetty), plans for bunkering activities, plans to become a port of operation for OREIs and the introduction of a new Marina and holiday park.
- Minesto appear to have moved from Holyhead to the Faroe Islands.

Key comments and concerns are summarised in **Table 10** below, and full meeting minutes are given in **Annex D**

Table 10: NRA Stakeholder Consultation Meeting Key Comments and Concerns.

Consultee	Key Shipping and Navigation Comments / Navigation Concerns
MCA	<ul style="list-style-type: none"> The MCA said they were content with the traffic conditions and will await the combined analysis of summer and winter before they comment. The MCA asked about fishing data and specifically if any had been captured and how Marico were going to capture the seasonal variation. The MCA said that ferries are more likely to undertake weather routeing in the winter and suggested that this be captured within the NRA. No changes to the area for vessel traffic from the previous NRAs.
Anglesey Charter Fishing/Commercial Fishermen	<ul style="list-style-type: none"> The traffic data looks exactly as expected. Fishermen work in and around the MDZ from mid-summer until now (November) and suggested that the work within the MDZ is all pot fishing. Fisherman work all year round. The Minesto project located in Holyhead Deep has moved to the Faroe Islands and no longer operate in the area. Vessels have been interested in the LiDAR research buoy currently within the MDZ. Once the marina has been built, recreational traffic would likely pick up again. The MDZ area experiences extreme winds and tides. Recreational dive vessels should also be included. During the summer months, fishers could have 700-800 pots in the area at any one time. 50 pots can be on one line that is ¾ mile long.
RNLI	<ul style="list-style-type: none"> The area may be busier (in summer) as the Regatta was cancelled through August and took place at a later date. Traffic numbers might be higher due to a post-covid surge. However, it won't be particularly busy within the vicinity of the MDZ. Kayak movements have increased since the covid pandemic (2019). The RNLI have not only recovered inexperienced users but also experienced users this year.

	<ul style="list-style-type: none"> The RNLI won't send out a team in harsh weather.
Trinity House	<ul style="list-style-type: none"> Trinity House suggested that there were no changes with regards to Aids to Navigation or general traffic that they could recall. Trinity House mentioned that there are no planned updates/changes to aids to navigation in the area of interest.
Anglesey County Council (ACC)	<ul style="list-style-type: none"> ACC suggested that he expected more activity coming out of Trearddur Bay. ACC suggested there appears to be less vessels on the water that use slipways and suggested that this could be down to the weather or the economic downturn. ACC suggested that there is certainly less vessels than previous years. ACC said that there has not been much change to other vessel types but suggested that SUPs have taken a gradual but significant reduction which he believed was because the interest had faded. ACC mentioned that over the last 2 years, there has been minimal change to activity, however, labelled the area as a "Hot Bed" for Kayaks. Suggesting that the area is popular for the more experienced kayakers. ACC mentioned the Penrhos holiday park development and suggested that it may bring more leisure users to the area. ACC mentioned that South Stack will still remain an area for experienced kayakers and the development is likely not to affect Trearddur Bay.

Stena Line Ferries (SLF)	<ul style="list-style-type: none"> Stena Line Ferries (SLF) mentioned that cruise liners can pass through the (MDZ) area once a day in season and typically come from the south towards Holyhead/Liverpool. SLF stated that they travel from Dublin to Holyhead using the Adventure and Estrid. (Each vessel makes one round trip from Dublin). SLF explained that the “gold area” as defined within the study area is used as part of their weather routeing plan for when dealing with strong gales. SLF explained that this is rare but does happen. Regarding the Gold area, as the submerged devices can be at any depth, all merchant and fishing vessels will need to regard the area as a no-go area. Could result in some operational restrictions for ourselves when weather routing and will also effect other traffic routing to and from the port of Holyhead when approaching from or departing to the South. SLF made a comment regarding the “Restrict Navigation through the Gold and Green MDZ Zones” mitigation. MP mentioned that this is not ideal weather routeing plan as they pass through the gold area and if there are submerged devices in the area. SLF had concerns over break out moorings and if devices were to break out, they could drift into the path of the ferries. SLF mentioned that the port has plans to bunker commercial vessels from Holyhead port. SLF said that the port will only get busier as they have become a free port. The port has bought the DW layby berth and plan to increase cruise ship movements. This should bring business to the area and may allow the port to expand operations, which could include becoming a mobilisation port for recent developments
Irish Ferries	<ul style="list-style-type: none"> Irish Ferries (IF) mentioned that Stena Line and Irish ferries may cross the zone for weather routeing. More often in winter months. IF suggested that if weather was heavier, Irish Ferries would travel further south to head into Holyhead port. IF suggested that on the chart, the zones looked fine. But still expressed a concern. IF had concerns over a breakout mooring and the recovering of the devices. They asked if the devices would have AIS so they were visible.

Trearddur Bay Sailing Club (TBSC)/ Holyhead Sailing Club (HoSC)	<ul style="list-style-type: none"> The majority of their activity is within the Trearddur Bay area and can extend to Rhoscolyn Therefore 95% of their activity will not be affected by the development. They do have one event per year where vessels pass the stacks to Holyhead which involves 20-25 boats, however this only lasts for one day TBSC asked where the ("Marinus") research buoy is located in relation to the site and new devices. TBSC stated that kayaking is growing consistently, however, they are very weather dependant. The weather in June was very good and therefore more kayakers were seen. TBSC stated that there is no capacity for additional safe moorings or extra public slipways on the West coast of Anglesey making it unlikely for traffic increases apart from kayaks. HoSC questioned the "gold areas" safety with regards to the depth of the devices. HoSC was surprised at the volume of traffic as a lot of vessels don't use AIS. HoSC suggested that vessel patterns should be considered for racing vessels catching the "eddy" for safety. HoSC asked where the cable is and was concerned of a snagging risk HoSC agreed that most yachts sail and do not use their motor.
NCI	<ul style="list-style-type: none"> NCI said that kayak traffic had increased since the covid pandemic. NCI said that there were more smaller craft which included SUPs and Kayaks but was surprised that there wasn't more recorded during the NCI watch from the RSPB Café. NCI expressed concerns over developing in an area with a high traffic density.
Stena Line Ports (SLP) (Harbour Master)	<ul style="list-style-type: none"> SLP also mentioned that the port has plans to expand and increase activities. SLP mentioned they had concerns over ferry routeing with the new development. SLP asked if the re-routeing of a ferry being accounted for. SLP suggested that the submerged devices (Gold area) would be the biggest risk.

Sea Kayaking Alliance (SKA)/Canoe Wales (CW)/ Snowdonia Canoe Club (SCC)	<ul style="list-style-type: none"> • SKA mentioned they collected the kayak data and that kayakers have varied risk levels depending on the type of kayak they are using. • SKA suggested that weather wouldn't make much difference to a kayaker going out. • CW said that across Wales, recreational activities have decreased and experienced paddlers are more likely to visit Anglesey as it is considered within the industry to be a highly experienced area. • SKA added that kayaks riding waves leads to a high probability of capsizing and kayaks could drift into the zone. They suggested that this could be individuals or groups of 15. • SKA explained that SUPs get into the most trouble at sea as they are likely the most inexperienced. • SKA said that sea kayakers are trained at South Stack and that generally sea kayakers are lower risk as they are experienced. • SCC said that Canoe Wales consider the area to be an advanced area and it is a risk for inexperienced SUPs. • CW suggested that there have been 3 incidents in the last 10 years that he could recall where kayakers have capsized and drifted, all of which were luckily recovered. • SKA suggested that consideration must be given to third party risks such as business risks. • CW suggested that hazards will also be present from support vessels during device installation. • SKA suggested that Jet skis should be listed under powered recreational vessels. • SKA suggested that consideration must be given to people who have lost power. • CW suggested that the only risk present in the area currently is the (Marinus) buoy.
Rhosnegir Scuba	<ul style="list-style-type: none"> • Rhosnegir Scuba had concerns for people under the water who could drift into the devices. • Rhosnegir Scuba suggested a no-diving area be implemented.
UK Chamber of Shipping (UKCoS)	<ul style="list-style-type: none"> • Cruise traffic reduced during covid. This year (2023) is a representable year for cruise traffic. • Zonal approach was agreed with passenger ferries including the weather routeing during the original NRA process. • UKCoS suggested that a standardise approach would be useful towards the marking of the devices.

- UKCoS stated that the zonal approach mitigated concerns from the ferry users in the original NRA process.

The following organisations were invited and did not respond or were unable to attend consultation either online or in person:

- Bangor University Sub Aqua Club
- Anglesey Sea Kayaking
- Anglesey Sea Kayak Symposium
- Bangor University Canoe Club
- Snowdonia Canoe Club
- All Wales Boat and Leisure Show
- North Wales Cruising Club
- Red Wharf Bay Sailing and Watersports Club
- Anglesey School of Yachting
- Around Anglesey Race Organisers
- Charles Henry Ashley Society
- Royal Anglesey Yacht Club
- RYA
- RYA Cymru Wales
- The Yacht Shop Holyhead Marina
- Anglesey Adventures
- Anglesey Outdoor Centre
- Conwy Centre
- Mor a Mynydd
- Plas Menai
- Rib Ride Anglesey Boat Trips
- Sian Sykes | Psyched Paddleboarding
- Anglesey Tourism Association
- Holyhead Marina
- Holyhead Towing
- Liverpool Pilots
- Anglesey Charter Fishing
- Fishing in Wales Office
- My Way 2 Sea Fishing Charters
- SBS Charters Anglesey Aubrey Diggle
- Spindrift charters

- South Quay Shellfish
- Amlwch Harbour Master - Geoff Price
- Caernarfon Harbour Trust
- BDMLR
- UK Search and Rescue: Bristow Group Inc.

6.3 DATA ANALYSIS

6.3.1 Vessel Classification

Following assessment of the primary vessel types present within the area, vessel types were grouped into the categories outlined in **Table 11** for analysis and assessment within the NRA. The following vessel types remain unchanged from the previous NRA.

Table 11: Vessel Categories

Ref	Vessel Type Category	Draught	Including
1	Commercial Vessel	>3m	Cargo vessels, tankers, dredgers, survey vessels (draught >3m), buoy laying vessels, commercial fishing vessels/ fish carriers
2	Passenger Vessel	>3m	Ferries, cruise ships
3	Project Vessels	>3m	Cable laying vessels, barges and heavy lift vessels.
3	Fishing Vessel	<3m	Fishing Vessels
4	Powered Recreational Vessel	<3m	Yachts, power boats, recreational RIBs, Recreational fishing boats, recreational dive vessels, personal watercraft
5	Un-Powered Recreational Vessel	<3m	Sailing dinghies, kayaks, canoes, rowing boats, SUPs
6	Other Vessel	<3m	Tugs and tows, survey vessels, RNLI, construction and maintenance vessels, cable laying vessels, workboats, commercial RIBs

6.3.2 Vessel Track Analysis by Type

It should be noted that at the time of the surveys, a LiDAR Research Buoy was present within the area (See **Figure 2**). It was noted in consultation that recreational vessels had been to visit the buoy and therefore there might be more tracks within its vicinity that usual. The buoy is due to be removed from the area before the deployment of any devices.

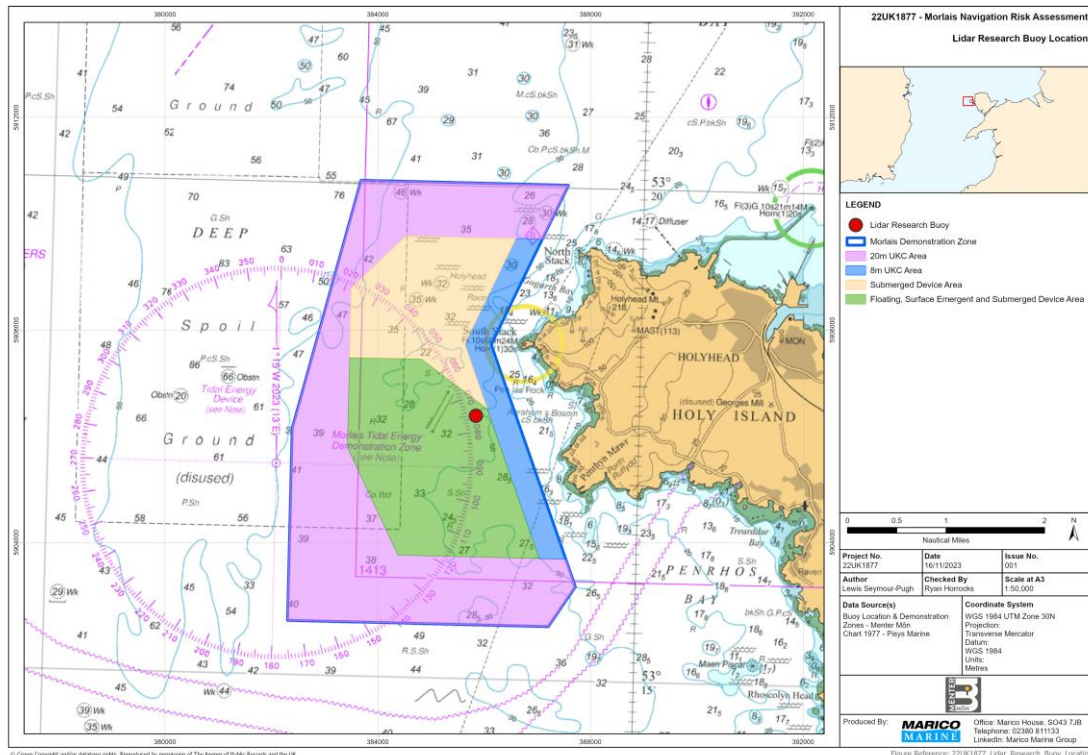


Figure 2: LiDAR Research Buoy Location

6.3.2.1 All Vessels

All vessel tracks recorded by AIS and radar between 23rd August – 29th August, 1st September – 7th September 2023 (summer Period) and 27th October – 9th November 2023 (winter Period) are shown in **Figure 3**. This figure demonstrates the inshore zone used throughout the summer period and the ferry route to the north of the MDZ utilised by Irish Ferries and Stena Line (see **Figure 7**). The NCI undertook observations of vessel numbers during the same time periods as seen in **Figure 4** below, total count for summer came to 327 and winter came to 117.

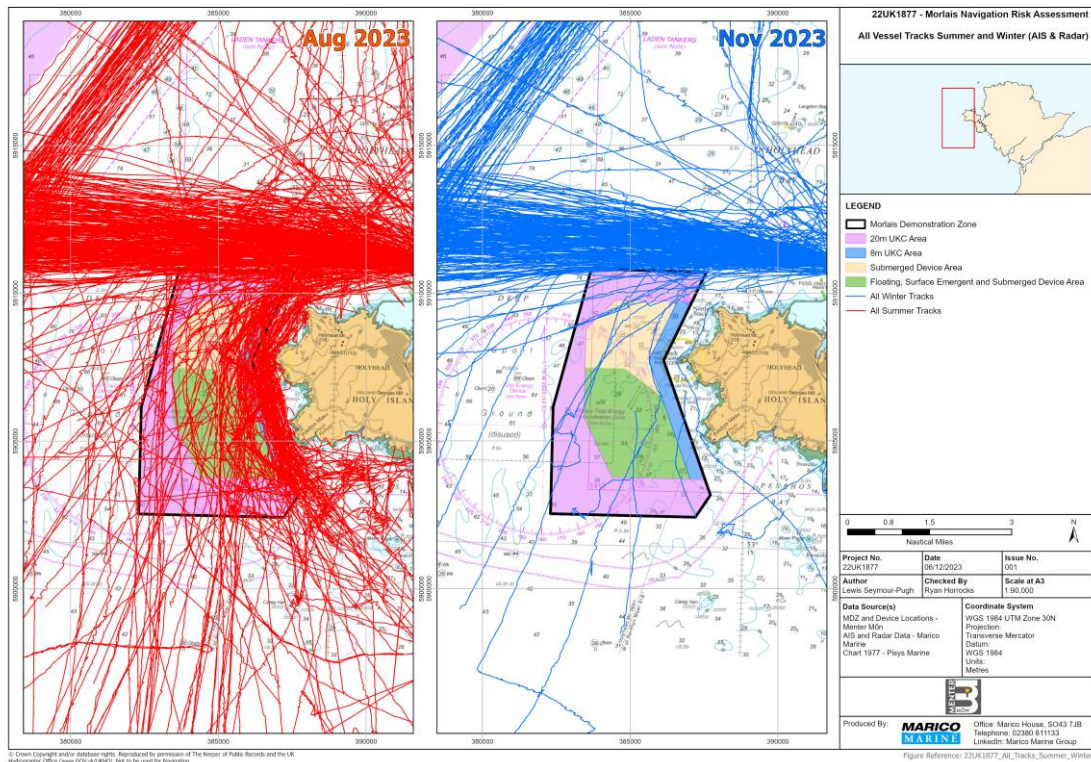


Figure 3: All Vessel Tracks

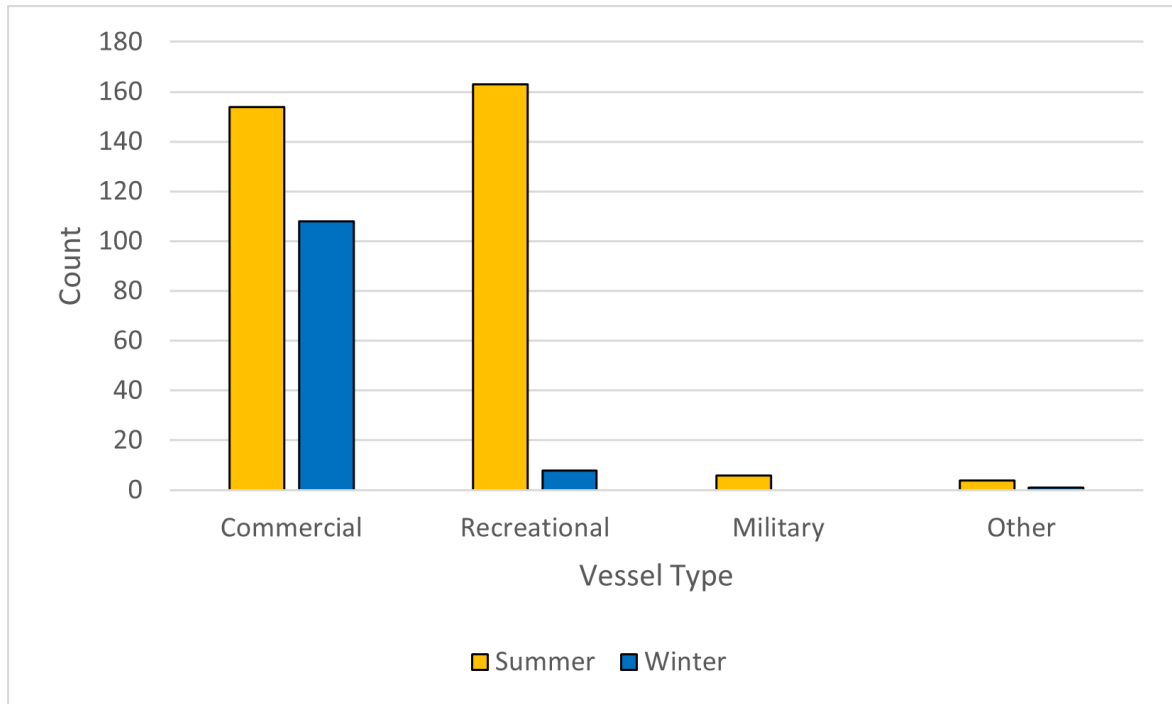


Figure 4: NCI Vessel Count by Type across Summer and Winter

6.3.2.2 Commercial Vessels

The tracks of commercial vessels (cargo and tankers) recorded during two-weeks of summer 2023 and two weeks of winter 2023 are shown in **Figure 5** and **Figure 6**.

1 cargo vessel was recorded within the MDZ during the summer dataset and 1 tanker vessel within the MDZ during the summer data. No cargo or tankers were recorded within either winter dataset.

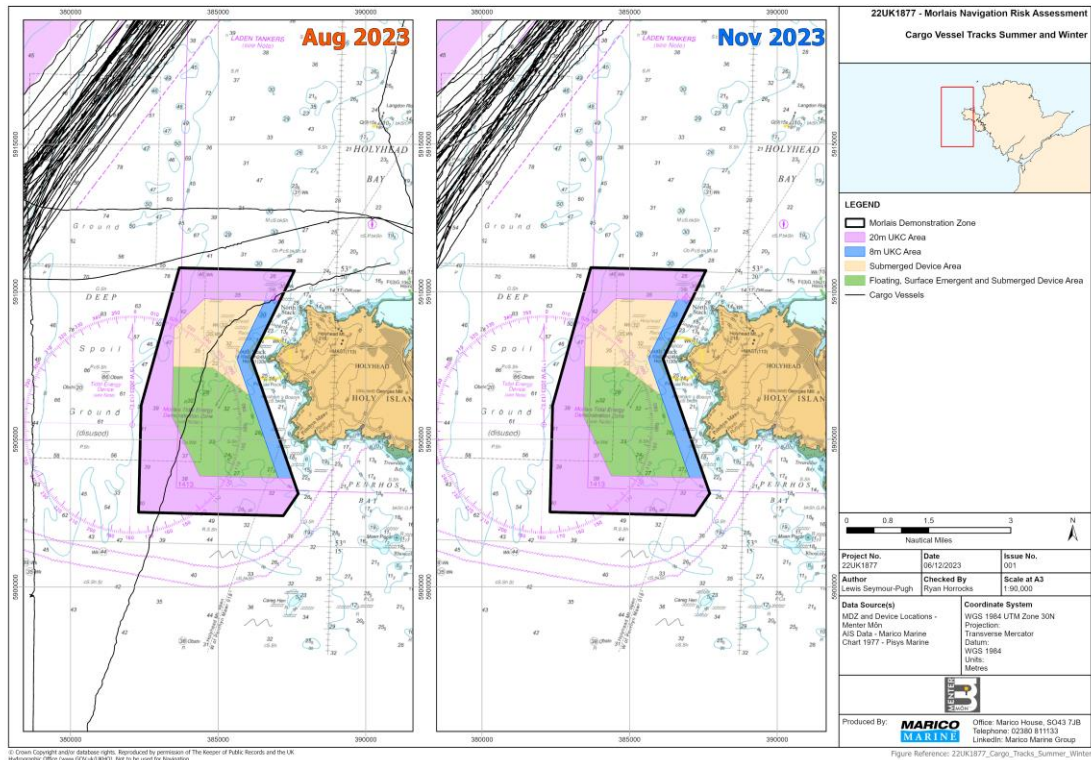


Figure 5: Cargo Vessel Tracks

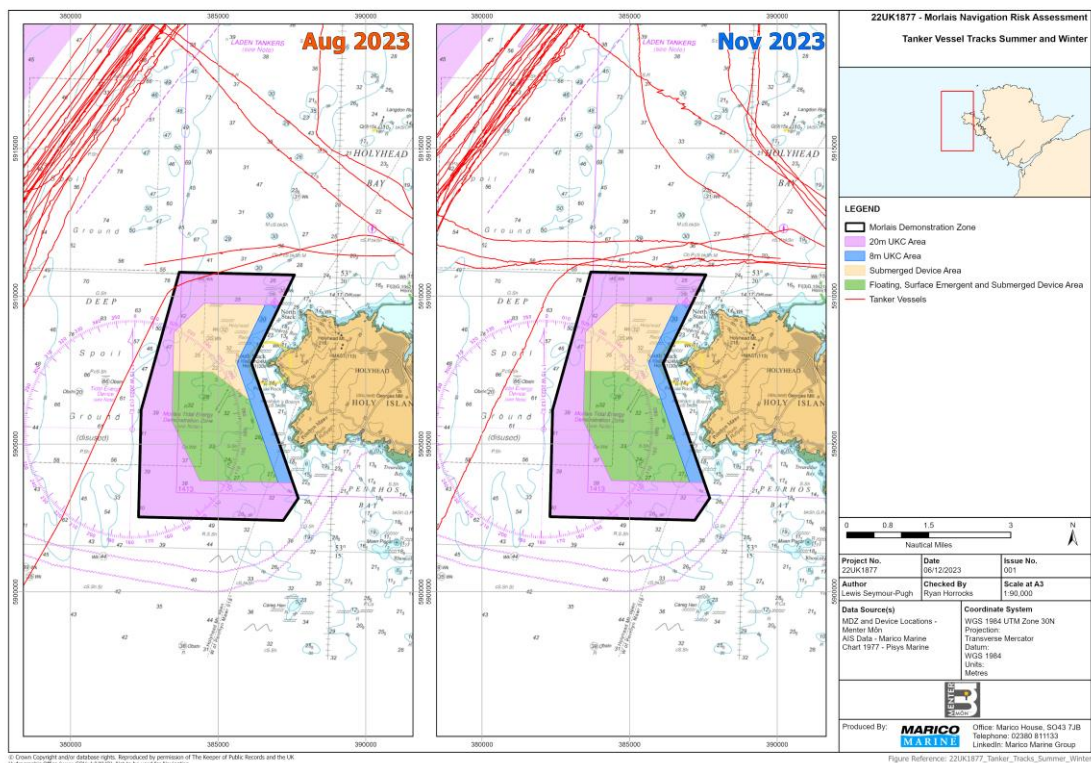


Figure 6: Tanker Vessel Tracks

6.3.2.3 Passenger Vessels

Irish Ferries and Stena Line ferries operate to the north of the proposed MDZ as shown in **Figure 7**. These ferries are seen to typically transit clear of the MDZ, however, can be occasionally seen to pass within the northern and western sections during poor weather conditions. 22 passenger tracks entered the MDZ during the summer period compared to 15 in the winter period. A depiction of poor weather routing is given within **Figure 8**.

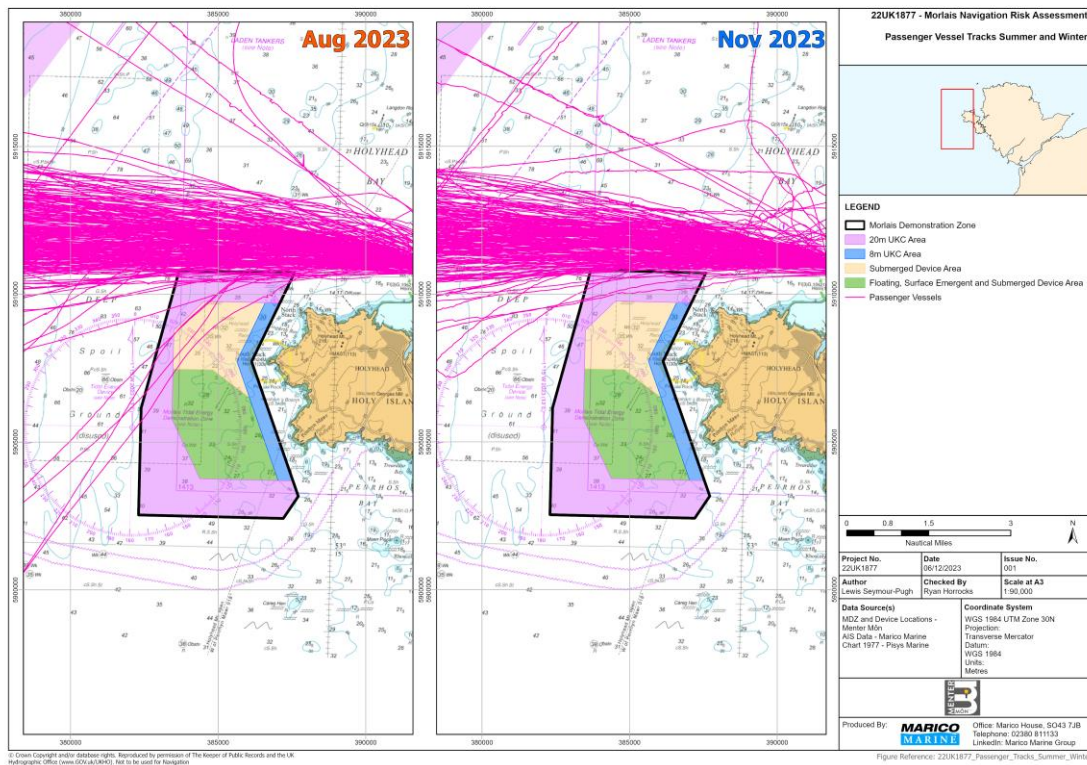


Figure 7: Passenger Vessel Tracks

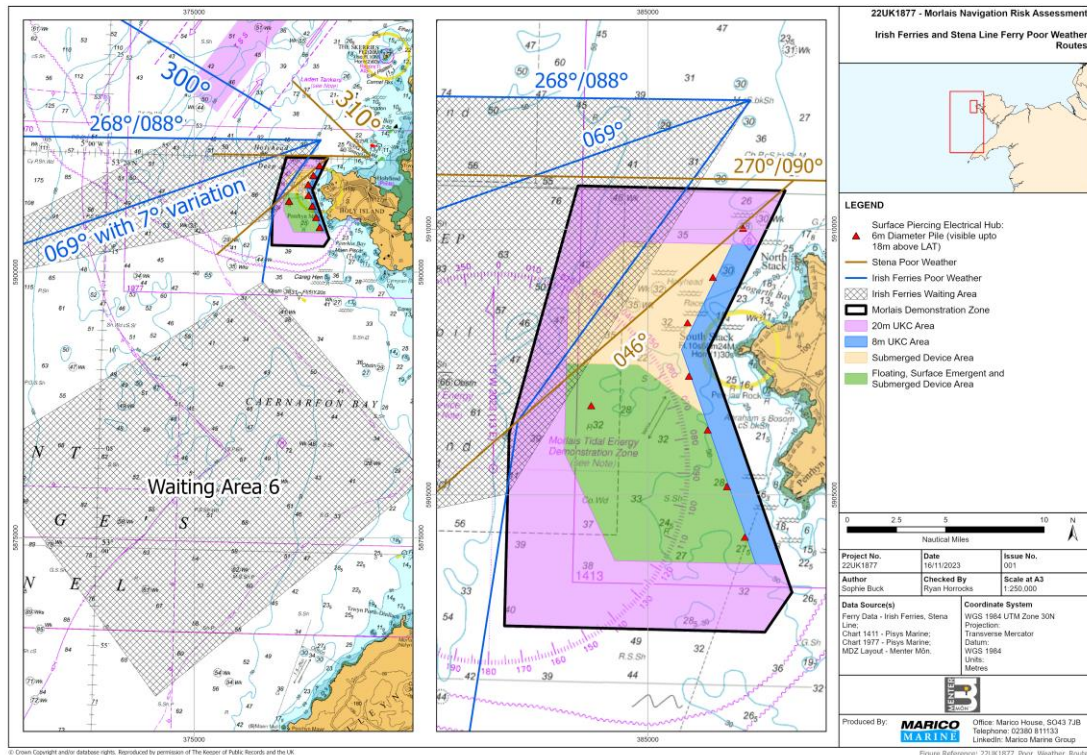


Figure 8: Ferry Poor Weather Routing

In addition to ferries, cruise ships were observed to transit within the MDZ and show the largest LOA of vessels within the area. Cruise ships undertake thorough passage planning and in contrast to ferries may more easily alter passage plans to accommodate for offshore infrastructure.

6.3.2.4 Military Vessels

Not all military vessels broadcast AIS so numbers may be lower within the dataset than actuality. **Figure 9** shows the military vessel tracks recorded within the summer and winter 2023 surveys.

4 military vessels were recorded within the MDZ during the summer period, transiting through the Zone. During the winter period only 1 military vessel was recorded within the MDZ.

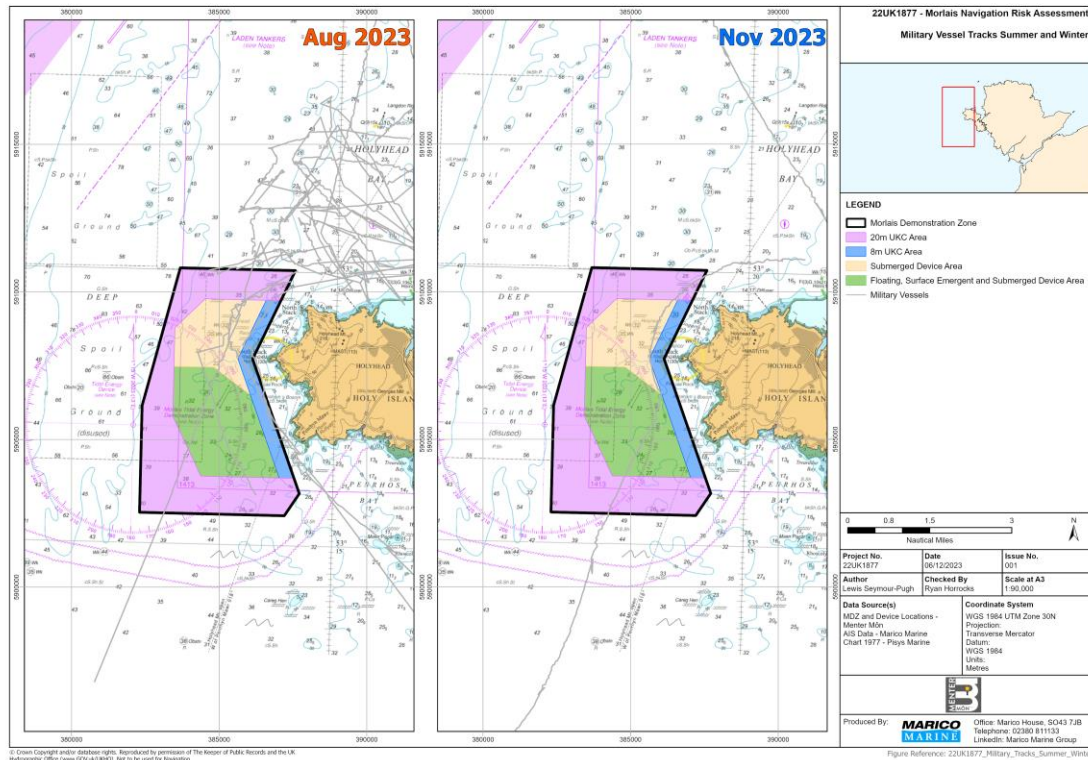


Figure 9: Military Vessel Tracks

6.3.2.5 Other Vessels

Figure 10 shows other vessel tracks within and around the MDZ, including tugs and tows, survey vessels, RNLI vessels, construction and maintenance vessels and cable laying vessels. *MV Seekat C* is noted undertaking Morlais project related surveys within the summer dataset, accounting for the specific shaped repetition of tracks within the figure. 8 other vessels were recorded entering the MDZ in the summer compared to 4 in the winter.

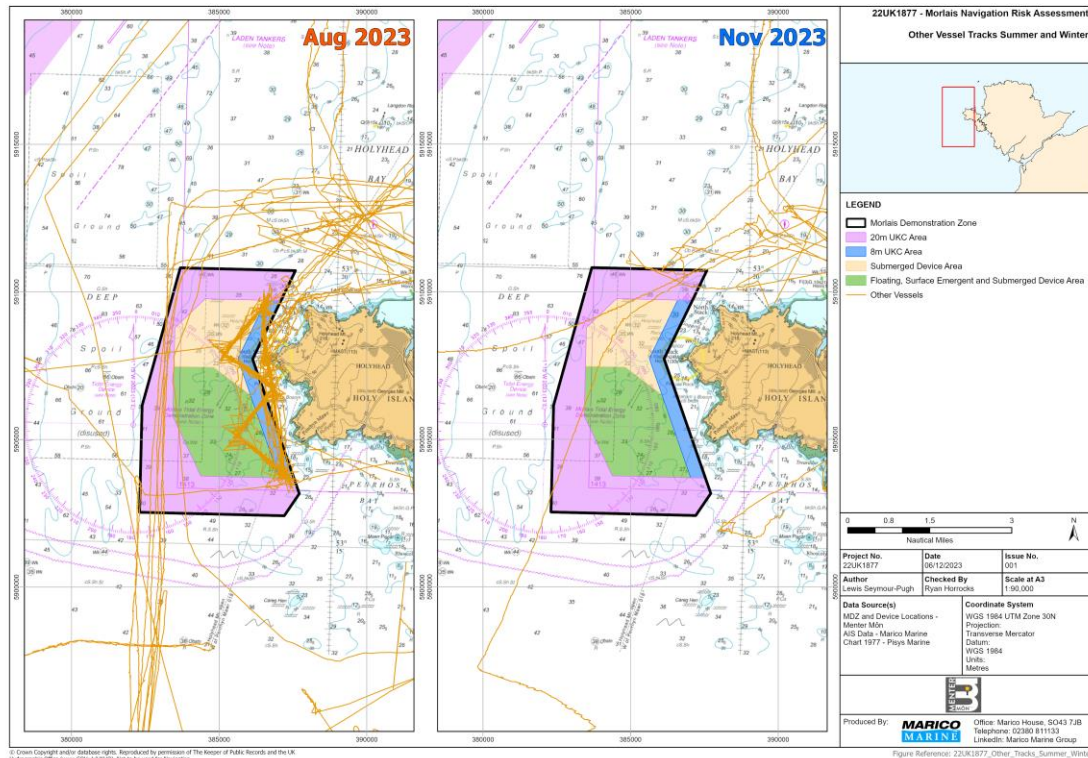


Figure 10: Other Vessel Tracks

6.3.2.6 Fishing Vessels

Holyhead is one of three main commercial fishing ports in Wales. Catch types within the vicinity of the MDZ include; velvet crab, lobster, green shore crab, whelks, scallops and skate. Fishing methods include; fixed netting, Danish ring netting, longlining and potting. It was noted during consultation that, although runs within the area are good, very little pelagic fishing occurs as there is no quota to fish it. Subsequently, no demersal or pelagic fish are landed at Holyhead.

Fishing vessels are present within the MDZ for both seasonal recordings, with 12 tracks in the summer and 2 tracks in the winter (**Figure 11**). A large number of fishing vessels are observed to use the Inshore Passage through the summer data, avoiding the demonstration zone. It should be noted that not all fishing vessels carry AIS equipment and so may be recorded within non-AIS radar data.

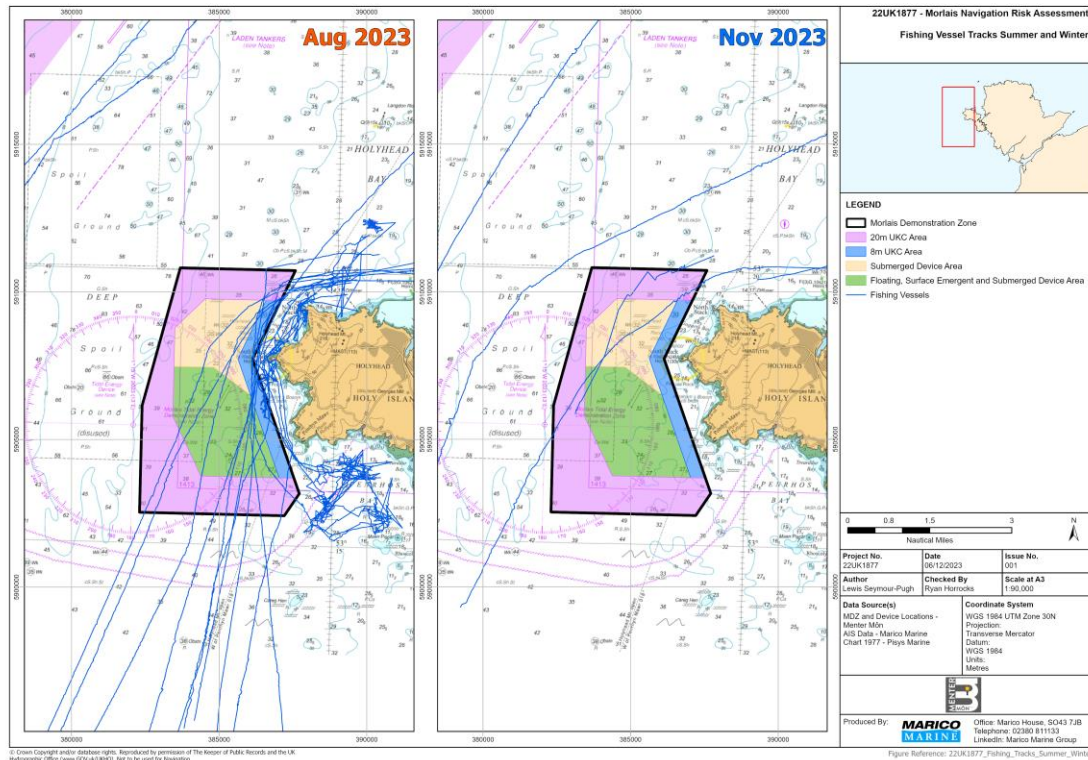


Figure 11: Fishing Vessel Tracks

Fishing data is also seen within the MMO dataset, recorded using the Vessel Monitoring System (VMS). VMS is required on vessels greater than 15m LOA and effort is presented in kW hours (kWh) (calculated by multiplying the time associated with each VMS report in hours by the engine power of the vessel concerned at the time of the activity).

Fishing intensity is shown within **Figure 12**. Fishing intensity is seen to be low at both the Northern and Western areas of the MDZ, with a higher intensity at the more central sections.

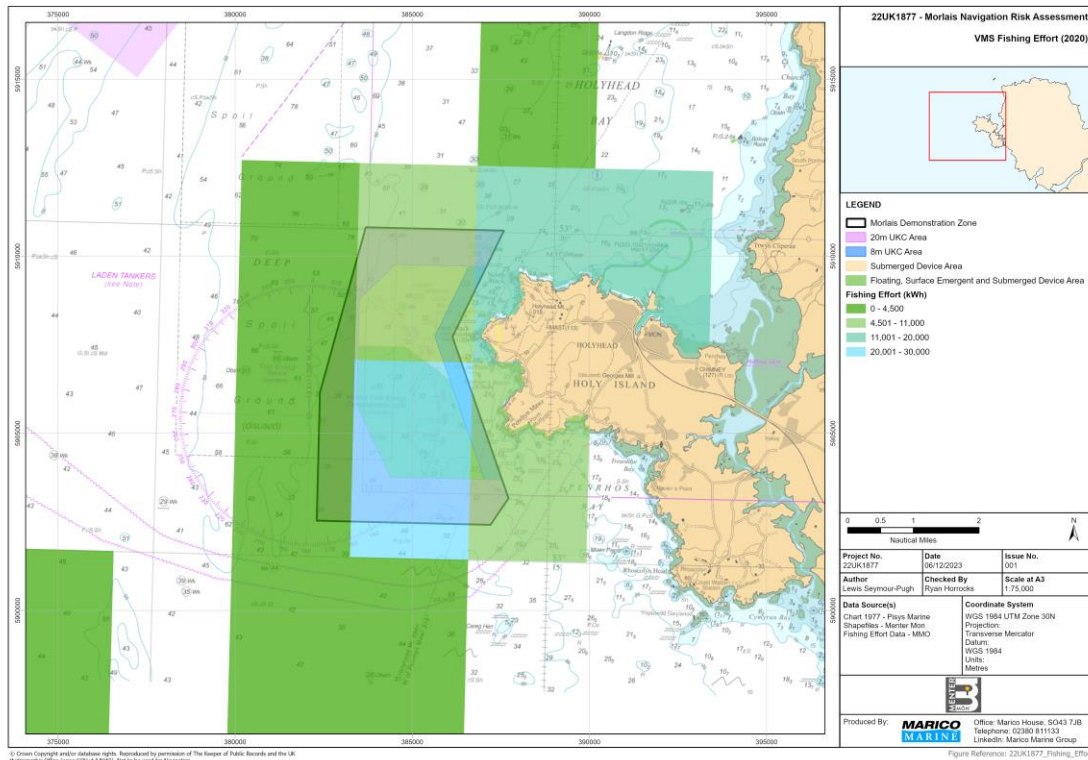


Figure 12: Fishing Intensity

6.3.2.7 Recreational Vessels

The tracks of recreational vessels are given within **Figure 13**. A majority of these tracks are close to shore, with a section using the Inshore Passage, expected within these crafts that hug the coast and are known to transit from Holyhead and Trearddur bay. A seasonal variation was observed during the survey periods with 43 recorded tracks within the MDZ through summer compared to only 1 track in winter.

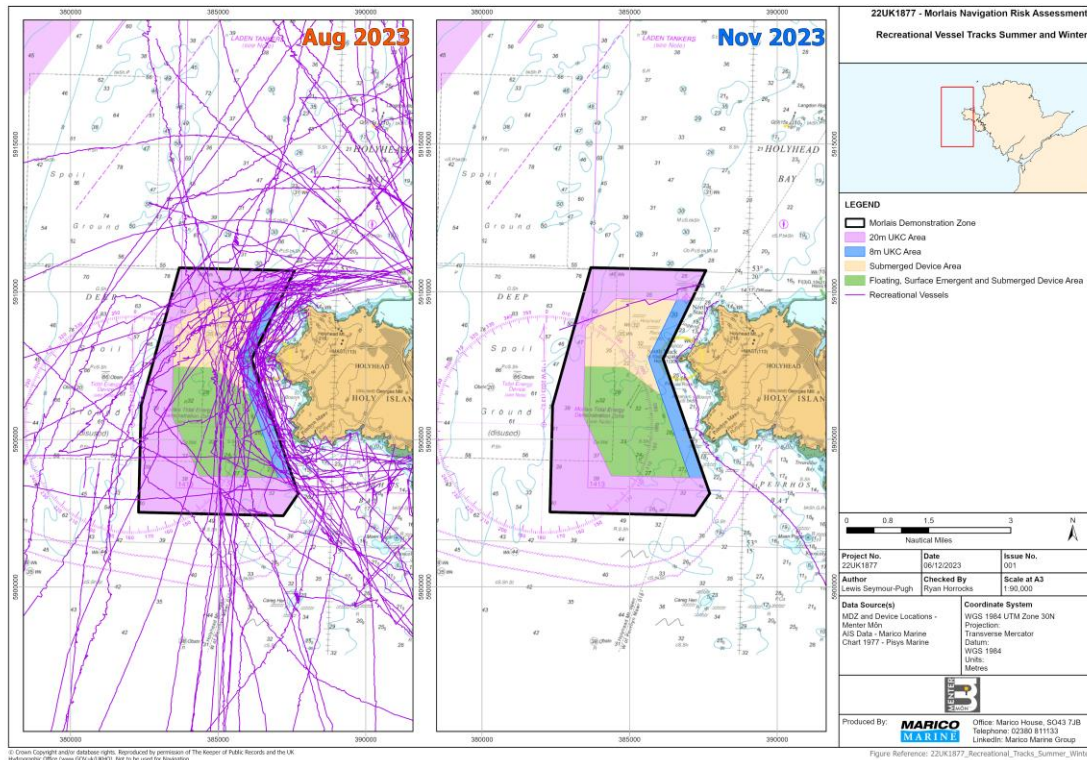


Figure 13: Recreational Vessel Tracks

The RYA UK Coastal Atlas of Recreational Boating (CA) provides relative AIS intensity data, general boating areas, and locations of clubs and training centres. The CA utilises AIS data from the summers of 2014 and 2017, to indicate the intensity of boating activity per 0.25km x 0.25km unit area in coastal waters around the UK. An updated version of the RYA Coastal Atlas is not currently commercially available.

It is noted that the dataset is limited in that it only represents vessels that carry AIS transponders, which may exclude a large proportion of small un-powered recreational craft. General boating polygon areas are provided to compliment the AIS data. The Intensity within these polygons can be seen within **Figure 14**.

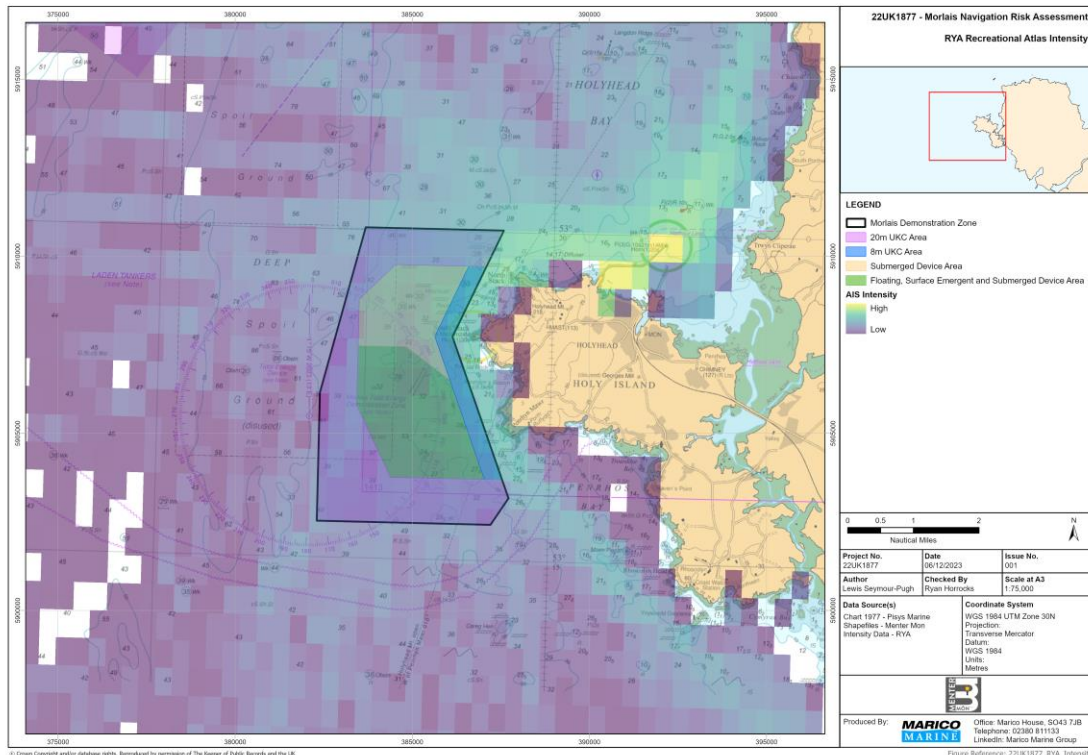


Figure 14: RYA Coastal Atlas AIS mean of summer 2014 and summer 2017. © Data reproduced under licence from the Royal Yachting Association.

Activities of small un-powered recreational craft such as kayaks, canoes and small dinghies, similarly to sailing vessels, were reported in consultation to operate primarily close inshore within the inshore passage. This is further corroborated by **Figure 15** which demonstrates indicative kayak transits, these tracks were provided by the Anglesey Sea Kayak Alliance. The majority of these kayak tracks are observed within the inshore passage, close to the shore.

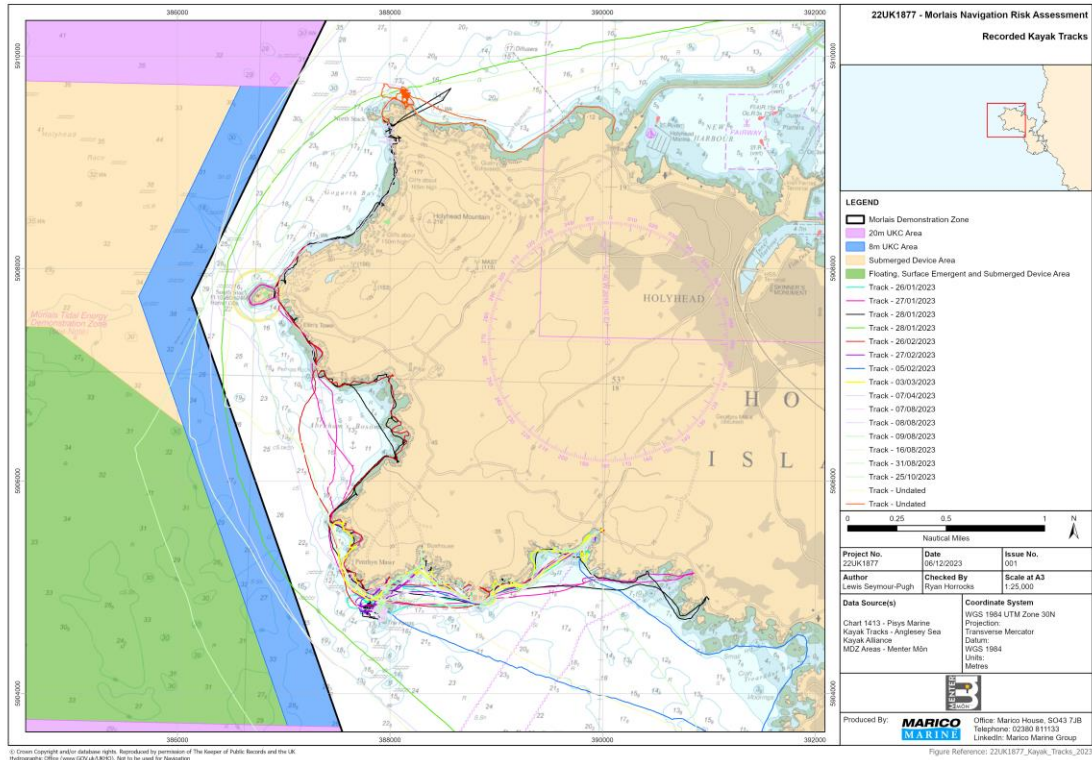


Figure 15: Indicative Kayak GPX Tracks

6.3.2.8 Non-AIS

Many vessels transiting through the study area do not carry AIS and as such have been recorded within radar data and displayed in **Figure 16**. Radar tracks have limitation in that they have a smaller range, can be affected by weather and do not provide vessel information but fill a useful gap in vessel data. During the data periods there were 196 recorded vessel tracks within the MDZ through the Summer period and 9 vessel tracks within the Winter period, this could tie into the similar difference in count observed in **Figure 13** (recreational vessels), as many of the non-AIS targets are likely smaller craft used recreationally and so would also demonstrate seasonal variation. Some of these tracks may have early termination due to radar limitations around south stack, causing targets to drop signal when close into shore around the survey site. Also, radar is limited by the size of vessels it can record, the smallest vessels such as kayaks and personal watercraft may not appear within recorded data.

This radar target data is also supplemented by the visual observations during the survey periods. **Figure 17** and **Figure 18** demonstrate the visual counts of vessel types during both summer and winter observations that transited either within the MDZ or the inshore passage. During the summer two-week period of observations 231 vessels were seen, whereas only 3 vessels were observed in the winter period. Visual observation dates slightly differ to radar records so may produce different counts.

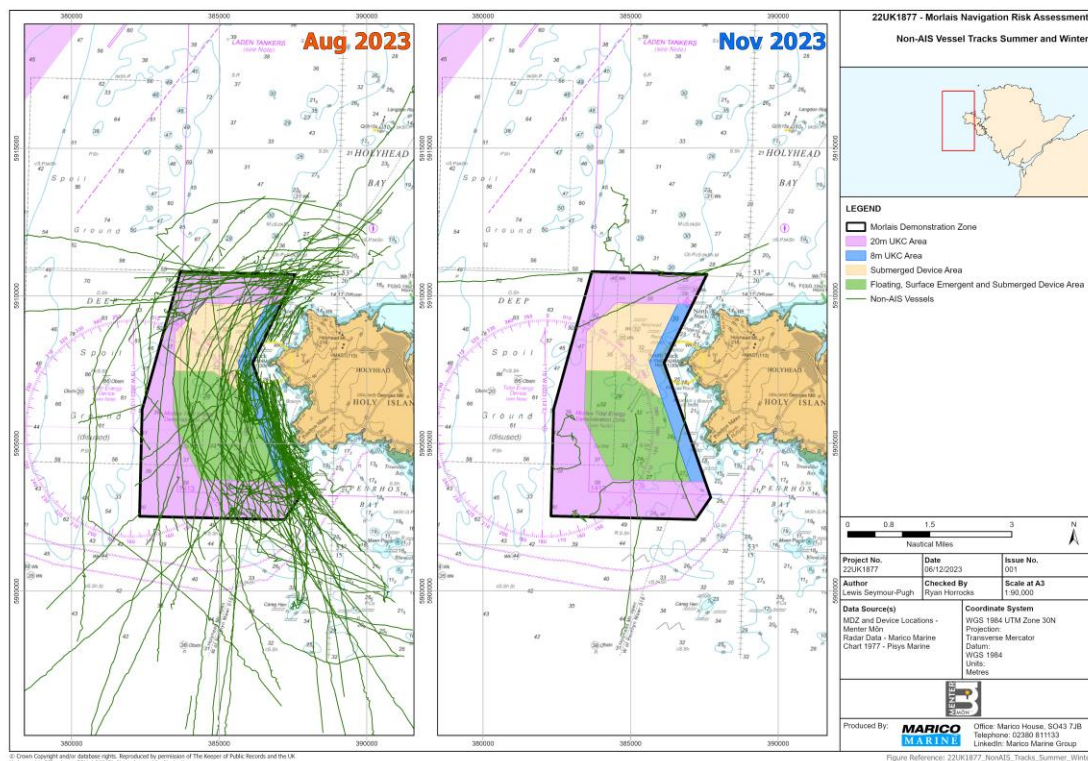


Figure 16: Non-AIS Vessel Tracks

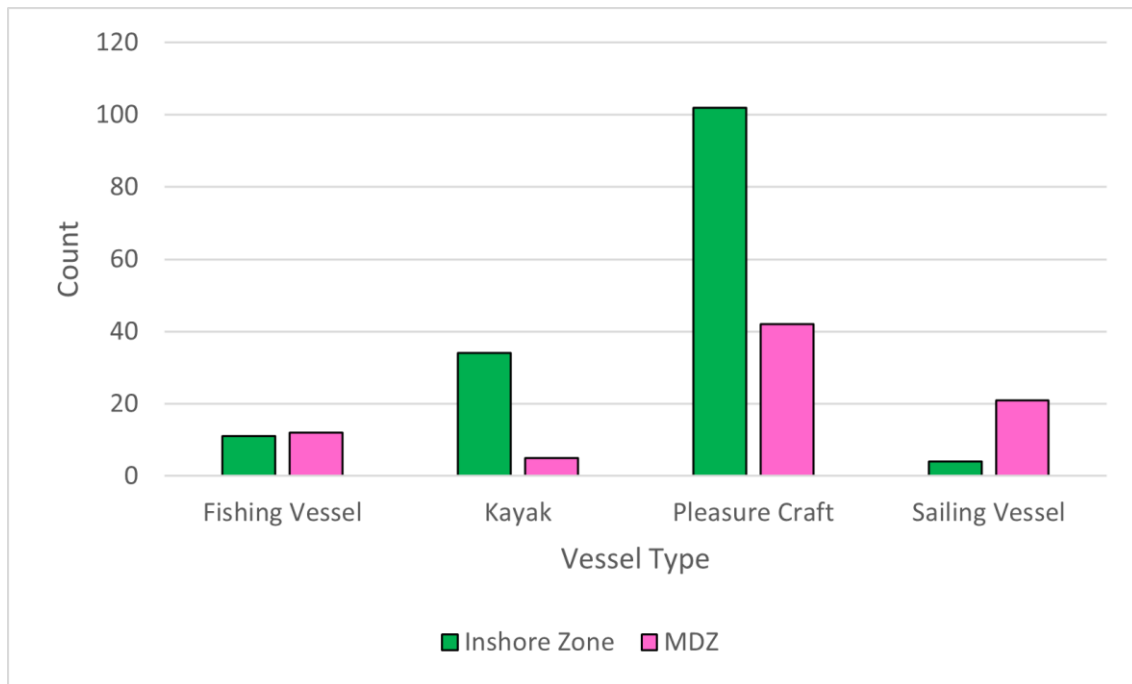


Figure 17: Non-AIS Vessels by Type within Summer Data

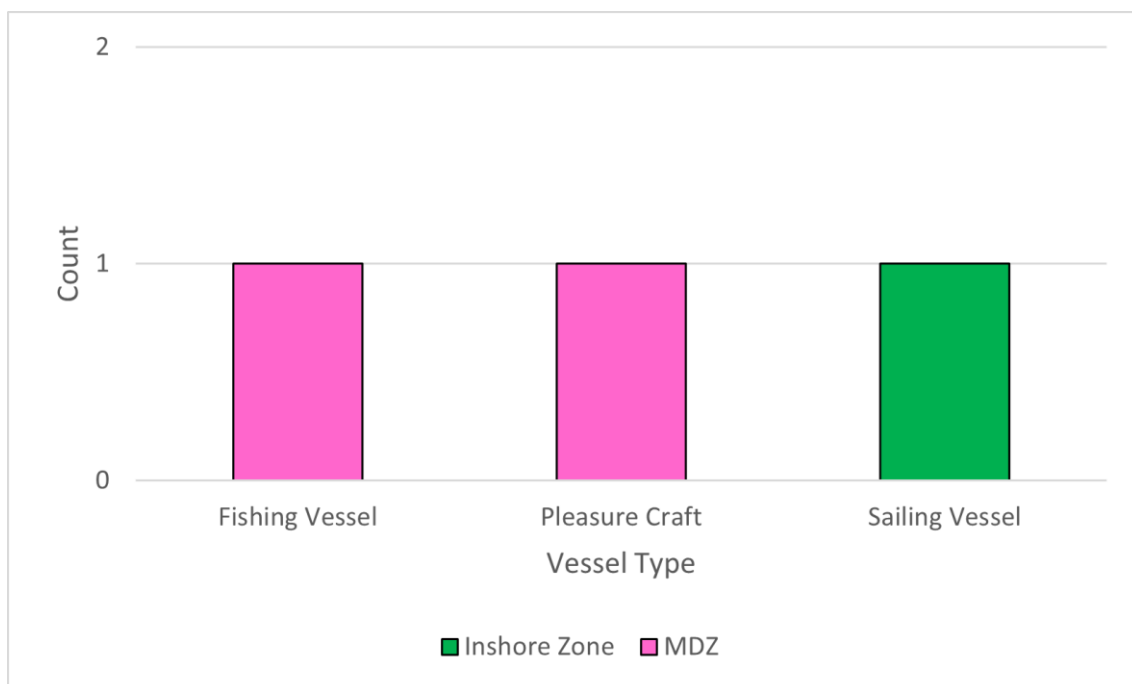


Figure 18: Non-AIS Vessels by Type within Winter Data

Table 12 illustrates the visual observations data of recreational vessels across both the summer and winter periods. Marico Marine visual observations record vessels either within the MDZ or Inshore Passage. NCI visual observations show a count of all vessels transiting in front of observation point at the RSPB South Stack, offering a different observations area. These counts demonstrate numbers of recreational users in the area and kayak counts where possible.

Table 12: Recreational Vessel Transits from Visual Observations – Summer and Winter Surveys

Data Source	Season	Duration	Time Period	Recreation/Sailing Vessel Count	Kayak Count
Marico	Summer	2 weeks	16 th August - 29 th August 2023	208	39
Marico	Winter	2 weeks	30 th October – 12 th November 2023	2	0
NCI	Summer	2 weeks	16 th August - 29 th August 2023	163	N/A
NCI	Winter	2 weeks	30 th October – 12 th November 2023	8	N/A

6.3.3 Vessel Track Analysis by Length

Vessel transits by LOA from AIS across summer and winter periods are shown in **Figure 19**. The majority of vessels transiting through the MDZ are <50m Length, some of the larger vessels such as ferries are observed to transit through northern most section of the MDZ. The largest length vessel recorded across both periods was the Island Princess cruise ship within the summer dataset, measuring at 294m LOA.

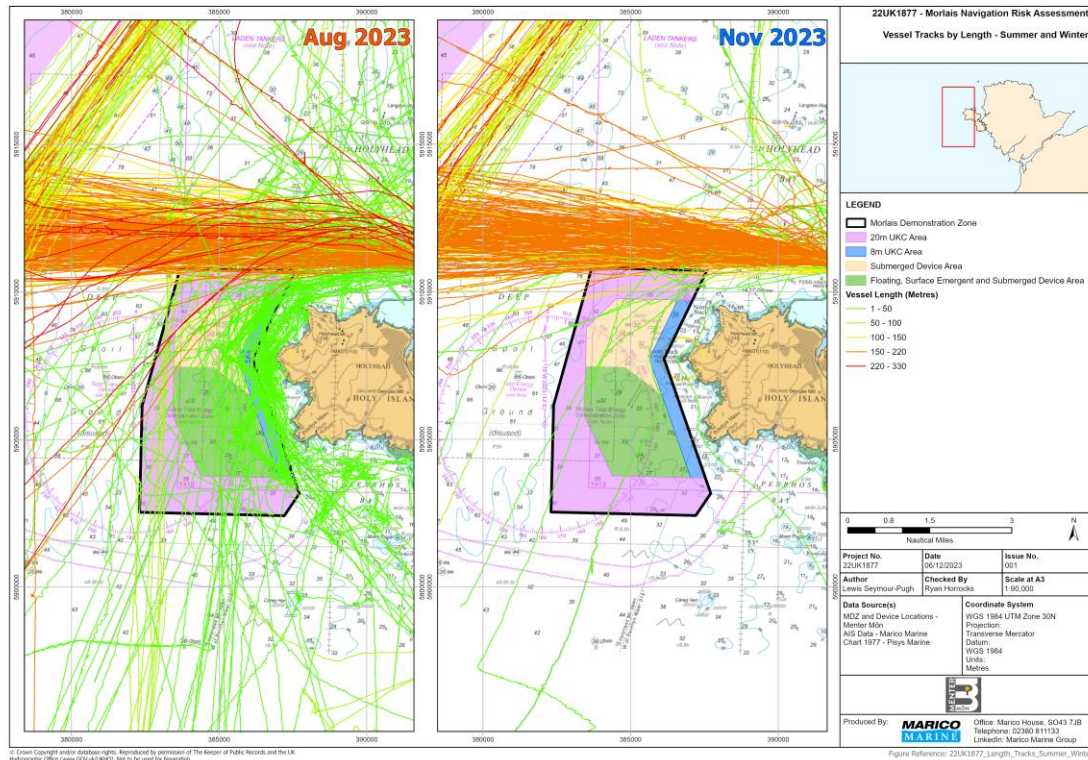


Figure 19: Vessel Tracks by Length

6.3.4 Density Analysis

Density analysis was undertaken across the sitewide study area. The sitewide analysis was undertaken against a 10,000m square grid. Vessel transit density from the summer and winter radar and AIS surveys are represented within **Figure 20**, depicting the northern ferry route and inshore passage but also displaying the traffic separation scheme in place to the northwest of the MDZ location.

It is evident that traffic density of larger vessels carrying AIS is low within the MDZ during the winter period, with some density increases in the northern most section of the MDZ as a result of the ferry route.

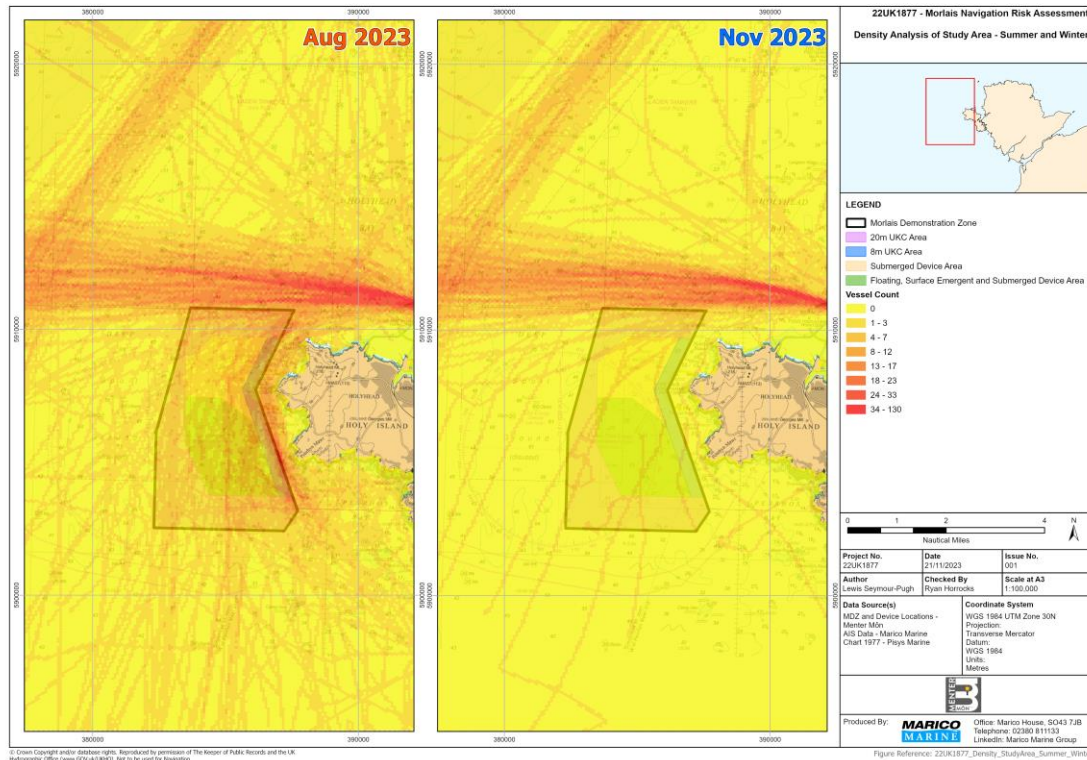


Figure 20: Density Analysis – Sitewide

6.3.5 Gate Analysis

Gate analysis is a tool used by Marico Marine to examine the frequency and direction of traffic through a linear 'gate'. The gate displays frequency and direction of vessel tracks passing through the transect.

Gate analysis was conducted across an east to west trending gate through the centre of the proposed MDZ from South Stack as depicted within **Figure 21**.

The sitewide gate analysis shown in **Figure 21** demonstrates the use of the inshore channel and shows the difference between the two passage lanes, however these numbers could be affected by loss of radar targets when close to the South Stack survey equipment. Overall, 153 transits were recorded within the summer data and just 5 during the Winter period. Of these summer transits 'Other' vessels were the most common showing 41% abundance as seen in **Figure 22**, this could be due to the activities of survey vessels in the area increasing transit counts.

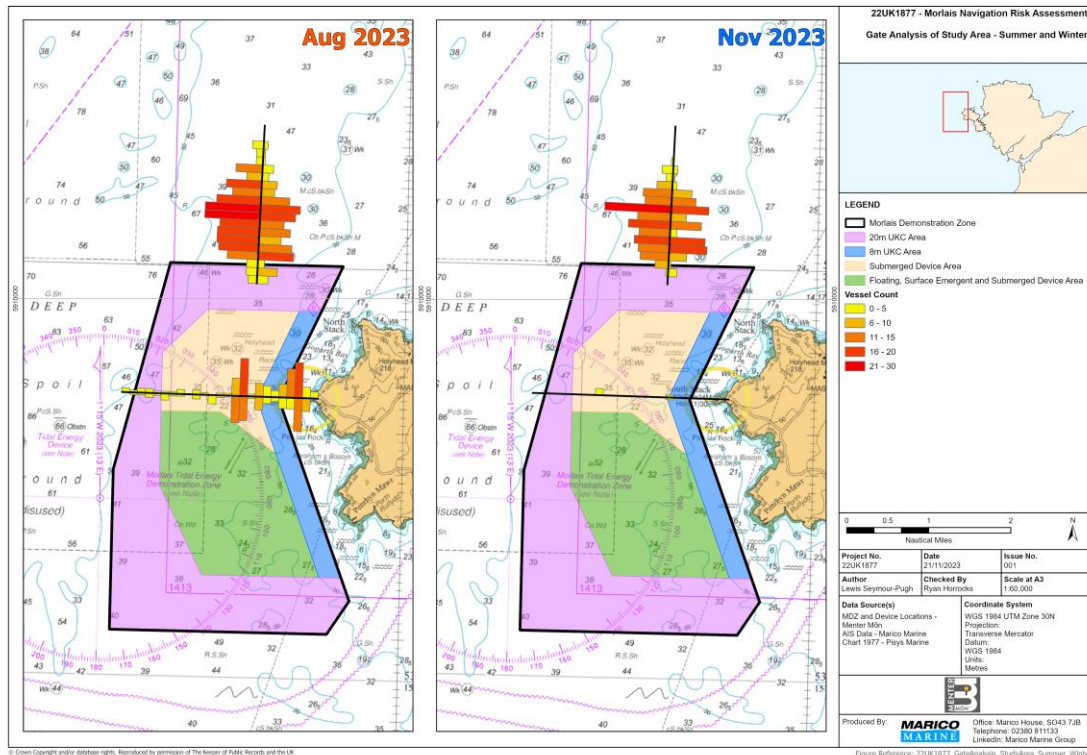


Figure 21: Gate Analysis – Sitewide

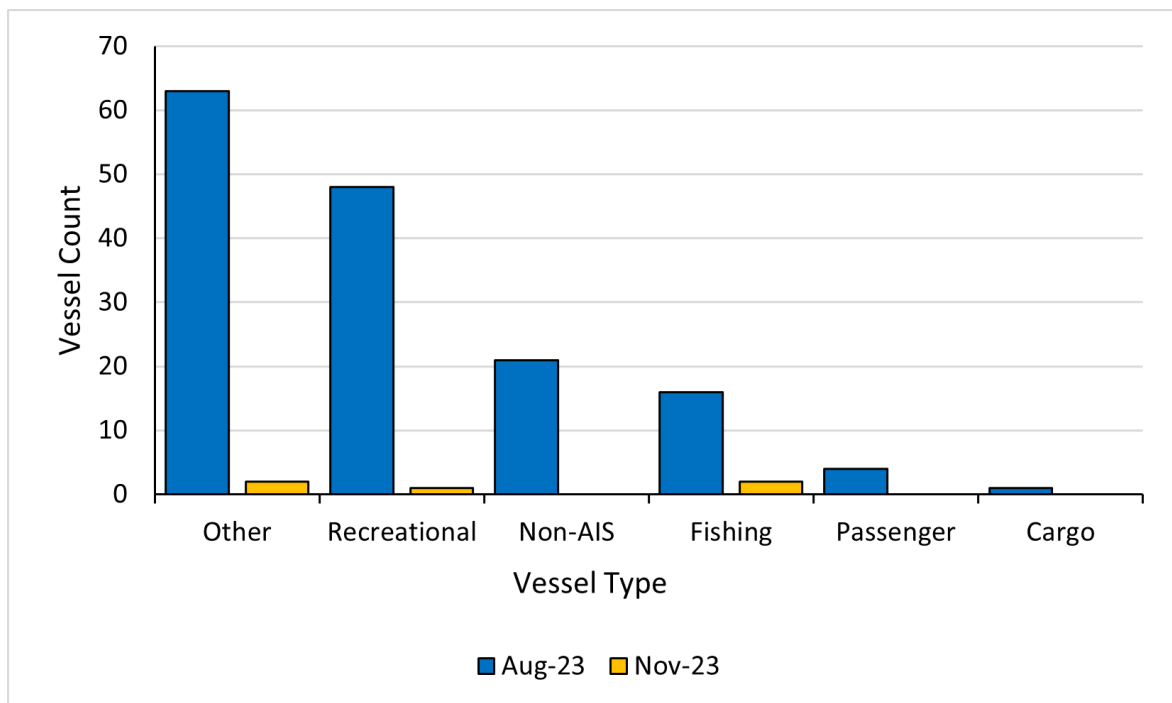


Figure 22: Frequency of transits by vessel type

Length of vessel transiting the sitewide gate are shown in **Figure 23**. The majority (85%) of vessels are less than 15m LOA in the summer period, with the largest vessels being cruise ships recorded entering the MDZ. 5 vessels were recorded transiting in the winter period with lengths no greater than 45m.

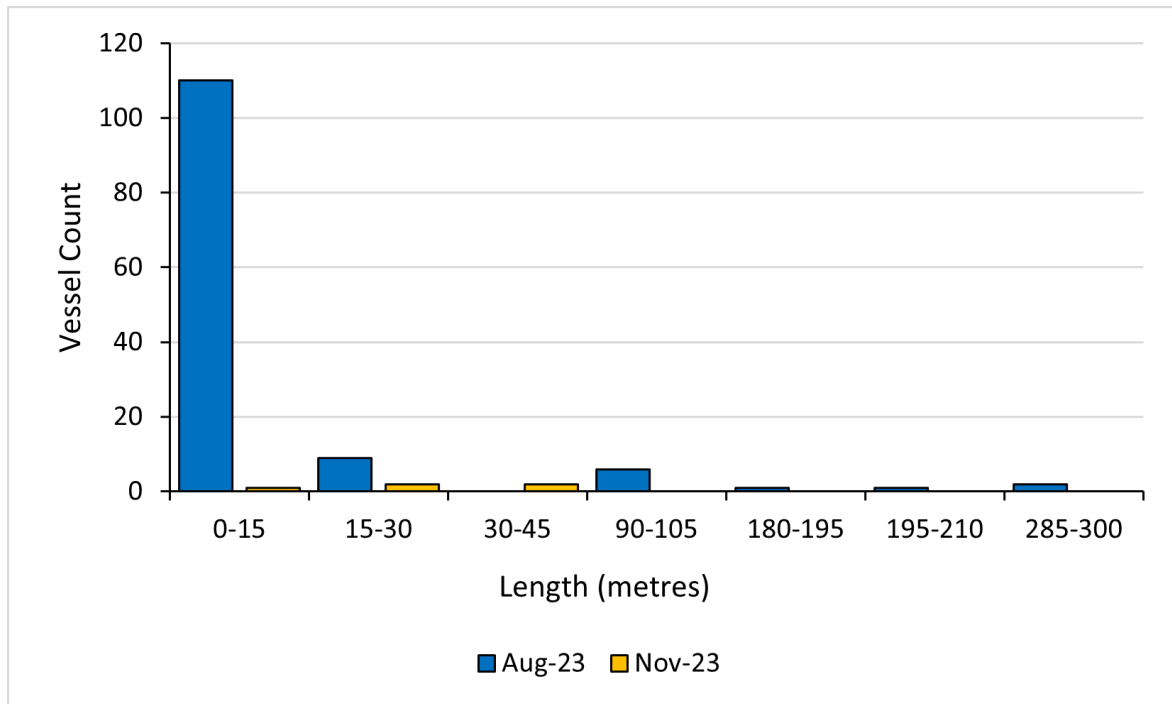


Figure 23: Vessel transits by LOA

Draughts of the sitewide gate are shown in **Figure 24**. The most common summer draught was between 3m and 8m accounting for 52% of transits, there were two vessels with recorded draughts greater than 8m, both of which were cruise ships.

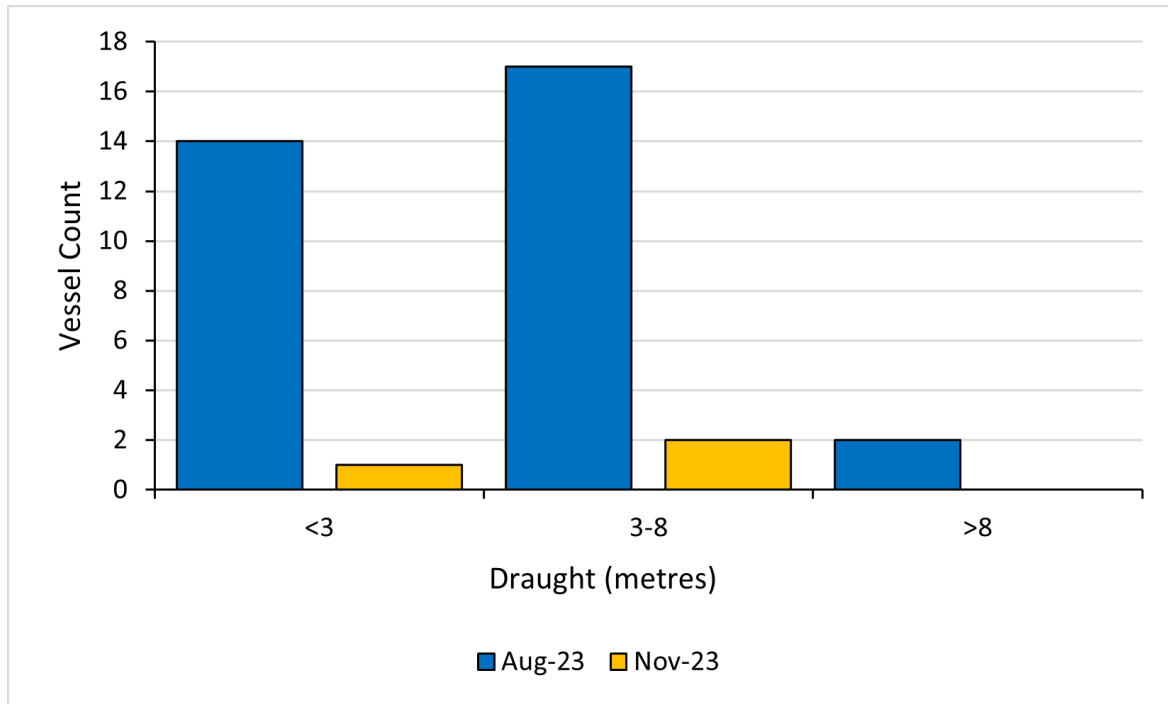


Figure 24: Vessel transits by Draught

6.3.6 Future Vessel Traffic Levels

Account must be taken of any future changes to the vessel traffic profiles anticipated near to the project site. These changes can be the result of:

- Macro-economic drivers to regional/national economy;
- Localised port developments (new terminals/marinas); and
- Planned alterations of existing activities/routes.

6.3.6.1 Future Traffic Predictions

During consultation with key stakeholders, the following was mentioned with regards to the future traffic profile of the site:

- Holyhead Port is undergoing works to increase the capacity of the port. This includes the development of a Deep-Water layby berth, plans to introduce bunkering activities, increase cruise ship movements and plans to rebuild the Holyhead Marina, which has been largely out of service since 2018;
- A scoping opinion from 2017 also details plans for a berth extension to enable the handling of more general cargo and larger cruise ships. Dredge material from Holyhead Port likely to be disposed of at Holyhead North disposal site to the west of the MDZ;

- From a tourism perspective, ACC currently have a focus on “quiet enjoyment” which includes appropriate usage of the sea, this includes encouraging kayaks and SUPs to safely use the waters. There are also plans to develop a new holiday park on the island which may bring more recreational users to the area. However, the area is considered to be “experienced” by the recreational community; and
- Due to the economic downturn in recent years, fewer recreational users have been seen to use the waters in and around the MDZ.

6.3.7 Interactive Boundary Assessment

An assessment of vessel routeing was undertaken to establish the potential impact that the MDZ could have on vessel traffic routeing. 90th percentile shipping lanes were identified using AIS data collected from both summer and winter data periods. The lanes illustrated in **Figure 25** were identified using the percentages of traffic generated from the gate analysis tool as seen in **Section 6.3.5**. The gates are drawn based on AIS vessel density, if a potential lane has less than 0.5 tracks per day, it is not identified as a busy lane/popular route.

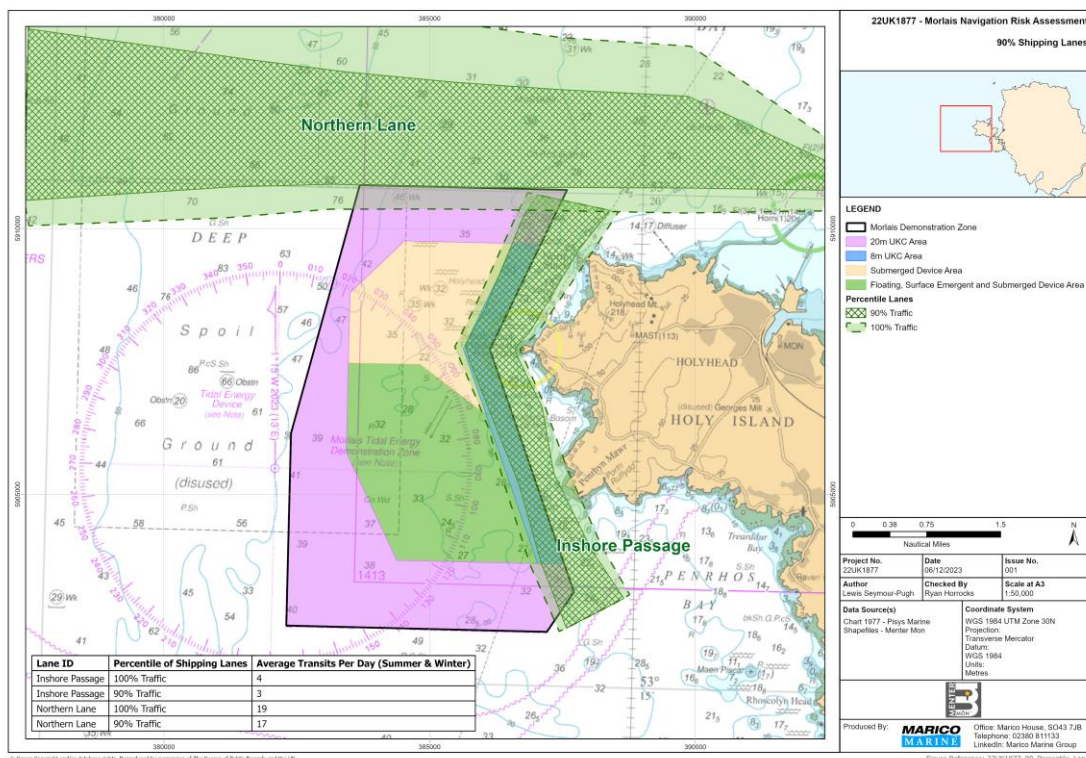


Figure 25: 90% Analysis

Two 90th percentile shipping lanes were identified within the vicinity of the MDZ. The inshore passage was found to cross into the gold zone of the MDZ, with the northern lane being approximately 0.55nm from the gold zone of the MDZ at the closest point of approach. **Table 13** shows an analysis for both lanes, including narrowest width, largest draught and length recorded and whether the lane is tolerable as per the template

shown within Annex 2 of the MCAs MGN 654. Both lanes have sufficient sea space on at least one side for the largest vessel identified to complete a round turn as per the Standards for Ships Manoeuvrability.

Table 13: 90% Shipping Lane Analysis

Lane	CPA (nm) from MDZ Gold and Green Zones	Narrowest Lane Width over MDZ (nm)	Av. No. of Tracks Recorded through each lane over both summer and winter	Av. No. of Tracks per Day over both summer and winter	Largest recorded Draught and Length (m)	Description	Tolerability as per MGN 654 Annex 2
Northern Route	0.55	0.99	467	17	Draught: 8.63 Length: 294	A ferry route across the north of the MDZ from Dublin to Holyhead used primarily by passenger vessels.	Tolerable
Inshore Passage	0.00	0.37	89	3	Draught: 3.00 Length: 24	The area between the coastline and MDZ, the passage also contains an 8m UKC zone within the MDZ.	Intolerable

7 HISTORIC INCIDENTS NEAR PROJECT SITE

To support the hazard identification and analysis of the frequency of incidents, a review of the Marine Accident Investigation Bureau (MAIB) incident database was conducted. Accident records within the vicinity of the MDZ and geographic areas of high-risk were analysed and are represented within **Figure 26**.

The RNLI returns of service dataset was also reviewed to look at callout numbers and incident type responded to within the sitewide study area. The location of these incidents is displayed within **Figure 28** for the areas within 5nm of the MDZ.

Small recreational vessels are also noted to experience incidents within the tide races. One incident recorded by the Anglesey Sea Kayak Alliance from August 2022 noted that SUP users had been caught out by faster tides/weather and required assistance in returning to shore from kayakers.

7.1 MAIB ACCIDENT REPORTS

Figure 26 shows marine accidents investigated by the MAIB in proximity to the MDZ between 1997 and 2022. There was a total of 191 separate MAIB incidents recorded within 5nm of the MDZ.

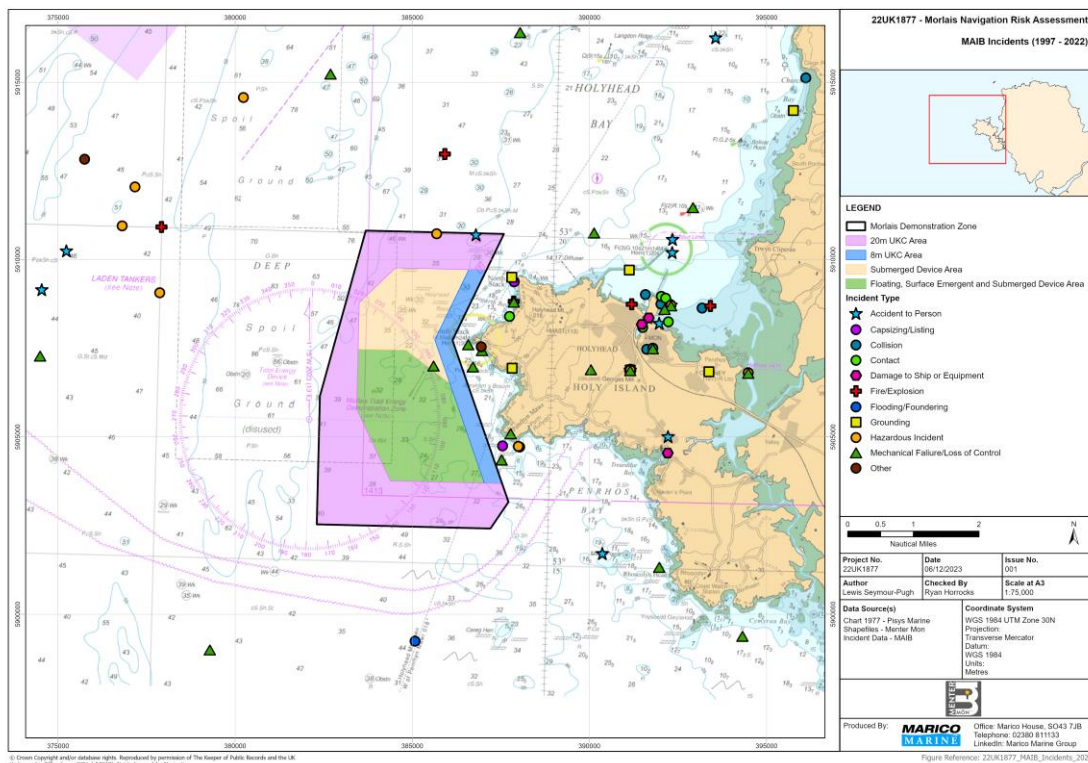


Figure 26: MAIB Incidents (1997– 2022)

The types of recorded incidents are seen within **Figure 27**, demonstrating the profile of risks within the surrounding areas. Accident to Person was the largest count of incident type and made up 35% of recorded events.

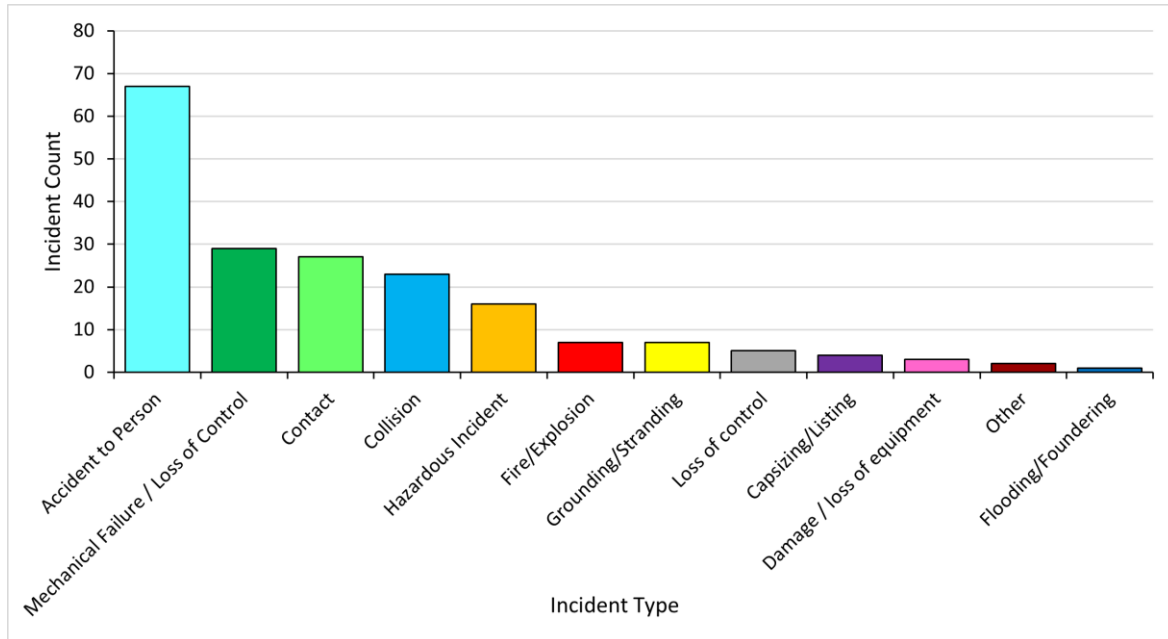


Figure 27: MAIB Incidents by type within 5nm of MDZ

7.1 RNLI CALLOUTS

RNLI callouts are shown within **Figure 28**. A total of 736 callouts occurred within 5nm of the MDZ, or approximately 56 per year over the 12-year dataset. Of these, 419 callouts (57%) were to leisure incidents as seen in **Figure 29**, with this next most common incident response being to people. RNLI callout data is unavailable past 2020.

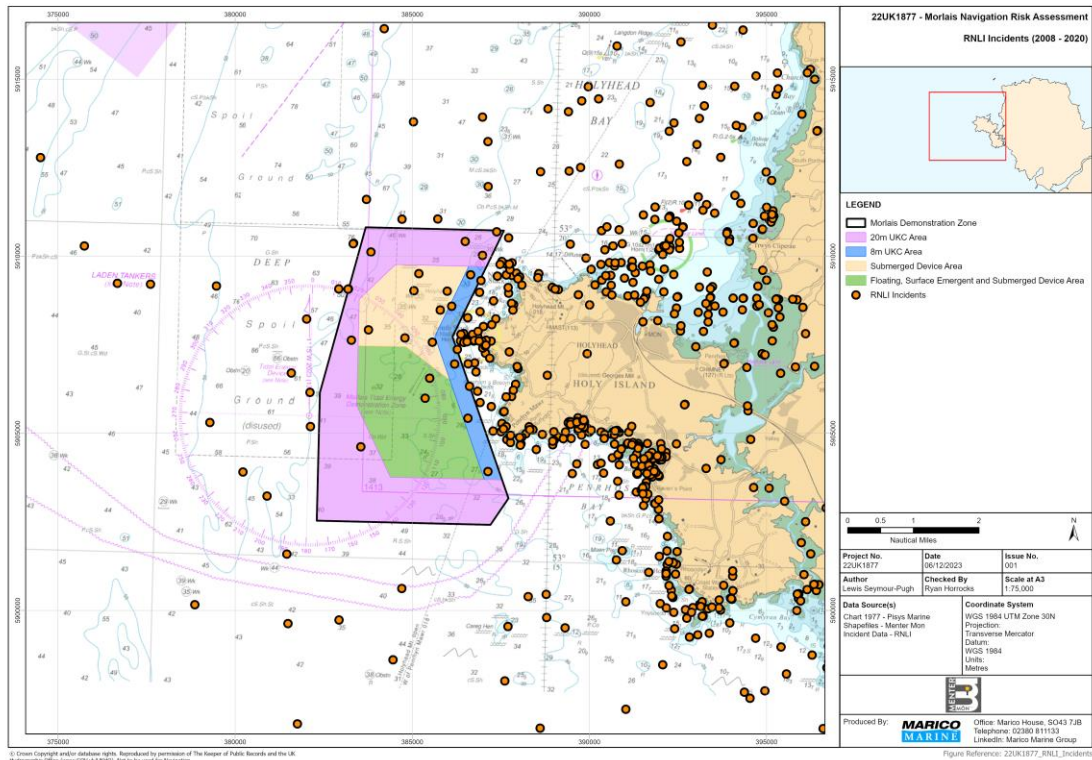


Figure 28: RNLI Callouts (2008 to 2020)

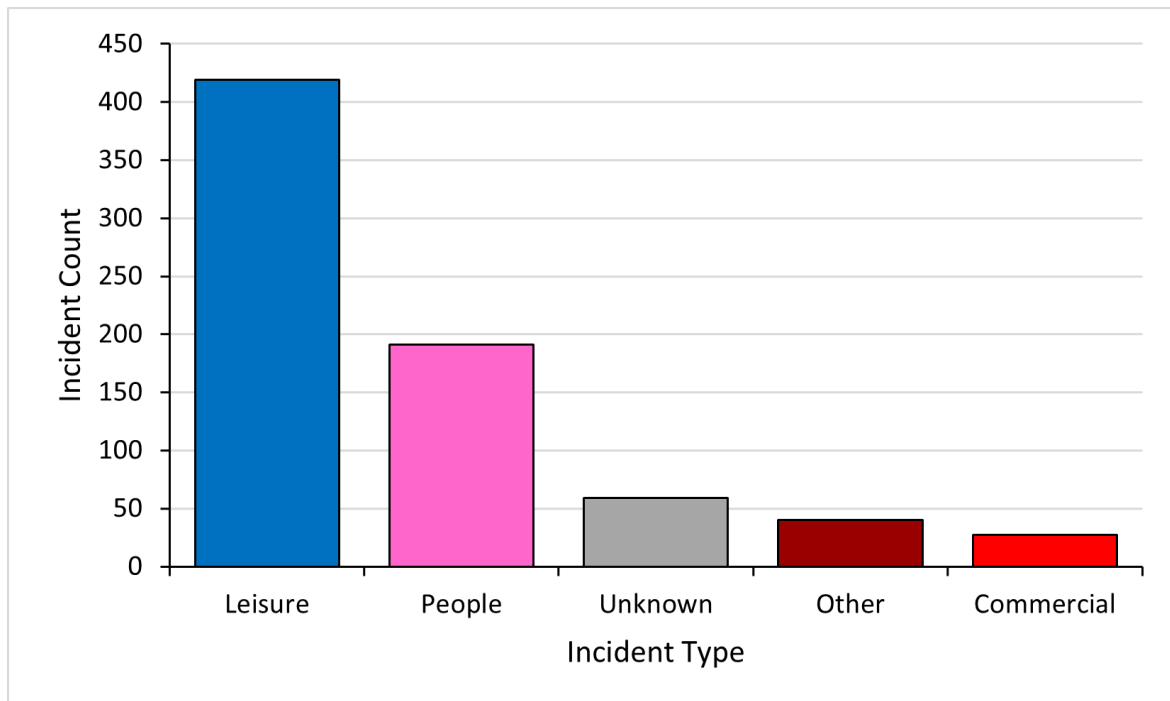


Figure 29: RNLI Callouts within 5nm of MDZ

8 MET-OCEAN IMPACTS

The following information has been extracted from HR Wallingford's Coastal Processes Modelling Report produced in 2020 which details the effects that the sitewide will have on tidal streams and waves within the vicinity of the MDZ.

8.1 HR WALLINGFORD COASTAL PROCESSES MODELLING REPORT

8.1.1 Tidal Stream

Since completion of the 2019 NRA, a Coastal Processes Modelling Report (CPMR) was completed by HR Wallingford in March 2020⁷. The assessment utilised a validated flow model to assess tidal current flow speed variations resulting from the presence of the proposed worst-case scenario on flow speeds.

The results of the predicted changes to tidal streams induced by the scheme were presented as differences in maximum flow speeds and differences in average flow speeds. The study found that the difference in maximum speeds at spring tides varies between a decrease of 0.7m/s (1.3 knots) within the MDZ sub-zones and an increase of 0.3m/s (0.6 knots) between the MDZ and the shore (inshore route). The difference in average speeds is mostly a decrease up to 0.2m/s (0.4 knots) within the MDZ.

Presuming that the Eastern Inshore Route is between the MDZ and the coast, then the worst-case differences in maximum flow speeds are a reduction of up to 0.3m/s and an increase up to 0.3m/s across the length and width of the Route (**Figure 1**). The largest area of change south of South Stack is a decrease and north of South Stack is an increase. With respect to average speeds, the changes are much smaller both in magnitude and spatially. Most of the Route is affected by changes to currents of +/- 0.1m/s with small areas where the speeds reduce or increase by up to 0.2m/s.

8.1.2 Waves

The CPMR additionally assessed the impact of the worst-case MDZ layout on waves utilising a highly resolved Simulating Waves Nearshore (SWAN) model. The differences in maximum heights were found to be located mainly within the MDZ and to vary between a decrease of 0.4m and an increase of 0.2m, based on representative wind speeds of 13m/s (Force 6) and above. Prudent recreational users, particularly un-powered recreational, would not normally be expected to be navigating in the area in Force 6 or above under normal passage planning.

⁷ 06_MOR-HRW-DOC-0001_HR Wallingford Coastal Processes Modelling Report

Waves from all directions were found to reduce within the MDZ as the structures dissipate wave energy. In areas either side of the development area, where current velocities increase, the waves increase post construction of the devices due to shoaling of waves in opposing flows. However, these increases in wave heights are predominantly away from the coastline with waves from 300°N and 330°N still seeing a reduction in wave heights.

For both representative and extreme wave conditions across the Eastern Inshore Route, the wave heights generally reduce in height from the baseline with the scheme in place. The largest predicted reduction in wave heights is for waves approaching from the west where the predicted reductions for representative waves are between 0.1m and 0.6m. For extreme waves, the lowering of wave heights is predicted to be between 0.2m and 1.2m across the Route.

For all wave directions, the effects of changes in tidal streams and resulting shoaling under some tidal conditions due to the turbines have a small impact over a wider area than the direct impact from the structures themselves. There will likely be a combined effect which is likely to be small and localised.

The changes in flow speeds and wave heights are therefore considered to be minimal and of low significance in terms of impact to navigation risk across all vessel types.

MGN 654 Section 4.9 sets out the requirement for consideration of the effect of tides and tidal streams which are further discussed, with reference to the CPMR⁸ in **Table 14**.

⁸ 06_MOR-HRW-DOC-0001_HR Wallingford Coastal Processes Modelling Report

Table 14: MGN 654 Section 4.9 – The effects of tides, tidal streams and weather

MGN 654 Section 4.9		NRA Response
A	Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa.	<ul style="list-style-type: none"> • Zones of minimum UKC recommended from 2019 NRA embedded into project design. • Dynamic UKC has been calculated in Section 10 for vessels with the largest draught.
B	The set and rate of the tidal stream, at any state of the tide, has a significant effect the handling of vessels in the area of the OREI site.	<ul style="list-style-type: none"> • The impacts of the MDZ with all devices in on the tidal streams in the area are assessed within the HR Wallingford CPMR⁹ and the predicted changes are assessed to be of low significance in terms of impact to navigation risk across all vessel types. The effect of the tidal set and rate on the handling of vessels in the area of the MDZ are considered to be of similar impact as the current baseline. The effect of the tidal streams should be considered as part of normal passage planning. • Equipment / Mechanical Failure and Loss of Control considered as causal factors within the risk assessment. • Analysis of historical incident data identified that the historical incident rate given the baseline tidal conditions is low.
C	The maximum rate tidal stream runs parallel to the major axis of the proposed OREI site layout, and if so, its effect on vessel handling and manoeuvring.	<ul style="list-style-type: none"> • The maximum rate tidal stream runs parallel to the major axis of the proposed MDZ and eastern inshore channel. In the event of an equipment or mechanical failure, vessels in the

⁹ HR Wallingford (2020) DER6261-RT001-R02-00 – Morlais Demonstration Zone Coastal Processes

MGN 654 Section 4.9		NRA Response
		eastern passage are unlikely to be set onto the devices within the MDZ, however, vessels navigating within the MDZ could be set onto devices in the vicinity.
D	The set is across the major axis of the OREI layout at any time, and, if so, at what rate.	<ul style="list-style-type: none"> The maximum rate tidal stream runs parallel to the major axis of the proposed MDZ and eastern inshore channel. In the event of an equipment or mechanical failure, vessels in the eastern passage are unlikely to be set onto the devices within the MDZ, however, vessels navigating within the MDZ could be set onto devices in the vicinity.
E	In general, whether engine and/or steering failure, or other circumstance could cause vessels to be set into danger by the tidal stream.	<ul style="list-style-type: none"> Equipment / Mechanical Failure and Loss of Control considered as causal factors within the risk assessment (See also C and D above).
F	The structures themselves could cause changes in the set and rate of the tidal stream.	<ul style="list-style-type: none"> The impacts of the MDZ to the tidal stream are assessed within the HR Wallingford CPMR¹⁰ and are assessed to be minimal and of low significance in terms of impact to navigation risk across all vessel types. The effect of the tidal set and rate on the handling of vessels in the area of the MDZ are considered to be of similar impact to the current baseline. The effect of the tidal stream should be considered as part of normal passage planning.
G	The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the OREI area or adjacent to the area.	<ul style="list-style-type: none"> The MDZ is predicted to have little impact on this residual sediment transport. As detailed within the HR Wallingford CPMR¹¹.

¹⁰ HR Wallingford (2020) DER6261-RT001-R02-00 – Morlais Demonstration Zone Coastal Processes

¹¹ HR Wallingford (2020) DER6261-RT001-R02-00 – Morlais Demonstration Zone Coastal Processes

MGN 654 Section 4.9		NRA Response
H	The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to all vessels that might pass through or in close proximity to it.	• Adverse Environmental Conditions and Poor Visibility are identified as causal factors in the assessment of navigation risk.
		• Mitigation measure 'Marked in accordance with Trinity House' embedded in project.
		• Additional mitigation 'Undertake Device /Array Specific Risk Assessments to include NavAids and Marker Buoys' suggested.
I	The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	• The design of the devices are expected to have a low freeboard and are unlikely to cause wind masking, turbulence and sheer (unlike for windfarms).
J	In general, taking into account the prevailing winds for the area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referred to above.	• The prevailing winds in the area of the MDZ are in the south-westerly quadrant and the Holy Island coast remains the predominant lee shore hazard. (See also A to G above).
		• 'Grounding / Forced Ashore' identified as a primary hazard within the risk assessment.
		• Hazard 'Grounding / Forced Ashore' assessed for all vessel types.

9 UNDER KEEL CLEARANCE

Under-Keel Clearance (UKC) is defined as the minimum clearance available between the deepest point on the vessel and the bottom in still water and is calculated using the following formula:

$$\text{UKC} = (\text{Charted Depth of Water} + \text{Height of Tide}) - (\text{Static Draught})$$

The static draught is the *"draught when the vessel is not making way or subject to sea and swell influences"*.

Generally, transits will be planned for any state of tide which, of course, will affect the available depth of water. Two key factors need to be considered when determining the UKC:

- The vertical safety margin between the devices and sea surface; and
- The maximum draught of vessels likely to transit above the device.

9.1 VESSEL DRAUGHTS

Vessel transits through the MDZ by draught for both summer and winter periods are given in **Figure 30**.

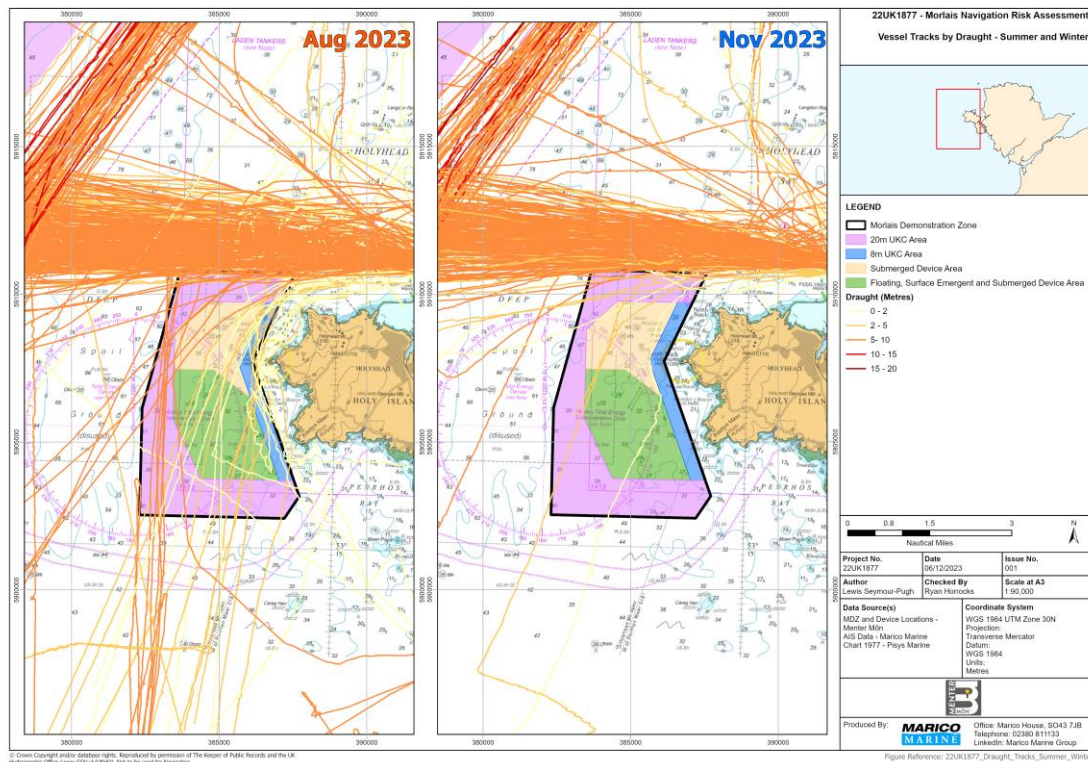


Figure 30: Vessel Track by Draught (AIS only)

The top five maximum draught vessels transiting within, the MDZ are detailed in **Table 15**. These vessels transited to the north and the west of the MDZ over the purple and gold areas travelling into Holyhead port.

Table 15: Maximum draughts identified within MDZ

Vessel	Vessel Type	Reported Draught (m)
JEWEL OF THE SEAS	Passenger Vessel	8.6
ISLAND PRINCESS	Passenger Vessel	8.0
SEVEN SEAS VOYAGER	Passenger Vessel	7.1
EPSILON	Passenger Vessel	6.8
STENA HORIZON	Passenger Vessel	6.7

In accordance with the NOREL Under Keel Clearance Policy Paper (UCKP) ¹², *‘where there is no safe and reasonable deviation for marine traffic using the area, Under Keel Clearance (UKC) over tidal turbines or other man made under water obstructions must allow for the safe transit of vessels at all states of tide.’*

The UKCP states that device height including a vertical safety margin along with vessel draught are two key factors that need to be considered when determining UKC. In open waters a larger UKC allowance is necessary in order that the dynamic movement of the vessel while underway (pitching, rolling, heeling and vertical heave) as a result of swell, sea waves and wind. The available depth of water is, in addition, impacted by the height of tide and, therefore, UKC calculations should consider the worst case - Low Water (LW) tidal conditions considered to be Chart Datum (CD).

9.2 UKC SUMMARY

Given that the devices to be deployed within the UKC areas (purple and blue) at Morlais are unknown, the calculation as described in the policy paper were unable to be applied to known tidal device scenarios. In lieu of known device heights, the NRA focuses instead on establishing the minimum required vessel UKC (draught*dynamic factor* safety margin) that the commercial operators require to maintain safe passage, irrespective of tidal device, which was informed by consultation.

The draughts of passenger vessels operating in vicinity of the MDZ and the corresponding required UKC for each vessel, given the approach above, are shown within **Table 16** where:

- Dynamic factor: 2 x draught to account for vessel motions in accordance with PIANC principles.
- Safety Margin: 30% as stipulated within MCA UKC Policy Paper.

¹² MCA MGN 654 Annex 3 - Under Keel Clearance Policy Paper, NOREL, May 2014, Guidance to Developers in Assessing Minimum Water Depth over Tidal Devices.

Table 16: Passenger Vessel Draughts and Required UKC.

Vessel	Reported Draught (m)	Required Vessel UKC (m)
JEWEL OF THE SEAS	8.6	22.4
ISLAND PRINCESS	8.0	20.8
SEVEN SEAS VOYAGER	7.1	18.5
EPSILON	6.8	17.7
STENA HORIZON	6.7	17.4

The previous NRA established two critical minimum UKC values required in order to maintain continued and safe navigation as outlined within **Table 17**.

Table 17: Minimum Under Keel Clearance

Draught (m)	Minimum UKC
<3	8m
>3m	20m

Where surface or near surface devices are utilised and navigation is, therefore, inhibited, marking of devices in accordance with Trinity House Lighthouse Service (THLS) requirements will be required in order to mitigate contact hazards.

Given that the devices to be deployed at Morlais are unknown and the calculation as described in the policy paper was unable to be applied to known tidal device scenarios, it is recommended that UKC should be assessed on a case-by-case basis for each device within array Specific NRAs.

10 NAVIGATION RISK ASSESSMENT

10.1 METHODOLOGY

Following vessel traffic analysis and stakeholder consultation, a further review of the 2020 NRA addendum risk assessment was undertaken to assess the navigation risk for the full site, which includes the construction and operational phases. Both operation and construction risk assessments have been assessed independently. The NRA has been commissioned to satisfy conditions outlined within Menter Môn's Marine Licence. The NRA is limited to identifying and quantifying any additional or increased navigational risk resulting from the project. It subsequently identifies possible mitigation measures where appropriate and makes recommendations.

The site-wide risk assessment assesses the risk for when the full site is in operation and all devices are in the water. The construction phase assesses the risks to navigating vessels during both the construction phase,

when the devices are first installed, and during repowering which is considered to be the replacement of the array of tidal devices with another array of tidal devices, which will be after 10 years.

The risk assessments were conducted in accordance with the International Maritime Organisation (IMO) Formal Safety Assessment (FSA) methodology for risk assessments. A detailed description of the methodology is provided in **Annex A**.

Hazard identification is the first fundamental step in the risk assessment process and was informed by analysis and feedback from stakeholders. Key navigational hazards were identified and grouped with the identified vessel types operational in the vicinity of the MDZ to form the list of potential impacts for both assessments. The hazards were then assessed as a factor of likelihood (frequency) and consequence. This approach considered two scenarios; “most likely” and the “worst credible”. The quantified values of frequency and consequence were then combined using Marico Marines HAZMAN II software to produce a risk score for each hazard and collated into a “Ranked Hazard List”. Risk control measures were then suggested that may reduce the hazard to ALARP (See **Table 26**).

10.2 HAZARD IDENTIFICATION

A review of the previous 2020 NRA addendum was undertaken. Hazard Identification was also undertaken using the results of the analysis and feedback from local stakeholders. Hazards are determined to be a factor of hazard category, vessel type/draught and device type/depth.

The primary hazard categories identified for assessment within the NRA are outlined within **Table 18**. The hazards identified remain unchanged from the previous NRA.

Table 18: Hazard Categories

Ref	Hazard Category	Hazard Detail	Comments	Sitewide	
				Construction Phase	Operation Phase
1	Contact	Surface Device	One or more vessels makes contact with a surface device.	7	6
		Device <8m below CD	One or more vessels makes contact with a submerged device <8m below CD or a marker buoy.	7	6
		Device >8m below CD	One or more vessels makes contact with a submerged device >8m below CD or a marker buoy.	7	6
		Device >20m below CD	One or more vessels makes contact with a submerged device >20m below CD or a marker buoy.	7	6
		Electrical Hubs	One or more vessels makes contact with an electrical hub.	7	6

Ref	Hazard Category	Hazard Detail	Comments	Sitewide	
				Construction Phase	Operation Phase
2	Collision	All Vessel Types	A vessel collides with another vessel (Including construction vessels not underway).	28	21
3	Grounding / Forced Ashore	All Vessel Types	A vessel unintentionally makes contact with the seabed or is forced ashore onto the cliffs.	7	6
4	Swamping / Capsize	All Vessel Types	A vessel fills with water for any reason including capsize, and when overwhelmed, sinks.	7	6
5	Snagging / Obstruction	All Vessel Types	Gear (e.g. fishing gear or anchor) snags on submerged device, mooring arrangements or export cables. (include Hubs)	7	6
6	Breakout / Device not at stated depth.	All Device Types	Device breaks its moorings and becomes a hazard to shipping or runs aground (including during construction works).	1	1
Total Hazards Assessed				85	70

In order to focus the assessment of navigation risk within the MDZ, vessel types have been grouped into the vessel categories outlined in **Table 19**. These categories are a factor of vessel type; established from analysis undertaken within **Section 6.3**, and draught; as informed by the assessment of UKC within **Section 9**. The following vessel types remain unchanged from the previous NRA.

Table 19: Vessel Categories

Ref	Vessel Type Category	Draught	Including
1	Commercial Vessel	>3m	Cargo vessels, tankers, dredgers, survey vessels (draught >3m), buoy laying vessels, commercial fishing vessels/ fish carriers.
2	Passenger Vessel	>3m	Ferries, cruise ships
3	Project Vessels	>3m	Cable laying vessels, barges and heavy lift vessels.
3	Fishing Vessel	<3m	Fishing Vessels
4	Powered Recreational Vessel	<3m	Yachts, power boats, recreational RIBs, Recreational fishing boats, recreational dive vessels, powered watercrafts
5	Un-Powered Recreational Vessel	<3m	Sailing dinghies, kayaks, canoes, rowing boats, SUPs.
6	Other Vessel	<3m	Tugs and tows, survey vessels, RNLI, construction and maintenance vessels, cable laying vessels, workboats, commercial RIBs, Military.

The device categories considered within the NRA are outlined within **Table 20**. Device depths were informed by stakeholder consultation and the assessment of UKC within **Section 9**.

Table 20: Device Categories

Ref	Device Category	UKC (m)
1	Surface Devices	0
2	Mid-Water Devices	<8
3	Mid-Water Devices	>8
4	Sea-Bed Devices	>20

Hazards were assessed according to both an operation and construction phase. 85 individual hazards were identified for assessment within the construction phase and 70 individual hazards for the operational phase. A full list of hazard categories is located within **Annex B** for the construction phase assessment, and **Annex C** for the operational phase assessment.

10.3 ASSUMPTIONS

The NRA has been undertaken based upon information provided by the client at the time of commencement. The assumptions outlined within **Table 21** are, therefore, applicable to the NRA. The assumptions listed remain unchanged from the previous NRA.

Table 21: Site-Wide NRA Assumptions

Assumption	Description
Utilisation of worst-case maximum capacity (240MW).	A Project Design Envelope (PDE) approach to consent is sought for an array of up to 240MW installed capacity. Therefore, a device specific layout has not been provided prior to undertaking the NRA. Full deployment to a worst-case of 240 MW could comprise up to a maximum of 620 tidal devices, supporting up to 1,648 TECs and up to 740 inter-array cables within the MDZ.
Any device type may be deployed within any zone in accordance with embedded required minimum UKC.	The Project will install multiple technology types. Device types will be determined through consideration of the direction of future developments and technology. The deployment of any device within any zone of the MDZ in line with embedded minimum UKC requirements has been considered to represent the worst case.
Each single array will be comprised of the same type of tidal device / technology.	Each array will consist of uniform device/ technology types of approximately 30 MW installed capacity per array.
Maximum 9 x 33 kV export cables.	A series of seabed installed cables will be laid between individual offshore electrical hubs and the landfall location. The exact locations of the cable routes have not yet been determined, however, they will make landfall at Abrahams Bosom.
Embedded mitigation measures are in place prior to construction.	Embedded mitigation listed within Table 22 are assumed to be in place and as such are reflected in the scores.
Displaced traffic due to MDZ.	Hazard assessment informed by traffic analysis assumes the worst-case displacement of traffic into the areas around the MDZ.

10.4 EMBEDDED MITIGATION MEASURES

The embedded risk control measures listed within **Table 22** were assumed to be in place when scoring the NRA. The embedded risk control measures identified remain unchanged from the previous NRA.

Table 22: Embedded Risk Controls –assumed to be in place for the risk assessment.

ID	Embedded Risk Control	Description
1	Compliance with applicable guidance and regulations.	All construction, operational and maintenance operations are to be fully compliant with legislation, guidance and best practice as well as in accordance with up to date written procedures. Adherence to the MCA Guidance on Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response. Adherence to Diving Regulations 1997.
2	Promulgation of information to local stakeholders.	Promulgation of information and warnings through local Notices To Mariners (NTM) and other appropriate Maritime Safety Information (MSI) dissemination methods. Rolling and regular updates during construction phases. Planning and coordination between developer and vessel operators.
3	Selection of appropriate construction and maintenance vessels	Suitable vessels are to be utilised and personnel are to be trained and competent persons. Use of appropriate Personal Protective Equipment (PPE) by personnel.
4	Incidents and near misses are reported and investigated by developer and operators.	The developer should undertake their own includes investigation to identify the root cause and implement preventative measure to prevent the recurrence of an incident. Incidents to be reported to the MAIB in accordance with MGN 564: Marine Casualty and Marine Incident Reporting. ¹³
5	Marked/lit in accordance with Trinity House requirements	Devices to be marked in accordance with MGN 654 and to comply with IALA standards.
6	Surveyed and charted as required by UKHO	It should be determined at what depth below the seafloor export cables are buried to ensure there are no changes to charted depths. Changes to charted depth arising from tidal turbines and the burial depth of cabling should be surveyed. Cable routes and devices shall be marked on navigational charts.

¹³ Marine Accident Investigation Branch (2017) Marine Casualty and Marine Incident Reporting, MGN 564 (M+F)

ID	Embedded Risk Control	Description
		<p>Detailed and accurate hydrographic surveys are required pre and post construction and following decommissioning.</p> <p>Where traffic patterns are altered as a result of installed generating assets - it may be considered necessary that a hydrographic survey of alternate passages be undertaken.¹⁴</p>
7	Formulation and implementation of an Emergency Response Co-operation Plan (ERCoP)	Creation of an ERCoP with the MCAs Search and Rescue Branch to outline general safety procedures and provide guidance on emergency response procedures in the event of SAR operations. To be in place for the construction phase onwards. The MCA document ' <i>Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response</i> ' outlines the SAR requirements. This will include details of access to a safe havens and places of refuge in the event of an emergency or stress of weather.
8	Passage plans for construction and maintenance craft	Development of routeing plans between site and offshore base.
9	Consideration of weather and sea state during construction planning	Limit hazardous activities during adverse weather conditions.
10	Devices >8m minimum UKC below CD to be deployed within the blue area Figure 1 .	To increase space for navigation within the inshore passage for small vessels (draught <3m).
11	Devices >20m minimum UKC below CD deployed within the purple area Figure 1 .	To increase available space for navigation of large vessels (>3m draught) including fair weather and poor weather ferry routes.
12	Global Positioning System off station alarm / Supervisory Control and Data Acquisition (SCADA) monitoring system.	-
13	Construction vessels to be marked and lit in accordance with COLREGS	To ensure that construction craft remain visible at all times and to ensure passing craft are aware of construction activities.

¹⁴Maritime and Coastguard Agency (2021) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) Guidance on UK Navigational Practice, Safety and Emergency Response. MGN 654 (M+F);
Maritime and Coastguard Agency (2014) Hydrography Guidelines for Offshore Developers;
Maritime and Coastguard Agency (2014) Offshore Developers: Post-Construction Hydrographic Guidelines

11 NAVIGATION RISK ASSESSMENT RESULTS

Risk assessments for the construction and operation phases for the sitewide MDZ were conducted. The assessment was undertaken utilising the FSA¹⁵ five step approach. A breakdown of the hazard scores for the baseline assessment of risk (i.e. risk with no additional mitigation measures) for the construction and operation phases is shown in **Table 23**. The baseline risk scores remain unchanged from the previous NRA.

Table 23: Baseline Risk Assessment Results Summary – Construction and Operational Phases - Sitewide

Hazard Category	Category Definition	Construction Phase Results	Operation Phase Results
High Risk	Between 9 and 10	0	0
Significant Risk	Between 7 to 8.99	0	0
ALARP	Between 4 to 6.99	19	6
Low Risk	Between 2 to 3.99	47	46
Negligible Risk	Between 0 to 1.99	3	3
N/A	N/A	16	21

The hazards scoring ALARP within the baseline construction phase assessment for the MDZ sitewide, are shown below in **Table 24**. A full list of ranked hazard scores is located within **Annex B**.

The top ten hazards identified for the baseline operational phase for the MDZ sitewide, are shown below in **Table 25**. A full list of ranked hazard scores is located within **Annex C**.

Table 24: Sitewide top hazards scoring ALARP - Construction Phase

Rank	ID	Hazard Title	Baseline Score	Risk
1	10	Contact Project Vessel with Mid-Water Device (<8m below CD)	5.28	
2	68	Grounding / Forced Ashore Powered Recreational Vessel	5.27	
3	63	Collision Other Vessels ICW Other Vessels	5.13	
4	11	Contact Fishing Vessel with Mid-Water Device (<8m below CD)	5.00	
5	7	Contact Other Vessels with Surface Device	4.72	
6	14	Contact Other Vessels with Mid-Water Device (<8m below CD)	4.72	
7	85	Breakout of device / device not at stated depth	4.72	
8	53	Collision Project Vessel ICW Other Vessel	4.63	
9	49	Collision Project Vessel ICW Project Vessel	4.53	
10	81	Snagging/ Obstruction Fishing Vessel	4.50	

¹⁵ International Maritime Organisation (2018) Revised Guidelines for Formal Safety Assessment (FSA) MSC-mepec.2/Circ.12/Rev.2

11	12	Contact Powered Recreational Vessel with Mid-Water Device (<8m below CD)	4.47
12	60	Collision Powered Recreational Vessel ICW Other Vessel	4.47
13	3	Contact Project Vessel with Surface Device	4.38
14	58	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	4.35
15	76	Swamping / Capsize Un-Powered Recreational Vessel	4.13
16	80	Snagging / Obstruction Project Vessels	4.13
17	35	Contact Other Vessels with Electrical Hubs	4.07
18	9	Contact Passenger Vessels with Mid-Water Device (<8m below CD)	4.06
19	43	Collision Passenger Vessel ICW Passenger Vessel	4.00

Table 25: Sitewide top ten hazards - Operational Phase

Rank	ID	Hazard Title	Baseline Score	Risk
1	55	Grounding / Forced Ashore Powered Recreational Vessel	4.67	
2	66	Snagging/ Obstruction Fishing Vessel	4.50	
3	9	Contact Fishing Vessel with Mid-Water Device (<8m below CD)	4.23	
4	62	Swamping / Capsize Un-Powered Recreational Vessel	4.13	
5	10	Contact Powered Recreational Vessel with Mid-Water Device (<8m below CD)	4.01	
6	37	Collision Passenger Vessels ICW Passenger Vessel	4.00	
7	8	Contact Passenger Vessels with Mid-Water Device (<8m below CD)	3.82	
8	30	Contact Other Vessels with Electrical Hubs	3.72	
9	44	Collision Fishing Vessel ICW Un-Powered Recreational Vessel	3.67	
10	46	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	3.64	

12 SUGGESTED ADDITIONAL RISK CONTROL MEASURES

While all of the of hazards identified and scored for this risk assessment fell into the ALARP or below categories of risk (see **Section 10**), further mitigation risk control measures were suggested in the 2020 NRA update, for the hazards assessed as ALARP or above (>4).

The additional risk control measures that have been identified and are recommended in order to ensure safe and efficient operations are listed in **Table 26**. The suggested additional risk control measures remain unchanged from the original NRA and are carried through for this (2023) update.

Table 26: Suggested Additional Risk Control Measures

ID	Risk Control	Description	Phase
1	Continuous Monitoring by Marine Co-ordination Centre	Monitoring by radar, AIS, Closed Circuit Television (CCTV) or other agreed means. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones or ATBA.	All Phases
2	Restrict Navigation through the Gold and Green MDZ Zones.	<p>For example; via designation of site as an Area To Be Avoided (ATBA) or Precautionary Area (PA).</p> <p>In the UK, all vessels have freedom to transit through OREIs, subject to any applied safety zones, and their own risk assessments and passage plans, which should take account of factors such as vessel size, manoeuvrability, environmental factors and competency of the Master and crew. MGN 372¹⁶ (or subsequent update) provides further guidance on navigation in and around OREIs.</p> <p>An ATBA is an area within defined limits that should be avoided by all ships or certain classes of ship, in which navigation is particularly hazardous or in which it is exceptionally important to avoid casualties. In general, ATBAs should be established only in places where: inadequate survey or insufficient provision of aids to navigation may lead to danger of stranding; where local knowledge is considered essential for safe passage; where there is the possibility that unacceptable damage to the environment could result from a casualty; or where there may be hazards to a vital aid to navigation¹⁷.</p> <p>PA's are defined as areas within defined limits where ships must navigate with particular caution and within which the direction of flow of traffic may be recommended. ¹⁸</p>	All Phases
3	MDZ designation as No Fishing Zone	To prevent fishing gear snagging on underwater devices and their associated infrastructure.	All Phases
4	Appropriate alignment and spacing of devices	The MCA has statutory obligations to provide Search and Rescue services in and around OREIs in UK waters. Device layout designs must be designed to ensure clear lines of sight and navigation allow safe transit by rescue craft and those vessels that decide to transit through them including during poor visibility, high sea states and at night.[3]	All Phases

¹⁶ Maritime and Coastguard Agency (2008) MGN372 Amendment 1 (M+F) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs.

¹⁷ International Maritime Organisation (1985) General Provisions on Ships' Routeing, adopted Nov. 20, 1985, IMO Resolution A.572(14).

¹⁸ International Maritime Organisation (1985) General Provisions on Ships' Routeing, adopted Nov. 20, 1985, IMO Resolution A.572(14).

ID	Risk Control	Description	Phase
		<p>In order to minimise risks to surface vessels transiting through an OREI, structures (turbines, substations etc) should be aligned and in straight rows or columns. Multiple lines of orientation provide alternative options for passage planning and for vessels to counter the environmental effects on handling i.e. sea state, tides, currents, weather, visibility etc. Developers should plan for at least two lines of orientation unless they can clearly demonstrate that fewer is acceptable.</p> <p>The MCA document 'Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response' outlines the SAR requirements.</p> <p>See also 15:'Undertake Device / Array Specific Risk Assessments'</p> <p>It was noted during consultation with recreational stakeholders that 'if surface devices are spaced adequately then sailing could occur between them, although this would not be recommended at night'.</p>	
5	Check device surveys	To ensure devices remain at the stated charted depth. Changes to charted depth arising from tidal turbines should be surveyed and marked on navigational charts.	All Phases
6	Guard vessel to monitor passing traffic	To prevent a vessel contacting a device / partially constructed device during construction / installation. To keep watch and warn vessels that may be in danger, for example, to prevent a collision as a result of third-party avoidance.	Construction
7	Establish no anchoring areas	No anchoring areas to be established around nearshore cable route.	All Phases
8	Enhanced cable protection	If burial is not possible, for example due to underwater features and/or seabed ground conditions export cables should be suitably protected such as by rocks or other such suitable mattress placements to mitigate the risks to the cable and vessels. The MCA would be willing to accept up to 5% reduction in surrounding charted depths referenced to Chart Datum, unless developers are able to demonstrate evidence that any identified risks to any vessel type are satisfactorily mitigated. ¹⁹	All Phases
9	Implementation of Safety Zones	Safety zones of appropriate configuration, extent and application; typically: 500m during construction, extension, maintenance or decommissioning and 50m during operation.	Construction

¹⁹ MGN 654

ID	Risk Control	Description	Phase
10	Temporary navigation aids as required by Trinity House	Temporary marking, lighting and buoyage should be utilised during construction phase in accordance with Trinity House requirements.	Construction
11	Undertake Device / Array Specific Risk Assessments to include NavAids and Marker Buoys.	<p>Further site-specific assessments should be undertaken to build on previous assessments and assess the proposed locations of individual turbine devices, substations, platforms and any other structure within the tidal array. This assessment should include the potential impacts the proposed location may have on navigation and SAR activities and should be undertaken in liaison with the MCA. Additionally, this assessment should consider the tow / delivery of devices to and from the site.</p> <p>MCA has statutory obligations to provide Search and Rescue (SAR) services in and around OREIs in UK waters. Turbine layout designs must be designed to allow safe transit through OREIs by SAR helicopters operating at low altitude in bad weather, and those vessels (including rescue craft) that decide to transit through them. Developers should therefore carry out further site-specific assessment to build on previous assessments to assess the proposed locations of individual turbine devices, substations, platforms and any other structure within the wind farm or tidal/wave array. This assessment should include the potential impacts the proposed location may have on navigation and SAR activities.</p> <p>Risk assessments for proposed layouts should build on earlier work conducted as part of the Navigation Risk Assessment and the mitigations identified as part of that process. Where possible, this original assessment should be referenced to confirm where information or the assessment remains the same or can be further refined due to the later stages of project development</p>	Construction
12	Provision of life saving equipment on fixed structures and floating devices.	Provide a refuge for people in the water for example; grab chains and ladders.	All Phases
13	Minimise use of marker buoys in zones of minimum UKC.	To reduce the risk of contact with buoys by vessels navigating in the zones of minimum UKC. It was reported by recreational stakeholders in consultation that <i>'if the devices are under water with a sufficient UKC preference would be that there is no buoy at the surface to maintain navigation'</i> .	All Phases

13 RESIDUAL RISK ASSESSMENT

The risk assessments for the construction and operation were re-assessed following the implementation of the suggested risk control measures. A breakdown of the hazard scores for the residual risk assessment of risk for the construction and operation phases is shown in **Table 27**. In total for the sitewide, 6 hazards within the construction phase and 3 hazards within the operational phase score higher than 4 (low-risk) in the residual assessment. The residual risk scores remain unchanged from the previous NRA.

Table 27: Sitewide Residual Risk Assessment Results Summary – Construction and Operational Phases

Hazard Category	Category Definition	Construction Phase Results	Operation Phase Results
High Risk	Between 9 and 10	0	0
Significant Risk	Between 7 to 8.99	0	0
ALARP	Between 4 to 6.99	6	3
Low Risk	Between 2 to 3.99	59	51
Negligible Risk	Between 0 to 1.99	4	1
N/A	N/A	16	21

The top ten hazards identified for the residual construction phase assessment for the MDZ sitewide, are shown below in **Table 28**. A full list of ranked hazard scores is located within **Annex B**.

The top ten hazards identified for the residual operational phase for the MDZ sitewide, are shown below in **Table 29**. A full list of ranked hazard scores is located within **Annex C**.

Table 28: Sitewide top ten residual hazards – Construction Phase

Rank	ID	Hazard Title	Residual Score
1	68	Grounding / Forced Ashore Powered Recreational Vessel	4.93
2	49	Collision Project Vessel ICW Project Vessel	4.53
3	10	Contact Project Vessel with Mid-Water Device (<8m below CD)	4.38
4	76	Swamping / Capsize Un-Powered Recreational Vessel	4.13
5	35	Contact Other Vessels with Electrical Hubs	4.07
6	43	Collision Passenger Vessels ICW Passenger Vessel	4.00
7	9	Contact Passenger Vessels with Mid-Water Device (<8m below CD)	3.82
8	7	Contact Other Vessels with Surface Device	3.81
9	14	Contact Other Vessels with Mid-Water Device (<8m below CD)	3.81
10	31	Contact Project Vessel with Electrical Hubs	3.77

Table 29: Sitewide top ten residual hazards – Operational Phase

Rank	ID	Hazard Title	Residual Score
1	55	Grounding / Forced Ashore Powered Recreational Vessel	4.18
2	62	Swamping / Capsize Un-Powered Recreational Vessel	4.13
3	37	Collision Passenger Vessels ICW Passenger Vessel	4.00
4	8	Contact Passenger Vessels with Mid-Water Device (<8m below CD)	3.82
5	30	Contact Other Vessels with Electrical Hubs	3.72
6	61	Swamping / Capsize Powered Recreational Vessel	3.55
7	10	Contact Powered Recreational Vessel with Mid-Water Device (<8m below CD)	3.49
8	46	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	3.47
9	32	Collision Commercial Ship ICW Passenger Vessels	3.45
10	7	Contact Commercial Ship with Mid-Water Device (<8m below CD)	3.20

14 CUMULATIVE IMPACTS

Cumulative impacts refer to the impact upon receptors, proposed developments and activities and any other foreseeable project proposals arising from the presence of the MDZ. The closest development across the offshore wind, oil and gas and aggregates industries is the Awel y Mor wind farm extension approximately 48.37km from the proposed MDZ.

Based on the information provided within **Section 4**, the cumulative impacts within the vicinity of the proposed development have been deemed low risk. As such, cumulative impact specific risk controls in addition to those recommended within the project specific risk assessment are not proposed.

15 2023 SITEWIDE NRA UPDATE SUMMARY

This NRA has been undertaken in response to the Developer's marine licence to operate the MDZ.

To undertake this work in compliance with the requirements for an Offshore Renewable Installation NRA, as defined by MGN654 and associated guidance, all input data has been reviewed, checked or updated as necessary to confirm the validity of the previous most recent NRA which supported the granting of the site licence.

For the sake of clarity this document follows the same format as the 2020 update, and therefore stands alone as a sitewide NRA, albeit retaining much of the previous descriptive text.

Where necessary data inputs have been updated to reflect current (2023) information. In particular the following have been updated:

- Vessel traffic data: full re-surveys of vessel traffic in the area during representative summer and winter periods, supported by reanalysis to confirm vessel types, sizes and routes;
- Incident data: to confirm the frequency at which identified hazards may have been occurring;
- Both of the above data sets were corroborated by a full re-consultation with local stakeholders, to seek informed local expertise on vessel traffic movements, incidents, and any changes in local navigational behaviour over the last two years.

In summary, it was confirmed that there had in fact been very little change in either the density, or the behaviour of local navigators.

While previously identified concerns and risks were corroborated, no new risks were identified, and the frequency with which incidents were assessed to occur remained unchanged.

No new risk mitigation factors were identified.

Based on a comprehensive review of previous site conditions, and taking into account extensively updated data, the authors confirm that the findings of the 2020 NRA update remain valid.

16 CONCLUSIONS AND RECOMMENDATIONS

This NRA has assessed the baseline and residual navigation risk profiles of the consented MDZ and approaches, to fulfil the requirement set out within Menter Môn's marine licence to undertake a biennial sitewide navigation risk assessment. The assessment has:

- Established an updated baseline traffic profile including traffic densities, incident history, future developments and plans, and interactive boundaries;
- Confirmed the baseline marine environment including an assessment on metocean characteristics, proximities to sea-space uses, and offshore developments; and
- Reviewed and compared the changes from the previous navigation risk assessment undertaken in 2020 entitled 20UK1647_MM_Morlais NRAAddendum_20-issue02.

Compared with the conclusions of the previous NRA, no new hazard categories or risk scenarios were identified; the original 155 hazards were reviewed using the most recent data collected, but no changes made.

No additional/new embedded risk controls or suggested risk controls were identified or suggested during the assessment and stakeholder consultation.

Overall, no change in the overall risk profile was identified since the 2020 NRA and therefore the baseline and residual risk for the site, including the conclusions reached within the 2020 NRA, remain unchanged.

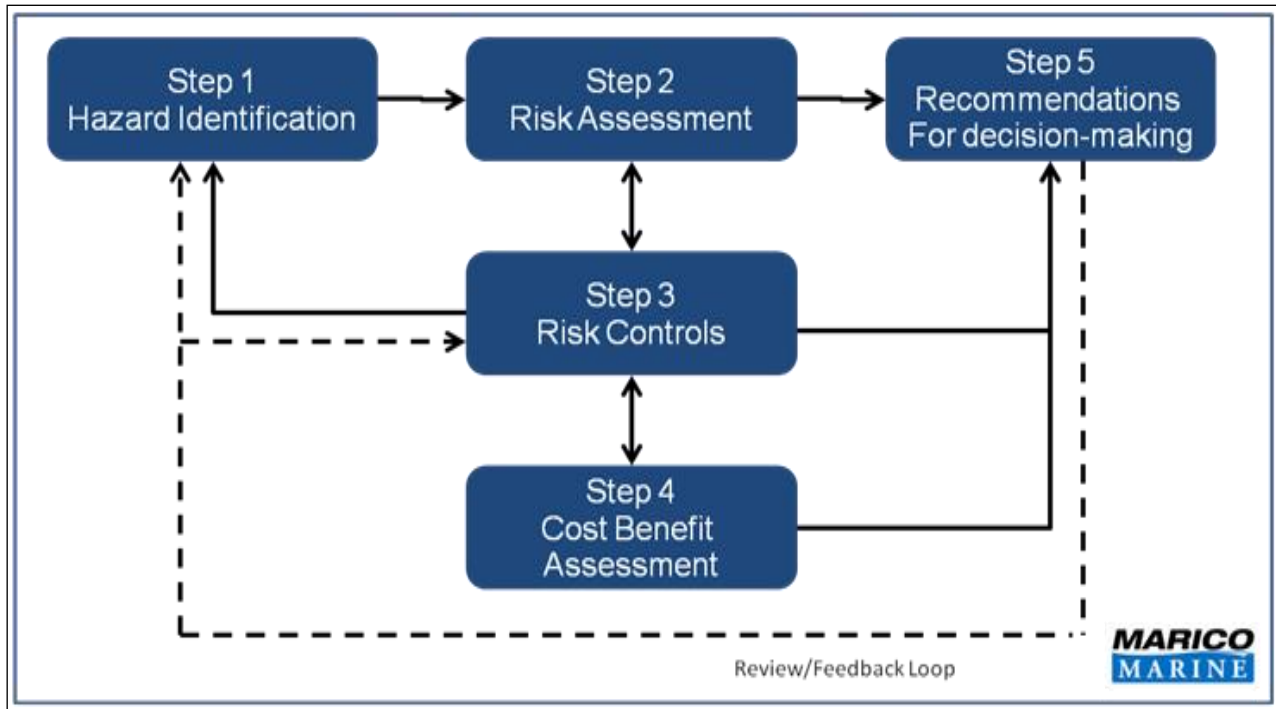
It is recommended that the risk profile, baseline conditions and mitigations are all reviewed and reassessed within the next biennial navigation risk assessment due in 2025.

The project is therefore assessed to be acceptable in terms of navigational risk assuming compliance with embedded, and implementation of, suggested additional mitigation measures where appropriate for hazards scoring as ALARP.

Annex A Risk Assessment Methodology

RISK ASSESSMENT METHODOLOGY

The Navigation Risk Assessment methodology is based on the Formal Safety Assessment (FSA) methodology as adopted by IMO. Marico Marine uses a form of risk assessment that has been specifically adapted for navigational use. It is fundamentally based on concepts of “Most Likely” and “Worst Credible”, which reflect the range of outcomes arising from a shipping accident.

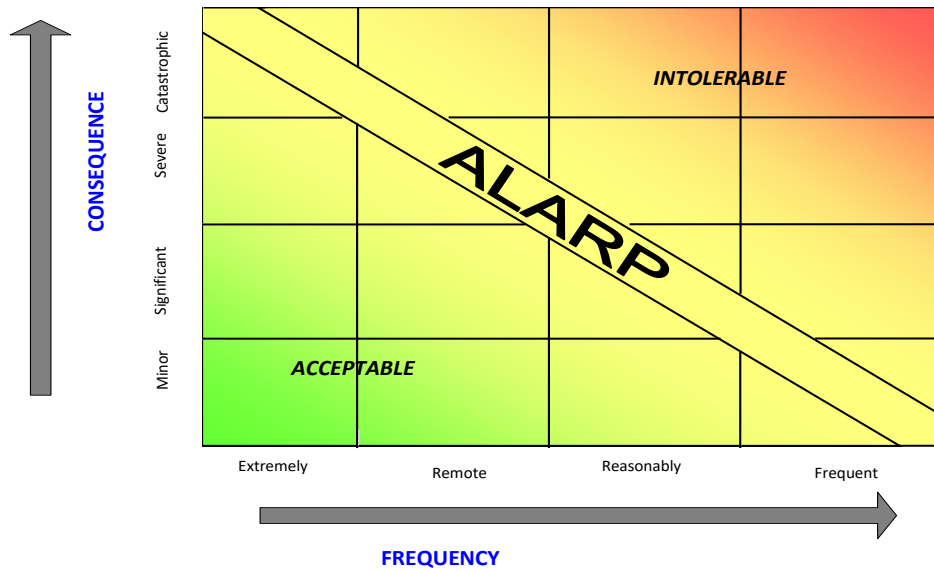


Formal Safety Assessment Risk Assessment Process.

Definitions

IMO Guidelines define a hazard as “something with the potential to cause harm, loss or injury”, the realisation of which results in an accident. The potential for a hazard to be realised can be combined with an estimate or known consequence of outcome. This combination is termed “risk”. Risk is therefore a measure of the frequency and consequence of a particular hazard. One way to compare risk levels is to use a matrix approach as illustrated below.

The IMO guidelines allow the selection of definitions of frequency and consequence to be made by the organisation carrying out the risk assessment. This is important, as it allows risk to be applied in a qualitative and comparative way. To identify high risk levels in a purely mathematically quantitative way would require a large volume of casualty data, which is rarely available in the maritime context. ALARP can be accepted as being “Tolerable”, if the further reduction of the risk is impracticable, or if the cost of such reduction would obviously be highly disproportionate to the improvement. It can also be considered “Tolerable”, if the cost of reducing the risk is greater than any improvement gained.



Frequency / Consequence Matrix

General Risk Matrix

The combination of consequence and frequency of occurrence of a hazard is combined using a risk matrix which enables hazards to be ranked and a risk score assigned. The resulting scale can be divided into three general categories:

1. Acceptable;
2. As Low as Reasonably Practicable (ALARP); and
3. Intolerable.

At the low end of the scale, frequency is extremely remote and consequence minor, and as such the risk can be said to be “acceptable”, whilst at the high end of the matrix, where hazards are defined as frequent and the consequence catastrophic, then risk is termed “intolerable”. Every effort should be made to mitigate all risks such that they lie in the “acceptable” range. Where this is not possible, they should be reduced to the level where further reduction is not practicable. This region, at the centre of the matrix is described as the ALARP region. It is possible that some risks will lie in the “intolerable” region, but can be mitigated by measures, which reduce their risk score and move them into the ALARP region, where they can be tolerated, albeit efforts should continue to be made when opportunity presents itself to further reduce their risk score.

The FSA methodology proposed determines where to prioritise risk control options for the navigational aspects of a project site. The outcome of the risk assessment process should then act as the basis for a Navigation Safety Management System, which can be used to manage navigational risk.

Hazard Identification

Hazard identification is the first and fundamental step in the risk assessment process. A hazard and its description need to be defined including:

- Hazard Title;
- Description;
- Areas Affected;
- Stakeholders Affected;
- Vessel Types Affected;
- Consequences; and
- Risk Controls.

Risk Matrix Criteria

Frequency of occurrence and likely consequence are both assessed for the “most likely” and “worst credible” scenario. Frequencies are assessed according to the levels set out below.

Scale	Description	Definition
5	Frequent	An event that could be expected to occur more than once per year.
4	Likely	An event that could be expected to occur between 1 to 10 years.
3	Possible	An event that could be expected to occur between 10 to 100 years.
2	Unlikely	An event that could be expected to occur between 100 to 1000 years.
1	Remote	An event that could be expected to occur less than once in 1000 years.

Using the assessed notional frequency for the “most likely” and “worst credible” scenarios for each hazard, the probable consequences associated with each are assessed in terms of damage to:

1. People - Personal injury, fatality etc.;
2. Property – Project and third party;
3. Environment - Oil pollution etc.; and
4. Business - Reputation, financial loss, public relations etc.

Cat.	People	Property	Environment	Business
C1	Negligible Possible very minor injury (e.g. bruising)	Negligible Costs <£10k	Negligible No effect of note. Tier1 <u>may</u> be declared but criteria not necessarily met. Costs <£10k	Negligible Costs <£10k
C2	Minor (single minor injury)	Minor Minor damage Costs £10k – £100k	Minor Tier 1 – Tier 2 criteria reached. Small operational (oil) spill with little effect on environmental amenity Costs £10K–£100k	Minor Bad local publicity and/or short-term loss of revenue Costs £10k – £100k
C3	Moderate Multiple minor or single major injury	Moderate Moderate damage Costs £100k - £1M	Moderate Tier 2 spill criteria reached but capable of being limited to immediate area within site Costs £100k -£1M	Moderate Bad widespread publicity Temporary suspension of operations or prolonged restrictions to project Costs £100k - £1M
C4	Major Multiple major injuries or single fatality	Major Major damage Costs £1M -£10M	Major Tier 3 criteria reached with pollution requiring national support. Chemical spillage or small gas release Costs £1M - £10M	Major National publicity, Temporary closure or prolonged restrictions on project operations Costs £1M -£10M
C5	Catastrophic Multiple fatalities	Catastrophic Catastrophic damage Costs >£10M	Catastrophic Tier 3 oil spill criteria reached. International support required. Widespread shoreline contamination. Serious chemical or gas release. Significant threat to environmental amenity. Costs >£10M	Catastrophic International media publicity. Project site closes. Operations and revenue seriously disrupted for more than two days. Ensuing loss of revenue. Costs >£10M

Consequence Categories and Criteria

Hazard Data Review Process

Frequency and consequence data is assessed for each hazard drawing initially on the knowledge and expertise of the Marico Marine specialists. This is subsequently influenced by the views and experience of the many stakeholders, as well as historic incident where available. It should be noted that hazards are scored based on the “status quo” i.e., with all existing mitigation measures taken into consideration.

Having decided in respect of each hazard which frequency and consequence criteria are appropriate for the four consequence categories in both the “most likely” and “worst credible” scenarios, eight risk scores are obtained using the following matrix.

Consequences	Cat 5	5	6	7	8	10
	Cat 4	4	5	6	7	9
	Cat 3	3	3	4	6	8
	Cat 2	1	2	2	3	6
	Cat 1	0	0	0	0	0
	Frequency	>1,000 years	100-1,000 years	10-100 years	1 to 10 years	Yearly

Risk factor matrix used for hazard assessment

Where:

Risk Number	Risk
0 to 1.9	Negligible
2 to 3.9	Low Risk
4 to 6.9	As Low as Reasonably Practical
7 to 8.9	Significant Risk
9 to 10.0	High Risk

It should be noted that occasionally, a “most likely” scenario will generate a higher risk score than the equivalent “worst credible” scenario; this is due to the increased frequency often associated with a “most likely” event. For example, in the case of many small contact events, the total damage might be of greater significance than a single heavy contact at a much lesser frequency.

Hazard Ranking

The risk scores obtained from the above process are analysed further to obtain four indices for each hazard as follows:

1. The average risk score of the four categories in the “most likely” set;
2. The average risk score of the four categories in the “worst credible” set;
3. The maximum risk score of the four categories in the “most likely” set; and

4. The maximum risk score of the four categories in the “worst credible” set.

These scores are combined in Marico Marine’s hazard management software “HAZMAN II” to produce a single numeric value representing each of the four indices. The hazard list is sorted in order of the aggregate of the four indices to produce a “Ranked Hazard List” with the highest risk hazards prioritised at the top.

Mitigation

Mitigation measures that could be employed to reduce the likelihood or consequence of the hazards occurring are then identified. Risk controls are reviewed and discussed, and recommendations made as to which would be suitable for the project. Risk controls are proposed that show the greatest reduction in risk to the highest scoring identified hazards and following feedback from consultees.

Annex B Hazard Log – Site-Wide Construction

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
1	Contact Commercial Ship with Surface Device	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations.	Multiple minor or single major injury; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	2	3	4	3	4	1	2.58	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	2.58
2	Contact Passenger Vessels with Surface Device	A ferry / cruise ship contacts the device	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	2	3	4	2	4	1	2.49	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	2.49
3	Contact Project Vessel with Surface Device	A project vessel contacts with the device	Construction vessel inadvertently contacts surface device during installation; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Partially constructed device not visible.	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations.	Multiple minor or single major injury; Major damage to vessel; Tier 1 to Tier 2 Spill Criteria, small operational oil spill;; Temporary closure / prolonged restrictions on operations.	1	2	1	2	5	3	4	2	4	2	4.38	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	3.47

☰	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
4	Contact Fishing Vessel with Surface Device	A fishing vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4	4	3	1	3	2.5	3.47	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green Morlais Zones; MDZ designation as no fishing zone; Appropriate spacing of devices. Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Provision of life saving equipment on fixed structures and floating devices.	2.86
5	Contact Powered Recreational Vessel with Surface Device	A powered recreational vessel contacts with the device	Construction vessel contacts device during installation; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4.5	4	3	1	2	3	3.94	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices. Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	2.76

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
6	Contact Un-Powered Recreational Vessel with Surface Device	An unpowered recreational vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to device / pinned by tidal stream; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	1	2	3	3.59	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of Safety Zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	2.76
7	Contact Other Vessels with Surface Device	Small vessel (including maintenance Vessel) contacts the device	Construction vessel working on device makes inadvertent contact; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	5	4	4	1	3	3	4.72	Restrict Navigation through the Gold and Green MDZ Zones; Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices. Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	3.81

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
8	Contact Commercial Ship with Mid-Water Device (<8m below CD)	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	2	3	4	3	4	1	3.20	Restrict Navigation through the gold and green MDZ zones; Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	3.20
9	Contact Passenger Vessels with Mid-Water Device (<8m below CD)	A ferry contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	3.5	3	4	2	4	2	4.06	Restrict Navigation through the gold and green MDZ zones; Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	3.82
10	Contact Project Vessel with Mid-Water Device (<8m below CD)	A Project Vessel contacts the device	A construction vessel inadvertently makes contact with the device during installation; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations and prolonged restrictions.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Tier 1 to Tier 2 Spill Criteria, small operational oil spill; Temporary closure / prolonged restrictions on operations.	1	3	1	3	5	3	4	2	4	2	5.28	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Check device surveys; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	4.38

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
11	Contact Fishing Vessel with Mid-Water Device <8m below CD)	A fishing vessel contacts with the device	Insufficient Lookout; Poor passage planning; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Heavy contact, person in water, entanglement with device or moorings; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	2	4.5	4	3	1	3	4	5.00	Restrict navigation through the gold and green MDZ zones; Continuous Monitoring by Marine Co-ordination Centre; MDZ designation as No Fishing Zone; Check Device Surveys; Appropriate alignment and spacing of arrays and devices; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Undertake device / array specific risk assessments to include NavAids; Temporary navigation aids as required by Trinity House; Provision of life saving equipment on fixed structures and floating devices.	3.02
12	Contact Powered Recreational Vessel with Mid-Water Device (<8m below CD)	A powered recreational vessel contacts with the device	Insufficient Lookout; Poor passage planning; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	4	4	3	1	3	3	4.47	Restrict navigation through the gold and green MDZ zones; Continuous Monitoring by Marine Co-ordination Centre; Check Device Surveys; Appropriate alignment and spacing of arrays and devices; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	3.49

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
13	Contact Un-Powered Recreational Vessel with Mid-Water Device (<8m below CD)	An un-powered recreational vessel contacts with the device	Insufficient Lookout; Poor passage planning; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to device by tidal stream; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	1	3.5	4	2	1	3	3	3.18	Restrict navigation through the gold and green MDZ zones; Continuous Monitoring by Marine Co-ordination Centre; Check Device Surveys; Appropriate alignment and spacing of arrays and devices; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Undertake device / array specific risk assessments to include NavAids; Temporary navigation aids as required by Trinity House; Provision of life saving equipment on fixed structures and floating devices.	2.61
14	Contact Other Vessels with Mid-Water Device (<8m below CD)	Maintenance Vessel contacts with the device	Construction vessel contacts device during installation; Insufficient Lookout; Poor passage planning; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	2	5	4	4	1	3	3	4.72	Restrict Navigation through the Gold and Green MDZ Zones; Continuous Monitoring by Marine Co-ordination Centre; Check Device Surveys; Appropriate alignment and spacing of arrays and devices; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	3.81

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
15	Contact Commercial Ship with Mid-Water Device (>8m below CD)	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy Contact, person in the water; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	1	3	4	2	4	1	2.88	Restrict Navigation through the Gold and Green MDZ Zones; Continuous Monitoring by Marine Co-ordination Centre; Check Device Surveys; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Minimise use of marker buoys in zones of minimum UKC.	2.88
16	Contact Passenger Vessels with Mid-Water Device (>8m below CD)	A ferry / cruise ship contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	2	3	4	2	4	1	3.11	Restrict Navigation through the Gold and Green MDZ Zones; Continuous Monitoring by Marine Co-ordination Centre; Check Device Surveys; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Minimise use of marker buoys in zones of minimum UKC.	3.11
17	Contact Project Vessel with Mid-Water Device (>8m below CD)	A project vessel makes contact with the device	A construction vessel inadvertently makes contact with the device during installation; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy Contact, person in the water; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	2	3	4	2	4	1	3.11	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Check device surveys; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	3.11

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
18	Contact Fishing Vessel with Mid-Water Device (>8m below CD)	A fishing vessel contacts the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
19	Contact Powered Recreational Vessel with Mid-Water Device (>8m below CD)	A powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
20	Contact Un-Powered Recreational Vessel with Mid-Water Device (>8m below CD)	An un-powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
21	Contact Other Vessels with Mid-Water Device (>8m below CD)	Maintenance Vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
22	Contact Commercial Ship with Sea-Bed Device >20m UKC	A deep draught commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy Contact, person in the water; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	1	3	4	2	4	1	2.88	Restrict Navigation through the Gold and Green MDZ Zones; Continuous Monitoring by Marine Co-ordination Centre; Check Device Surveys; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Minimise use of marker buoys in zones of minimum UKC.	2.88
23	Contact Passenger Vessels with Sea-Bed Device >20m UKC	A ferry contacts the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
24	Contact Project Vessel with Sea-Bed Device >20m UKC	A Project Vessel contacts the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
25	Contact Fishing Vessel with Sea-Bed Device >20m UKC	A fishing vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
26	Contact Powered Recreational Vessel with Sea-Bed Device >20m UKC	A powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
27	Contact Un-Powered Recreational Vessel with Sea-Bed Device >20m UKC	An un-powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
28	Contact Other Vessels with Sea-Bed Device >20m UKC	Maintenance Vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
29	Contact Commercial Ship with Electrical Hubs	Commercial vessel makes contact with fixed electrical hub.	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Electrical hub present in zone of 20m minimum UKC.	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations.	Multiple minor or single major injury; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	1	3	4	3	4	1	2.45	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	2.45

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
30	Contact Passenger Vessels with Electrical Hubs	Passenger vessel makes contact with fixed electrical hub.	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Electrical hub present in zone of 20m minimum UKC.	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	2	2	1	2	3	4	4	2	4	1	2.94	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	2.68
31	Contact Project Vessel with Electrical Hubs	A Project Vessel makes contact with a fixed electrical hub	A construction vessel inadvertently makes contact with the electrical hub during installation; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Partially constructed electrical hub not visible.	Single minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	2	2	1	2	4	4	4	2	4	2	3.77	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	3.77
32	Contact Fishing Vessel with Electrical Hubs	A fishing vessel makes contact with fixed electrical hub.	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	3.5	4	3	1	2	2	2.93	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; MDZ designation as No Fishing Zone; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	2.54

☰	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
33	Contact Powered Recreational Vessel with Electrical Hubs	A powered recreational vessel makes contact with a fixed electrical hub.	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	3.5	4	3	1	2	2	2.93	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	2.76
34	Contact Un-Powered Recreational Vessel with Electrical Hubs	An un-powered recreational vessel makes contact with a fixed electrical hub.	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to device by tidal stream; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	2	1	1	1	2	4	2	1	1	1	1.94	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	1.94

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
35	Contact Other Vessels with Electrical Hubs	Small vessel (including construction vessel) makes contact with a fixed electrical device.	Construction vessels contacts electrical hub during installation; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4.5	4	3	1	3	3	4.07	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Provision of life saving equipment on fixed structures and floating devices.	4.07
36	Collision Commercial Ship ICW Commercial Ship	Two commercial vessels collide due to the presence of the devices.	Increased traffic density to the north and west due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	2	1	4	4	3	3	1	2.54	Continuous Monitoring by Marine Co-ordination Centre; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.54
37	Collision Commercial Ship ICW Passenger Vessels	A commercial vessel collides with a passenger vessel due to the presence of the devices	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Multiple fatalities; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	3	1	5	4	3	4	1	3.45	Continuous Monitoring by Marine Co-ordination Centre; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	3.45

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
38	Collision Commercial Ship ICW Project Vessel	A commercial vessel collides with a project vessel	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Multiple major injuries or single fatality; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	3	1	4	4	3	4	1	3.13	Continuous Monitoring by Marine Co-ordination Centre; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	3.13
39	Collision Commercial Ship ICW Fishing Vessel	A commercial vessel collides with a fishing vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.27
40	Collision Commercial Ship ICW Powered Recreational Vessel	A commercial vessel collides with a powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.72

IDHazard TitleHazard DetailPossible CausesMost Likely OutcomeWorst Credible Outcome						Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
41	Collision Commercial Ship ICW Un-Powered Recreational Vessel	A commercial vessel collides with an un-powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.72
42	Collision Commercial Ship ICW Other Vessel	A commercial vessel collides with an other vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	2	4	4	1	2	1	2.43	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.27
43	Collision Passenger Vessels ICW Passenger Vessel	A passenger vessel collides with a passenger vessel due to the presence of the devices	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations / temporary closure or prolonged restrictions on project operations.	Multiple fatalities; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	3	2	4	1	5	4	3	4	1	4.00	Continuous Monitoring by Marine Co-ordination Centre; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	4.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
44	Collision Passenger Ship ICW Project Vessel	A passenger vessel collides with a project vessel	A ferry collides with a construction vessel carrying out construction activities in the north of the MDZ; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Multiple major injuries or single fatality; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	3	2	5	4	3	4	1	3.71	Continuous Monitoring by Marine Co-ordination Centre; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids.	3.71
45	Collision Passenger Vessels ICW Fishing Vessel	A passenger vessel collides with a fishing vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	2	4	4	1	2	1	2.43	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.34
46	Collision Passenger Vessels ICW Powered Recreational Vessel	A passenger vessel collides with a powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	2	4	3	1	3	1	2.96	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.82

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
47	Collision Passenger Vessels ICW Un-Powered Recreational Vessel	A passenger vessel collides with an un-powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	2	4	3	1	3	1	2.96	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.96
48	Collision Passenger Vessels ICW Other Vessels	A passenger vessel collides with an other vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	3	4	4	1	2	2	3.00	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Implementation of safety zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.43
49	Collision Project Vessel ICW Project Vessel	A project vessel collides with a project vessel	A project vessel collides with another project vessel while undertaking construction activities; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or short term loss of revenue.	Multiple major injuries or single fatality; Major damage to vessel; Tier 1 - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	2	4	4	4	2	4	2	4.53	Continuous Monitoring by Marine Co-ordination Centre; Temporary navigation aids as required by Trinity House.	4.53

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
50	Collision Project Vessel ICW Fishing Vessel	A project vessel collides with a fishing vessel	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	3	4	4	1	2	2	3.00	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through the gold and green MDZ zones; MDZ designation as a no fishing zone; Appropriate alignment and spacing of devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Minimise use of marker buoys in zones of minimum UKC.	2.43
51	Collision Project Vessel ICW Powered Recreational Vessel	A project vessel collides with a powered recreational vessel	Insufficient Lookout; Poor passage planning; Insufficient planning and individual risk assessment prior to departure; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to construction activities as a result of tidal stream; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Moderate impact, temporary suspension of operations or prolonged restrictions on operations.	2	2	1	2	3	4	3	1	3	2	3.02	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through the gold and green MDZ zones; Appropriate alignment and spacing of devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Minimise use of marker buoys in zones of minimum UKC.	2.76

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
52	Collision Project Vessel ICW Un-Powered Recreational Vessel	A project vessel collides with an un-powered recreational vessel	Insufficient Lookout; Poor passage planning; Insufficient planning and individual risk assessment prior to departure; Human Error; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to construction activities / pinned as a result of tidal stream; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Moderate impact, temporary suspension of operations or prolonged restrictions on operations.	2	2	1	2	2	4	2	1	3	2	2.66	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through the gold and green MDZ zones; Appropriate alignment and spacing of devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Minimise use of marker buoys in zones of minimum UKC.	2.66
53	Collision Project Vessel ICW Other Vessel	A project vessel collides with an other vessel	Project vessel collides with small workboat / construction vessel while undertaking construction activities; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Moderate impact on operations, temporary suspension or prolonged restrictions.	2	2	1	2	5	4	4	1	3	2	4.63	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through the gold and green MDZ zones; Appropriate alignment and spacing of devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Undertake device / array specific risk assessments to include NavAids; Minimise use of marker buoys in zones of minimum UKC.	3.57
54	Collision Fishing Vessel ICW Fishing Vessel	A fishing vessel collides with a fishing vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	4	3	1	2	1.5	2.38	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.38

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
55	Collision Fishing Vessel ICW Powered Recreational Vessel	A fishing vessel collides with a recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	2.5	4	3	1	3	2	3.31	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.99
56	Collision Fishing Vessel ICW Un-Powered Recreational Vessel	A fishing vessel collides with an un-recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	1	1	1	3	4	2	1	3	3	3.67	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.78
57	Collision Fishing Vessel ICW Other Vessels	A fishing vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	1	2	3	3.59	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Implementation of safety zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.76

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
58	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	A recreational vessel collides with a recreational vessel due to the presence of the devices	Narrowing of the inshore route during construction activities; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	3.5	4	3	1	3	3	4.35	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	3.64
59	Collision Powered Recreational Vessel ICW Un-Powered Recreational Vessel	A powered recreational vessel collides with an un-recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	1	3.5	4	2	1	3	3	3.18	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.61
60	Collision Powered Recreational Vessel ICW Other Vessel	A recreational vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	4	4	3	1	3	3	4.47	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	3.49

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
61	Collision Un-Powered Recreational Vessel ICW Un-Powered Recreational Vessel	An un-powered recreational vessel collides with un-powered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	1	1	1	1	5	4	1	1	3	3	2.13	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.00
62	Collision Un-Powered Recreational Vessel ICW Other Vessel	A un-powered recreational vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	1	1	1	3	4	2	1	3	2	3.24	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	2.94
63	Collision Other Vessels ICW Other Vessels	An other vessel collides with an other vessel due to the presence of the devices.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	5	4	3	1	2	4	5.13	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Minimise use of marker buoys in zones of minimum UKC.	3.59

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
64	Grounding / Forced Ashore Commercial Ship	A commercial vessel grounds due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
65	Grounding / Forced Ashore Passenger Vessels	A passenger vessel grounds due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
66	Grounding / Forced Ashore Project Vessels	A project vessel runs aground	While undertaking construction activities in vicinity of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Major damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations, temporary closure or prolonged restrictions.	2	2	1	1	2	4	4	2	4	1	2.57	Continuous Monitoring by Marine Co-ordination Centre; Temporary navigation aids as required by Trinity House.	2.57
67	Grounding / Forced Ashore Fishing Vessel	A fishing vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones. Running for shelter / safe haven in poor weather.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	2	2	3	3.74	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device/ array specific risk assessment to include NavAids and marker buoys; Minimise use of marker buoys in zones of minimum UKC.	2.88

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
68	Grounding / Forced Ashore Powered Recreational Vessel	A recreational vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Grounding with little damage; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Forced ashore onto rocks / cliffs; Multiple fatalities; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations / temporary closure or prolonged restrictions on project operations.	3	2	1	2	4	5	3	2	4	3	5.27	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device/ array specific risk assessment to include NavAids and marker buoys; Minimise use of marker buoys in zones of minimum UKC.	4.93
69	Grounding / Forced Ashore Un-Powered Recreational Vessel	An un-powered recreational vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Grounding with little damage; Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple fatalities; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Moderate impact upon operations / temporary suspension or prolonged restrictions.	2	1	1	1	4.5	4	2	1	3	3	3.67	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device/ array specific risk assessment to include NavAids and marker buoys; Minimise use of marker buoys in zones of minimum UKC.	3.37

☰	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
70	Grounding / Forced Ashore Other Vessel	An other vessel / contacts seabed, rocks or cliff grounds due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	2	2	3	3.74	Continuous Monitoring by Marine Co-ordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Undertake device/ array specific risk assessment to include NavAids and marker buoys; Minimise use of marker buoys in zones of minimum UKC.	3.34
71	Swamping / Capsize Commercial Ship	A commercial vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
72	Swamping / Capsize Passenger Vessels	A passenger vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
73	Swamping / Capsize Project Vessels	A project vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
74	Swamping / Capsize Fishing Vessel	A fishing vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Narrowing of the inshore route; Human Error; Overloading; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink;	Vessel lost, persons in water;	2	2	1	2	3	4	3	2	3	2	3.13	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Provision of life saving equipment on fixed structures and floating devices; Minimise use of marker buoys in zones of minimum UKC.	3.13
75	Swamping / Capsize Powered Recreational Vessel	A powered recreational vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Narrowing of the inshore route; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink;	Vessel lost, persons in water;	2	2	1	2	3	5	3	2	4	2	3.55	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Provision of life saving equipment on fixed structures and floating devices; Minimise use of marker buoys in zones of minimum UKC.	3.18

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
76	Swamping / Capsize Un-Powered Recreational Vessel	An un-powered recreational vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Narrowing of the inshore route; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink;	Vessel lost, persons in water;	2	1	1	1	5	4	2	1	3	3	4.13	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Provision of life saving equipment on fixed structures and floating devices; Minimise use of marker buoys in zones of minimum UKC.	4.13
77	Swamping / Capsize Other Vessel	An other vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Narrowing of the inshore route; Human Error; Overloading; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink;	Vessel lost, persons in water;	2	2	1	2	3	4	3	2	3	3	3.62	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Provision of life saving equipment on fixed structures and floating devices; Minimise use of marker buoys in zones of minimum UKC.	3.62
78	Snagging/ Obstruction Commercial Ship	A commercial vessel's anchor interacts with a cable or the device and its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared on weighing anchor; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared on weighing anchor seriously damaging moorings, devices or power cables; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	2	1	1	1	4	1	1.85	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through gold and green MDZ zones; Establish no anchoring areas; Enhanced cable protection.	1.74

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
79	Snagging/Obstruction Passenger Vessels	A ferry's anchor interacts with a device, its moorings or a cable.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared on weighing; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared on weighing seriously damaging moorings, devices or power cables; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	2	1	1	1	4	2	2.09	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through gold and green MDZ zones; Establish no anchoring areas; Enhanced cable protection.	1.85
80	Snagging / Obstruction Project Vessels	A project vessels anchor interacts with a device, its moorings or a cable.	Construction vessel snags cable while undertaking installation activities; Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings or power cables; Multiple minor injuries or a single major; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	5	3	2	1	4	3	4.13	Continuous Monitoring by Marine Co-ordination Centre; Establish no anchoring areas; Enhanced cable protection.	3.37

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
81	Snagging/ Obstruction Fishing Vessel	A fishing vessel's gear/ anchor interacts with a cable or the device and its moorings.	Fishing gear snags moorings, device or power cable; Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Fishing gear or anchor snags mooring lines or power cables but cleared; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Fishing gear or anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	2	2	1	1	5	3	2	1	4	3	4.50	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through gold and green MDZ zones; MDZ designation as no fishing zone; Establish no anchoring areas; Enhanced cable protection.	2.76
82	Snagging/ Obstruction Powered Recreational Vessel	A recreational vessel's gear/ anchor interacts with a cable or the device and its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	1	1	1	1	2	2	1	1	2	1	0.56	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through gold and green MDZ zones; Establish no anchoring areas; Enhanced cable protection; Minimise use of marker buoys in zones of minimum UKC.	0.56
83	Snagging/ Obstruction Un-Powered Recreational Vessel	An un-powered recreational vessel's gear/ anchor interacts with a cable, the device, marker buoy or its moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

☰	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
84	Snagging/ Obstruction Other Vessel	An other vessel's gear/anchor interacts with a cable or the device and its moorings.	Construction vessel inadvertently snags mooring lines or power cables during works; Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	3	2	1	4	3	3.59	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through gold and green MDZ zones; Establish no anchoring areas; Enhanced cable protection.	3.36
85	Breakout of device / device not at stated depth	The device's moorings fail, device becomes a hazard to navigation.	Equipment / mooring failure; Adverse Environmental Conditions; Breaks adrift during deployment operations; Device or its mooring lines hit / snagged by vessel.	Mooring failure, device remains in position and at stated depth; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Mooring failure, device breaks free or no longer at stated depth / required UKC and becomes contact hazard. Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	5	4	4	1	3	3	4.72	Restrict Navigation through gold and green MDZ zones; Continuous Monitoring by Marine Co-ordination Centre; Check device surveys; Establish no anchoring areas; Implementation of safety zones; Temporary navigation aids as required by Trinity House.	2.40

Annex C Hazard Log – Site-Wide Operational

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
1	Contact Commercial Ship with Surface Device	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather;	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations.	Multiple minor or single major injury; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	2	3	4	3	4	1	2.58	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones;	2.58
2	Contact Passenger Vessels with Surface Device	A ferry / cruise ship contacts the device	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	2	3	4	2	4	1	2.49	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones;	2.49
3	Contact Fishing Vessel with Surface Device	A fishing vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather;	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4	4	3	1	3	2.5	3.47	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; MDZ designation as No Fishing Zone; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices.	2.86

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
4	Contact Powered Recreational Vessel with Surface Device	A powered recreational vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	1	2	3	3.59	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices.	2.76
5	Contact Un-Powered Recreational Vessel with Surface Device	A non-powered recreational vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to device / pinned by tidal stream; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	1	2	3	3.59	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices.	2.76

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
6	Contact Other Vessels with Surface Device	Small vessel (including maintenance Vessel) contacts with the device	Maintenance vessel working on device makes inadvertent contact; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4	4	4	1	3	2.5	3.56	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices.	2.95
7	Contact Commercial Ship with Mid-Water Device (<8m below CD)	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	2	3	4	3	4	1	3.20	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Check device surveys.	3.20
8	Contact Passenger Vessels with Mid-Water Device (<8m below CD)	A ferry contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	3	3	4	2	4	2	3.82	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Check device surveys.	3.82

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
9	Contact Fishing Vessel with Mid-Water Device <8m below CD)	A fishing vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Heavy contact, person in water, entanglement with device or moorings. Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	2	4	4	3	1	3	3.5	4.23	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; MDZ designation as No Fishing Zone; Appropriate alignment and spacing of arrays and devices; Check device surveys; Provision of life saving equipment on fixed structures and floating devices.	3.02
10	Contact Powered Recreational Vessel with Mid-Water Device (<8m below CD)	A powered recreational vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	1	3	3.5	4.01	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Check device surveys; Provision of life saving equipment on fixed structures and floating devices.	3.49

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
11	Contact Un-Powered Recreational Vessel with Mid-Water Device (<8m below CD)	An un-powered recreational vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to device by tidal stream; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Moderate impact upon operations / temporary suspension or prolonged restrictions.	2	1	1	1	3	4	2	1	3	3	3.04	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Check device surveys; Provision of life saving equipment on fixed structures and floating devices.	3.07
12	Contact Other Vessels with Mid-Water Device (<8m below CD)	Maintenance Vessel contacts with the device	Maintenance vessel working on device makes inadvertent contact; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Heavy contact, person in water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	2	3.5	4	4	1	3	3	3.57	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Check device surveys; Provision of life saving equipment on fixed structures and floating devices.	2.95

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
13	Contact Commercial Ship with Mid-Water Device (>8m below CD)	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	1	3	4	2	4	1	2.88	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Check device surveys; Minimise use of marker buoys in zones of minimum UKC.	2.88
14	Contact Passenger Vessels with Mid-Water Device (>8m below CD)	A ferry / cruise ship contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	3	1	3	2	3	4	2	4	1	3.11	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Check device surveys; Minimise use of marker buoys in zones of minimum UKC.	3.11
15	Contact Fishing Vessel with Mid-Water Device (>8m below CD)	A fishing vessel contacts the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
16	Contact Powered Recreational Vessel with Mid-Water Device (>8m below CD)	A powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
17	Contact Un-Powered Recreational Vessel with Mid-Water Device (>8m below CD)	An un-powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00		0.00
18	Contact Other Vessels with Mid-Water Device (>8m below CD)	Maintenance Vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
19	Contact Commercial Ship with Sea-Bed Device >20m UKC	A commercial vessel such as a cargo vessel or tanker contacts the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
20	Contact Passenger Vessels with Sea-Bed Device >20m UKC	A ferry contacts the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
21	Contact Fishing Vessel with Sea-Bed Device >20m UKC	A fishing vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
22	Contact Powered Recreational Vessel with Sea-Bed Device >20m UKC	A powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
23	Contact Un-Powered Recreational Vessel with Sea-Bed Device >20m UKC	An un-powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00		0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
24	Contact Other Vessels with Sea-Bed Device >20m UKC	Maintenance Vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	N/A	0.00
25	Contact Commercial Vessel with Electrical Hubs	Commercial vessel makes contact with fixed electrical hub.	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Electrical hub present in zone of 20m minimum UKC.	Minor contact; No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	1	3	4	3	4	1	2.45	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones.	2.45
26	Contact Passenger Vessels with Electrical Hubs	Passenger vessel makes contact with fixed electrical hub.	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Electrical hub present in zone of 20m minimum UKC.	Light contact; No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Heavy contact; Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	2	2	1	2	2	4	4	2	4	1	2.68	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones.	2.68

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
27	Contact Fishing Vessel with Electrical Hubs	A fishing vessel makes contact with fixed electrical hub.	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	3	4	3	1	3	2	2.86	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; MDZ designation as No Fishing Zone; Provision of life saving equipment on fixed structures and floating devices.	2.65
28	Contact Powered Recreational Vessel with Electrical Hubs	A powered recreational vessel makes contact with a fixed electrical hub.	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	3	4	3	1	2	2	2.76	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Provision of life saving equipment on fixed structures and floating devices.	2.76

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
29	Contact Un-Powered Recreational Vessel with Electrical Hubs	An un-powered recreational vessel makes contact with a fixed electrical hub.	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to device by tidal stream; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	2	1	1	1	2	4	2	1	1	1	1.94	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Provision of life saving equipment on fixed structures and floating devices.	1.94
30	Contact Other Vessels with Electrical Hubs	Small vessel (including maintenance Vessel) contacts with the device	Workboat undertaking Maintenance on hub makes inadvertent contact; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4	4	3	1	3	3	3.72	Continuous Monitoring by Marine Co-ordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Provision of life saving equipment on fixed structures and floating devices.	3.72
31	Collision Commercial Ship ICW Commercial Ship	Two commercial vessels collide due to the presence of the devices.	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	2	1	4	4	3	3	1	2.54	Minimise use of marker buoys in zones of minimum UKC.	2.54

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
32	Collision Commercial Ship ICW Passenger Vessels	A commercial vessel collides with a passenger vessel due to the presence of the devices	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Multiple fatalities; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	3	1	5	4	3	4	1	3.45	Minimise use of marker buoys in zones of minimum UKC.	3.45
33	Collision Commercial Ship ICW Fishing Vessel	A commercial vessel collides with a fishing vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.27
34	Collision Commercial Ship ICW Powered Recreational Vessel	A commercial vessel collides with a powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.72

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
35	Collision Commercial Ship ICW Un-Powered Recreational Vessel	A commercial vessel collides with an un-powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.72
36	Collision Commercial Ship ICW Other Vessel	A commercial vessel collides with an other vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.27
37	Collision Passenger Vessels ICW Passenger Vessel	A passenger vessel collides with a passenger vessel due to the presence of the devices	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations / temporary closure or prolonged restrictions on project operations.	Multiple fatalities; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	3	2	4	1	5	4	3	4	1	4.00	Minimise use of marker buoys in zones of minimum UKC.	4.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
38	Collision Passenger Vessels ICW Fishing Vessel	A passenger vessel collides with a fishing vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	2	4	4	1	2	1	2.43	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.34
39	Collision Passenger Vessels ICW Powered Recreational Vessel	A passenger vessel collides with a powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	2	4	3	1	3	1	2.96	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.82
40	Collision Passenger Vessels ICW Un-Powered Recreational Vessel	A passenger vessel collides with an un-powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	2	4	3	1	3	1	2.96	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.82

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
41	Collision Passenger Vessels ICW Other Vessels	A passenger vessel collides with an other vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	2	4	4	1	2	1	2.43	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.34
42	Collision Fishing Vessel ICW Fishing Vessel	A fishing vessel collides with a fishing vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	4	3	1	2	1.5	2.38	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.38
43	Collision Fishing Vessel ICW Powered Recreational Vessel	A fishing vessel collides with a powered recreational vessel due to the presence of the devices.	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	2.5	4	3	1	3	2	3.31	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	3.13

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
44	Collision Fishing Vessel ICW Un-Powered Recreational Vessel	A fishing vessel collides with an un-powered recreational vessel due to the presence of the devices.	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	1	1	1	3	4	2	1	3	3	3.67	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.91
45	Collision Fishing Vessel ICW Other Vessels	A fishing vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	3	4	3	1	2	2	2.76	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.47
46	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	A powered recreational vessel collides with a powered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	3	4	3	1	3	2	3.64	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	3.47

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
47	Collision Powered Recreationa I Vessel ICW Un-Powered Recreationa I Vessel	An powered recreational vessel collides with an un-powered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment and Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	1	4	4	2	1	3	2	2.94	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.94
48	Collision Powered Recreationa I Vessel ICW Other Vessel	A recreational vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	2.5	4	3	1	3	2.5	3.51	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	3.16
49	Collision Un-Powered Recreationa I Vessel ICW Un-Powered Recreationa I Vessel	An un-powered recreational vessel collides with an un-powered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	1	1	1	1	5	4	1	1	3	3	2.13	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
50	Collision Un-Powered Recreational Vessel ICW Other Vessel	An un-recreational vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	1	1	1	2	4	2	1	3	2	2.94	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.94
51	Collision Other Vessels ICW Other Vessels	An other vessel collides with an other vessel due to the presence of the devices.	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2.5	4	3	1	2	2	2.64	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.64
52	Grounding / Forced Ashore Commercial Ship	A commercial vessel grounds due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
53	Grounding / Forced Ashore Passenger Vessels	A passenger vessel grounds due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
54	Grounding / Forced Ashore Fishing Vessel	A fishing vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Minor impact upon operations / short term loss of revenue.	2	2	1	1	3	4	3	2	2	2	2.88	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.75
55	Grounding / Forced Ashore Powered Recreational Vessel	A recreational vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Grounding with little damage; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Forced ashore onto rocks / cliffs; Multiple fatalities; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations / temporary closure or prolonged restrictions on project operations.	3	2	1	2	3	5	3	2	4	3	4.67	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	4.18

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
56	Grounding / Forced Ashore Un-Powered Recreational Vessel	An un-powered recreational vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Grounding with little damage; Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations / short term loss of revenue.	Forced ashore onto rocks / cliffs; Multiple fatalities; Minor damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Moderate impact upon operations / temporary suspension / prolonged restrictions.	2	1	1	1	4	4	2	1	3	3	3.37	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.61
57	Grounding / Forced Ashore Other Vessel	An other vessel / contacts seabed, rocks or cliff grounds due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Minor impact upon operations / short term loss of revenue.	2	2	1	1	3	4	3	2	2	2	2.88	Appropriate alignment and spacing of arrays and devices; Minimise use of marker buoys in zones of minimum UKC.	2.88
58	Swamping / Capsize Commercial Ship	A commercial vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
59	Swamping / Capsize Passenger Vessels	A passenger vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
60	Swamping / Capsize Fishing Vessel	A fishing vessel overwhelmed by sea and swamps / capsizes.	Human Error; Insufficient planning and individual risk assessment prior to departure; Overloading; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Vessel lost, persons in water; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	2	3	4	3	2	3	2	3.13	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices; Minimise use of marker buoys in zones of minimum UKC.	3.13
61	Swamping / Capsize Powered Recreational Vessel	A powered recreational vessel overwhelmed by sea and swamps / capsizes.	Human Error; Insufficient planning and individual risk assessment prior to departure; Taking additional risks during racing; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Vessel lost, persons in water; Multiple fatalities; Moderate damage to vessel; Minor effect upon the Environment / No pollution; Temporary closure or prolonged restrictions.	2	2	1	2	3	5	3	2	4	2	3.55	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices; Minimise use of marker buoys in zones of minimum UKC.	3.55

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
62	Swamping / Capsize Un-Powered Recreational Vessel	An un-powered recreational vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Human Error; Insufficient planning and individual risk assessment prior to departure; Taking additional risks during racing; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink; Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations / short term loss of revenue.	Vessel lost, persons in water; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	1	5	4	2	1	3	3	4.13	Continuous monitoring by marine coordination centre; Provision of life saving equipment on fixed structures and floating devices.	4.13
63	Swamping / Capsize Other Vessel	An other vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Human Error; Insufficient planning and individual risk assessment prior to departure; Overloading; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Vessel lost, persons in water; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	2	3	4	3	2	3	2	3.13	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices; Minimise use of marker buoys in zones of minimum UKC.	3.13
64	Snagging/ Obstruction Commercial Ship	A commercial vessel's anchor interacts with a cable, the device, its moorings or marker buoy moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Running for shelter / safe haven in poor weather. Poor Visibility; Navigation aid failure.	Anchor snags mooring lines or power cables but cleared on weighing; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared on weighing anchor seriously damaging moorings, devices or power cables; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	2	1	1	1	4	1	1.85	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection; Minimise use of marker buoys in zones of minimum UKC.	1.74

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
65	Snagging/Obstruction Passenger Vessels	A ferry's anchor interacts with a cable, the device, marker buoy or its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Navigation aid failure.	Anchor snags mooring lines or power cables but cleared on weighing; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared on weighing seriously damaging moorings, devices or power cables; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	2	1	1	1	4	2	2.09	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through gold and green MDZ zones; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection; Minimise use of marker buoys in zones of minimum UKC.	1.85
66	Snagging/Obstruction Fishing Vessel	A fishing vessel's gear/ anchor interacts with a cable, the device, marker buoy or its moorings.	Fishing gear snags moorings, device or power cable; Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Navigation aid failure.	Fishing gear or anchor snags mooring lines or power cables but cleared; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Fishing gear or anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	2	2	1	1	5	3	2	1	4	3	4.50	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through gold and green MDZ zones; MDZ designation as no fishing zone; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection; Minimise use of marker buoys in zones of minimum UKC.	2.76
67	Snagging/Obstruction Powered Recreational Vessel	A powered recreational vessel's gear/ anchor interacts with a cable, the device, marker buoy or its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	1	1	1	1	2	2	1	1	2	1	0.56	Continuous Monitoring by Marine Co-ordination Centre; Restrict navigation through gold and green MDZ zones; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection; Minimise use of marker buoys in zones of minimum UKC.	0.56

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
68	Snagging/Obstruction Un-Powered Recreational Vessel	An un-powered recreational vessel's gear/ anchor interacts with a cable, the device, marker buoy or its moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
69	Snagging/Obstruction Other Vessel	An other vessel's gear/anchor interacts with a cable, the device, marker buoy or its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	3	2	1	4	2	2.54	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection; Minimise use of marker buoys in zones of minimum UKC.	2.38
70	Breakout of device / device not at stated depth	The device's moorings fail, device becomes a hazard to navigation.	Equipment / mooring failure; Adverse Environmental Conditions; Contact by vessel.	Mooring failure, device remains in position and at stated depth; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Mooring failure, device breaks free or no longer at stated depth / required UKC and becomes contact hazard; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	3	4	4	1	3	2	2.95	Restrict Navigation through gold and green MDZ zones; Continuous Monitoring by Marine Coordination Centre; Check device surveys; Establish no anchoring areas.	2.40

Annex D NRA Stakeholder Minutes

Minutes of Meeting held on 02-October-2023 – MCA

Client: Menter Môn
Project: 22UK1877
Venue: MS Teams
Date of Meeting: 02-October-2023 at 11.00

Present: MCA Nick Salter (NS)
Vinu John (VJ)
Marico Marine Ryan Horrocks (RH)
William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project.	
1.1	<ul style="list-style-type: none"> Both NS and VJ are aware of the project VJ mentioned that he is leading on Tidal and Wave energy projects for the MCA. 	
2	WH showed the MCA the development and results of the VTS AIS and Radar Analysis.	
2.1	<ul style="list-style-type: none"> WH ran through the slides and the MCA made the following comments: VJ asked if the devices are the same as those being installed at Fall of Warness, Orkney by Magallanes. WH responded with, yes. <p>All vessel tracks;</p> <ul style="list-style-type: none"> No comment <p>Non-AIS (only Radar) tracks;</p> <ul style="list-style-type: none"> No comment <p>Recreational tracks; and</p> <ul style="list-style-type: none"> No comment <p>Passenger tracks;</p> <ul style="list-style-type: none"> No comment <ul style="list-style-type: none"> The MCA said they were content with the traffic conditions and will await the combined analysis of summer and winter before they comment. Marico Marine's winter survey is due to take place in October. NS suggested that the MCA would consider this more of an Autumn survey. WH stated that the guidance does not state "summer" and "winter" and that the survey in October should cover variation between seasons. VJ asked about fishing data and specifically if any had been captured and how Marico were going to capture the seasonal variation. RH suggested that fishing vessels operate all year round in the area of interest (<i>based on results from the previous NRA, more fishing occurs during the summer. In the winter, vessels tend to transit through the site rather than fish</i>). NS asked if any other AIS data had been collected. 	RH to send Fishing Tracks

	<ul style="list-style-type: none"> RH mentioned that AIS data had been collected in March, to which NS stated he believed that was more of a spring survey. WH asked if the MCA could provide scope on what the MCA expect to see from the Winter survey. NS suggested that a winter survey should cover different weather conditions and capture for bad weather routing. 	
3	WH asked if NS had any other views/changes in vessel traffic.	
3.1	<ul style="list-style-type: none"> VJ said that ferries are more likely to undertake weather routing in the winter and suggested that this be captured within the NRA. No changes to the area for vessel traffic. VJ asked if any additional data had been collected other than AIS and Radar. WH said that visuals had been conducted over the two-week summer period. 	
4	WH showed the hazard list from the previous NRA.	
4.1	<ul style="list-style-type: none"> The MCA had no comment. 	
5	WH showed the vessel types identified within the previous NRA.	
5.1	<ul style="list-style-type: none"> The MCA had no comment. 	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	<ul style="list-style-type: none"> VJ mentioned mitigation 3 – “Restrict Navigation through the Gold and Green MDZ Zones” and questioned what it meant. WH said that he assumes it would be advice and notices however, this is something to clarify within the NRA. NS believed that this was raised within the NRA process previously. NS mentioned that the layout plan would need agreement from the NRA. NS questioned mitigation 4 “MDZ designation as No Fishing Zone”. WH suggested that this would be clarified within the next NRA. NS mentioned that 3rd party verification of mooring arrangements for tidal devices would be needed, and consideration would need to be given to the MCA guidance entitled “Regulatory expectations on moorings for floating wind and marine devices” 2017. VJ questioned if safety zones would be implemented just through installation or through the entirety of the project. NS stated that the MCA will review the NRA and provide a list of conditions which are subject to review for specific devices. 	WH to check
7	WH asked about cumulative impacts	
7.1	<ul style="list-style-type: none"> VJ mentioned Minetso to the west of Morlais and suggested it should be considered. VJ also suggested that research should be undertaken to consider future plans. 	
8	WH asked if there were any further comments.	
8.1	<ul style="list-style-type: none"> VJ questioned if the NRA was for the sitewide of Morlais. WH said that the NRA will consider the 4 devices mentioned, a device specific NRA will be undertaken for each installation and assumed that each device installation would need a separate license. 	

	<ul style="list-style-type: none">• NS stated that the MCA could review the application and may add a few more conditions.	
--	--	--

Minutes of Meeting held on 02-October-2023 – UK Chamber of Shipping

Client: Menter Môn
Project: 22UK1877
Venue: MS Teams
Date of Meeting: 02-October-2023 at 15.00

Present: UK CoS Robert Merrylees (RM)
Marico Marine Ryan Horrocks (RH)
William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked RM about the UK CoSs activity within the area of interest.	
1.1	<ul style="list-style-type: none"> RM was involved in the project in 2017-2018. The UK Chamber of Shipping is the primary trade organisation for the UK's shipping industry. RM said that the CoS was primarily interested in the development from a navigation risk perspective for commercial operators. RM asked about the continual monitoring of the project and agreed with the requirement that an NRA is to be undertaken every two years. 	
2	WH showed RM the development and results of the VTS AIS and Radar Analysis.	
2.1	<ul style="list-style-type: none"> WH ran through the slides and RM made the following comments: <p>All vessel tracks;</p> <ul style="list-style-type: none"> No comment <p>Non-AIS (only Radar) tracks;</p> <ul style="list-style-type: none"> No comment <p>Recreational tracks; and</p> <ul style="list-style-type: none"> No comment <p>Passenger tracks;</p> <ul style="list-style-type: none"> Cruise traffic reduced during covid. This year (2023) is a representable year for cruise traffic. Zonal approach was agreed with passenger ferries including the weather routeing during the original NRA process. RM asked if the area would be an exclusion zone. WH suggested that this would not be possible in the UK and installations should be individually marked. 	
3	WH asked if RM had any other views/changes to the area.	
3.1	<ul style="list-style-type: none"> RM mentioned there were projects in the Irish sea with ongoing consultation (Morgan, Mona, Morecambe.) and would be Isle of Man waters. RM asked what is agreed for the lighting/marketing of the devices. 	

	<ul style="list-style-type: none">• RH mentioned that Marico are producing an Aids to Navigation plan with input from Trinity House and for device specific marking, a decision will be made closer to the installation date.• RM suggested that a standardise approach would be useful towards the marking of the devices.• RM stated that the zonal approach mitigated concerns from the ferry users in the original NRA process.• RM asked whether there would be multiple cables along the inshore passageway and if so, would there be any coordination. This was through concerns over CBRAs and Nagging risks etc.• WH believed there were 9 cables accounted for through the consenting process connecting up to 200 devices as per the marine licence.• Irish getting going with MARA for offshore renewables and may want to be involved in the consultation.	WH to check
--	--	-------------

Minutes of Meeting held on 02-November-2023 – Anglesey Charter Fishing

Client: Menter Môn
Project: 22UK1877
Venue: MS Teams
Date of Meeting: 02-November-2023 at 08.00

Present: Anglesey Charter Fishing Aaron Smith (AS)
Marico Marine Ryan Horrocks (RH)
William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked AS about their activity within the area of interest.	
1.1	<ul style="list-style-type: none">AS stated that there are 3 commercial fishermen including himself that actively fish within the MDZ. AS mentioned that there is another fisherman who occasionally fishes around the area.AS suggested that he was acting as a representative of the commercial fishermen in the area.AS said that he is based at the Holyhead Fish Docks and works over the full western side of the island.AS mentioned that fishermen work in and around the MDZ from mid-summer until now (November) and suggested that the work within the MDZ is all pot fishing. AS suggested that they fish all year round.AS also mentioned that he is the only fisherman to take charters out for anglers.AS said that there are also 2 additional angling vessels, separate to the 4 mentioned previously which operate in the same season.AS mentioned that he had undertaken surveys for the project.AS mentioned that he has fished the area for a long time. AS said that there are no lobsters until July/August and fishers will fish until the weather is too harsh.	
2	WH showed AS the development and results of the VTS AIS and Radar Analysis.	
2.1	<ul style="list-style-type: none">WH ran through the slides and MB made the following comments: All vessel tracks;<ul style="list-style-type: none">No commentNon-AIS (only Radar) tracks;<ul style="list-style-type: none">AS mentioned that Radar will struggle to pick up smaller vessels.RH stated that visual observations were also undertaken.Recreational tracks; and<ul style="list-style-type: none">No commentPassenger tracks;<ul style="list-style-type: none">Prince Madog may be the vessel that “zigzags” over the wrecks.	

	<ul style="list-style-type: none"> AS mentioned that the traffic data looks exactly as expected. AS said that not much angling takes part in the area due to strong tides. AS mentioned that Holyhead is one of the main stop-off ports on in the Irish sea and it is the only deep-water port in the area. WH mentioned he was aware that there was no marina at the moment due to storm damage. AS mentioned that when the marina was in place, it had 40-50 vessels during its peak. AS suggested that once the marina has been built, recreational traffic would likely pick up again. 	
3	WH asked if AS had any other views/changes in vessel traffic.	
3.1	<ul style="list-style-type: none"> AS could not recall any changes to the area or vessel traffic in recent years. AS mentioned that the only change observed was when the Marina was shut down. AS said that vessels have been interested in the LiDAR research buoy currently within the MDZ. AS said that he is a member of the RNLI and could not recall any incidents within the site. AS mentioned that some incidents occurred around North Stack, most of which break downs. AS also mentioned that getting to North Stack at the wrong time can catch out inexperienced mariners. Most incidents are involving people lacking experience. 	
4	WH showed the hazard list from the previous NRA.	
4.1	<ul style="list-style-type: none"> AS suggested that devices could get caught on lobster buoys, however, they are usually only out for an hour per day on the surface. AS mentioned that the area experiences extreme winds and tides. AS was surprised that the area had been chosen considering the conditions. WH suggested that tidal conditions are the attraction for the development 	
5	WH showed the vessel types identified within the previous NRA.	
5.1	<ul style="list-style-type: none"> AS mentioned that he once encountered a "Human Hamster Ball". AS suggested that recreational dive vessels should also be included. 	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	<ul style="list-style-type: none"> AS suggested that for a quarter of the year, the area can become busy with fishing/recreational vessels. AS suggested that wind farms north of the site have used guard vessels. 	
7	WH asked about cumulative impacts	
7.1	<ul style="list-style-type: none"> AS suggested that the Minesto project located in Holyhead Deep has moved to the Faroe Islands and no longer operate in the area. AS mentioned that their offices in Holyhead appear vacant. AS also mentioned that Holyhead marina was the only development in the area that he was aware of. 	
8	WH asked if there were any further comments.	
8.1	<ul style="list-style-type: none"> AS stated that the fishermen's main concern is potential loss fishing grounds. AS mentioned that the fishers could not afford to lose the area 	

	<p>as a potential fishing ground. AS said that they work all year round and move offshore in August.</p> <ul style="list-style-type: none">• AS suggested that during the summer months, fishers could have 700-800 pots in the area at any one time. AS mentioned that 300 of those could be his.• AS said that 50 pots can be on a line that is $\frac{3}{4}$ mile long.	
--	--	--

Minutes of Meeting held on 04-October-2023 – Various Consultees

Client: Menter Môn
Project: 22UK1877
Venue: MS Teams
Date of Meeting: 04-October-2023 at 17.00

Present:	Irish Ferries	Andreas Cabans (AC)
	NCI	Trevor Sturrock (TS)
		Caro Wilson (CW)
	RNLI	Andrew Hodgson (AH)
		Megan Dixon (MD)
		Delme Mullings (DM)
		Paul Moffat (PM)
	Holyhead Port	John Goddard (JG)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project.	
1.1	<ul style="list-style-type: none"> Andreas Cabans – Master on Irish Ferries Vessel, Ulysses. Trevor Sturrock - Station Manager for NCI Rhoscolyn. Caro Wilson - Assistant Station Manager for NCI Rhoscolyn. Andrew Hodgson – RNLI Crewmember. Megan Dixon - RNLI Crewmember. Delme Mullings - RNLI Crewmember. Paul Moffat – RNLI Operations Manager. John Goddard – Holyhead Harbour Master. <p>Magallanes device information stated within meeting (all measurements are subject to change):</p> <ul style="list-style-type: none"> Approx. height of devices is 3.4m (2.09m above sea level); Approx. draught is 29.6 with blades (approx. 23m diameter); Approx. length of devices is 55m; and 4-point gravity mooring is planned. 	
2	WH showed the room the development and results of the VTS AIS and Radar Analysis.	
2.1	<ul style="list-style-type: none"> CW asked if the 4 devices being installed would be just below the surface. WH explained that the device will be on the surface in the green zone. PM asked what the height of the Magallanes devices would be, if they are to be aligned, and how many of those devices would they be able to fit in the area. PM also asked if there are taller devices going through the regulator. And if they exceeded 3.4m. 	

	<ul style="list-style-type: none"> PM asked what the max height of a device could be. AC asked if there were more than those devices (Magallanes) in the water. WH explained that any major changes to the device specification will need to be updated within the document. <p>All vessel tracks;</p> <ul style="list-style-type: none"> No comment <p>Non-AIS (only Radar) tracks;</p> <ul style="list-style-type: none"> No comment <p>Recreational tracks; and</p> <ul style="list-style-type: none"> MD suggested that the area may be busier as the Regatta was cancelled through August and took place at a later date. RH mentioned that the plot should look denser as most of the Non-AIS tracks were also recreational tracks. Tracks also don't include kayakers and smaller craft that are identified by Radar. <p>Passenger tracks;</p> <ul style="list-style-type: none"> AC mentioned that Stena Line and Irish ferries may cross the zone for weather routeing. More often in winter months. <ul style="list-style-type: none"> AH said that traffic numbers might be higher due to a post-covid surge. However, it won't be particularly busy. WH asked if Kaker traffic had increased. DM, TH both agreed that kayak traffic had increased since the covid pandemic. TH suggested that South Stack tends to be a bit safer for kayaks. CW said that there were more smaller craft which included SUPs and Kayaks but was surprised that there wasn't more recorded during the NCI watch from the RSPB Café. TH agreed with CW and expected the area to be busier. CW said that their watch site missed the very narrow area over the cliffs that may contain more kayaks. TH suggested they missed an area of approximately 100m. JG asked if a winter survey was due to be completed. Ac asked if the devices are equipped with Aids to Navigation for example AIS, Racon etc. WH said that Marico Marine are developing an Aids to Navigation plan for the area which is subject to TH approval. AC also asked if there were any exclusion zones for vessels. WH suggested that as far as he was aware, permanent exclusion zone cannot be established under current legislation. However, recommendations to avoid an area can be made. DM suggested that from his experience, there are more jet skis in the area. These can be more dangerous as they have no knowledge of the area and can come from afar to transit the area. Some jet skiers come in groups, launch on local beaches and don't respect by laws. They may not be aware of local regulations. CW added that they see a lot of groups of jet skis. Some have no consideration for other water users and NCI tend to see more in the summer. 	
--	---	--

3	WH asked if anyone had any other views/changes in vessel traffic.	
3.1	<ul style="list-style-type: none"> JG said that more windfarms are moving south and will need mobilization ports within the area. JG also mentioned that the port has plans to expand and increase activities. JG mentioned they had concerns over ferry routeing with the new development. AC suggested that if weather was heavier, Irish Ferries would travel further south to head into Holyhead port. JG expressed concerns for passenger ferry safety and asked if the zones had been agreed. AC suggested that on the chart, the zones looked fine. But still expressed a concern. JG explained that the area can't be completely free to navigation due to the nature of the devices being installed and asked if there were plans from Trintiy House regarding aids to navigation. JG suggested that area would effectively be a "no-go area". JG also asked who would be liable if a ferry was to use the weather route and collide with a device. JG asked how their input would enter the assessment. WH explained that comments made in this session will be considered as a part of the assessment and that the meeting minutes will be included within the report. JG asked if the re-routeing of a ferry being accounted for. AH explained that if the RNLI were searching in the area, they could miss targets. JG asked if the previous NRA was available for viewing. JG asked if the risk assessment will be for all the devices that go in. JG asked if consultation would occur every time devices enter the water and if they would be considered as a group or as individual turbines. WH explained that as devices enter the water, the cumulative impacts would be assessed. PM explained that the RNLI get an alert when they deploy which does not give them much time to respond. JG asked if there would be a blade breaching the surface of the water. WH explained that there will not be a blade breaching the water. AC had concerns over a breakout mooring and the recovering of the devices. They asked if the devices would have AIS so they were visible. WH said that the control room should monitor the health and activity of devices 	RH to provide link to previous NRA
4	WH showed the hazard list from the previous NRA.	
4.1	<ul style="list-style-type: none"> No comments from group 	
5	WH showed the vessel types identified within the previous NRA.	
5.1	<ul style="list-style-type: none"> DM asked if the environmental impacts had been assessed. WH explained that Marico Marine are only involved with regards to navigation, but environmental risks are fully considered as part of the project. 	

	<ul style="list-style-type: none"> JG asked if rogue vessels were considered, mainly because of their inexperience. JG explained that they currently have a rogue vessel in port limits that was trying to travel from Ireland to Africa. DM suggested that the RNLI have not only recovered inexperienced users but also experienced users this year. 	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	<ul style="list-style-type: none"> JG suggested that guard vessels as a mitigation is not realistic. They may be used for the installation but didn't think they'd be used for any other part of the project. JG suggested that the submerged devices (Gold area) would be the biggest risk. AH asked if there were only tidal devices being installed in the area. WH explained that only tidal devices are to be installed. DM suggested that the devices will have an effect on South Stack as it is a popular area. PM questioned the validity of assessment as consultancies conducting assessments are not based locally. WH explained that the consultation process is designed to include the views and concerns from local, experienced users. PM also asked when the devices are to be installed and at what point do they decide what goes in the water. PM asked if there is an action plan in place if an incident was to occur. PM explained that they won't send out a team in harsh weather. RH explained that the assessment will be undertaken in line with MCA guidance. CW expressed concerns over developing in an area with a high traffic density. WH explained that the site has been identified as a productive site for tidal energy and the area has been previously risk assessed and will continue to be risk assessed. CW agreed that the site is good for tidal energy but had concerns over the visual impact. DM asked if the substation had been built. WH explained that they had started to build the substation. AC asked if different turbines are due to be installed and what is the selection process of the different devices. 	
7	WH asked about cumulative impacts	
7.1	<ul style="list-style-type: none"> No comments from group 	
8	WH asked if there were any further comments.	
8.1	<ul style="list-style-type: none"> No comments from group 	

Minutes of Meeting held on 04-October-2023 – Various Consultees

Client: Menter Môn
Project: 22UK1877
Venue: MS Teams
Date of Meeting: 04-October-2023 at 19.00

Present:	Sea Kayaking Alliance	Jenny Wong (JW)
	Canoe Wales	Alistair Dickson (AD)
		Alistair Pattullo (AP)
	Holyhead Sailing Club	Mark Rosenthal (MR)
	Snowdonia Canoe Club	Jim Potter (JP)
	Rhosneigr Scuba	Andy Easter (AE)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project.	
1.1	<ul style="list-style-type: none"> Jenny Wong – representative for the Anglesey Sea Kayak Alliance. Alistair Dickson – CEO of Canoe Wales. Alistair Pattullo – representative for Canoe Wales. Mark Rosenthal – representative for Holyhead Sailing Club. Jim Potter - representative for Snowdonia Canoe Club. Andy Easter - representative for Rhosneigr Scuba. <p>Magallanes device information stated within meeting (all measurements are subject to change):</p> <ul style="list-style-type: none"> Approx. height of devices is 3.4m (2.09m above sea level); Approx. draught is 29.6 with blades (approx. 23m diameter); Approx. length of devices is 55m; and 4-point gravity mooring is planned. 	
2	WH showed the attendees the development and results of the VTS AIS and Radar Analysis.	
2.1	<ul style="list-style-type: none"> JW assumed the NRA would consider the whole MDZ site. WH explained that the NRA will cover the site-wide and also consider device specific information. JW suggested that the first NRA was vague when considering the site and questioned if there was a new plan for the site. WH explained that the site layout has the same areas as the first NRA produced and will also show the locations of the 4 devices to be installed in 2026. AP clarified by asking if the NRA would consider the sitewide with the devices. JW suggested that the risk assessment should be focused. 	

	<ul style="list-style-type: none"> MR asked if the assessment is being considered for location specific or sitewide. WH explained that the NRA will cover the sitewide and the location of the 4 devices to the best of our knowledge. MR asked if sailing clubs have been considered as part of the consultation. AD suggested that they could pass information on through their contacts with regards to sailing clubs. MR questioned the "gold areas" safety with regards to the depth of the devices. AP questioned how the devices are due to moored. MR questioned the efficiency of the mooring and believed that they could be ineffective due to a varied wave pattern. JW suggested that Orkney is more sheltered therefore moorings within the devices installed there would be more effective when compared to the same devices at South Stack. WH explained that the mooring arrangement discussion was out of our scope. WH explained that Marico would assess the risk of a breakout mooring. In response to JW, RH explained the indicative diameter of the turbine blade on the proposed devices was 23m. MR assumed that the devices would be inline the flow rate. JW suggested that a device specific NRA could not be undertaken as there no final design details because details are subject to change. AE questioned if the moorings would be taught or moving. WH explained that devices are likely to move slightly. MR suggested that tide rise and fall should be considered as devices will move in the water. In response to JW, RH stated the dates of the summer survey were 23-29 August and 1-7 September 2023. MR was surprised at the volume of traffic as a lot of vessels don't use AIS. AE suggested that the devices could become an attraction to many users. MR suggested that it would be helpful if Marico Marines figures were on a larger scale so they could view more of the surrounding area. MR suggested that clubs from Liverpool and South tend to transit around the surrounding area. AD suggested that the devices are being installed in what looks to be the busiest area. WH explained that currently, there is the Marinus Buoy which is located in the area of interest and many users went to inspect it. MR suggested that vessel patterns should be considered for racing vessels catching the "eddy" for safety. AE had concerns for people under the water who could drift into the devices. AD suggested that mitigations should be for the developer, not the user. WH explained that mitigations are on both the user and developer. AP added that risk should be ALARP and measures must be put in place that are reasonably practical. MR questioned how the power will get ashore. 	MR to supply contacts for Sailing clubs that use the area
--	--	---

	<ul style="list-style-type: none"> • WH explained that the site has inter-array cables and a corridor route. • JW asked what vessels are picked up on the radar installed at South Stack. • RH explained that Jet skis and ribs can be detected depending on location and weather conditions, but mainly it is small yachts and sailing vessels. The radar could not pick up kayaks, however they could be captured within the visual observations. • AE explained that weather has been bad this year and for the survey period and question if any more data had been collected. • WH explained that we have a winter survey to undertake and have kayak data and NCI visual observations to support NRA. • JW mentioned she collected the kayak data and that kayakers have varied risk levels depending on the type of kayak they are using. • MR added that you will also have users of varied experience on kayaks. • JW added that there is a different risk for a stand up paddleboarder (SUP) compared to a touring group of sea kayakers. • AP suggested that August weather was worse than expected and that traffic recorded could be lower than expected. • JW suggested that weather wouldn't make much difference to a kayaker going out. • JW added upon review that <i>"This looks like a misunderstanding. If I made a point here it would have been that experienced sea kayakers do seek out 'conditions' so there can be people out in severe weather. However, this wasn't intended to downplay the point that August this year was particularly poor and overall numbers of people out around the Stacks would have been much lower than in good weather."</i> • AD said that across Wales, recreational activities have decreased and experienced paddlers are more likely to visit Anglesey as it is considered within the industry to be a highly experienced area. • AP said that kayak races involve surfing waves. • JW added that this leads to a high probability of capsizing and kayaks could drift into the zone. They suggested that this could be individuals or groups of 15. • JW suggested that kayaks could spend up to 2 hours at a time in the area. • JW suggested that incidents that could occur within the MDZ may originate other areas where kayakers have drifted into the zone. • JW suggested that consideration must be given to the areas around the site as well as the site itself. • They explained that SUPs get into the most trouble at sea as they are likely the most inexperienced. • AD mentioned that nice weather may bring recreational users out. • MR said that no training is required for most recreational vessels and recommended that training is provided to ensure that users are safe on the water. • AD added that the RYA are reluctant to run training but do offer it. • JW said that sea kayakers are trained at South Stack and that generally sea kayakers are lower risk as they are experienced. • JP said that Canoe Wales consider the area to be an advanced area and it is a risk for inexperienced SUPs. • AP added that some SUPs don't read the tides and people may be attracted to the devices installed. 	<p>JW shared information surrounding swimmers passing south stack on the 2nd Sept 2023.</p>
--	---	--

	<ul style="list-style-type: none"> JW said that the devices could produce wake for kayakers to ride. MR explained that Anglesey Council displays signs at the bay detailing weather conditions for recreational users. WH asked the group what they thought was the falling frequency of SUPs/capsizing for kayakers. JP added they were not aware. AP suggested that there have been 3 incidents in the last 10 years that he could recall where kayakers have capsized and drifted, all of which were luckily recovered. JW said that there was an incident at South Stack where a race group were evacuated, the RNLI were not called for this particular incident. AP suggested that it is not infrequent for this to happen. AP believed that the devices have three snagging risks which could damage kayakers and vessels. JW suggested that consideration must be given to third party risks such as business risks. AP suggested that hazards will also be present from support vessels during device installation. AD asked how frequent the maintenance for the devices is. MR asked where the cable is and was concerned of a snagging risk. AP suggested that a tether off the device with the cable on it could reduce the risk of snagging. MR suggested that the ferries don't run in severe weather. AE questioned if the devices will have beacons. WH mentioned that Marico Marine are developing an Aids to Navigation plan that is subject to approval by Trinity House. AP suggested that marker points on each end of the device would be helpful to identify devices on approach. AE asked if the devices have a battery backup. 	
3	WH showed the hazard list from the previous NRA.	
3.1	<ul style="list-style-type: none"> MR and AD agreed that most yachts sail and do not use their motor. JW suggested that Jet skis should be listed under powered recreational vessels. AE suggested a no-diving area be implemented. MR thought that the exclusion zone was removed during the first NRA. AE suggested that there have been cases of divers becoming lost. JW suggested that consideration must be given to people who have lost power. MR suggested that if the exclusion zone was implemented it could be similar to that of a wind farm. AP suggested that this is the first time an area of high recreational use has had access to tidal devices and wanted to ensure they were safe. JP suggested that area can't be inherently safe as the devices will be present and people can hit them. AP suggested that the devices are pushed further out to sea as they pose a danger. 	

	<ul style="list-style-type: none"> AD suggested that the traffic numbers are more than an argument for mitigation. AP suggested that the original plan was that devices were 500m offshore, this was since increased as ALARP was reached. AP questioned how this can be safe if ALARP is not reached within the NRA. JW believed the risk was too high for kayakers in the area to mitigate. JW added upon review <i>"My point was it is difficult to mitigate risks as most kayakers in distress would be drifting at the mercy of tide/wind/waves."</i> AE suggested that reviews of the NRA should be better informed with data. AP suggested that the only risk present in the area currently is the (Marinus) buoy. AD suggested that the process should try and pre-empt the risks. WH explained that this is one of the reasons we undertake consultation. MR suggested that the risks for the full site are incomprehensible to user. 	
4	WH showed the vessel types identified within the previous NRA.	
4.1	<ul style="list-style-type: none"> No comments from group 	
5	WH showed the mitigations suggested from the previous NRA.	
5.1	<ul style="list-style-type: none"> No comments from group 	
6	WH asked about cumulative impacts	
6.1	<ul style="list-style-type: none"> No comments from group 	
7	WH asked if there were any further comments.	
7.1	<ul style="list-style-type: none"> JW questioned the MCAs MGN 654 and asked if there were plans to undertake tidal stream modelling and believed that this could determine if the devices have an effect on waves/tides in the area. JW suggested that aspects of the original NRA were omitted that she believes should be considered. AD questioned the reason for consultation and suggested that the process is not very structured. MR suggested that a document containing relevant information could be provided before consultation. In response to AP, WH suggested that the previous NRA is within the public domain. The NRA being produced may also be within the public domain when complete. AD suggested that it makes more sense to see a draft of the document before consultation so that details can be discussed. WH explained that consultation is a necessary step to complete the NRA and is important in the process. JW suggested that an NRA workshop should be undertaken after the NRA has been completed. AP believed that IMO guidance suggests a workshop should be undertaken. AD questioned the relevance of the meeting and suggested an NRA workshop after data has been gathered. AD did not believe that this meeting identified any further risks and was reluctant to get involved after this meeting. JW believed that the buoy can't be called a buoy due to its size. 	

	<ul style="list-style-type: none">• MR suggested that the weather this week has had low pressure, high winds, spring tides and should give details on the movement of the buoy.• In response to AP, WH suggested the NRA would be complete by the end of 2023.• AP questioned whether a kayaker would be considered in the NRA if they fell in the water.• JW explained that 3 swimmers swam around the stacks this year which is likely to increase.• AP suggested they had an issue within the methodology used and questioned the validity of the risk methodology being used as he believed it was not compliant with the IMO or HSE.	AP shared his thoughts on Methodology
--	---	---------------------------------------

Minutes of Meeting held on 16-October-2023 – Anglesey County Council

Client: Menter Môn
Project: 22UK1877
Venue: MS Teams
Date of Meeting: 16-October-2023 at 11.00

Present: Anglesey County Council Andy Godber (AG)
Marico Marine Ryan Horrocks (RH)
William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked AG about their activity within the area of interest.	
1.1	<ul style="list-style-type: none"> Andy Godber – Visitor Economy and Coastal Areas Manager. AG stated his role involves managing beach wardening, statutory harbours, navigation risk, biodiversity. AG has been with the council for 6 months. AG was interested in how the devices were going to be marked and raised concerns over devices just below or on the water. AG asked if the cables for the 4 devices being installed would be on the seabed. AG requested how they are due to be moored. WH explained that the cable will be on the seabed and that a 4-point mooring will be used for the devices. 	
2	WH showed AG the development and results of the VTS AIS and Radar Analysis.	
2.1	<ul style="list-style-type: none"> WH ran through the slides and AG made the following comments: AG asked if devices would be on the seabed. WH explained that there will be various devices at different depths over the course of the project and proceeded to explain how the zoning of the MDZ worked. AG suggested that devices could have an impact over all phases of the project from construction to operation. <p>All vessel tracks;</p> <ul style="list-style-type: none"> No comment <p>Non-AIS (only Radar) tracks;</p> <ul style="list-style-type: none"> No comment <p>Recreational tracks; and</p> <ul style="list-style-type: none"> No comment <p>Passenger tracks;</p> <ul style="list-style-type: none"> No comment 	

	<ul style="list-style-type: none"> AG suggested that he expected more activity coming out of Trearddur Bay. WH explained that the image shown was AIS and Radar, which were unlikely to pick up all the activity in the Trearddur Bay area as most vessels are non-AIS. AG asked if the radar would be able to detect Jet Skis. Based on the images shown, AG suggested that most activity appears to be within the inshore passage of the MDZ, slightly east of the devices. 	
3	WH asked if AG had any other views/changes in vessel traffic.	
3.1	<ul style="list-style-type: none"> AG suggested there appears to be less vessels on the water that use slipways and suggested that this could be down to the weather or the economic downturn. AG suggested that there is certainly less vessels than previous years. AG said that jet skis come from all over to (Liverpool/Manchester etc) to ride around the island but in recent years have been unable due to the price of filling up their cars. AG said that there has not been much change to other vessel types but suggested that SUPs have taken a gradual but significant reduction which he believed was because the interest had faded. AG mentioned that over the last 2 years, there has been minimal change to activity, however, labelled the area as a "Hot Bed" for Kayaks. Suggesting that the area is popular for the more experienced kayakers. 	AG to provide Figures.
4	WH showed the hazard list from the previous NRA.	
4.1	<ul style="list-style-type: none"> AG suggested that the council have many incident reports, mainly around Trearddur Bay. 	AG to provide Incident reports.
5	WH showed the vessel types identified within the previous NRA.	
5.1	<ul style="list-style-type: none"> AG had no comment. 	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	<ul style="list-style-type: none"> WH explained that an Aids to Navigation plan was being created by Marico Marine for the area. AG asked if the devices were being treated as isolated hazards or marked as a group. AG questioned if an impact assessment had been undertaken to assess how the lights on devices would affect bird populations. 	
7	WH asked about cumulative impacts	
7.1	<ul style="list-style-type: none"> AG mentioned the Penrhos holiday park development and suggested that it may bring more leisure users to the area. AG mentioned that from a tourism perspective, they are focusing on quiet enjoyment which includes appropriate usage of the sea, this includes encouraging kayaks and SUPs. AG mentioned that South Stack will still remain an area for experienced kayakers and the development is likely not to affect Trearddur Bay. 	
8	WH asked if there were any further comments.	
8.1	<ul style="list-style-type: none"> AG had no comment. 	

Minutes of Meeting held on 16-October-2023 – Trinity House

Client: Menter Môn
Project: 22UK1877
Venue: MS Teams
Date of Meeting: 16-October-2023 at 14.00

Present:	Menter Môn	Helen Roberts (HR)
	Trinity House	Trevor Harris (TH)
		Stephen Vanstone (SV)
	Marico Marine	Ryan Horrocks (RH)
		Paul Brown (PB)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	PB introduced himself and proceeded to talk through Draft A / V1 of the Aids to Navigation plan.	
1.1	<ul style="list-style-type: none"> TH mentioned that IALA Recommendation O-139 has been superseded by IALA Guideline G1162. PB stated that he would update the AtNP. SV mentioned that within the Aids to Navigation Plan, they would only want to see the final version as agreed with Trinity House. 	PB
2	PB explained the structure of the Aids to Navigation Plan using excerpts from paragraph 2.4.2.& 2.51 of G1162.	
2.1	<p><i>"Unlit individual structures can be made more conspicuous with retro-reflective areas."</i></p> <ul style="list-style-type: none"> TH that this would require a lot of retro-reflective material and there might be a problem with keeping the material on the devices. TH recommended that the yellow colouring at each of the devices would suffice. SV suggested that a reflective strip could be added around the ID number – this was incorporated into the plan. <p><i>"Use of flashing yellow lights with a nominal range of 2 nautical miles"</i></p> <ul style="list-style-type: none"> SV mentioned that Trinity House do not require the lights to synchronize however, it would not be an issue with Trinity House if they were to commit to the synchronization of the lights on the four devices. PB stated that synchronisation would be preferable. SV agreed that the devices should be treated as corner markers themselves. <p><i>"Sectoring the Lights"</i></p> <ul style="list-style-type: none"> PB mentioned that this could be as simple as a 0-180° or they can align with the shore. SV suggested the sectoring could be along 345° and align with the devices. TH suggested that sectoring of the lights will also be dependent on the mooring method and device specifics. 	

	<ul style="list-style-type: none"> An agreement was made between SV, PB and TH for 345° to be the dividing line between the range sectoring of the lights and this would be included the Aids to Navigation plan. <p><i>"Racons"</i></p> <ul style="list-style-type: none"> TH mentioned that RACONS would not be considered necessary by Trinity House for the four devices. <p><i>"AIS"</i></p> <ul style="list-style-type: none"> TH questioned how the devices will be monitored. PB explained that CCTV and 3G monitoring will be utilized for the devices and suggested that AIS should be used for safety of navigation, not monitoring. TH suggested that AIS would merge if it were installed on all 4 devices and suggested that if AIS is to be used for the safety of navigation, then AIS should be installed on the most northern and south western devices. WH suggested that this would appeal to local stakeholders and could be encouraging from a PR perspective. PB suggested that AIS should therefore be installed on most northern and southwestern devices which received no objections from Trinity House. 	
3	PB explained Aids to Navigation Plan Paragraph 2.5.2	
3.1	<p><i>"To improve the effectiveness of the lighting and taking into account background lighting, synchronisation can be used."</i></p> <ul style="list-style-type: none"> SV mentioned that this had been discussed briefly previously within <i>"Use of flashing yellow lights with a nominal range of 2 nautical miles"</i>. However, had no objections to the synchronization of the lights. WH suggested that this would satisfy the views of local stakeholders. <p><i>"Individual wave and tidal energy devices within a site that extend above the surface are painted yellow above the waterline."</i></p> <ul style="list-style-type: none"> PB added that devices could be grey in the middle and yellow at each end. TH suggested that if devices are white in the middle, they may be harder to see depending on the weather and suggested that a vertical yellow stripe be added down the centre of the devices. HR asked if the device was white rather than grey would that negate the need for a yellow stripe. TH explained that it would not make a difference to the visibility of the devices and suggested that a yellow stripe would be necessary to satisfy Trinity House. TH stated that the devices being totally yellow would be unnecessary. PB stated that a midships yellow stripe behind the ID number and surrounded by a reflective strip will be added to the AtNP. <p><i>"If marked, the individual devices should have flashing yellow lights. The flash character of such lights must be sufficiently different from those displayed on the boundary lights with a nominal range of not less than 2 Nautical miles."</i></p> <ul style="list-style-type: none"> SV mentioned that this had previously been discussed within <i>"Use of flashing yellow lights with a nominal range of 2 nautical miles"</i>. SV questioned what the expected flash character of the lights was. PB stated that 3s flash character had been suggested. SV suggested that Trinity House would be satisfied with a flash character of 5s where all 4 devices have a synchronized flash. PB stated that 5s vs 3s will be incorporated into the plan. 	

	<p><i>"Based on risk assessment, a single wave or tidal energy extraction structure, standing alone, may be marked as follows:</i></p> <ul style="list-style-type: none"> ○ <i>Isolated Mark</i> ○ <i>Special Mark"</i> • PB recommended that a 1.2m cross yellow special mark be displayed at least 1m above the structure. • TH suggested that this would be adequate. <p><i>"Specific guidance to small craft needs early consideration".</i></p> <ul style="list-style-type: none"> • TH suggested that an individual NRA should be undertaken to satisfy the marine license but also consider small craft and site-specific risk. 	
4	Additional comments/concerns	
4.1	<ul style="list-style-type: none"> • TH questioned whether the introduction of AIS is likely to be done through a classification society as Menter Môn might find it hard to obtain a license. TH mentioned that they have had similar issues with floating wind. • TH mentioned that Menter Môn will also need to obtain insurance. • TH mentioned that the Aids to Navigation plan will need to consider any responses to a casualties/maintenance of lights which also achieves 99% availability. 	
5	Summary	
5.1	<p>The following Aids to Navigation have been agreed with Trinity House and will be added to the Morlais Aids to Navigation Plan:</p> <ul style="list-style-type: none"> • Reflective strip to be added around the ID number. • Vertical yellow strip down the center of the devices. • 345 sectoring lights. • No Racon. • AIS to be installed on the most northern and southwestern devices. • 5s flash character yellow lights that are synchronized between devices with a 2nm range. • 1.2m cross yellow special mark be displayed at least 1m above the structure • GPS confirmed by HR to be on the device for monitoring purposes. • Will need to provide details regarding responses to casualties for lights. 	
	Morlais NRA Consultation	
1	<p>WH introduced himself and asked Trinity House if they were aware of anything that might have changed within the last 2 years within the area of interest.</p>	
	<ul style="list-style-type: none"> • WH mentioned that the license has already been issued and a 2 yearly review condition had been written into the marine license. • TH suggested that there were no changes with regards to Aids to Navigation or general traffic that they could recall. • SV quested if the NRA was for the sitewide or site-specific for devices. • WH explained that this is the first 2 yearly NRA and will consider the 4 devices mentioned. • SV clarified that as per the marine license, a new NRA should be completed every time new devices enter the water. • TH mentioned that there are no planned updates/changes to aids to navigation in the area of interest. 	

Minutes of Meeting held on 25-September-2023 – Stena Line Ferries

Client:	Menter Môn
Project:	22UK1877
Venue:	MS Teams
Date of Meeting:	25-September-2023 at 13.00

Present:	Stena Line Ferries	Michael Proctor (MP)
		Neil Whittaker (NW)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked Stena Line Ferries (SLF) about their activity within the area of interest.	
1.1	<ul style="list-style-type: none"> NW stated that they travel from Dublin to Holyhead using the Adventure and Estrid. (Each vessel makes one round trip from Dublin). 	
2	WH showed SLF the development and results of the VTS AIS and Radar Analysis.	
2.1	<ul style="list-style-type: none"> WH ran through the slides and MB made the following comments: <p>All vessel tracks;</p> <ul style="list-style-type: none"> No comment <p>Non-AIS (only Radar) tracks;</p> <ul style="list-style-type: none"> No comment <p>Recreational tracks; and</p> <ul style="list-style-type: none"> No comment <p>Passenger tracks;</p> <ul style="list-style-type: none"> MP explained that the “gold area” as defined within the study area is used as part of their weather routing plan for when dealing with strong gales. MP explained that this is rare but does happen. RH mentioned that the gold area is for fully submerged devices. MP mentioned that cruise liners can pass through the (MDZ) area once a day in season and typically come from the south towards Holyhead/Liverpool; and MP mentioned that there might be a concern from the port with vessels travelling up from the south of the development. 	<p>SLF to share route.</p> <p>RH to check</p>
3	WH asked if MP had any other views/changes in vessel traffic.	
3.1	<ul style="list-style-type: none"> MP mentioned that the port has plans to bunker commercial vessels from Holyhead Port. MP said that the port will only get busier as they have become a free port. The port has bought the DW layby berth and plan to increase cruise ship movements. This should bring business to the area and may allow the 	

	port to expand operations, which could include becoming a mobilisation port for recent developments.	
4	WH showed the hazard list from the previous NRA.	
4.1	<ul style="list-style-type: none"> MP had concerns over break out moorings and if devices were to break out, they could drift into the path of the ferries. MP asked what the plan for recovery is and what will be the mobilization port? If mobilization is from Holyhead MP had concerns over disruption to SLF schedule. MP stated that in previous endeavors, ports have worked around SLF schedule, so they are not disrupted. 	RH to check
5	WH showed the vessel types identified within the previous NRA.	
5.1	<ul style="list-style-type: none"> SLF had no comment. 	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	<ul style="list-style-type: none"> MP made a comment regarding the "Restrict Navigation through the Gold and Green MDZ Zones" mitigation. MP mentioned that this is not ideal weather routeing plan as they pass through the gold area and if there are submerged devices in the area. 	
7	WH asked about cumulative impacts	
7.1	<ul style="list-style-type: none"> MD had no comment and no additional information. 	
8	WH asked if there were any further comments.	
8.1	<ul style="list-style-type: none"> SLF had no comment Reply on email - Regarding the Gold area, as the submerged devices can be at any depth, all merchant and fishing vessels will need to regard the area as a no-go area. This as I mentioned will result in some operational restrictions for ourselves when weather routing and will also effect other traffic routing to and from the port of Holyhead when approaching from or departing to the South. 	

Minutes of Meeting held on 25-September-2023 – Trearddur Bay Sailing Club**Client:** Menter Môn**Project:** 22UK1877**Venue:** MS Teams**Date of Meeting:** 25-September-2023 at 11.00

Present: Trearddur Bay Sailing Club Michael Davis (MD)
Marico Marine Ryan Horrocks (RH)
 William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked MD about the TBSCs activity within the area of interest.	
1.1	<ul style="list-style-type: none">MD explained that he is a long-standing member of the TBSC and mentioned that he was representing on behalf of the club. He explained that the club was established in 1919 is mainly built up of holiday residents, however many are now Anglesey residents;The main activity for the club happens over a 4-week period (or 5 weekends) running over July/August. The club tends to run about 20 races through this period;The majority of their activity is within the Trearddur Bay area and can extend to Rhoscolyn Therefore 95% of their activity will not be affected by the development. They do have one event per year where vessels pass the stacks to Holyhead which involves 20-25 boats, however this only lasts for one day;MD suggested that there are no concerns as long as the inshore passage remains navigable;The club members do have powerboats in the water from Easter to September which might use the inshore passage;Therefore, MD explained that they should not be affected by the development;WH then asked if they could make a longer passage; andMD replied stating that passages tend to be shorter, with only a couple of longer passages that he could recall in the last 10 years and they tend to be in coastal passages straight lines from point A to B. Some vessels travel to and from Bardsey and travel around the stacks to the Skerries or around Anglesey.	
2	WH showed MD the development and results of the VTS AIS and Radar Analysis.	
2.1	<ul style="list-style-type: none">MD asked where the ("Marinus") research buoy is located in relation to the site;RH explained what dates the survey had been undertaken from to which MD replied that the busiest times within the area of interest for recreational traffic are July and August. A drop in traffic volume tends to occur after the August Bank Holiday weekend; andWH ran through the slides and MB made the following comments:	RH to send location

	All vessel tracks; <ul style="list-style-type: none"> No comment Non-AIS (only Radar) tracks; <ul style="list-style-type: none"> No comment Recreational tracks; and <ul style="list-style-type: none"> No comment Passenger tracks; <ul style="list-style-type: none"> No comment – MD mentioned that they can see cruise ships coming to/from Holyhead. 	
3	WH asked if MD had any other views/changes in vessel traffic.	
3.1	<ul style="list-style-type: none"> MD stated that kayaking is growing consistently, however, they are very weather dependant. The weather in June was very good and therefore more kayakers were seen; and MD stated that there is no capacity for additional safe moorings or extra public slipways on the West coast of Anglesey making it unlikely for traffic increases apart from kayaks. 	
4	WH showed the hazard list from the previous NRA.	
4.1	<ul style="list-style-type: none"> MD had no comment 	
5	WH showed the vessel types identified within the previous NRA.	
5.1	<ul style="list-style-type: none"> MD had no comment 	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	<ul style="list-style-type: none"> MD had concerns over the 500m safety distance for installation and how it would impact the inshore passage; and MD brought attention to the MDZ being a “no fishing zone” mitigation. MD stated that the area is heavily potted and questioned if pots would count as part of this. 	
7	WH asked about cumulative impacts	
7.1	<ul style="list-style-type: none"> MD had no comment and no additional information. 	
8	WH asked if there were any further comments.	
8.1	<ul style="list-style-type: none"> MD had no comment 	

Annex E Data Received from Recreational Stakeholders

Coastal Atlas AIS - Standard and Log10 Scaling Source: RYA UK Coastal Atlas of Recreational Boating 2.1 User Guide



Figure 4 UK AIS with a standard scale

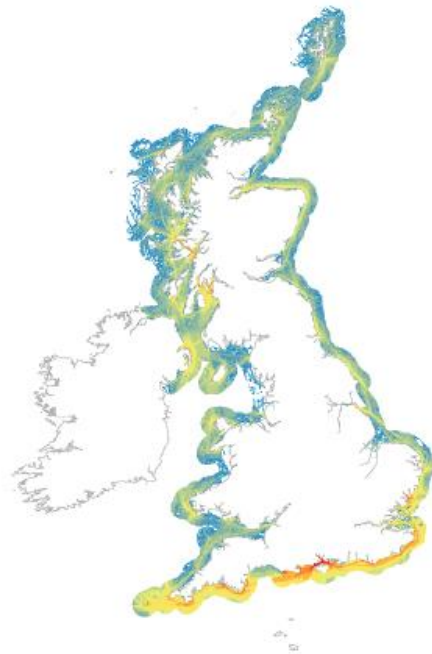
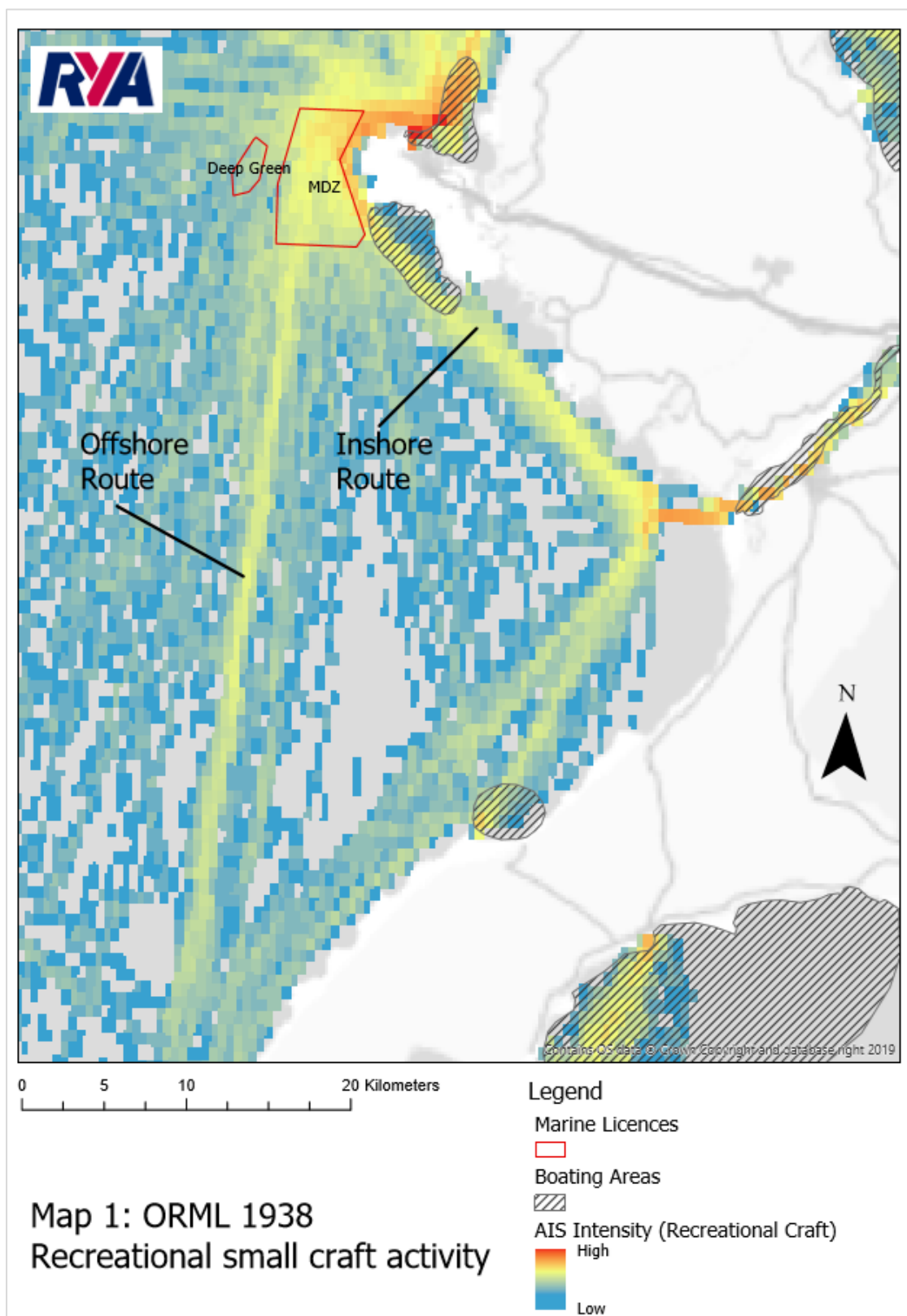


Figure 5 UK AIS with a log₁₀ scale

RYA Recreational Small Craft Activity in Vicinity of MDZ –Log10 AIS– Source RYA March 2020



RYA Passage Planning Guidance

 Search

 Quick Navigation

 Support

 Club Zone

 Register

 Sign in

 Join the RYA



RYA Membership

About the RYA

Start Boating

Courses & Training

Knowledge & Advice

News & Events

Racing & Performance

Programmes & Initiatives

Shop Online



Safe Boating	▼
Have A Plan	▼
Weather & Tides	>
Overhead Wires	>
Notices to Mariners	>
Night Boating	>
Engine Checks & Preventing Fuel Contamination	>
Counterfeit Charts & Publications	>
Lights, Shapes and Sound Signals	>
Know Your Limits	
Look After Yourself	
Keep In Touch	
Other Resources	▼
Safety Advisories	
RYA SafeTRX	
RYA Safety Management Policy	
Safety Tips & Comments	
Emily's Code	>

Have A Plan



Be prepared; think 'what if?' and don't ruin a good day out on the water with insufficient planning.

An element of planning is required for even the simplest and shortest of journeys. Passage planning is an obligation for all seafarers under the [International Convention on Safety of Life at Sea \(SOLAS V\)](#)

However, a passage plan needn't be complicated. The type of boat you have and the trip you are intending to take will determine how much planning you need to do.

Essential elements to your plan

The plan will consider where you want to go and how you will go about getting there safely.

Route: a straight line from A to B will seldom be possible. Your prior planning will establish your intended route, any hazards or navigational risks that need to be avoided and constraints that may limit your options.

Tides & currents: check the anticipated currents and tidal predictions for your trip and ensure that they fit with what you are planning to do. [Why are tides important?](#)

Navigation dangers: check up-to-date charts and current pilot books, [notices to mariners](#), almanacs or river guides for any navigational dangers such as shoals, overfalls, weirs, overhead wires and buoyage.

Be aware that [counterfeit charts and publications](#) are in circulation and pose a danger to the safety of a vessel and its crews.

Constraints: you also need to plan for the unexpected, which might include deteriorating weather conditions, an illness, injury or gear failure occurring on board, the trip taking longer than expected, missing a tidal gate or simply deciding not to complete the trip.

Refuge: you should look at the charts and pilot book before you leave and consider alternative destinations and places where you could take shelter if necessary.

Daylight: could delays lead to unexpected [night time boating](#)?

Weather: before you go check the weather forecast and get regular updates if you are planning to be out for any length of time. Read more about [weather forecasts](#). Seagoing boats equipped with a VHF radio can monitor Coastguard [maritime safety information](#) broadcasts for updates whilst at sea.

Limitations of the boat: consider whether your boat is up to the proposed trip and that you have the appropriate [safety equipment](#) and stores with you.

Engine: checking your engine before you set off could avoid breaking down when you are underway. [Read more about engine checks](#).

Crew: take into account the experience and physical ability of your crew. Are they up to the trip you are planning? Are they kitted out with the right personal [safety equipment](#) and have they been briefed on the voyage plan?

A skipper should ensure that everyone on board knows where the safety equipment is stowed and how to use it. Talk them through your plan as well as your contingency plans should something go wrong, including who should take over if you are injured or taken ill. Other aspects are: check that they know how to start the engine, how to send a Mayday and to make them aware of any on board hazards.

Share your plan: let someone onshore know your plan and make sure they understand what to do should they become concerned about your well-being.

Canoe and Kayak UK, PESDA Sea Kayak Route Card -#08- The Stacks.

sponsored by



WWW.DAGGEREUROPE.COM

PESDA SEA KAYAK ROUTE CARD #08

THE STACKS




PESDA PRESS





© The cliffs of Gogarth Bay are popular with rock climbers | Andy Biggs



The Stacks

No. 8 | Grade C | 12km | OS Sheet 114 | Tidal Port Liverpool

Start ▲ Porth Dafarch (233 800)

Finish ● Soldiers' Point, Holyhead (236 837)

HW/LW High and low water at Porth Dafarch occur around 1 hour 20 minutes before Liverpool. High and low water at Holyhead are around 48 minutes before Liverpool.

Tidal times At Penrhyn Mawr the NW going stream (flood) starts around 3 hours 30 minutes after HW Liverpool, the SE going stream (ebb) starts around 1 hour 15 minutes before HW Liverpool. At South Stack the NNE going stream (flood) starts around 4 hours 50 minutes after HW Liverpool, the SSW going stream (ebb) starts around 1 hour 10 minutes before HW Liverpool. At North Stack the NE going stream (flood) starts around 5 hours after HW Liverpool, the SW going stream (ebb) starts 2 hours before HW Liverpool.

Tidal rates This area has a reputation for fast tidal streams, which can exceed 6 knots on spring tides.

Coastguard Holyhead, Tel. 01407 762051, VHF Weather 0235 UT.

INTRODUCTION Having negotiated the jagged headland and associated overfalls of Penrhyn Mawr you will be committed for the rest of this awe-inspiring journey around South and North Stack.

DESCRIPTION The narrow rocky bay at Porth Dafarch makes an ideal place to launch soon after the flood stream begins and you will arrive at Penrhyn Mawr in plenty of time to watch the overfalls build. Porth Ruffydd has a small pebbly beach. It is possible to land here and walk the short distance to the headland, if you feel the need to check the mood of the sea before reaching the waves and whirlpools of Penrhyn Mawr. As you emerge from the overfalls South Stack and the lighthouse appear but are still over 2km away. The route to South Stack from here is a matter of choice. The quick way is to stay offshore. Follow the tidal stream flowing north-west, then north, giving swift passage through more overfalls at South Stack. The slower, more interesting route is to stay close inshore. Abraham's Bosom is the rocky bay to the north of Penrhyn Mawr. It is possible to land on a pebbly beach here and escape to the coast road above the cliffs. But to carry a kayak up the steps is very difficult. South Stack, or Ynys Lawd, is a small island separated less than 3m from the mainland. This is the most westerly point of Holy Island. South Stack and the cliffs nearby are important seabird colonies and should be given a wide berth during the breeding season (May to August). With South Stack behind you, Gogarth Bay opens up ahead. The cliffs

here are popular with climbers. There are further caves and gullies on toward North Stack that are perfect for the inquisitive paddler but be aware of dangerous waves created by car ferries from Holyhead Harbour. The overfalls that develop at North Stack during the middle of the SW going ebb are just as spectacular as those at Penrhyn Mawr on the flood. The crux of this trip is to arrive at North Stack before the tide turns here. The final landing is little more than 1km beyond Ynys Welff. Waves breaking on the reef here often catch out paddlers and the pebbly beach at Soldiers' Point is steep and landing can be awkward. The track leading to the breakwater is privately owned, but frequently used without objection, however there is a public car park a short walk away at the Holyhead Breakwater Country Park.

TIDE & WEATHER A large eddy forms during both flood and ebb within Abraham's Bosom. Although the races at North and South Stack are not far, the strength of the tide is not felt within Gogarth Bay. Anything more than a gentle breeze from the south, west or north has a significant effect on the tidal races. Wind against tide can produce huge breaking seas that are, for mortals, better observed from land.



Excerpt abridged and adapted from *Welsh Sea Kayaking* by Andy Biggs & Jim Krawiecki ISBN 0954706188, published by Pesda Press, Caernarfon. For details of this and other books, as well as downloads of further mini-guides and route cards in this series, visit: WWW.PESDAPRESS.COM



Imray C52 Admiralty 1413 – Anglesey – Holyhead Bay

3.5 Anglesey – Holyhead Bay

*Imray C52, Admiralty 1413, 1977, 2011, SC5609**Adjust WGS84 for OSGB: 0°01S, 0°08E**Coastguard: Holyhead MRSC 01407 762051*

3.5.1 Sailing Directions

GENERAL DIRECTIONS

Holyhead Bay extends some 6 miles from North Stack in the southwest, to Carmel Head, in the northeast and has a depth from this chord, southeastward to Beddmanarch Bay, of 4 miles. The bay is almost free from shoals and, except for the Langdon Ridge, the only dangers lie close inshore on its southeastern shores, the more important of which are marked by buoys. Langdon Ridge lies 2 miles west-southwest from Carmel Head, and has a least depth of 13 metres. Severe overfalls frequently occur in the vicinity. The southern shore of Holyhead Bay is largely occupied by the harbour of Holyhead, the only harbour on the North Wales and Anglesey coasts which is accessible in all weathers and at all states of the tide.

The tidal race off South Stack has been described in Section 3.4.4, and turning the corner into Holyhead Bay can be expected to give immediate relief in southwesterlies. However, any wind with north in it can cause big seas along this entire stretch and sixty

foot seas have been reported 5 miles NW of North Stack in storm conditions.

The area around Carmel Head and the Skerries should be treated with special caution since not only do several tides meet, but the seabed is very uneven, giving rise to overfalls. In 'normal' conditions, the area is totally safe for vessels drawing less than 3 m of water, and SE of the line joining North Stack to Carmel Head, wave height and steepness decrease rapidly as tidal rates drop. It is often possible to day sail in Holyhead Bay when a passage would be inadvisable or impossible.

Southerly winds cause fewer problems, with only normal overfalls off the Head and steeper seas in Church Bay. Timing a passage for LW slack dissipates many of these problems.

Crossing from North Stack to Carmel Head, presents another particularly lumpy stretch of water which may be avoided by shaping a course into Church Bay, towards the *Bolivar* (G con) buoy and, when it is sighted, turning north for Carmel Head.

3.4.3 Passage making

Most passages will start in the Menai Strait which is covered in Section 3.3.3. However, there are times, in settled weather, when a passage may be planned from Llanddwyn Island.

North bound from Caernarfon Bar or Llanddwyn Island, the trip should be timed to arrive at South Stack at LW slack (Dover LW), carrying an adverse tide of between ½ knot and 1 knot along the coast – slackest about 3 miles offshore.

In addition, tide races off the headlands and offlying rocky outcrops – in particular Maen Piscar (dries 1.7m), NW of Rhoscolyn Head – makes a track at least 2 miles offshore a reasonable option.

In wind over tide, and Spring tide conditions, overfalls develop on underwater spurs between Rhosneigr and Trearddur Bay, and a passage 3 miles offshore along this stretch of coast is needed to avoid them. The overfalls are seldom dangerous in winds of less than Force 5.

The Stacks

South Stack offers an area of particularly confused seas (see 4.2.4) and in heavy conditions an offing of 7 miles is needed to

avoid overfalls and tide races. Northwest of the Stacks, the sharp escarpment into Holyhead Deep can produce some character forming seas at the strength of the tide, irrespective of wind conditions.

Passages southbound from Llanddwyn Island to Bardsey Sound should be planned to reach Braich-y-Pwll at HW slack (HW Dover –0100). Late arrival at the Sound will usually result in some hours of practising 'sailing on the spot' – or even sailing backwards! For destinations further south, including Eire, full advantage should be taken of the ebb by leaving Llanddwyn at local HW (HW Dover –0130).

Southbound past the Stacks, North Stack is best passed about ½ hour before HW or, alternatively, soon after half ebb, when the race has begun to ease off.

In the event that there is any sign of a tide race off either Stack, it may be advantageous to stand in close to the cliffs and cut through the race as near as possible to the rocks.

It may be dangerous to attempt passage round the Stacks, in either direction, in any sort of wind over tide conditions or with winds of Force 5 or greater.

3.4.4 Tides

OFFSHORE

The tide floods northerly up the Irish Sea and divides in the region of Bardsey Island, one branch running directly to Holyhead. At South Stack, it again divides, the main stream travelling north and east to Liverpool Bay, the other diverted south down the Anglesey coast. The branch of the main stream, travelling north east up the coast of the Llyn Peninsula enters the Menai Strait over Caernarfon Bar and proceeds northwest to collide with the south going stream from South Stack. At the strength of the flood, overfalls, eddies and whirlpools may develop in and around Penrhos Bay and Abrahams Bosom.

Offshore tidal streams are generally less than 1 knot but overfalls and races off headlands and over outlying rocks considerably increase streams locally.

The effects are particularly noticeable off Rhoscolyn, South Stack and over Holyhead Deep.

North of Rhoscolyn, tidal streams increase rapidly, and the run across Trearddur Bay, round Penrhyn Mawr to South Stack will usually have to be made against a strong adverse tide if a generally favourable tide is to be carried from South Stack to Holyhead. Tide races exist at all the headlands, those at Rhoscolyn Head and Penrhyn Mawr being confined to within 1 mile of the coast. Both can create dangerous seas with onshore winds.

CAERNARFON BAR

Over the 3 miles of the Bar, the tidal rate decreases from 5 knots (Springs) in Belan Narrows to less than 1 knot at C1 (see Tidal Atlas, Section 2). On both flood and ebb, the flow sets strongly across the banks. HW coincides with slack water at approx. HW (Dover) -0145.

The combination of tides appears to result in a rapid increase in depth at around local LW +0200, followed by a stand until the last hour of the flood. It may be that the range on

half of the flood, a local eddy develops in the southeast corner of Penrhos Bay.

On the ebb, the tide makes a broad sweep of the bay before setting strongly off Rhoscolyn Head to form a rip tide. Thereafter, a large, circular, anticlockwise movement is induced, which spreads as far south as Rhoscolyn. As a result, in Penrhos Bay, the inshore stream starts to run westward shortly after half ebb and starts to run northwest off Ravenspoint about two hours before LW in Trearddur Bay.

During the strength of the flood, the stream runs at 5 knots (springs) past Penrhos Point, forming a tide race and heavy overfalls over the offlying rocks. In the Inshore passage, it flows in a westerly direction with a heavy rippling movement from Tide-rip Rock to a point about ½ mile off Penrhos Point.

During the ebb, the stream is much weaker due to its offset by South Stack. A inshore eddy develops in the first two hours of the ebb in the lee of South Stack, slowly extending over the whole of Penrhos Bay as the ebb develops. This results in the stream at Tide-rip Rock turning to the northwest about 2 hours before LW.

THE STACKS

The race at South Stack reaches 6 knots and can, in suitable conditions, create a confused steep sea with 2 metre breakers in wind strengths of Force 3.

Full tidal velocity is reached about 1½ hours after slack on both flood and ebb. (HW (Dover) +0020, -0445) On the flood, the race begins to ease at 4½ hrs after LW slack (HW (Dover) -0145): on the ebb, it eases approximately 3½ hrs after HW slack (HW (Dover) +0240). The race extends for 7 miles in strong winds (Force 7+) and Spring tides.

Tides, and tidal effects, slacken rapidly once North Stack is rounded into Holyhead Bay.

The main tidal streams off the Stacks set northeast with the flood and southwest with the ebb. The times of the change of direction of the stream coincide with the times of high and low water in the area, that is, 8 minutes before high and low water at Holyhead. (HW (Dover) -0045). Owing to the strength of the stream and the unevenness of the seabed in this locality, patches of overfalls occur within an area extending about 1½ miles northwestward from the Stacks. Inshore, tide-races run off the points of the Stacks at a rate of about 6 knots at springs and 3 knots at neaps, causing a steep, confused and breaking sea, especially when wind and tide are opposed.

Tidal streams in Gigorth Bay are weak, but during the strength of the tides eddy streams are set up in the lee of South Stack by the flood, and in the lee of North Stack by the ebb.

Once the flood stream has set in off the Stacks its velocity increases until, at about 1 hours of flood, it is running at full strength. The strong offset of the stream from the South Stack causes a tide-race, particularly violent over the 20 metre spur extending about 4

cables northwest, to run in a wide north-westerly arc for the next 3hr, at the end of which time it eases down perceptibly. A tide-rip is formed close northwestward of North Stack during the last hour of the flood tide. During the flood tide local eddy streams are formed in Gigorth Bay, and close inshore from Porth Namarch to close eastward of the point below North Stack Fog Signal Station.

During the ebb, the strong offset of the stream from North Stack causes a tide-race to extend in a wide westerly arc to a position close westward of South Stack until about 3 hours after HW. During the ebb tide, local eddy streams are formed in Gigorth Bay and in the lee of South Stack.

3.4.5 Harbours and Anchorages

The format used to describe harbours and anchorages throughout this Guide is based on a combination of sources, not all of which are consistent.

Hence, **chartlets must not be used for navigation** (see Section 1.2 for more details).

This is a coast for testing anchoring technique, including deploying an anchor buoy if you go to Rhosneigr or Trearddur Bay. There are occasional moorings in other bays, but most of the vessels laying moorings (all private and of questionable provenance) are small (less

than 25ft) fishing boats. Abandoned tackle may be found anywhere.

In this section the following anchorages are covered:

- Llanddwyn Island
- Pen-y-Parc
- Porth Trecastell
- Rhosneigr
- Silver Bay
- Rhoscolyn
- Trearddur Bay

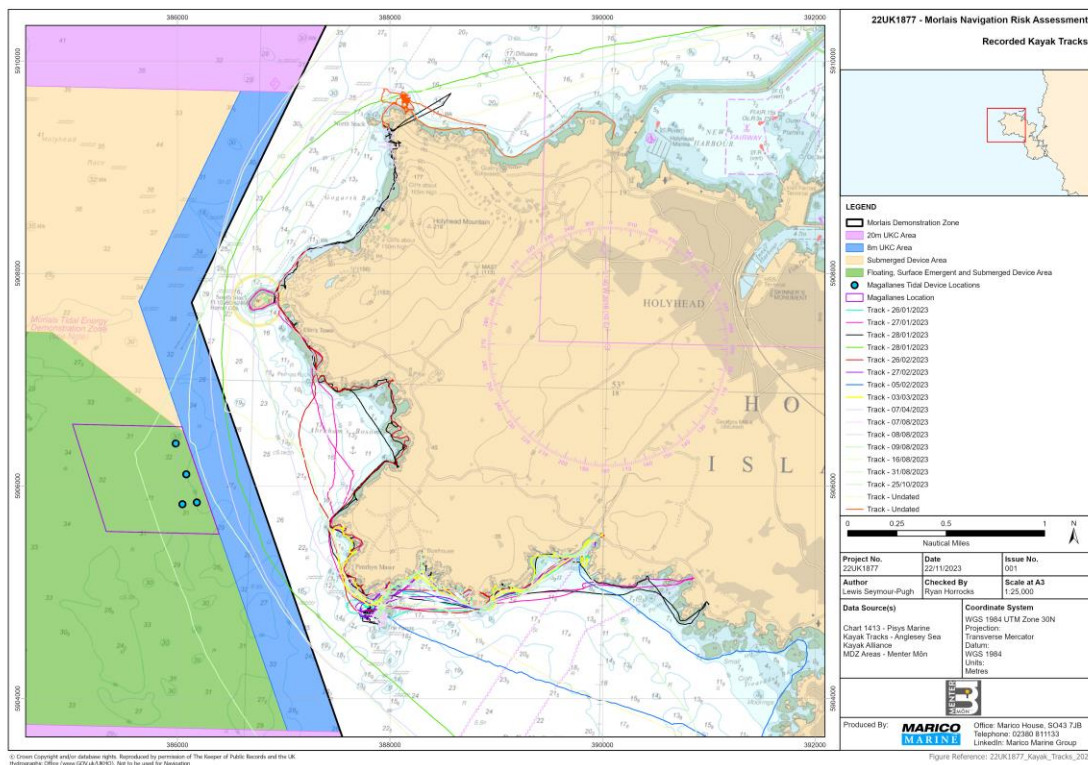


Figure 31: Indicative Kayak GPX Tracks

Annex F NCI Logbook Data