EMEC
THE EUROPEAN MARINE ENERGY CENTRE LTD

# Fall of Warness Site-Wide Navigational Risk Assessment (10 MW)

**April 2022**




# Document History

| Revision | Date | Description | Originated by | Reviewed by | Approved by |
|---|---|---|---|---|---|
| Issue 1 | Feb 2010 | Draft | Anatec | | |
| Issue 2 | Feb 2019 | Finalised Issue 2 | Marico | | |
| Issue 3 | Aug 2021 | Update given MGN654 release. | EMEC | | CL |
| Issue 4 | April 2022 | Site Wide Update | NASH Maritime | DL Proof read LvV/CR | DL |
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# Disclaimer

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# Executive Summary

The European Marine Energy Centre Ltd (EMEC) has provided purpose-built, grid connected berths for testing tidal energy convertors at the Fall of Warness for almost twenty years. In order to ensure the principal hazards to shipping and navigation activities at the site have been identified, and that appropriate risk control measures are in place, periodic review and update of Navigation Risk Assessments (NRAs) are conducted in compliance with MGN654. The scope of this assessment is device neutral, considering the general operation of the site rather than any single device. This update supersedes the previous version undertaken in 2018-2019.

A review of the site and navigational characteristics identified that the site is exposed to significant tidal, wind and wave conditions. Spring tides exceed 7 knots and in combination with gale force south-easterly and north-westerly winds, the conditions can become hazardous for vessels. The site falls outside of Orkney Islands Council harbour limits and therefore vessels are not under pilotage, nor is the site actively monitored by Vessel Traffic Services (VTS). The nearest Royal National Lifeboat Institution (RNLI) station is Kirkwall with Shetland Coastguard providing coordination for the area. There are numerous aquaculture sites adjacent to the test site, but no significant cumulative effects associated with the project.

Analysis of Automatic Identification System (AIS) data collected between 2019 and 2021 and consultation with local operators and regulators showed that there were few large commercial vessels transit through the site, although on occasion up to 235 m cruise ships have been known to use this route from the Islands. Smaller general cargo, cable layers or offshore supply vessels infrequently use this passage. During periods of adverse conditions, Orkney Ferries conduct specific manoeuvres through the limits of the site in order to prevent damage to vehicles or passenger injuries. Fishing boats and recreational craft make infrequent transits through the site, and more commonly pass to the west or south from Kirkwall towards the outer islands. Other small commercial vessels (workboats) supporting the fish farm industry or maintaining the EMEC devices frequently transit through the site but have good local knowledge.

Analysis of historical incident data from the Marine Accident Investigation Branch (MAIB) and RNLI, identified relatively few incidents, all of which were of minor consequence. There are no major projects that are likely to significantly alter shipping routes and vessel activities around the Fall of Warness site.

Modelling and analysis of the identified impacts reached the following conclusions. Firstly, quantitative risk modelling identified that the likelihood of allision and grounding within or adjacent to the test site was very low. Secondly, analysis of Under Keel Clearance requirements determined that 95% of vessels would pass clear over a 9 m subsurface device in significant metocean conditions and 99% would pass clear of a 13 m subsurface device. Thirdly, a review of impacts on communications, radar and positioning systems identified that no significant impacts are anticipated for the types of devices proposed for the Fall of Warness. Fourthly, no significant impacts on search and rescue, fishing activities, recreational activities or cumulative impacts were identified.

A structured NRA in compliance with MGN 654 identified 11 hazards associated with the site. A significant number of risk controls were identified, including:

1. Emergency Response Planning and Incident Investigation.
2. Operational Management including procedures, training and risk assessment.
3. Promulgation and Awareness including Notice to Mariners and consultation.
4. Site and Device Design including marking and lighting arrangements.

5. Site Monitoring through CCTV, GPS and Radar.

With these risk controls in place, all hazards were determined to be low risk. Three additional risk control options were identified:

1. Maintaining a navigational channel to the east of Muckle Green Holm for large vessel movements.
2. Maintaining a ferry manoeuvring route to support transits in adverse weather.
3. Improved promulgation of which devices are in place to key stakeholders.

This NRA has identified that the navigational risks at the Fall of Warness test site are managed below ‘as low as reasonably practicable’ (ALARP). It is recommended that this NRA is updated periodically, in accordance with MGN654 and to account for changing activities at the test site, following major incidents or in the context of a step-change in the numbers or types of devices installed.

# 1 Introduction

The European Marine Energy Centre (EMEC) has, since 2003, provided purpose-built, accredited open-sea testing facilities for wave and tidal energy convertors across four test sites in the Orkney Islands. The Fall of Warness site, located to the west of Eday, was established in 2005 and provides developers of tidal energy devices an opportunity to test in real-sea conditions.

To ensure the risks to navigation for vessels transit to or adjacent to the site are understood, regular Navigation Risk Assessments (NRAs) have been conducted periodically since 2010 (see **Table 1**). These site-wide NRAs are device neutral, considering the general impacts of the site, rather than any individual device design. Individual marine license applications (under Section 25 of the Marine Scotland Act 2010), supported by device-specific NRAs (see EMEC FORM292), are required for each project. The last significant update to the site-wide NRA was issued in Spring 2019. NASH Maritime Ltd have been instructed by EMEC to update these site-wide NRAs to account for changes in activities and conditions around the project sites, in compliance with the Maritime and Coastguard Agency's (MCA) Marine Guidance Note (MGN) 654 for assessing Offshore Renewable Energy Installations (OREIs).

EMEC currently holds a site-wide Section 36 consent under the Electricity Act 1989 to generate up to 10 MW of electricity at the Fall of Warness site. This consent has an end date of 22 March 2023 and a new consent application is proposed to extent the timeframe to 2040 (in line with the Scottish Crown Estate lease end date).

| Document Version | Date | Description |
|---|---|---|
| 1 | Feb 2010 | Site Wide NRA completed as Issue 1. |
| 2 | Feb 2019 | Site Wide NRA updated as Issue 2. |
| 3 | Aug 2021 | Update of Version 2 to account for changes following MGN 654 superseding MGN 543. |
| 4 | April 2022 | This Version |

**Table 1 | Superseded EMEC Fall of Warness NRAs.**

## 1.1 Study area

Figure 1 shows the location and key features of the Fall of Warness site. The site is approximately 2.3 nm in length by 1.1 nm in width between the islands of Eday and Muckle Green Holm.

Table 2 shows the status of the Fall of Warness berths at the time of issue.

| Berth | Device | Status |
|---|---|---|
| 1 | Magallanes Ocean_2G tidal energy platform | In-situ (February 2019) |
| 2 | Unoccupied (Previous TGL) | N/A |
| 3 | Unoccupied (Previous Nautricity)<br>Application for 2x Orbital Device | N/A<br>Installation c. Summer 2026 |
| 4 | Open Hydro fixed tidal turbine | In-situ (2006). Not operational |
| 5 | Orbital Tidal Device | In-situ (July 2021) |
| 6 | Unoccupied (Previous Atlantis)<br>Application for Orbital Device | N/A<br>Installation c. Summer 2023 |

| Berth | Device | Status |
|---|---|---|
| 7 | Unoccupied (Previous Voith) | N/A |
| 8 | Unoccupied (Previous Scotrenewables) | N/A |

**Table 2 | Status of Fall of Warness berths**

## 1.2 Scope and methodology

Figure 2 shows the general methodology utilised for the NRAs, conducted in compliance with MGN 654. The project methodology is based on the principles set out in the International Maritime Organization's (IMO) Formal Safety Assessment (FSA) (IMO, 2018). Hazards are identified through consultation and data analysis, before being assessed in terms of their likelihood and consequence. Based on existing risk controls, a risk matrix is utilised to identify the significance of each hazard. Where required, additional risk controls are then identified to reduce the risks to ALARP. This document is laid out as follows:

- Section 2: Description of the Fall of Warness test site.
- Section 3: Description of the waters surrounding the site, including other activities and regulations.
- Section 4: Provides analysis of the main vessel activities and historical incidents, including the projected future changes.
- Section 5: Evaluation of the key impacts of the site on navigation safety.
- Section 6: Structured risk assessment and consideration of embedded and additional risk controls.
- Section 7: Provision of conclusions and recommendations.

The assessment methodology was agreed during consultation with the MCA at the outset.

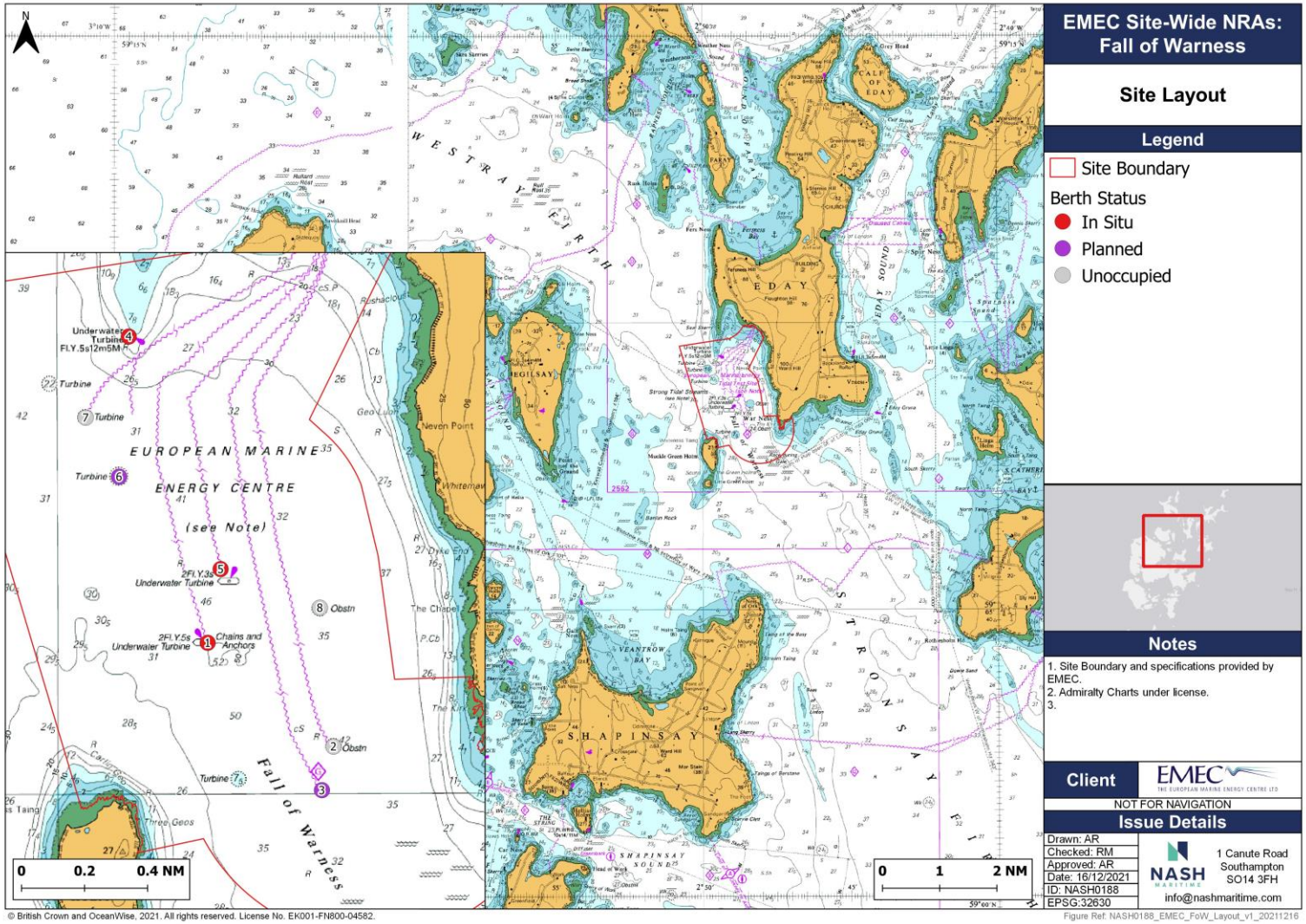



**Figure 1 | Site layout**

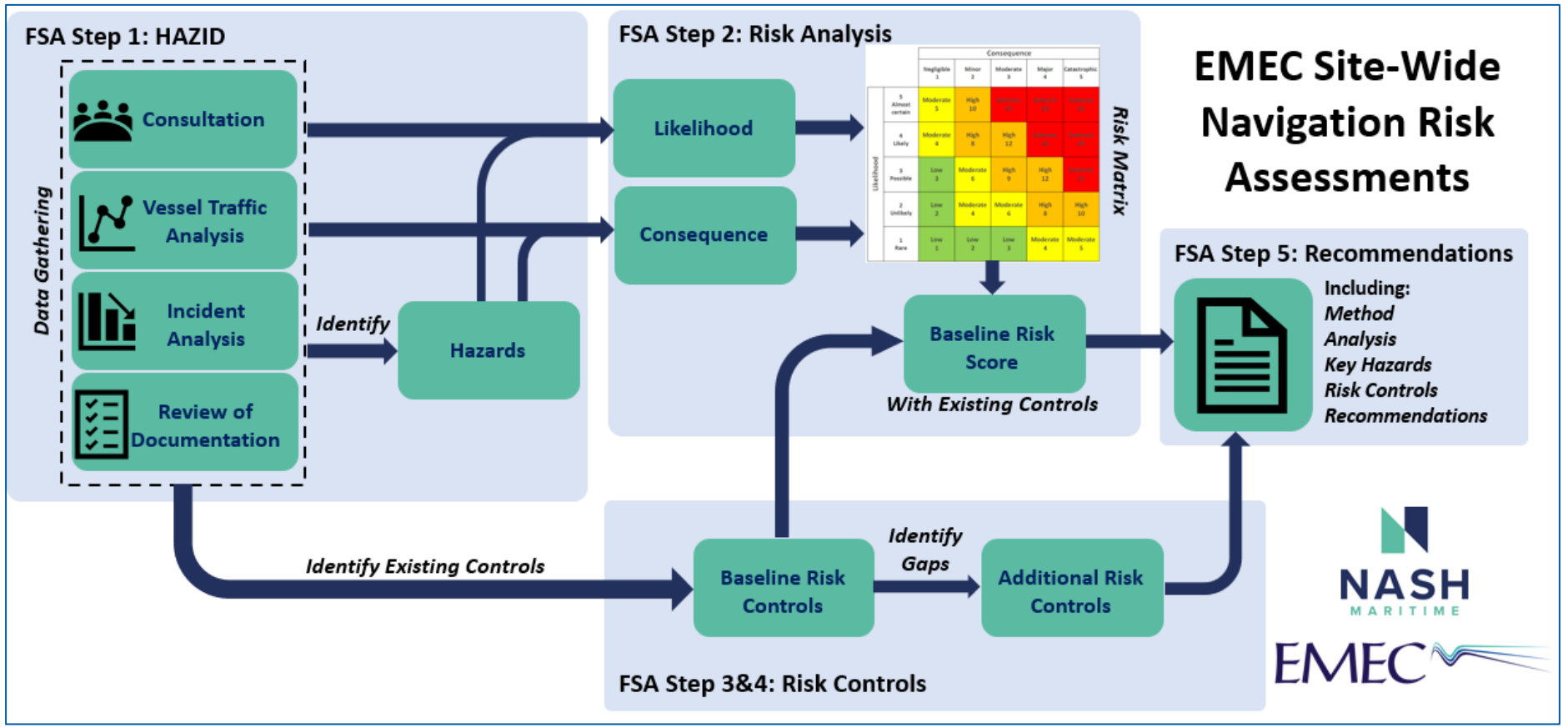



**Figure 2 | Methodology**

## 1.3 Principal Guidance

This assessment will be undertaken primarily in accordance with the requirements of the MCA MGN 654 (M+F), which defines the methodological requirements for the evaluation of navigation safety for OREI's. A summary of policy and guidance relevant to shipping and navigation is provided in Table 3.

| Guidance / Policy | Key Provision |
|---|---|
| MGN 654 (M+F) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response. | Highlights issues that need to be taken into consideration when assessing the impact on navigational safety and emergency responses caused by offshore renewable energy installation. MGN 654 provides guidance on traffic surveys, consultation, structure layout, collision avoidance, impacts on communications, radar and positioning systems and hydrography. |
| MCA Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations | This document is incorporated into MGN 654 as Annex 1 and should be read in conjunction. Its purpose is to be used as guidance for developers in preparing their navigation risk and emergency response assessment and includes a suggested template for preparing Navigational Risk Assessments for OREI projects. |
| MCA Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response | Accompanying Annex 5 to MGN654 providing a description of MCA policy and guidance, methodology for assessment, advice and specific requirements for assessing marine navigational safety and emergency response for OREI projects. |
| MGN 372 Guidance to Mariners Operating in the Vicinity of UK OREIS | Guidance outlining the issues to be considered when planning and undertaking voyages near OREIs off the UK coast. |
| MCA Offshore Renewable Energy Installations: Impact on Shipping | Guidance describing how wind farms and wave and tidal energy devices can endanger navigation, emergency response operations, marine radar and Global Positioning System (GPS) communications. |
| International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA AISM) G1162 the Marking of Man-Made Offshore Structures | Provides guidance to national authorities on the marking of offshore structures, including floating wind farms. |
| International Maritime Organisation (IMO) Formal Safety Assessment MSC-MEPC.2/Circ.12/Rev.2 | Outlines the process for undertaking marine navigation risk assessments. |
| Royal Yachting Association (RYA) Position on Offshore Energy Developments | Outlines potential the recreational boating impacts and surrounding offshore renewable energy developments. Provides considerations for assessment and risk controls. |
| HSE and MCA Regulatory expectations on moorings for | Provides guidance on the mooring arrangement for OREIs. |

| Guidance / Policy | Key Provision |
|---|---|
| floating wind and marine devices (2017) | |

Table 3 | Summary of policy and guidance relevant to shipping and navigation.

### 1.3.1 MGN 654 compliance table

To ensure compliance with MGN 654, the Annex 1 checklist is provided below in Table 4 whilst the full compliance table is provided in Annex C: MGN 654 Checklist.

MGN 654 Section 4.15 stipulates that site-wide NRAs (e.g., at testing sites) should be updated at regular intervals, specifically every two years.

| The following content is included: | MGN Section | Compliant Yes/No | Comments |
|---|---|---|---|
| A risk claim is included that is supported by a reasoned argument and evidence | 7 | P | Risk claim provided in **Section 7.3**. |
| Description of the marine environment | B3 | P | Description of the site, devices, geography and conditions are provided in **Sections 2** and **3**. |
| Search and Rescue (SAR) overview and assessment | 3.3 | P | Location of SAR facilities shown in **Section 3.3**. |
| Description of the OREI development and how it changes the marine environment | B3 | P | Specific impacts to navigation are described in **Section 5**. |
| Analysis of the marine traffic, including base case and future traffic densities and types. | B1<br>B2 | P | Analysis of vessel traffic data are contained in **Section 4**. |
| Status of the hazard log<br>Hazard Identification<br>Risk Assessment<br>Influences on level of risk<br>Tolerability of risk<br>Risk matrix | C1 &<br>F1<br>C2<br>C3<br>C4<br>C5 | P | The risk assessment and hazard logs are contained in **Section 6** and **Annex A**. |
| Navigation Risk Assessment<br>Appropriate risk assessment<br>MCA acceptance for assessment techniques and tools<br>Demonstration of results<br>Limitations | D1<br>D2<br><br>D3<br>D4 | P | The risk assessment and hazard logs are contained in **Section 6** and **Annex A**. The methodology is contained in **Section 1.2**. |
| Risk control log | E1 &<br>G1 | **P** | A risk control log is contained in **Section 6.3**. |

Table 4 | MGN 654 Annex 1 Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations

# 2 Fall of Warness test site

EMEC currently holds a site-wide Section 36 consent under the Electricity Act 1989 to generate up to 10 MW of electricity. This consent has an end date of 22 March 2023 and a new consent application is proposed to extend the timeframe to 2040. The Crown Estate site lease (00004614) expires in 2040 and therefore the consent and lease expirations would be synergised.

The existing design envelope for the Fall of Warness site is available in the 2014 Environmental Appraisal and is summarised in Table 5.[1]

| Design/activity parameter | Project Envelope |
|---|---|
| Mooring/Foundation design and installation method | Developer specific, including:<br>• Mono/Twin-pile(s) fixed to seabed (non-percussive drilling only - no pile driving).<br>• Tripod structure, pinned to seabed (pinned using non-percussive drilling).<br>• Tripod structure, held on seabed by gravity.<br>• Gravity-based anchor(s) with mooring line(s) attached (eg concrete, chain, gravel ballast).<br>• Embedment anchor(s) with mooring line(s) attached. |
| Rotor Diameter | 25 m for open-bladed rotors |
| Number of simultaneous turbines/rotors | 12 devices with up to 18 rotors |
| Rotor depth | Minimum depth – 2.5 m clearance from sea surface |

**Table 5 | Key development envelope maxima for EMEC Fall of Warness test site**

## 2.1 Existing 10 MW site

### 2.1.1 Test berths

The site is approximately 4 km by 2 km and consists of eight individually cabled berths. Each berth occupies a circular area of approx. 200 m radius from the cable end and can accommodate single devices or small arrays as well as components or mooring structures. The locations of the berths are shown Table 6.

| Test Berth | Latitude | Longitude |
|---|---|---|
| 1 | 59° 08.479'N | 002° 49.080'W |
| 2 | 59° 08.150'N | 002° 48.307'W |
| 3 | 59° 08.012'N | 002° 48.379'W |
| 4 | 59° 09.448'N | 002° 49.561'W |
| 5 | 59° 08.712'N | 002° 48.999'W |
| 6 | 59° 09.005'N | 002° 49.623'W |
| 7 | 59° 09.192'N | 002° 49.828'W |
| 8 | 59° 08.585'N | 002° 48.393'W |

[1] https://www.emec.org.uk/?wpfb_dl=168

Table 6 | Test berth locations (WGS84 datum)

### 2.1.2 Cables

Energy generated by devices at each test berth is transmitted via eight heavily armoured 11 kV subsea cables back to a shore-based sub-station for onward transmission to the national grid. The cables were laid directly onto the seabed, seven of which are serviced by EMEC and one is operated by a developer. At water depths of 15 m the cables have ductile iron cable protectors attached to provide additional protection in the surf zone. At the low water spring tide mark, each passes into a trench dug into the seabed and beach. Cast iron cable protectors are installed around the cable at points where the cable free-spans over underwater obstructions. Concrete mattresses are laid across the cables to provide added protection at points where cables may cross one another. In total approximately 30 km of sub-sea cable is installed at the site.

At the seaward end, each cable, when not occupied by a developer, is terminated using a specially designed connector which allows condition monitoring of any cables not in use by developers. These terminators can, if required, be converted into splices to enable developers to use umbilical cables to attach their devices to the cables.

### 2.1.3 Devices

The dimensions, materials, structure and weights of devices will vary by developer and technology. Examples of these technologies are provided on the EMEC website.[2] Table 7 shows examples of some of the devices which have been installed in the Fall of Warness.

[2] https://www.emec.org.uk/marine-energy/tidal-devices/

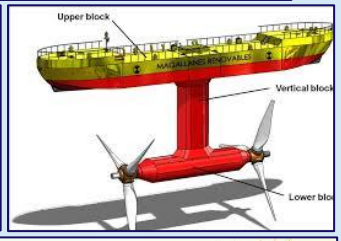
| Type | Examples |
|---|---|
| Floating Support Structure with Subsurface Blades:<br>• Orbital Marine Power (formerly Scotrenewables).<br>• Magallanes<br>• Bluewater Energy Services<br>• Sustainable Marine Energy |  <br>  <br>  <br>  |
| Seabed Mounted sub-surface:<br>• Alstom (formerly TGL).<br>• Andritz Hydro Hammerfest<br>• Atlantis Resources Corporation<br>• Kawaksaki Heavy Industries |  <br>  <br>  <br>  |
| Seabed Mounted surface piercing:<br>• Open Hydro |  |

**Table 7 | Types of devices installed at Fall of Warness**

### 2.1.4 Potential activities/deployments

The following activities and deployments are included within the project envelope and should be considered during any environmental assessment:

- Testing activities associated with single device and array deployments, including regular installation, maintenance and decommissioning works.
- Testing of mooring systems and foundation arrangements (e.g., tripod support structures) or individual stand-alone components of devices.
- Installation, maintenance and testing of subsea cables.
- Deployment of scientific instrumentation and associated cabling.
- Testing of buoys (maximum of two simultaneous tests).
- Potential for simultaneous operations, i.e., installation or maintenance activities, at more than one berth at the same time.

## 2.2 Site installations and maintenance

All installations and maintenance activities are subject to EMEC's control of work procedures (SOP003). Table 8 describes some of the typical marine operations that are undertaken during installation and maintenance at the project site.

| Activity | Likely vessels | Typical frequency/ duration* |
|---|---|---|
| Pre-installation†<br>ROV/diver surveys<br>ADCP deployment/retrieval<br>Bathymetry surveys<br>Sub-bottom profiling<br>Acoustic surveys | Workboat, survey vessel, dive support vessel | =< 1 week |
| Installation<br>drilling & grouting<br>lowering<br>foundation/anchors/nacelle<br>Cable works and connection to device | Tug, workboat, multicat workboat, dive support vessel, crane barge, DP vessel | =< 1 month |
| Testing of nacelle, gravity foundations, anchors or scientific equipment<br>ADCP deployments<br>Acoustic surveys | n/a | Specified in the test schedule to be submitted by each developer as supporting information to licence application. |
| Inspection & maintenance of devices<br>ROV inspection<br>Diver activities<br>Repairs below/above surface on site<br>Biofouling removal | Tug, workboat, multicat workboat, dive support vessel | Specified in the test schedule submitted as supporting information to licence application. Likely to be visits at regular intervals, over 3-12 months. |

| Activity | Likely vessels | Typical frequency/ duration* |
|---|---|---|
| Temporary retrieval and redeployment of nacelle, gravity foundations, anchors or scientific equipment | Tug, workboat, multicat workboat, dive support vessel, crane barge, DP vessel | =< 1 month |
| Inspection, maintenance and replacement of cables and protection<br>ROV inspection<br>Diver activities<br>Cable lifting/laying<br>Placement of mattressing/rock armouring | Tug, workboat, multicat workboat, dive support vessel, specialist cable-laying vessel | =< 1 week |

**Table 8 | Typical operational activities undertaken at the Fall of Warness**

## 2.3 Site management

Section 6.3 describes in detail the site and device specific risk controls applicable at the Fall of Warness, the most significant of which are the marking and lighting arrangements, and the various procedures established.

### 2.3.1 Marking and lighting

The Fall of Warness site is charted on Admiralty Charts 2562-2, 2249 and 2250 and described in the Sailing Directions. Chart 2250 contains the following note: "*Energy Devices: Extensive testing of tidal energy devices, both above and below the surface, takes place in this area. Mariners should exercise caution whilst navigating in this area and obtain local knowledge*".

There are no general navigational marks for the test site with all additional Aids to Navigation mounted on devices. All devices, equipment and infrastructure deployed at the test site are marked and lit in accordance with marine safety standards and as specified by the Northern Lighthouse Board (NLB) and MCA. It is anticipated that all infrastructure protruding above the water surface will be predominantly yellow in colour and, where required, be fitted with flashing lights, usually yellow. Typically, floating devices will be required to have an Aid to Navigation (AtoN) AIS fitted and transmitting as requested by the NLB.

### 2.3.2 Procedures

EMEC have in place a variety of established procedures and policies for managing the test site (Table 9).

| Document | Description |
|---|---|
| ERCoP (ERP014/015) | Emergency response and cooperation plans (ERCoP) for Search and Rescue (SAR) organisations and developers. |
| Control of Work (SOP003) | Permits to Work (PTW) and Permits to Access (PTA) EMEC Sites. Required for access of sites and devices. Specifies requirement for Task Risk Assessments (TRA) and Method Statements for any works conducted. |
| Marine Operating Guidelines (GUIDE010) | Procedures for the management of operations, emergency response, equipment and vessel requirements and environmental management at EMEC sites. |

| Document | Description |
|---|---|
| SimOps (SOP093/SOP095) | Procedures for managing simultaneous operations at EMEC sites. |
| Maritime Safety Information (SOP063 & FORM086A/B) | Procedures and specifications for Notice to Mariners. |
| Incident Reporting (SOP8/9/120) | Requirements for reporting and investigation of incidents and near misses. |

**Table 9 | Principal EMEC site procedures for shipping and navigation management**

# 3 Overview of the marine environment

The Orkney Islands, a group of more than 50 islands, lie NNE of the NE extremity of mainland Scotland, from which they are separated by the Pentland Firth. This section provides details of the test site and conditions as relate to navigation.

## 3.1 MetOcean conditions

### 3.1.1 Wind and wave

The Admiralty Sailing Directions for the North Coast of Scotland state that there are on average 50 days with gales each year in Kirkwall. This ranges from between one and nine per month, with gales most frequently in the winter months. The prevailing wind is south/south-westerly. Figure 3 shows the wind directions and speeds for the Fall of Warness site.

Figure 3 shows the wave rose for the site, the predominant direction is north-westerly and to a lesser extent, south-easterly with the significant wave heights generally below two metres.

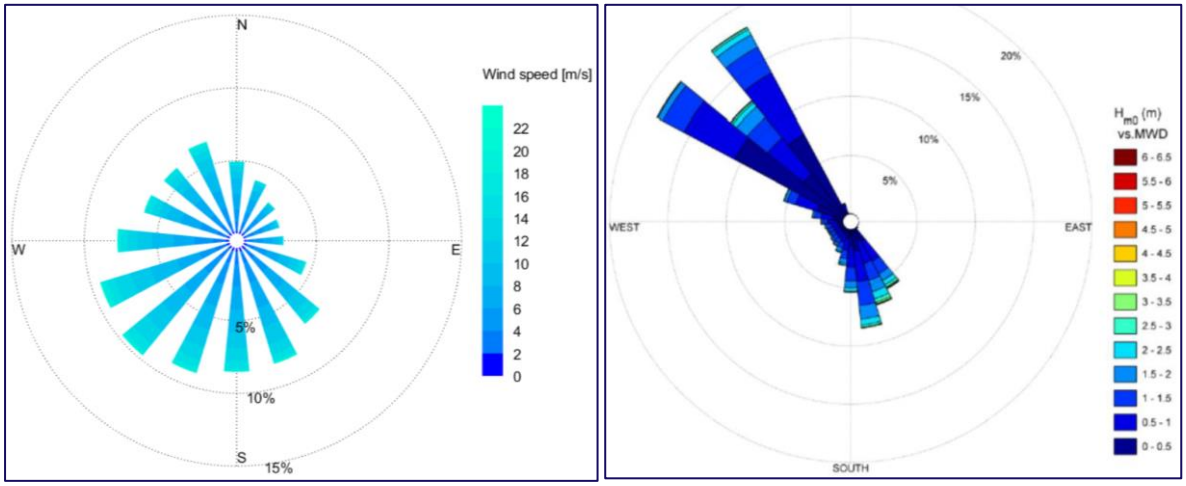



**Figure 3 | Percentage occurrence of wind (m/s) and wave heights (Hm0) and directions. Source: EMEC**

### 3.1.2 Tide

Table 10 and Table 11 give the tidal characteristics near to the test site. Spring tidal speeds are significant and can reach up to 7 knots while neap flows may reach 2.8 knots. Several overfalls are charted adjacent to the Fall of Warness site.

| Place | Lat N | Long W | HAT | MHWS | MHWN | MLWN | MLWS | LAT |
|---|---|---|---|---|---|---|---|---|
| Loth | 59°11’ | 002°42’ | 3.5m | 3.1m | 2.5m | 1.5m | 0.9m | 0.3m |
| Rapness | 59°15’ | 002°52’ | 4.1m | 3.6m | 2.9m | 1.6m | 0.7m | -0.1m |
| Kirkwall | 58°59’ | 002°58’ | 3.5m | 3.0m | 2.4m | 1.3m | 0.6m | -0.1m |

**Table 10 | Tidal heights (Source: Admiralty Chart).**

| Tidal Hour | Direction | Spring Rate (knots) | Neap Rate (knots) |
|---|---|---|---|
| -6 | 150 | 6.2 | 2.4 |
| -5 | 144 | 7.2 | 2.8 |
| -4 | 141 | 5.8 | 2.3 |
| -3 | 116 | 2.8 | 1.1 |
| -2 | 350 | 0.3 | 0.1 |
| -1 | 308 | 3.8 | 1.6 |
| HW | 329 | 6.4 | 2.5 |
| +1 | 329 | 6.5 | 2.5 |
| +2 | 320 | 4.9 | 1.9 |
| +3 | 325 | 3.8 | 1.7 |
| +4 | 324 | 1.2 | 0.5 |
| +5 | 160 | 1.7 | 0.7 |
| +6 | 153 | 5.7 | 2.3 |

**Table 11 | Admiralty Total Tide Predictions for study sites (59° 08.07'N 002° 48.40'W)**

### 3.1.3 Visibility

The Admiralty Sailing Directions for the North Coast of Scotland give the days with fog per year as 41 in Kirkwall. This ranges from between two and five per month, with fog most frequent in the summer months. Consultees identified that the Orkney Islands are frequently affected by thick fog.

## 3.2 Vessel traffic management in study area

Figure 4 shows the location of all key vessel traffic management features near to the study area.

### 3.2.1 Harbour areas

The Fall of Warness site lies outside of the limits of the Orkney Islands Council Statutory Harbour Authority (SHA) Area. These extend no further north than Shapinsay Sound and Wide Firth.

### 3.2.2 Pilotage

Pilotage is compulsory within the Orkney Harbour Competent Harbour Authority (CHA) areas for Passenger vessels over 65 m length overall (LOA), all other vessels over 80 m LOA, all vessels under tow where the combine overall length of the two is over 65 m and all vessels over 300 GT carrying persistent oils in bulk.[3] Pilotage is therefore not required for vessels navigating through the Fall of Warness.

### 3.2.3 Vessel traffic services

Orkney Islands vessel traffic services (VTS), based in Scapa Flow, do not routinely monitor vessels near the Fall of Warness site.

[3]https://www.orkneyharbours.com/site/assets/files/1113/the_orkney_pilotage_direction_1988_as_amended_2007-_2010_and_2016_v8_final.pdf

### 3.2.4 Vessel reporting

The Pentland Firth is an IMO adopted voluntary ship reporting system.

### 3.2.5 Ship routeing schemes

Following the Braer oil spill in 1993, an IMO-adopted Area To Be Avoided (ATBA) was designated around the Orkney Islands. To avoid the risk of pollution and damage to the environment, all vessels over 5000 GT carrying oil or other hazardous cargoes in bulk should avoid the ATBA.

## 3.3 Search and Rescue

Royal National Lifeboat Institution (RNLI) lifeboats are stationed in the Orkney Islands at Longhope (Hoy), Stromness and Kirkwall (both Orkney Mainland). The Kirkwall lifeboat is a Severn class all weather lifeboat. She is 17.3 m LOA, has a crew of seven, and is capable of 25 knots having a range of 250 nm.

Her Majesty's Coastguard (HMCG) helicopter assets are based at Sumburgh, Stornoway and Inverness.

Shetland Coastguard Operations Centre (CGOC) is the local coastguard base for the Orkney Islands. The 2015 implementation of the Future Coastguard Programme saw a restructuring of the CGOCs and implementation of a new IT system that enabled areas to be monitored and incidents responded to from any CGOC or from the National Maritime Operations Centre (NMOC), near Southampton. Therefore, whilst Shetland CGOC would likely manage an incident in the Orkney Islands, it could be managed from elsewhere.

## 3.4 Other offshore activities

Figure 4 shows the location of all key offshore activities near to the study area.

### 3.4.1 Aquaculture

There are a significant number of marine farms around the Orkney Islands. There are none within the limits of the Fall of Warness site, with the closest located 1.7 nm to the east, the far side of Eday, and >3.5 nm to the south and south-east.

### 3.4.2 Renewables

With the exception of the EMEC sites, there are no other wet renewables sites within the Orkney Islands. The nearest EMEC site is the Shapinsay Sound site, eight nautical miles to the south and the far side of Shapinsay. Additional renewables projects have been proposed (see Section 4.4).

### 3.4.3 Offshore oil and gas

There are no offshore oil and gas activity in the study area.

### 3.4.4 Subsea cables

Only EMEC installed subsea cables connected to the test berths exist within the study area. See Figure 4 for exact locations.

### 3.4.5 Anchorages

There are no charted anchorages within the limits of the Fall of Warness site, however, some vessels are shown to anchor along the shore of Eday (see Section 4.2). Several charted anchorages are located around Eday, including to the south (adjacent to The Graand), east (Bay of Backaland) and north (Fersness Bay).

### 3.4.6 Military exercise areas

A firing practice range is located clear to the east of the site (D809 North). No restrictions are placed on the right to transit the firing practice areas at any time. The firing practice areas are operated using clear range procedure; exercises and firing only take place when the areas are considered to be clear of all shipping.

### 3.4.7 Spoil grounds

There are no active spoil or dredging material disposal sites in the study area.

### 3.4.8 Aids to Navigation

A South Cardinal 2.6 nm to the west, at Point of the Graand, and a North Cardinal 1.5 nm to the east, south of Eday, are the closest navigational marks to the site. Additionally, navigation marks are fitted to the EMEC test devices, typically an all-round flashing yellow light and an AIS transponder.

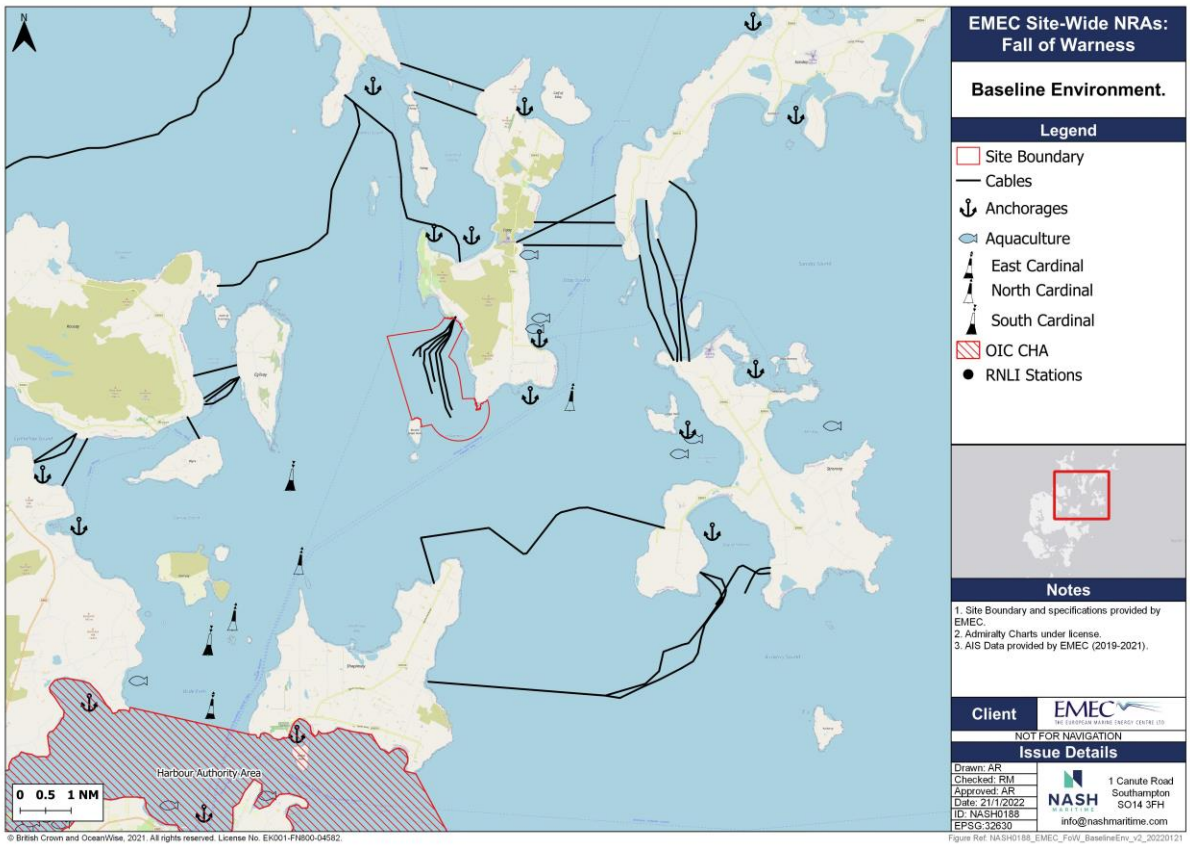



**Figure 4 | Overview of baseline environment**

# 4 Review of vessel traffic at the Fall of Warness site

## 4.1 Data sources

### 4.1.1 Automatic Identification System (AIS)

The movements of vessels were captured through collection of data from the Automatic Identification System (AIS). AIS is a transponder system fitted to most commercial vessels which broadcasts information about itself to other nearby vessels and was principally developed for collision avoidance. AIS data includes dynamic positional data (location, speed, course etc.) and static identification data (name, type, size, destination etc.). SOLAS Chapter V, Regulation 19 stipulates that the following vessels must be fitted with AIS:

- All ships of 300 gross tonnage and upwards engaged on international voyages.
- Cargo ships of 500 gross tonnage and upwards not engaged on international travel.
- Passenger ships irrespective of size.

Smaller vessels, fishing vessels and recreational craft are not obliged to carry AIS and therefore could be underrepresented in any analysis of AIS data. Therefore, other data sources and consultation were necessary to fully understand the significance of recreational activities within the study area.

AIS data was provided by EMEC between 2019 and 2021, to mitigate the potential impacts of the COVID pandemic on vessel numbers in recent years. Figure 5 shows a timeseries of the dataset received, and whilst there are some gaps in coverage, data was received on 773 days and therefore provides a significant sample of vessel traffic movements in the project area.

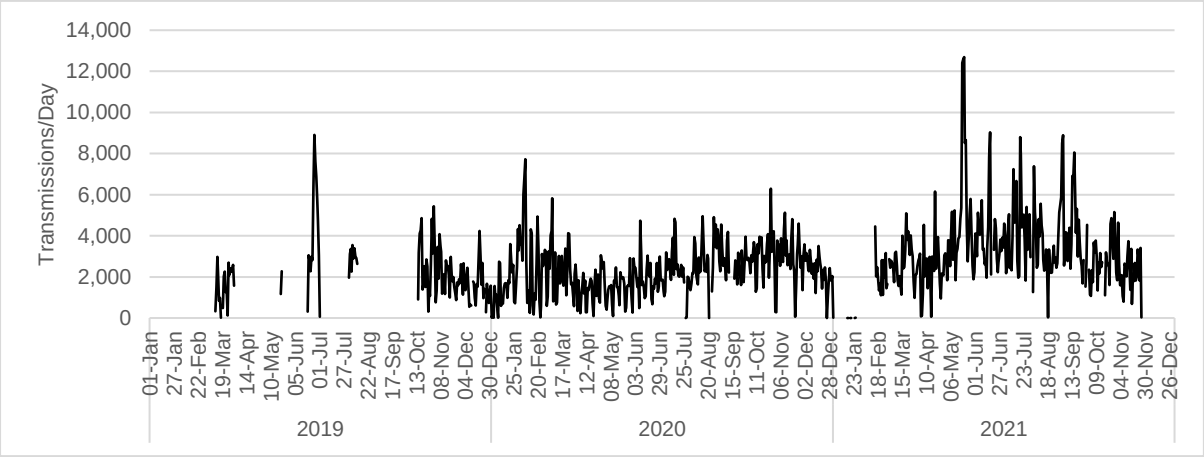



**Figure 5 | AIS data sample**

### 4.1.2 Incident data

Four principal sources of incident data were available and have been analysed:

- Marine Accident Investigation Branch (MAIB) data provided under Freedom of Information request for the years 2010-2020.
- Royal National Lifeboat Institute (RNLI) data for launches provided for 2008-2020.
- Incidents and near misses identified by consultees.

### 4.1.3 Consultation

Consultation was conducted with key stakeholders to better understand the activities and risks within the project site. Meeting minutes are contained in Annex B: Meeting Minutes.

| Consultee | Date | Summary |
|---|---|---|
| Maritime and Coastguard Agency | Teleconf 21-Dec-21 | Review of NRA Update scope and methodology.<br>Agreed with MCA. |
| Northern Lighthouse Board | Teleconf 25-Jan-22 | Review of NLB recommendations for individual devices.<br>Review of marking and lighting arrangements per site.<br>Identification of possible risk control measures. |
| Royal Yachting Association and Orkney Marinas | Teleconf 27-Jan-22 | Review recreational activity in the Orkney Islands and around EMEC sites.<br>Discuss experiences of recreational users navigating through sites.<br>Identification of possible risk control measures. |
| Orkney Ferries | Teleconf 27-Jan-22 | Establish baseline understanding of operations in Fall of Warness site during adverse weather.<br>Understand experiences of bridge teams navigating through EMEC site.<br>Identification of regions essential to Orkney Ferries navigation.<br>Identification of possible risk control measures. |
| Chamber of Shipping | 09-Feb-22 | Review commercial shipping movements around Orkneys.<br>Identify relevance of additional risk control measures. |
| Orkney Fisheries and Scottish Fisheries Federation | Teleconf 15-Feb-22 | Identify locations and activities of fishing within study area.<br>Determine impacts of site on fishing activities. |

**Table 12 | Summary of consultation conducted**

## 4.2 Vessel traffic analysis

### 4.2.1 Vessel categorisation

The following principal vessel types have been identified within the study area:

- **Large commercial vessels**: including cargo and tanker vessels carrying dry and liquid goods engaged in trade as well as other large maintenance vessels.
- **Passenger Ferries and Cruise Ships**: large vessels carrying significant numbers of persons either between two locations or for pleasure.
- **Fishing Boats**: small boats engaged in commercial or sustenance fishing and trawling.
- **Vessels Supporting the Fish Farm Industry**: small workboats identified as being either owned and operated, or conducting a significant proportion of their activities, in support of the fish farm industry.
- **Recreational Craft:** small powered and unpowered pleasure craft and yachts.

- **Tug and Service vessels:** other powered vessels utilised for commercial activities, such as pilot boats or workboats.

### 4.2.2 Overview

Figure 6 shows the principal shipping routes within the project area. Two principal routes are evident: firstly, vessels proceeding from a south-west to north-east direction, passing south of Muckle Green Holm and Eday, passing through the south-eastern extent of the site. Secondly, vessels proceeding from a south-west to north-east direction, passing to the west of Muckle Green Holm and Eday. Both of these routes are also ferry routes between Kirkwall on Mainland Orkney and other Orkney Islands. Several areas of high concentration are evident within the site, principally maintenance vessels attending to the EMEC devices.

The majority of vessels within the study area are less than 100 m in length, with only a few transits of greater sizes. The largest of these vessels are cruise ships on passage through the Orkney Islands, concentrated during 2019. However, in August 2021 the 236 m Spirit of Discovery passed through the Fall of Warness site.

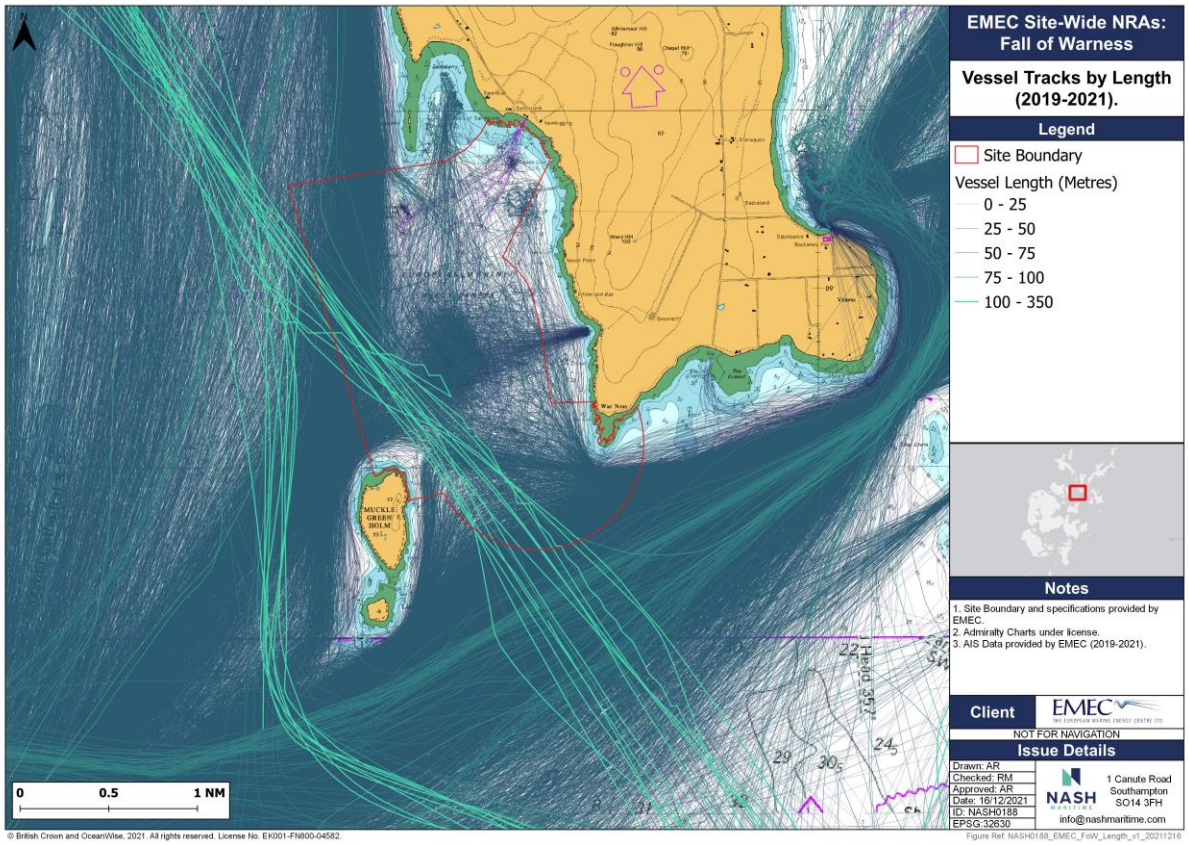



**Figure 6 | Vessel tracks by length (2019-2021)**

Figure 7 shows the number of vessel transits by type through and near to the Fall of Warness site. The majority of vessels through the site are either Orkney Ferries or maintenance vessels, with increasing numbers of fish farm vessels transiting near to the site as the search area becomes larger.

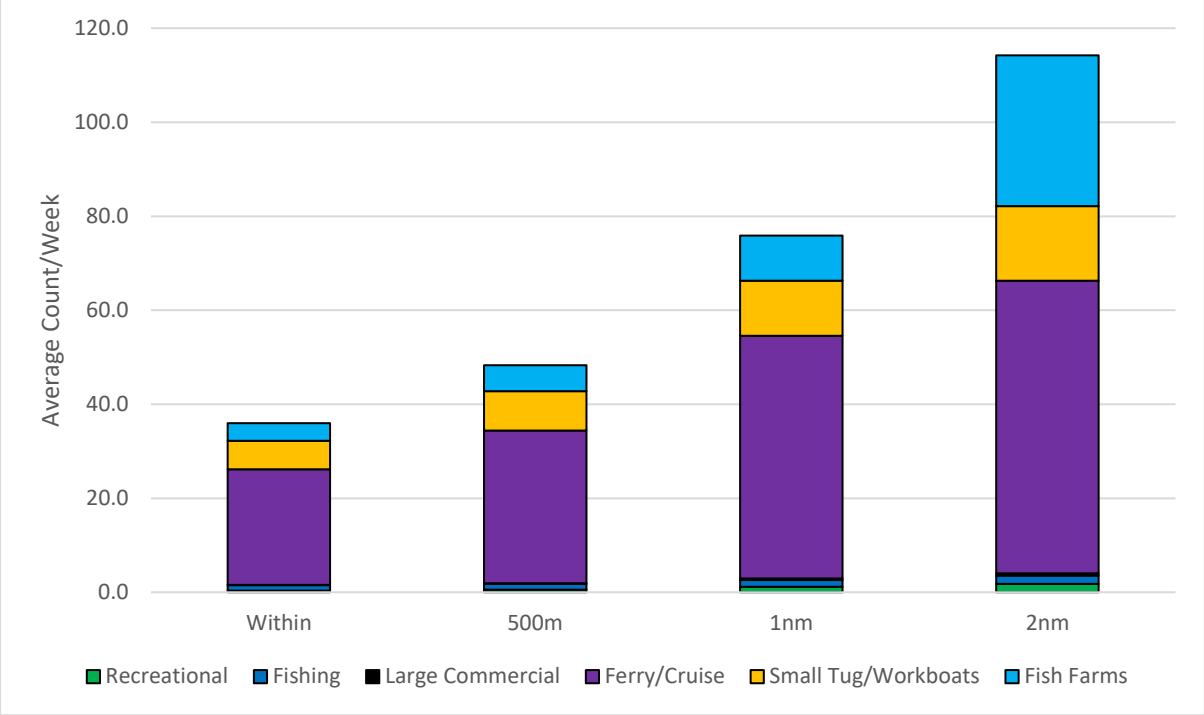



**Figure 7 | Vessel transits through Fall of Warness site**

### 4.2.3 Large commercial vessels

No large cargo or tanker vessels passed through the Fall of Warness site within the data period. Four passages adjacent to the site were by the 63 m General Cargo vessel CEG Cosmos and the 90 m General Cargo vessel Frakt Sund. Several other commercial vessels pass through the site, however. These include several transits by the C S Sovereign, a 130 m cable layer seen working both within the EMEC site and on the Eday charted cables outside of the project site. Other passages are recorded from a 142 m French warship, an 87m cable layers, a 96 m offshore supply ship and a 68 m fisheries research vessel.

Therefore, there are few transits of commercial vessels through the project site.

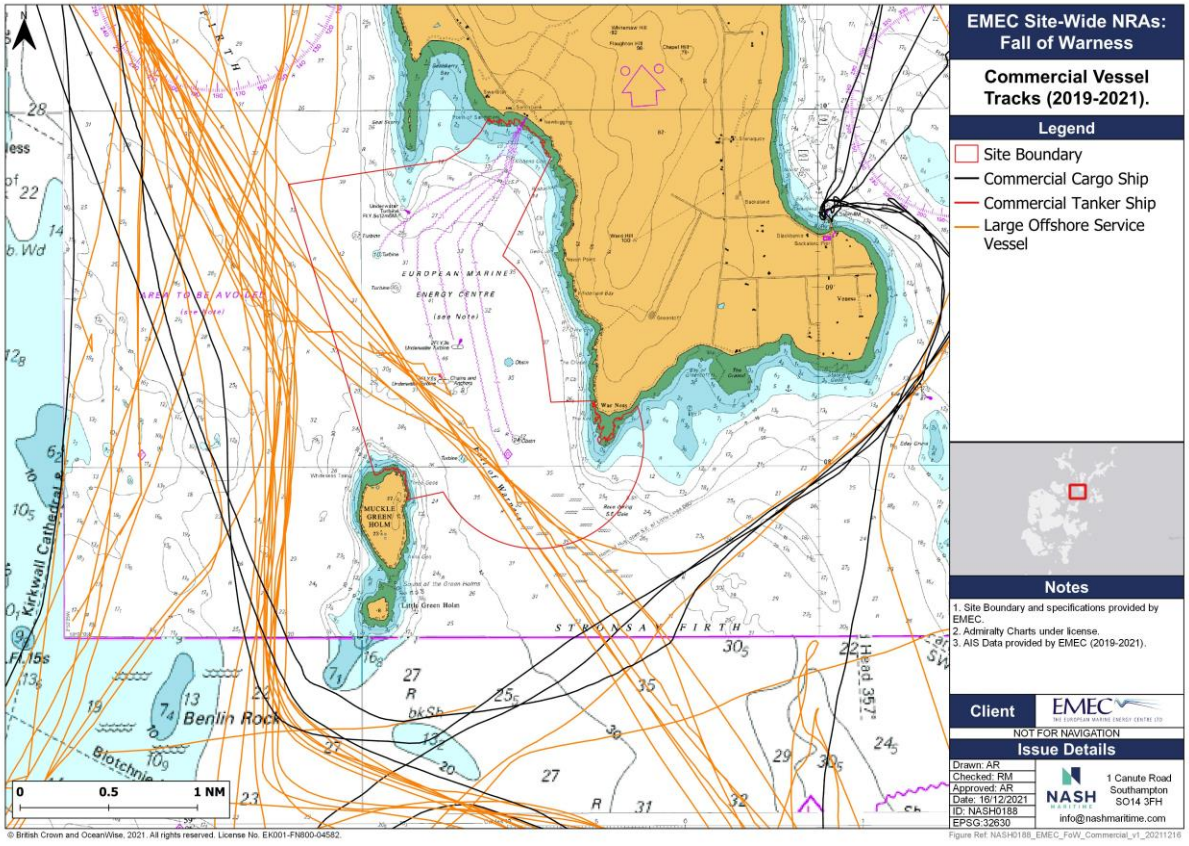



**Figure 8 | Commercial vessel tracks (2019-2021)**

### 4.2.4 Passenger ferries and Cruise ships

Passenger vessels are one of the most frequent vessel types within the study area (Figure 9). No passenger vessels operated in the EMEC site specifically, although the major ferry routes between Kirkwall and the northern islands, passed through or immediately adjacent to the EMEC boundary. These ferries are operated by Orkney Ferries, with most transits by the Earl Sigurd/Earl Thorfinn (45 m) and Varagen (50 m). These ferries call at Westray, Papa Westray, Sanday, North Ronaldsay and Eday itself. Whilst the direct routes pass clear of the Fall of Warness boundary, under specific metocean and tidal conditions, the vessels passage takes them through the test site (see Section 5.2 for specific discussions).

Cruise ships account for a small proportion of those transits, with only 12 recorded during the data period. The majority of these vessels are between 180 m and 236 m in length (Astor, Boudicca, Black Watch, Balmoral, Spirit of Discovery) with some smaller cruise ships (Hebridean Princess/Sky, Sea Cloud II and Star Breeze). Three cruise ships chose to navigate to the west of Muckle Green Holm, the 238 m Bolette and 285 m Zuiderdam.

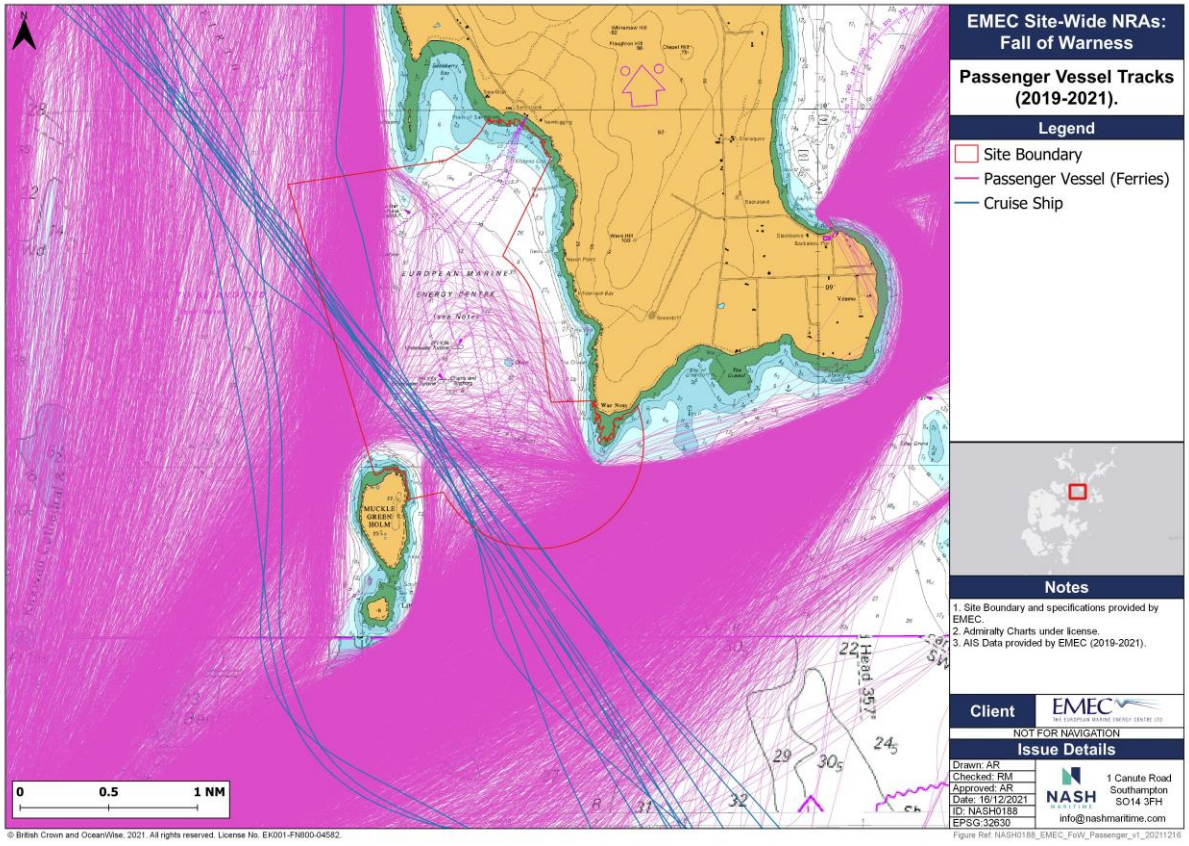



**Figure 9 | Passenger vessel tracks (2019-2021)**

### 4.2.5 Fishing boats

Whilst small fishing boats do not specifically carry AIS, several transits are identified in Figure 10. These vessels are principally on passage through the Orkney Islands are between 41 m and 15 m in length, on route to fishing grounds further offshore in the Atlantic (such as pelagic trawling for herring).

Consultation identified that the majority of Orkney based fishing boats (approximately 100) are under 10 m and therefore do not carry AIS. The principal catches are shellfish, concentrated in shallow/inshore waters, with most boats creel fishing or diving for scallops. The Fall of Warness is equidistant between the principal fishing harbours of Kirkwall and Westray so will be fished by both fleets. Responses from consultees identified that some creel fishing takes place in and around the project site, but generally inshore to Eday.

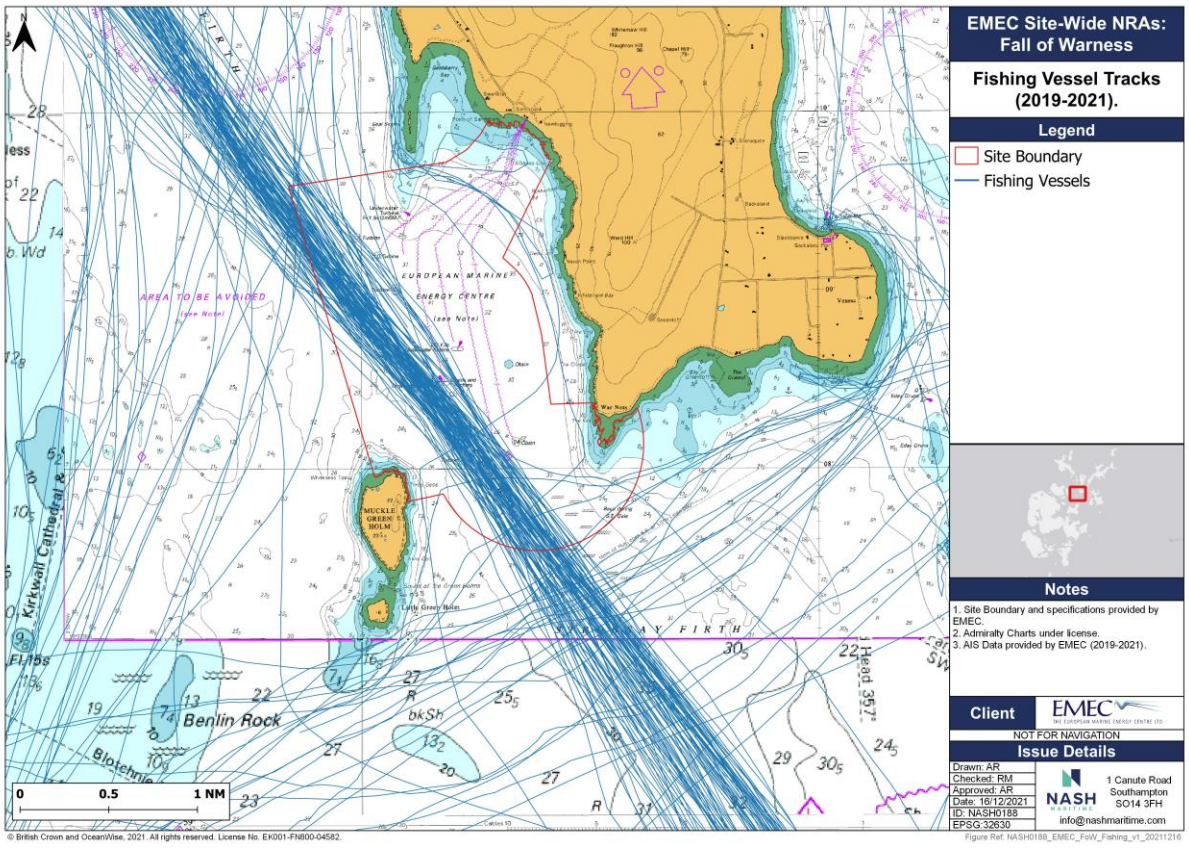



**Figure 10 | Fishing vessel tracks (2019-2021)**

### 4.2.6 Recreational craft

Figure 11 shows the tracks of recreational craft such as powered pleasure craft and yachts through the Fall of Warness site. Recreational craft are generally not required to carry AIS but some do voluntarily, with consultees estimating that approximately 25% of vessels choosing to do so when cruising the Orkney Islands.

Cruising in the Orkneys is popular, with peak season between May and August. The principal destinations are the marinas in Kirkwall, Stromness and Westray, however yachts are found cruising throughout the Orkney Islands. The nearest sailing clubs are Orkney Sailing Club, based in Kirkwall, and ones in Stromness and Holm. The area is not routinely used for organised events such as regattas or club racing.

Most recreational craft transit to the west of the site between Kirkwall and Westray (the only route highlighted in the Royal Yachting Association (RYA) coastal route atlas) or to the south-east between Kirkwall and the north-western islands. However, when compared to other locations within the RYA cruising atlas, the area has a low intensity. Whilst it is possible that small pleasure craft such as sea kayakers may be found in and around the site, the distance from Kirkwall and strong tidal flows makes this unlikely.

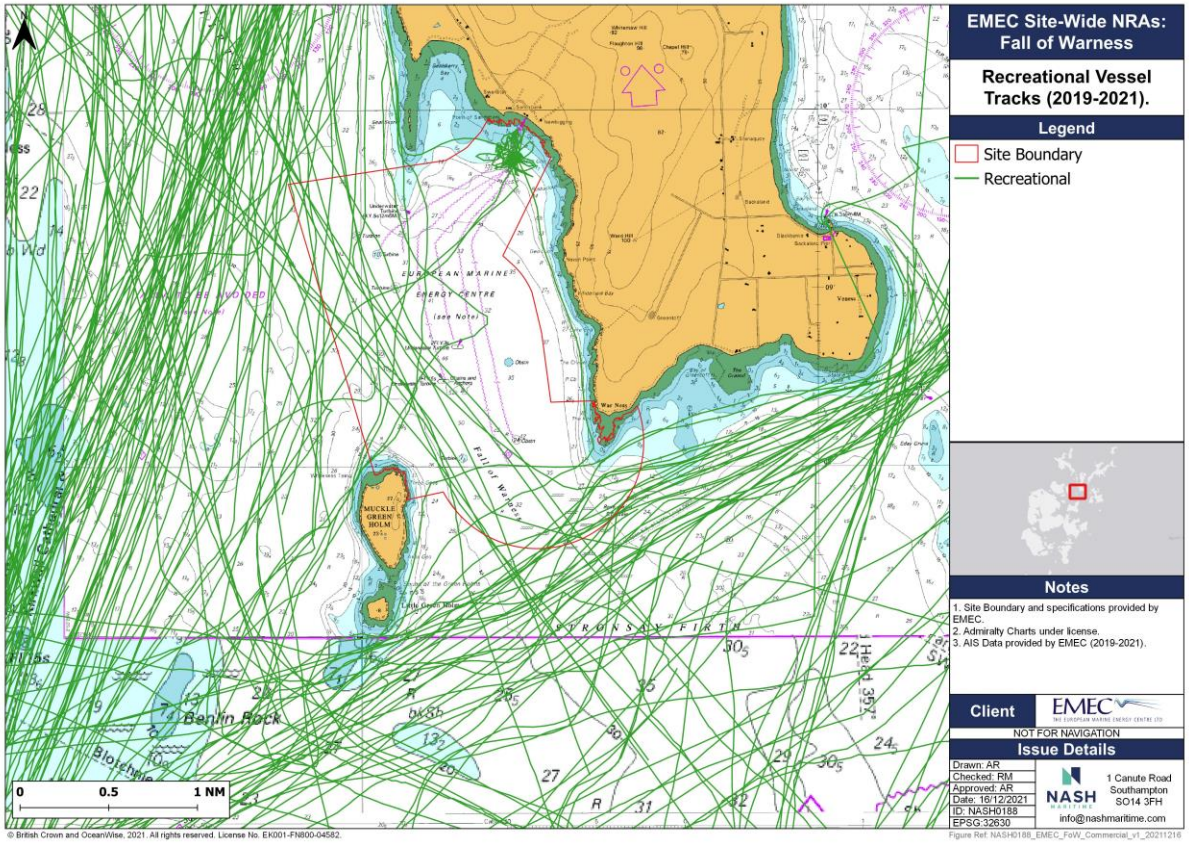



**Figure 11 | Recreational vessel tracks (2019-2021)**

### 4.2.7 Vessels supporting fish farm industry

There are a significant number of fish farms within the Orkney Islands, which require servicing by a variety of vessels such as small workboats or landing craft and larger maintenance vessels. Figure 12 identifies vessels that are shown to routinely be servicing these aquaculture sites, albeit the vessels may be chartered to other activities. For example, it can be seen that several workboats are operating on the EMEC devices within the centre of the lease area.

Some larger fish carriers transit through the site, such as the 70 m Ronja Challenger, 63 m Marsali and 55 m Ronja Commander. Most vessels passing adjacent to the site are small workboats between 10 m and 40 m. There is also evidence that these vessels pass close to Muckle Green Holm to efficiently navigate with the tidal conditions.

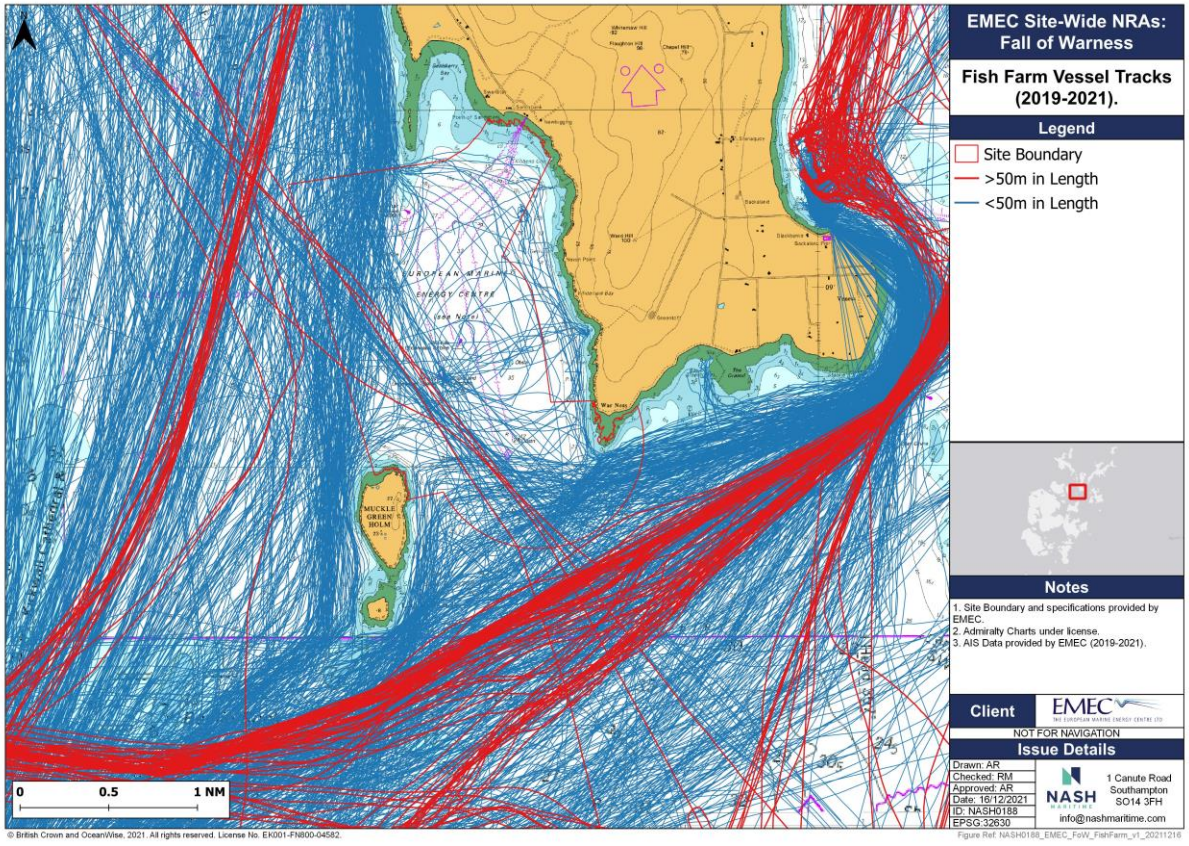



**Figure 12 | Fish farm vessel tracks**

### 4.2.8 Tug and Service vessels

Whilst there is some overlap between vessel types with vessels supporting the fish farm industry (see Section 4.2.7), Figure 13 shows the tracks of other workboat and service vessels. These include tugs, pilot boats, dredgers and other small commercial vessel. Within the project site, there are frequent movements by vessels supporting the EMEC devices operated by Leask Marine such as the C-Odyssey (26 m), CWind Athena (18 m) and C Spartan (12 m). Similarly, the Northerly Marine Services vessels Nigg Bay (18 m) and Causeway Explorer (12 m) conduct frequent trips into the site.

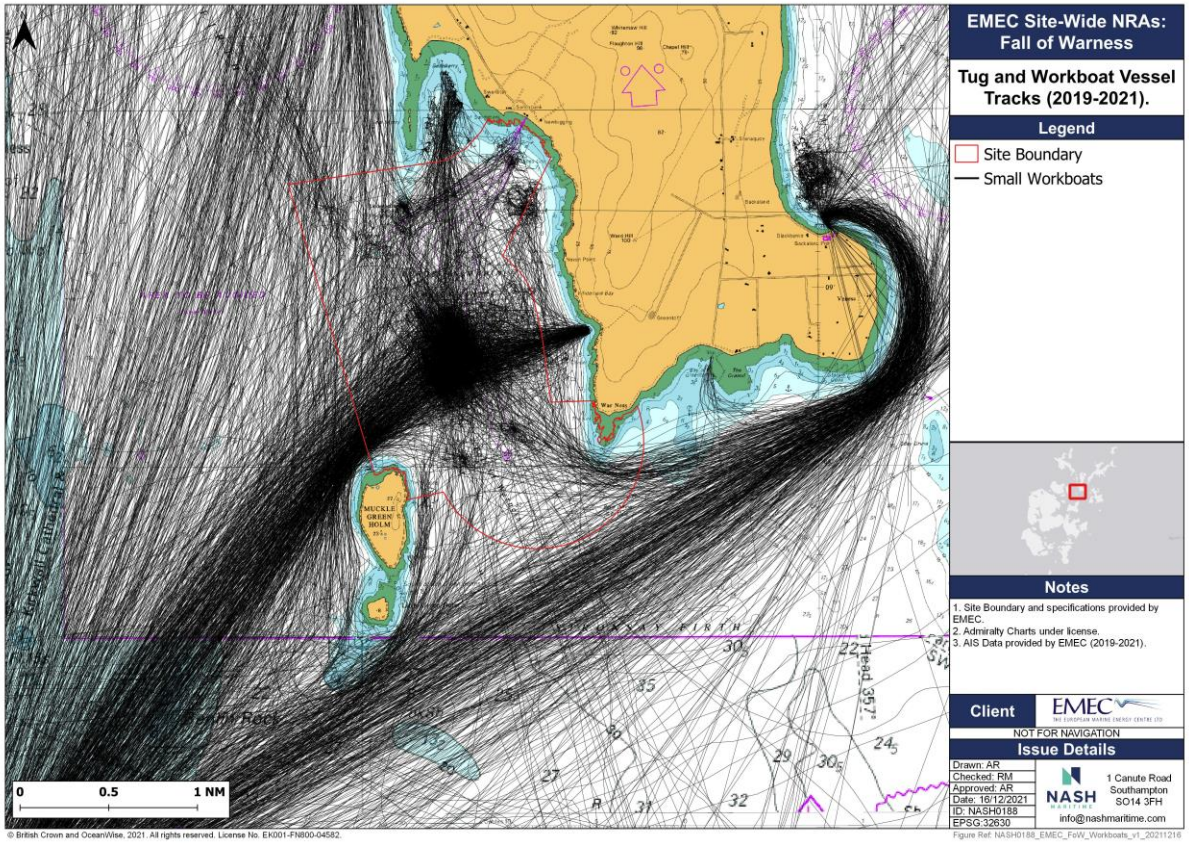



**Figure 13 | Tug and workboat vessel tracks**

## 4.3 Historical incident analysis

Three incidents are recorded in the MAIB data occurring within the Fall of Warness site between 2010 and 2020:

- These include an altercation between two fishing vessels in 2016
- An accident to person onboard a floating jack up barge in 2010.
- A grounding of a fishing vessel in Sealskerry Bay in 2014.

Other incidents have been responded to by the RNLI within the study area, all of which involve mechanical failure aboard a vessel.

In 2006, a towed jack-up barge ran aground on an uncharted outcrop to the south-west of Muckle Green Holm on passage to install a device in the Fall of Warness site.[4]

[4] https://assets.publishing.service.gov.uk/media/547c705140f0b60241000097/Harold_OctopusReport.pdf

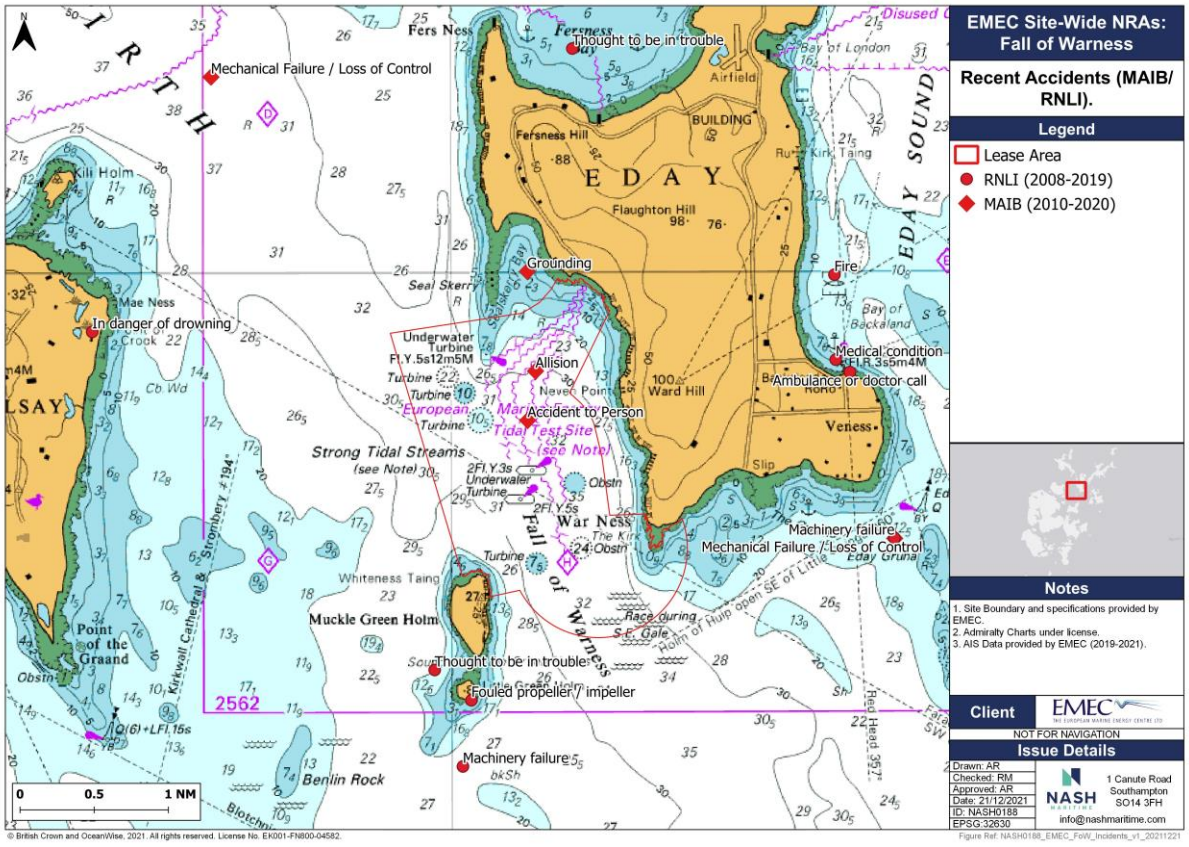



**Figure 14 | Incidents around the Fall of Warness site (MAIB/RNLI)**

## 4.4 Future traffic profile

Vessel traffic activities in the Orkney Islands have been significantly affected by the COVID-19 pandemic and therefore movement numbers for March 2020 onwards may not be representative of future conditions. Therefore, longer term analysis has been conducted to better understand how commercial and non-commercial activities might change around the EMEC sites.

### 4.4.1 Commercial shipping

Up until April 2020 and the COVID-19 pandemic, the following trends were observed for the Orkney Islands: [5]

- Pilotage movements had increased from 708/year in 2017/18 to 893/year in 2019-20.
- The number of ship-to-ship transfers (STS) at Scapa Flow had increased from 0 in 2014 to 61 in 2019/20.
- Tanker movements to Flotta Terminal reduced from 34 in 2018/2019 to 31 in 2019/20. This is part of a long-standing decline in the volume of crude oil exported from Flotta

[5] https://www.orkney.gov.uk/Files/Committees-and-Agendas/Harbour-Authority-Sub-committee/HA2021/HA19-01-2021/I08__Annual_Performance_Report.pdf

since the 1990s (see Figure 17), with operations expected to cease entirely within the next 20 years. [6]

- Ro-ro services have fluctuated with a modest increase (5-10%) in 2019/20 over the previous year.

Overall, commercial shipping trends have decreased by approximately 40% since 2000, as shown in Figure 15 and Figure 16, and will most likely continue to decrease. This is partly due to the decline in Flotta operations which will continue to decrease over the next decade or so, and partly due to the significant change of focus towards other ventures such as renewable energy and the cruise industry.

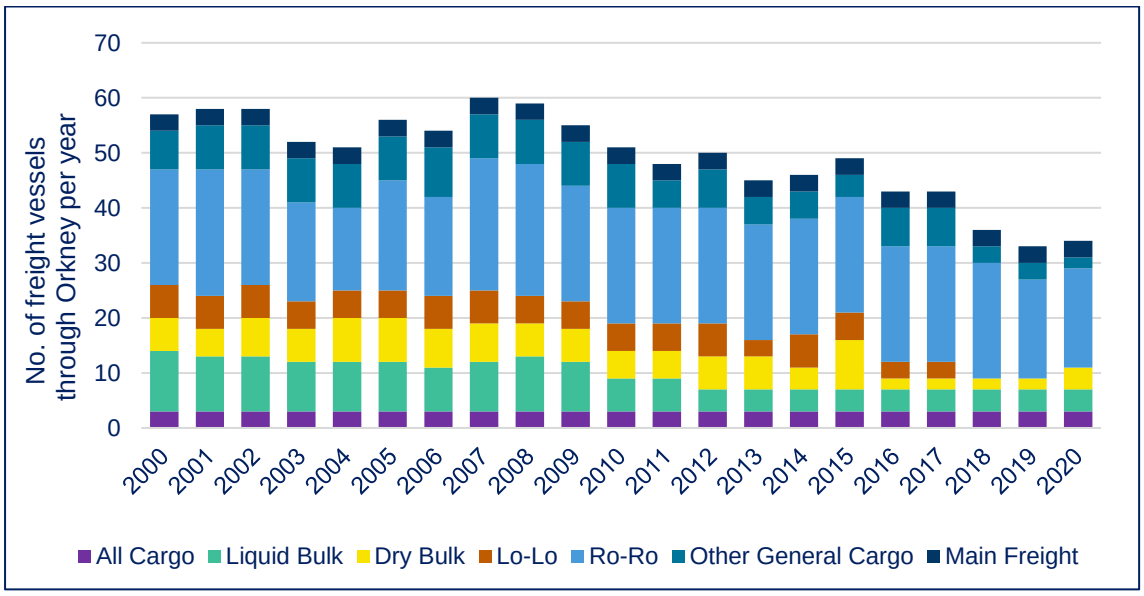



**Figure 15 | Commercial trends of freight vessel traffic in the Orkney Islands from 2000-2020. (Source: DfT, Port and domestic waterborne freight statistics - PORT0301)**

[6] https://www.orkneyharbours.com/documents/orkney-harbours-masterplan-phase-1

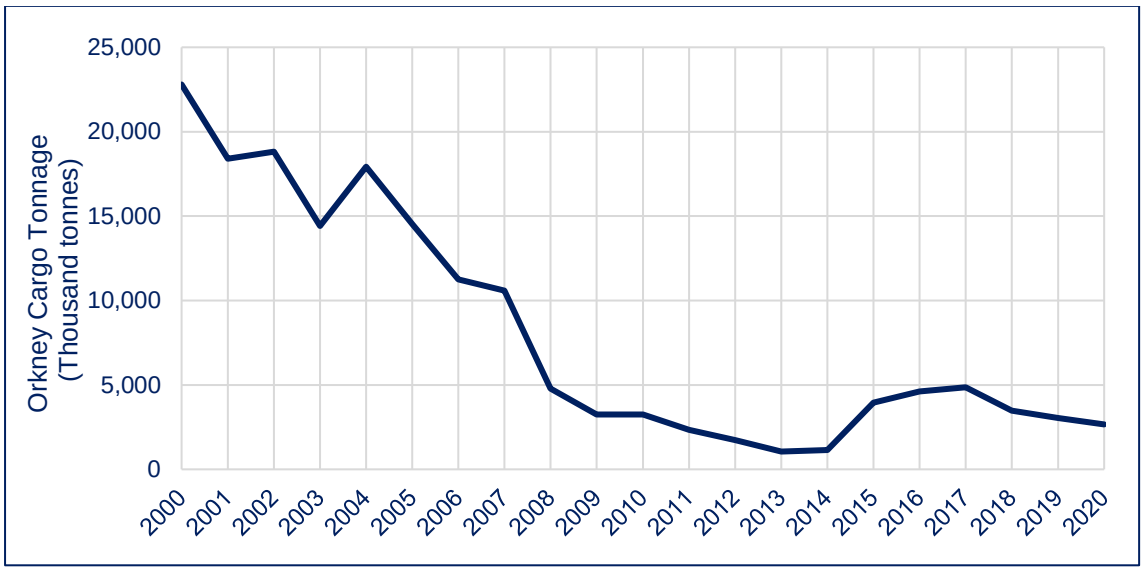



**Figure 16 | Orkney cargo tonnage from 2000-2020. (Source: DfT, Port and domestic waterborne freight statistics - PORT0301)**

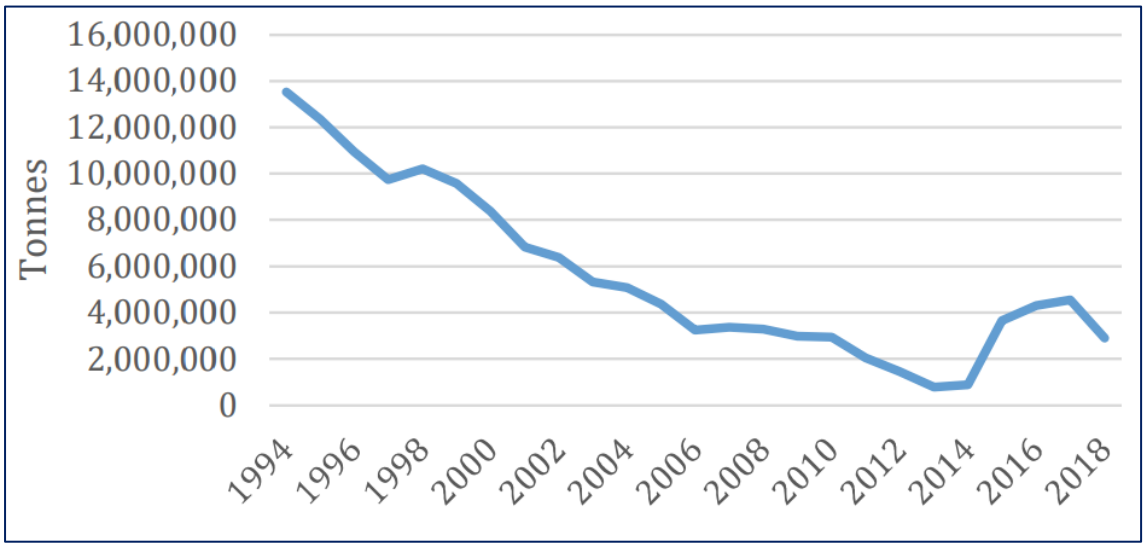



**Figure 17 | Volume of crude oil exported from Scapa Flow Flotta. (Source: Orkney Harbour Authority Masterplan).**

### 4.4.2 Ferries

Over the last few years, the internal Orkney ferry routes have shown marginal growth in the region of 2-5% (see Figure 18). The volume of passengers and cars on the internal Orkney Ferries' routes is over 1.5 times what is carried by the Northlink service (between the Scottish mainland, Orkneys and Shetland). Orkney Ferries Limited reports a marginal increase in passenger numbers across the inner isle routes but a marginal decrease on the outer isle routes. In general, other Ferry services have seen a steady increase in passenger and vessel numbers since 2015 which is likely to continue as the tourism industry expands.[7]

There was a notable decrease in ferry traffic during the ongoing COVID-19 pandemic. As with passenger numbers on other domestic and international routes, the reduction in passenger

[7] https://www.orkneyharbours.com/news/orkney-islands-council-harbour-authority-annual-report-2017-2018

numbers is associated with the disruption to travel and maritime operations during the pandemic[8]. Specifically, passengers on Scottish inter-island routes decreased to 3.8 million in 2020 from 8.6 million in 2019, a decrease of 55%. Ferry traffic is expected to return to normal activity post COVID restrictions, or even increase following pier and marina development plans.

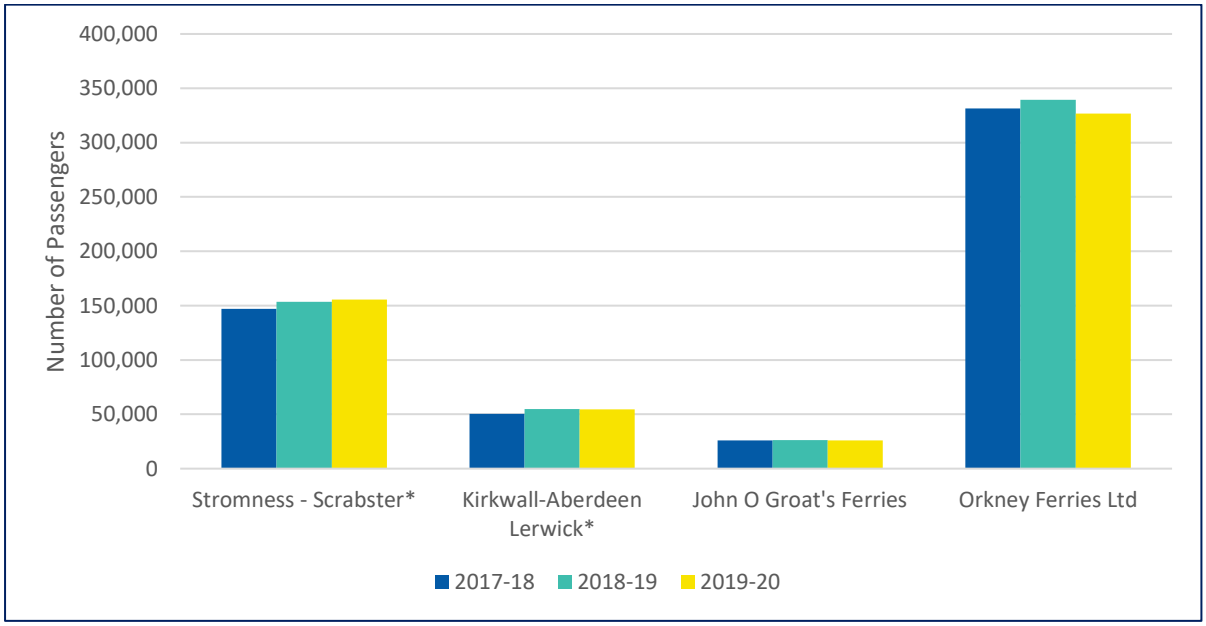



**Figure 18 | Ferry traffic in the Orkney islands (2017-2020). *Serco NorthLink Ferries Ltd**

### 4.4.3 Cruise

Orkney's cruise market has grown considerably since 2010 (see Figure 19). Reasons for this include the desirability of the Orkney Islands as a destination, marketing to cruise lines, the quality of marine and shoreside service and the extension of the Hatston Pier berth in 2012.[9] Over 156 cruise ships were booked for 2019 and that level of port calls was expected to be sustained (165 for 2020). It must be noted that the effect of the COVID-19 pandemic has been catastrophic to the cruise industry.[10] However, almost 200 cruise ships are booked to call in 2022, suggesting that the trend is being reversed[11] and a recovery to pre-pandemic levels is anticipated and assumed in this assessment.

[8] https://www.gov.uk/government/statistics/sea-passenger-statistics-all-routes-2020/sea-passenger-statistics-all-routes-2020

[9] https://www.orkneyharbours.com/documents/orkney-harbours-masterplan-phase-1

[10] https://www.orkney.gov.uk/Files/Committees-and-Agendas/Harbour-Authority-Sub-committee/HA2021/HA19-01-2021/I08__Annual_Performance_Report.pdf

[11] https://www.orkney.gov.uk/News?postid=4505

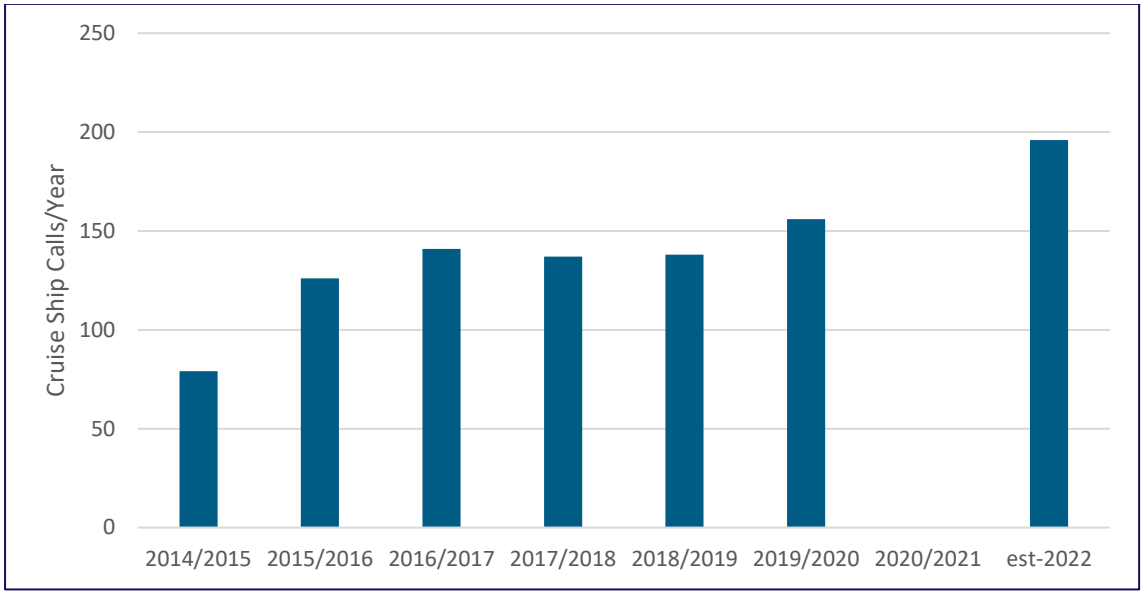



**Figure 19: Cruise volumes in the Orkney Islands. (Source: Orkney Harbour Authority).**

### 4.4.4 Recreational

Figure 20 shows the number of marina tickets sold each year between 2009 and 2021, issued for visiting vessels. The data shows that prior to the 2020 COVID pandemic, the numbers were steadily increasing from between 500-600 to between 650 and 750. Of these, the majority of vessel calls were to Kirkwall and Stromness, with fewer vessels venturing up to Westray. Furthermore, prior to the 2020 pandemic, in general, 50% of yachts were from the UK, with 10% from Norway and Netherlands and the remainder from across Europe and America. Since the restrictions on travel since 2020, the proportion from UK has increased to 90%. Whilst tickets reduced significantly during the pandemic in 2020, numbers were recovering in 2021 and a return to pre-pandemic levels is anticipated.

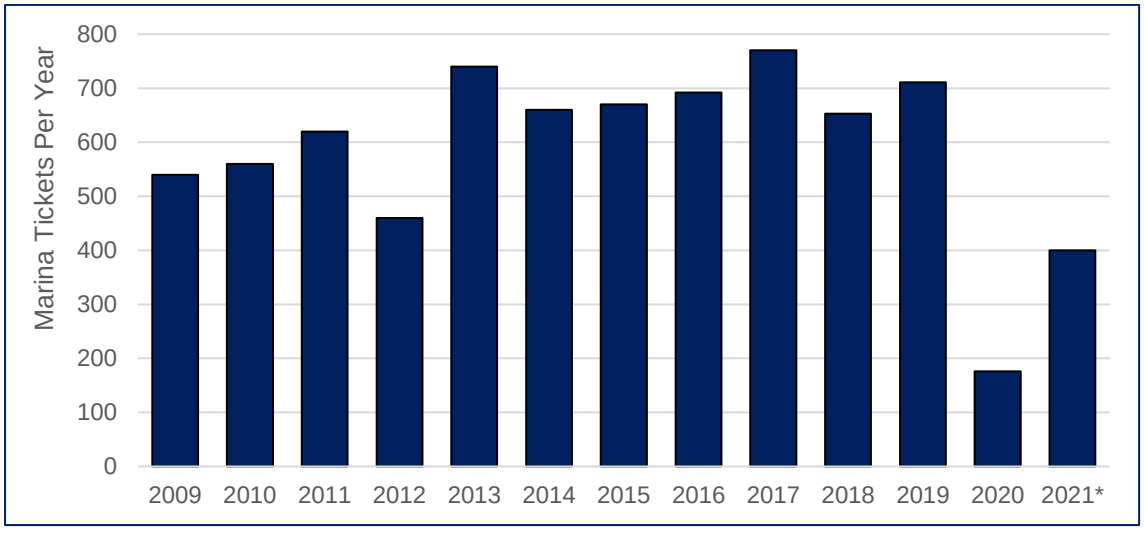



**Figure 20: Marina tickets sold per year (*2021 is partial) (Source: Orkney Marinas).**

### 4.4.5 Fishing

In 2020, there were 2,088 active Scottish registered vessels, down 10 vessels from 2019 (532 vessels >10 metres and 1,556 vessels <10 metres). Additionally, the number of fishers

employed is down 3% from 2019 to 2020. Figure 21 shows that there has been a gradual decline in the number of fishing boats registered in the Orkneys in the last 10 years.

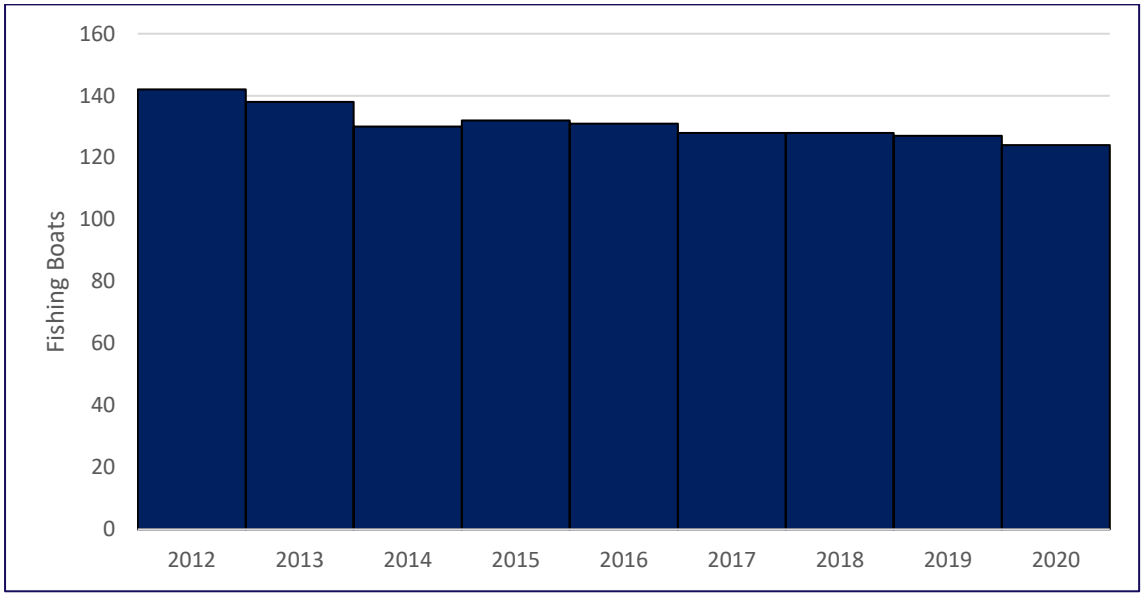



**Figure 21: Fishing boats registered in the Orkney Islands (Source: Scottish Sea Fisheries Statistics).[12]**

The impact on fishing vessel activity as a result of Brexit and other commercial factors is unclear for the foreseeable future.

### 4.4.6 Renewable energy vessel traffic

#### 4.4.6.1 Hydrogen

Orkney has been at the forefront of marine renewable energy research and development for the last decade driven by EMEC. There are many harbour facilities around Orkney which support wave and tidal energy development, particularly the handling and servicing of renewable energy devices and, most recently, the production and usage of hydrogen.[13]

The production of hydrogen remains of interest to the Harbour Authority and, it has participated fully in the Surf 'n Turf project and its fuel cell on Kirkwall Pier for the overnight powering of local ferries. The Harbour Authority is also involved in the EU Horizon 2020 for HYSEAS III for a hydrogen powered RoRo ferry and in EU ERDF funds for a low carbon and active transport and travel hub in Stromness, a project which will place the MV Hamnavoe onto shore based electrical power overnight. The contribution of hydrogen derived energy to grid load as a percentage is predicted to be the largest in Europe (1.5 MW out of 35 MW). The Authority is also still actively pursuing opportunities for LNG storage and bunkering in Scapa Flow identifying this fuel as the transition towards the truly carbon free fuels of green hydrogen and ammonia.[14]

#### 4.4.6.2 ScotWind

In January 2022, Crown Estate Scotland announced Options Agreements for ScotWind Leasing for 17 project sites. Orkney Islands Council has been in discussions with potential developers over a number of months with a view to the successful bidders using Scapa Flow

[12] https://www.gov.scot/collections/sea-fisheries-statistics/

[13] https://www.orkneyharbours.com/documents/orkney-harbours-masterplan-phase-1

[14] https://www.orkney.gov.uk/Service-Directory/S/Sustainable-Energy-Strategy.htm

as a base for operations. Alongside this, the Council has also been developing plans to provide improved infrastructure to support this work – known as the Scapa Flow Deep Water Quay project.

Sites to the west and east of Orkney were awarded, including the proposed 'West of Orkney Windfarm' which involves a consortium of companies headed by Offshore Wind Power, MacQuaries, Green Investment Group – for which the Council already has an agreement in place to work together. The 'West of Orkney Windfarm' project also includes the Flotta Hydrogen Hub - which could see hydrogen produced in Flotta for export.[15]

#### 4.4.6.3 Innovation and Targeted Oil and Gas (INTOG)

In early 2022, Crown Estate Scotland released details of its Innovation and Targeted Oil and Gas (INTOG) offshore wind leasing process. Whilst the potential locations are being considered in the ongoing Marine Scotland sectoral planning process, there is potential that this may include areas in vicinity of Orkney and that this may also lead to further use of Orkney marine infrastructure during construction and operations and maintenance.

#### 4.4.6.4 Westray South

In 2014 DP Energy acquired the development rights to a Crown Estate lease awarded in 2010 for a site to the north-west of Fall of Warness. This project has been in early planning since 2014, and at present, there is no known further development of the site.

[15] https://www.orkney.gov.uk/News?postid=5023

# 5 Impacts to navigation and hazard identification

## 5.1 Hazard identification

Based on a review of the documentation, collated data and consultation responses, the following key hazards were identified related to the project site.

| Number | Impact |
|---|---|
| 1 | Impact on Vessel Traffic Routeing |
| 2 | Impact on Contact/Allision and Grounding Risk |
| 3 | Impact on Collision Risk, Visual Navigation and Collision Avoidance |
| 4 | Impact on Under Keel Clearance |
| 5 | Impact on Communications, Radar and Positioning Systems |
| 6 | Impact of Failure of Moorings |
| 7 | Impact on Search and Rescue and Emergency Response |
| 8 | Impact on Interactions with Subsea Cables |
| 9 | Impact on Fishing and Recreational Activity |
| 10 | Cumulative and In-Combination Effects |

**Table 13 | Key impacts to navigation.**

## 5.2 Impact on vessel routeing

The Fall of Warness is a navigable waterway utilised by a variety of vessels (see Section 4). In particular, a route exists through the Orkney Islands between Stronsay Firth to the south-east and Westray Firth to the north-west, passing directly through the Fall of Warness. The width of this waterway, between Muckle Green Holm and War Ness is approximately 2.1 km (1.13 nm). Both the Admiralty Chart 2250 and Sailing Directions draw attention to the presence of the tidal device testing site. Principally this route is utilised by:

- Cruise ships.
- Fishing boats and trawlers.
- Large offshore service vessels (oil and gas supply boats).
- Occasional recreational craft.
- Little commercial traffic.

### 5.2.1 Effect of tides, tidal streams and weather

The Fall of Warness has a significant tidal rate that impacts upon the navigation of certain vessel types. Charted tidal races are evident to the south of the lease area which develop in south-easterly gale force conditions. The tidal diamond indicates that tidal streams run broadly north/south through the test site with a maximum rates of over 7 knots during spring tides.

In particular, analysis of historical traffic movements has identified that during specific conditions, passenger ferries re-route through the Fall of Warness (see Figure 22). The reasons behind these movements were explained during consultation with Orkney Ferries:

- Firstly (Route 1 in blue), during strong south-easterly winds and flood tides the ferries will occasionally pass to the north of Muckle Green Holm and inshore at War Ness (Eday), approximately following the 10 m contour. At these times the conditions are significant enough to damage vehicles and potentially injure passengers to better align the ferry to the prevailing conditions, improve seakeeping and reduce risk to cargo and

passengers. The more severe the conditions, the further north into the EMEC site the vessels run, and if the conditions are severe enough, they will choose to pass to the west and north of Eday.

- Secondly (Route 2 in orange), when the tides are north-westerly, ferries can be seen passing further north than the direct route in order to take advantage of the reduced flow rate and tidal eddy behind both Muckle Green Holm and Eday and passenger comfort.
- Thirdly (Route 3 in green), for vessels proceeding to the north from Kirkwall, there is evidence that they often take a less direct route, passing close to Muckle Green Holm and Seal Skerry, to mitigate the strong ebb tide. By doing so, these vessels pass within the western portion of the lease area.
- Fourthly (Route 4 in red), on some rare occasions, ferries are seen passing through the EMEC site and then inshore of the OpenHydro fixed device by Seal Skerry. This may improve passenger comfort during ebb tides and strong north-westerly conditions.

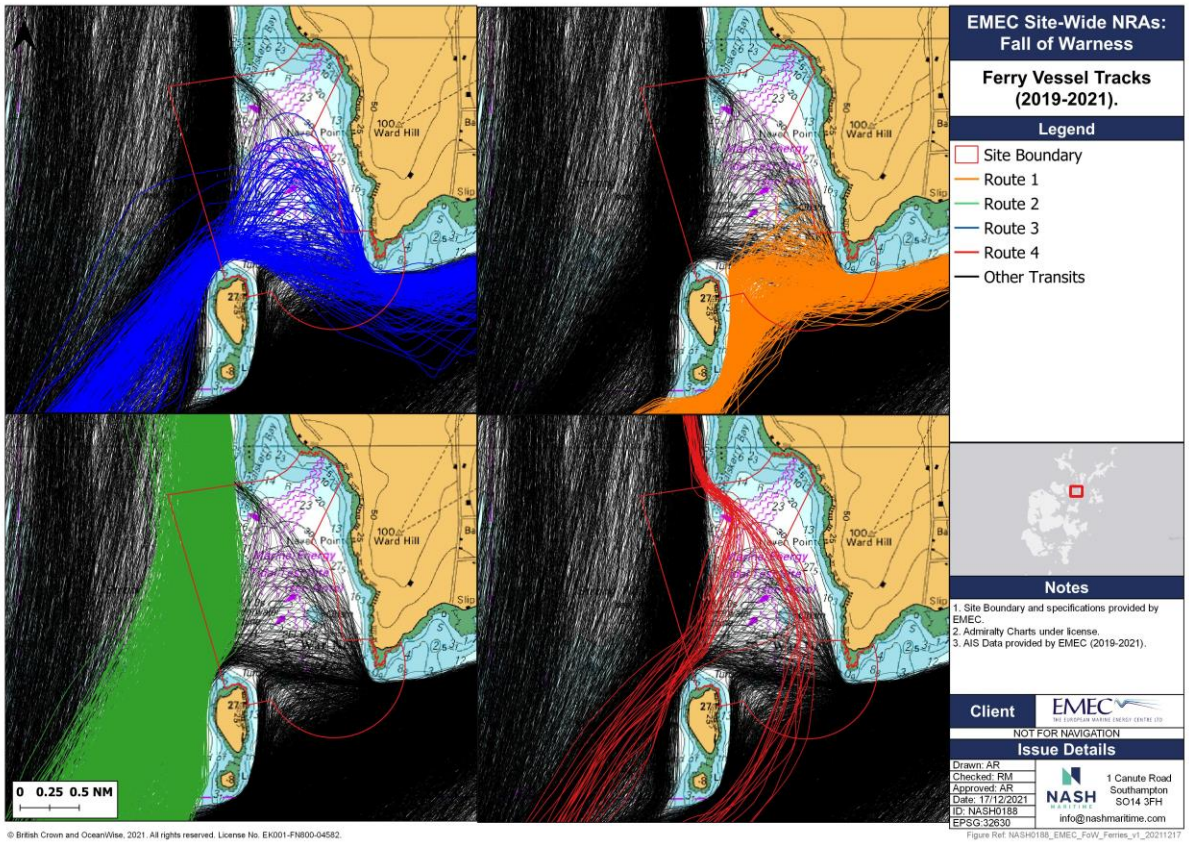



**Figure 22: Comparison of ferry transits.**

Given the high tidal streams, relatively frequent poor visibility and constricted navigating conditions, it is generally recommended that only vessels with local knowledge navigate through the Fall of Warness. However, there is generally a low traffic density that reduces the risk of two vessels meeting one another and therefore maximising the potential room to manoeuvre.

## 5.3 Impact on risk of contacts/allisions and groundings

The presence of the devices can have several direct hazards to navigating vessels; contacts/allisions with the structures by navigating vessels or grounding due to re-routeing around the devices. To assess these hazards, the Risk Management Toolbox “IWRAP” has

been utilised.[16] The model IWRAP MKII has been used which is a quantitative collision, contact and grounding model, developed by International Association of Lighthouse Authorities (IALA) as a component of the IALA Risk Management Tool recognised by the IMO. The model is a probability model with the underlying risk frequency analysis based on a mathematical model first introduced in 1974 by Fuji & MacDuff, and since modified by Pedersen and Friis-Hansen (2008). The method is probabilistic and based on statistical analysis of vessel routes. The study area is modelled using several vessel routes called legs which connect one waypoint to another. Several legs may be connected to the same waypoint, e.g., at a crossing or at a merging location. For each leg, a statistical distribution is assigned describing how far from the leg centre vessels are travelling. The general principle is to calculate how many collisions, allisions or groundings will occur if all the vessels sail straight ahead without taking any evasive manoeuvres or actions to avoid the occurrence. This gives the number of theoretical geometrical collisions, allisions and groundings.

Vessels do not generally navigate in this manner, and in general, around 1 or 2 in 10,000 encounters are not avoided as they should be - this is called the causation factor. The causation factor models the probability that the vessel does not react in time when on a collision course with another vessel, or alternatively an allision or grounding course. IALA has, together with a group of experts, defined a set of globally applicable causation factor values. The total number of collisions, allisions or groundings is the number of geometrical candidates multiplied by the causation factor. The method has been extensively tested and found to estimate the number of collisions and allisions close to the observed numbers all around the world. Within this study two IWRAP models are developed, a base case without the Project in place and another future case with the Project in place.

At the project site, an IWRAP model was developed with a model device in-situ at every existing berth.

[16] https://www.iala-aism.org/product/g1123-use-iala-waterway-risk-assessment-programme-iwrap-mkii/.

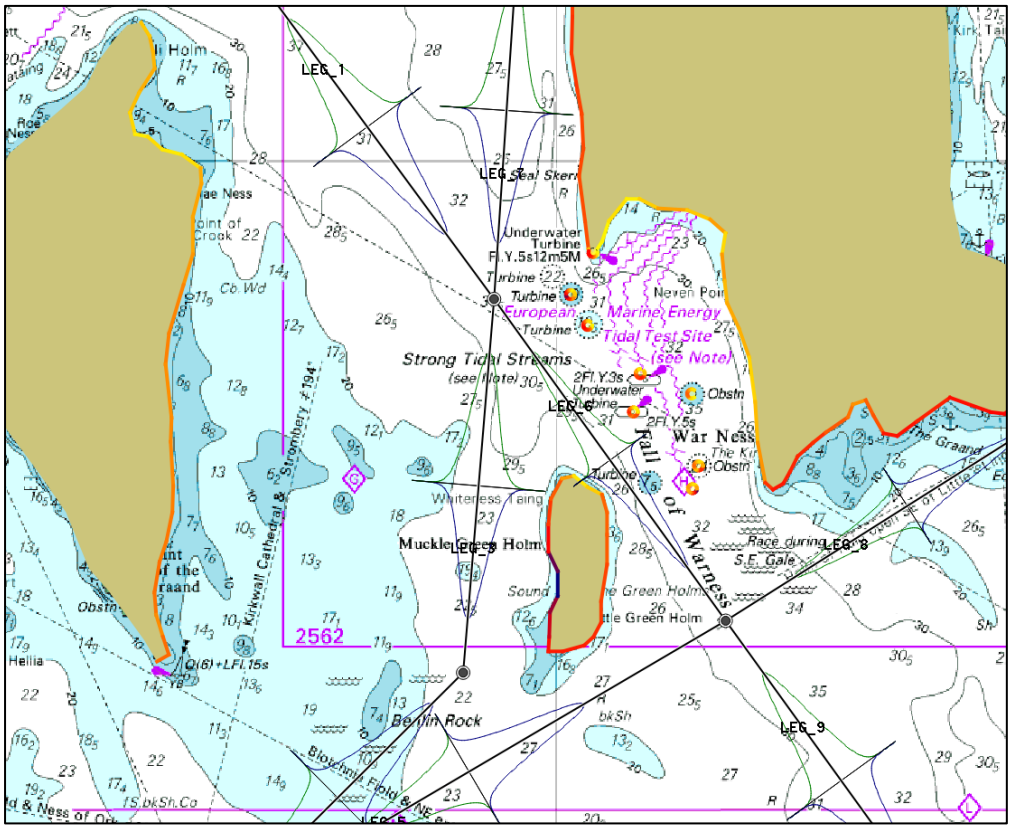



**Figure 23: IWRAP modelling results at Fall of Warness.**

### 5.3.1 Contact

The modelling suggests that the likelihood of a powered contact by a passing vessel of a device is remote, with a modelled frequency of less than once in 10,000 years. These incidents could occur due to human error or steering failure, or through the devices not being visible to passing vessels. The low frequency is due to the separation between the main routes and the devices site, with only a relatively low number of vessels transiting through the site. This modelling does not include the manoeuvring of ferries in adverse weather within the site.

Drift contacts, following mechanical failure, could result in vessels being swept onto the devices. The modelling shows a low likelihood of drift contacts, of less than once in 750 years.

Therefore, the modelled risk of a contact by a passing vessel with a device is not considered to be significant, with existing risk controls in place.

### 5.3.2 Grounding

Groundings are modelled to occur much more frequently than contacts, with a frequency of once in 15 years for powered groundings and once in 38 years for drift groundings. These higher rates are due to the much greater area in close proximity to the major routes upon which vessels can run aground than the isolated tidal devices. Groundings have occurred within the area for small fishing vessels.

### 5.3.3 Contact by maintenance vessels

Due to the nature of their operations, a contact between an installation vessel and a device is much more likely to occur than with another passing vessel. The vessel operators at the EMEC site have significant experience and local knowledge of operating in that area and are

governed by a variety of procedures to maintain safe operation. This mitigates the risk of incidents.

## 5.4 Impact on collision risk, visual navigation and collision avoidance

OREIs have the potential to disrupt traffic flows and obscure other navigating vessels which has the potential to result in a collision. Most devices proposed for installation at the site have heights above the waterline of less than 5 m and therefore vessels either side would be able to visually identify one another. Furthermore, analysis of historical AIS data estimates that relatively few vessels make passage through the Fall of Warness and, therefore, the likelihood that two vessels would navigate the passage at the same time and make a human or mechanical error that result in a collision is not significant.

## 5.5 Impact on under keel clearance

Whilst historically, most devices installed at the Fall of Warness site have some surface piercing element, there is the potential for bottom mounted or mid-water devices at the site (see Section 2). These might impact the available depth of water for navigating vessels and pose a risk of striking a ship's hull. Orkney Ferries for instance have a draught of 3.25 m and the masters believe that a dynamic draught of 8 m might occur during poor weather.

MGN 654 (supported by the UKC policy paper) states that "*To establish a minimum clearance depth over devices, the developer needs to identify from the traffic survey and data sources the deepest draught of observed traffic. This will then require modelling to assess impacts of all external dynamic influences giving a calculated figure for dynamic draught. A 30% factor of safety for under keel clearance (UKC) should then be applied to the dynamic draught, giving an overall calculated safe clearance depth to be used in calculations.*"

Therefore, the MCA utilise the following calculation to determine if the UKC of a submerged device is acceptable, where the UKC should be greater than 0:

$$UKC = Depth\ (at\ CD) - Device\ Elevation - (Ship\ Draught * Dynamic\ Factor * 1.3)$$

Where:

- Depth at Chart Datum is the depth of water at the site.
- Device elevation is the maximum height of device above seabed.
- Vessel draught is the deepest vessel draught (Which can be assessed from historic and existing vessel traffic records).
- Dynamic factor is a modelled representation of squat, heeling and other dynamic forces on the vessel A conservative calculation (using the principles of PIANC) has been used of vessel draught multiplied by 2.0 to account for dynamic motion.
- 1.3 is the recommended percentage safety factor for UKC.

Figure 24 shows the approximate draughts of vessels navigating through the Fall of Warness site during the collected data periods. The majority of transits were for vessels with draughts of between three and four metres, accounted for by the Orkney Ferries vessels. Smaller maintenance vessels and workboats have draughts less than three metres. Occasional transits of larger fishing vessels and fish carriers of draughts between four and six metres are recorded. The largest vessels with the deepest draughts were cruise ships, with Boudicca (7.5 m), Spirit of Discovery (7.3 m), Black Watch (7.3 m) and Balmoral (7.1 m) accounting for the greatest draughts.

Given these draughts, and applying the MCA formula, the suitable UKC requirements are shown in Figure 25. This identifies that 95% of vessels could safely transit over a device were there more than 9 m clearance from the surface, with 99% less than 13 m in the most severe conditions. The worst-case transit is of a large cruise ship in significant swells that might require up to 20 m surface clearance of a device, however, it is unlikely that the vessel would make this transit in such conditions. In consistency with previous NRAs, it is recommended that all devices maintain a 13 m surface clearance at Lowest Astronomical Tide (LAT).

For many surface devices, that have some underwater infrastructure such as rotors or moorings, vessels would need to be within close proximity to contact/allide with the infrastructure. In such a situation for larger vessels, a contact with the device would be inevitable.

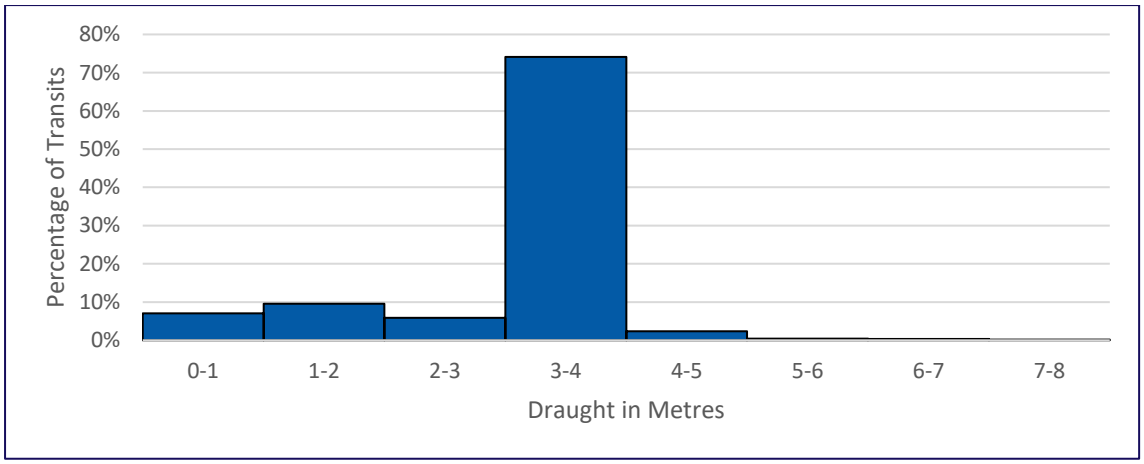



**Figure 24: Draught in metres of vessels within site.**

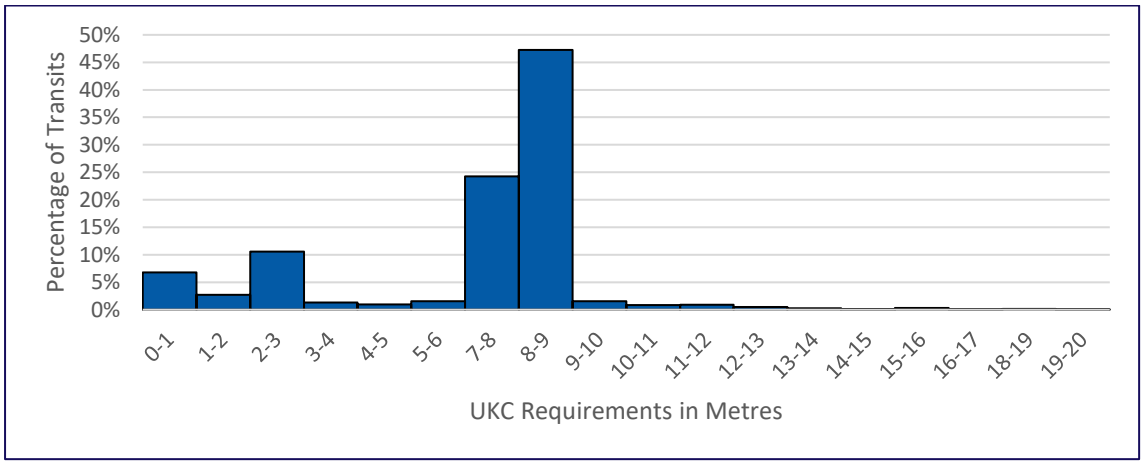



**Figure 25: UKC requirements in metres of vessels within site.**

## 5.6 Impact on communications, radar and positioning systems

MGN 654 notes that an OREI may have adverse impacts on the equipment used for navigation, collision avoidance or communications. Whilst several studies have considered the impacts from offshore wind turbines, the research into other OREI devices is limited. However, these are anticipated to be less than for offshore wind farms due to their reduced scale. Reference is therefore made to the studies of QinetiQ (2004) and BWEA (2007). Table 14 provides a summary of these potential impacts, for which there are not anticipated to be any significant effects.

| Impact on | Overview |
|---|---|
| **VHF** | VHF is essential for the communication between vessels and shore. VHF radio waves could be blocked or interfered with by an OREI. The QinetiQ study found no noticeable effect on VHF communications both ship-shore and ship-ship within or adjacent to the wind farm. The small size of the Devices makes this impact negligible. |
| **AIS** | AIS enhances the identification between vessels for collision avoidance. AIS signal could be blocked or interfered with by the presence of devices. The QinetiQ study found no noticeable effect on AIS reception. The small size of the Devices makes this impact negligible. |
| **GNSS** | GNSS (such as GPS) is used for satellite positioning systems and navigation. Satellite reception could be impacted by the presence of devices. The QinetiQ study found no noticeable effect on GPS reception. The small size of the Devices makes this impact negligible. |
| **Marine Radar** | Marine radar is used for both collision avoidance and vessel navigation and could be impacted by the devices. Whilst this is observed from offshore wind turbines, the small size of the Devices makes this impact negligible. It is possible that maintenance vessels alongside the Devices would not be discernible on radar, however they would be identifiable visually or through AIS. |
| **Noise** | The sound generated by the device could mask navigational sound signals from vessels or aids to navigation. Whilst Devices can make an audible sound whilst rotating, the low density of shipping and distance to other navigational marks makes this potential impact negligible. |
| **Compass** | Compasses are used for vessel navigation. These are potentially impacted by electromagnetic interference from the turbines or cable. The degree of this impact is related to the depth of water, cable design and alignment with the earth's magnetic field. Whilst this has impact has not been directly observed in studies, it is possible that small vessel compasses could be impacted near to cable landfall. However, navigation through this passage is anticipated to be predominantly visual. |

**Table 14 | Summary of impacts on equipment.**

Feedback from Orkney Ferries indicated that devices have been easily detected visually, by radar and by AIS given their large size. However, it is possible that future smaller devices during adverse conditions might be less prominent. Finally, it was noted during consultation that at times any associated mooring buoys with the devices can be dragged under the water and become less visible.

## 5.7 Impact of failure of moorings

A breakout of a device during extreme weather conditions could pose a hazard to other navigating vessels. The likelihood of this hazard occurring is not considered significant for the following reasons:

- The proposed mooring arrangements of each device is required to meet industry best practice and be certified. Most devices are attached with several mooring lines so there is sufficient redundancy with any single remaining mooring line is capable of holding platforms in place.
- During significant adverse weather conditions, the density of traffic would be low and therefore it is unlikely that it would meet another vessel.
- Several risk control measures are in place to detect an excursion from the site including:

- EMEC's SCADA system
- GPS and AIS monitoring
- Harbour Authority and EMEC radar
- Observations from nearby vessels and local residents.

At the project site, it is likely that were a device to break free, it would become grounded on a lee shore rather than pose a danger to other navigating vessels.

## 5.8 Impact on Search and Rescue

Larger OREIs can both limit the effectiveness of conducting search and rescue and pose hazards for accessing the area in an emergency. The small size of the devices and significant sea room would enable RNLI lifeboats to gain entry to the site and conduct a rescue. Furthermore, there is no significant overhead infrastructure that could impact upon HMCG helicopter operations. Furthermore, the Devices could serve as both landmarks and temporary places of refuge that support SAR operations. An ERCOP has been developed to support emergency cooperation at the Fall of Warness.

## 5.9 Impact of interactions with subsea cables

Subsea cables can pose hazards to navigating vessels through snagging anchors or fishing gear that might result in a capsize. Given the depths of water, the likelihood of anchoring near the device are remote and few fishing vessels would engage in fishing in close proximity to a snagging hazard. Analysis of the AIS data revealed no anchoring activity of third-party vessels.

## 5.10 Impact on fishing and recreational activities

Most fishing vessels recorded through AIS are on transit through the area and not engaged in fishing (see Section 4.2.5). However, consultation identified that some smaller local boats, particularly creel fishermen, operate around the test site but close to shore. These activities are variable both in location and season. Given their local knowledge of the potential hazards of entanglement with the tidal devices, most avoid fishing near to the devices. Therefore, the impact on fishing safety is not considered significant.

The Orkney Islands are a popular cruising destination, particularly during the summer (see Section 4.2.6). The vessel traffic analysis identified few vessels making the passage through the Fall of Warness, however it is likely other yachts and pleasure craft not carrying AIS make the passage. There are also no nearby marinas and no regular yachting racing around the project site. Given the sufficient sea room and low numbers of transits, the impact on recreational vessels is not anticipated to be significant. Furthermore, it is likely that the Orkney Islands have a relatively high proficiency of yachtsman as the area is isolated from the UK and yachts must cross either the North Sea or Pentland Firth to reach the area. It is however possible that curious yachts may make close approaches to the devices when passing by and therefore promulgation of maintaining a safe distance would reduce the risk of allision.

## 5.11 Cumulative and in-combination effects with other activities

There are few potential cumulative and in-combination effects of other projects:

- Firstly, the Westray South Tidal Project, located to the northwest of the Fall of Warness, was awarded an Agreement for Lease in 2010 for 200 1 MW turbines. However, there has been limited further activity towards gaining consent since 2014.

- Secondly, a Scotwind leasing round was launched in 2020 to develop new offshore wind farms in Scottish waters. This may result in changes to the vessel traffic through the Fall of Warness, however, this is not considered to be significant.
- Thirdly, there are further developments within the Orkney Islands, such as a proposed Hydrogen Processing Facility, based in Flotta that might increase vessel numbers through the islands.

Collectively, it is not anticipated that these will contribute a significant change in vessel numbers through the project site.

# 6 Navigational Risk Assessment

## 6.1 Hazard identification

Following a review of the collated datasets, analysis and consultation feedback, the hazards identified as part of the previous site-wide NRAs are considered valid. The NRA therefore considers the following11 hazards (Table 15).

| # | Title | Rationale |
|---|---|---|
| 1 | Large commercial ship contacts a device | Analysis identifies that large vessels up to 250 m in length are known to navigate through the site. Given the tidal conditions and waterway hazards, a contact with a device whilst on passage is feasible. |
| 2 | Passenger vessel contacts a device | Analysis and consultation identified that ferries make frequent transits through the site in specific metocean and tidal conditions. Furthermore, cruise ships up to 250 m in length and are known to navigate through the site. Given the tidal conditions and waterway hazards, a contact with a device whilst on passage is feasible. |
| 3 | Fishing vessel contacts a device | Analysis and consultation identified that fishing boats transit through the Fall of Warness and some smaller boats fish within the site. Given the proximity of operations, a contact with a device is feasible. |
| 4 | Recreational vessel contacts a device | Analysis and consultation identified that recreational vessels transit through the Fall of Warness. Given the tidal conditions and waterway hazards, a contact with a device whilst on passage is feasible. |
| 5 | Maintenance vessel contacts a device | O&M support vessels necessarily navigate within the site and in close proximity to the device. A contact with a device is a realistic scenario during operations. |
| 6 | Fishing gear interaction with a device or subsea cable | Analysis and consultation identified that fishing boats transit through the Fall of Warness and some smaller boats fish within the site. Given that some devices are subsurface, fishing gear may become snagged with device infrastructure. |
| 7 | Third party collision due to avoidance of site | The presence of the site and devices may influence vessel traffic flows, increasing interactions between non-project vessels that might result in a collision. |
| 8 | Collision with site maintenance vessel | The movements of site maintenance vessels poses an additional risk of collision to other transiting vessels. |
| 9 | Third party grounding due to avoidance of site | The presence of the site and devices may influence vessel traffic flows, increasing the proximity to shallow water which could result in a grounding. |
| 10 | Grounding of maintenance vessel | O&M support vessels necessarily navigate within the site and near to shallow water which could result in a grounding. |
| 11 | Breakout of a device from moorings | The devices moorings could be damaged and a breakout occur which poses a risk to other navigating vessels. |

Table 15 | Hazard list.

## 6.2 Methodology

The assessment methodology is based on the IMO's Formal Safety Assessment (FSA) as approved in 2002 and most recently amended in 2018 by MSC-MEPC.2/Circ.12/Rev.2. The identified hazards are scored given their likelihood and consequence against a defined scale, to produce a risk score. The risk assessment constitutes the risks with existing risk controls in place.

The risk assessment process aims to ascertain risk levels and specify the requirement to apply measures to mitigate risk to lower levels. The methodology consists of four aspects:

- Likelihood parameters (see Table 16) – the expected frequency for which hazards occur, presented as a return rate per year. Five likelihood bands were chosen from between once in one year to once in less than 100 years.
- Severity parameters (see Table 17) – the expected consequence of each hazard were it to occur. This has been scored separately for consequences to people (loss of life), environment (pollution), property (damage) and business (reputational/economic impacts).
- Risk matrix (see Table 17**)** – based on the likelihood and each of the four severity scorings, risk scores were derived using a risk matrix.
- Risk classification (see Table 17) - based on the resulting risk score, the risk was classified from 'Negligible' and 'Acceptable' through to 'High Risk' and 'Unacceptable'.

Each hazard was scored for the likelihood of occurrence and expected consequence (in terms of people, property, environment and business) for both a 'most likely' and 'worst credible' occurrence. Some hazards occur frequently with low consequence (minor injuries or damage), and less frequently with high consequence (loss of life/major pollution). The overall risk score was then the average of all the 'most likely' risk scores, all the 'worst credible' risk scores and the highest individual scores from the most likely and worst credible assessments.

The scorings were conducted following a review of all the data collected, historical incident record, feedback from consultees and the expertise of the project team. The primary mitigation measure against the hazard of vessels colliding with one another is the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS) and Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1995. This risk assessment, in considering measures to minimise the risk of hazards in respect of navigation within the study area, assumes that vessels will be compliant with the COLREGS and STCW.

| Value | Berth 3 Interpretation | Tow Interpretation |
|---|---|---|
| 1 | Occurring less than once in 1,000 years. | Rare – has not occurred for similar projects within wider industry (<0.1%). |
| 2 | Occurring between once in 100 and once in 1,000 years. | Has occurred elsewhere in industry but infrequently (>0.1%). |
| 3 | Occurring between once in 10 and once in 100 years. | Could occur at site but unlikely with adopted risk control measures (>1%). |
| 4 | Occurring between yearly and once in 10 years. | Reasonably probable that it could occur at site (>10%). |
| 5 | Yearly. | Almost Certain to occur frequently at site (>50%). |

Table 16 | Likelihood value interpretations.

| Consequence | | | | | Likelihood | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 |
| Score | People | Property | Environment | Business | Negligible | Extremely Unlikely | Remote | Reasonably Probable | Frequent |
| 1 | None | Less than £10,0000 | No Impact | No Impact | 1 | 2 | 3 | 4 | 5 |
| 2 | Slight injury(s) | £10,000-£100,000 | Tier 1 Local assistance required | Local negative publicity Minor damage to device | 2 | 4 | 6 | 8 | 10 |
| 3 | Multiple minor or single serious injury | £100,000-£1million | Tier 2 Limited external assistance required | Widespread negative publicity Moderate damage to device | 3 | 6 | 9 | 12 | 15 |
| 4 | Multiple serious injury or single fatality | £1million-£10million | as Tier 2 Regional assistance required | National negative publicity Major damage to device | 4 | 8 | 12 | 16 | 20 |
| 5 | More than one fatality | >£10million | Tier 3 National assistance required | International negative publicity Major damage to device | 5 | 10 | 15 | 20 | 25 |

| Risk Definitions | |
|---|---|
| 1-3.99: Negligible | Broadly Acceptable - Current controls to be monitored |
| 4-8.99: Low Risk | |
| 9-14.99: Medium Risk | Tolerable (if ALARP) - further controls to be considered and existing controls monitored. |
| 15-19.99: Significant | Unacceptable - Activity not to proceed and controls to be immediately implemented to reduce risk |
| 20-25: High Risk | |

**Table 17 | Risk matrix.**

## 6.3 Embedded risk controls

### 6.3.1 Marking and lighting requirements

Marking and lighting requirements for man-made offshore devices are described in IALA Recommendation G1162 2021 (previously O-139 2013). All surface piercing structures should be marked as:

- Individual wave and tidal energy devices within a site that extend above the surface are painted yellow above the waterline;
- If marked, the individual devices should have flashing yellow lights. The flash character of such lights must be sufficiently different from those displaying on the boundary lights with a nominal range of not less than 2 nautical miles; and
- A single wave or tidal energy structure standing alone may be marked as either an isolated danger mark or a special mark.

It is also recommended that:

- Radar reflectors, retro-reflecting material, Racons and / or AIS transponders should be considered where the level of traffic and degree of risk requires it;
- The lit Aid to Navigation must be visible to the mariner from all relevant directions in the horizontal plane, by day and night;

- Any floating AtoNs should be located outside the moorings of the floating structures; and
- AtoNs should comply with IALA Recommendations and have an appropriate availability, normally not less than 99% (IALA Category 2).

The NLB, would typically request that any devices being installed at EMEC, would have as a minimum:

- Yellow Day Marking/Painting;
- Flashing yellow special mark light (Category 1);
- Day top mark (if deemed necessary);
- Radar Reflector; and
- AIS AtoN.

Larger devices may require two lights at either end, with synchronised yellow lights. Light ranges are required to be at least three nautical miles. Lighting arrangements are considered on a case by case basis to properly account for the circumstances of each site and the proximity of other devices.

During consultation, the feasibility and benefits of adding additional AtoNs at the Fall of Warness if more devices were placed in situ were discussed. IALA G1162 2021 (previously O-139 2013) includes guidance on marking areas of wave and tidal devices are given in Figure 26.

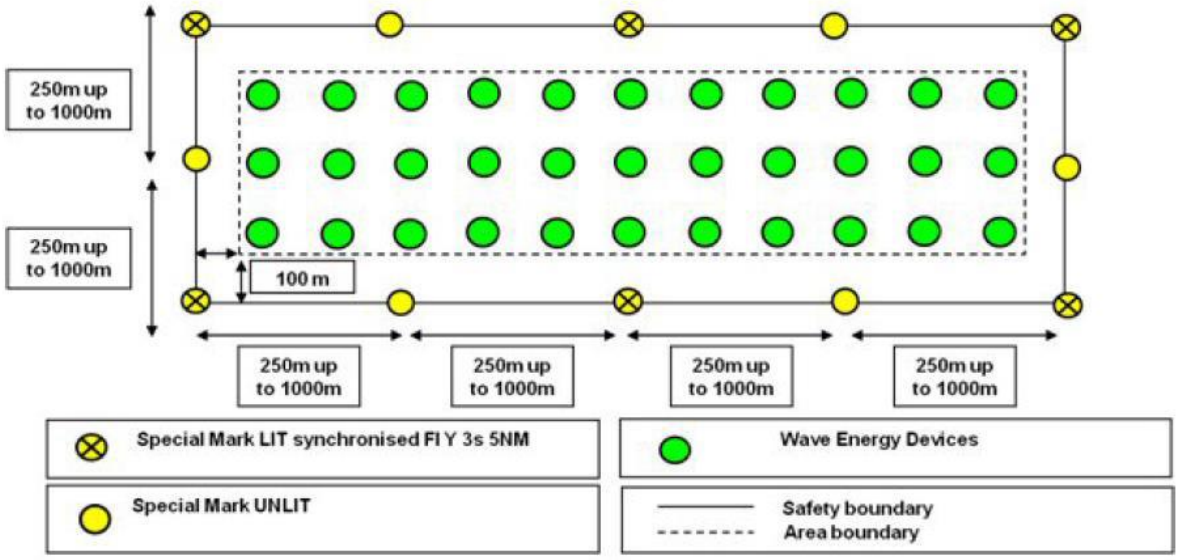



**Figure 26: G1162 Recommendations for Marking Wave/Tidal Generation Areas.**

### 6.3.2 Site wide and device specific risk controls

Table 18 shows the key risk controls in place at the EMEC sites. These are categorised as Emergency Response, Operational Management, Promulgation and Awareness, Device Specific and Site Monitoring. These controls are significant and have been in place for almost twenty years, successfully managing navigational safety in and around the sites.

| Number | Title | Description | Responsible | EMEC Reference |
|---|---|---|---|---|
| **Emergency Response and Incident Investigation (EMER)** | | | | |
| **EMER1** | Site Wide ERCOP | Emergency Response and Cooperation Plan, to ensure that arrangements are in place for the protection of all employees and other persons that may be present in the area or premises and/or reputation in the event of an emergency occurring. Includes:<br>-Liaison arrangements between EMEC and HMCG<br>-Details of the Sites and Activities (including layouts)<br>-Roles and Responsibilities<br>-Procedures and Communications Channels<br>-SAR Assets Details and Capabilities | EMEC | ERP014 v2 14/08/2020<br>ERP015 v6 22/09/2021 |
| **EMER2** | Developer ERCOP | Provision of details, pictures and arrangements of specific devices/vessels by developers to update the site-wide ERCOP. | Developer | FORM264 v2 27/11/2018 |
| **EMER3** | Emergency Shutdown | If there is an indication of an incident with a device onsite (e.g. mooring failure, device loss) the EMEC duty manager has the ability to initiate a shutdown and/or disconnection of a device remotely. | EMEC / Developer | ERP014 v2 14/08/2020 |
| **EMER4** | Periodic Exercises | Periodic emergency management and response exercises will be run at EMEC, ran in conjunction with CGOC/SAR. | EMEC / HMCG | ERP014 v2 14/08/2020 |
| **EMER5** | Incident Reporting and Investigation | There are statutory incident reporting requirements and expectations:<br>-MAIB (Merchant Shipping Act)<br>-HSE (RIDDOR)<br>-Orkney VTS if in Harbour Authority Area<br>-EMEC Duty Manager<br>Site-Wide/Device Specific risk assessments to be reviewed following incidents, and additional risk controls identified if appropriate. | Various | FORM024 v7 03/05/2019<br>SOP008 v8 24/07/2018<br>SOP009 v5 16/12/2019<br>SOP120 v3 23/01/2020 |

| Number | Title | Description | Responsible | EMEC Reference |
|---|---|---|---|---|
| **Operational Management (OPS)** | | | | |
| **OPS1** | Control of Work | The EMEC Permit to Work and Permit to Access Site systems are intended to allow EMEC and contractors to control/coordinate safe activities within the site. Method Statements and Task Risk Assessments are required to be approved prior to access to or any works on site. | EMEC | SOP003 v17 28/10/2021 |
| **OPS2** | Marine Operating Guidelines | Detailed guidance for marine operations to promote high standards in the areas of health, safety and the environment during the planning and execution of all work on EMEC sites. Includes<br>-Health and Safety<br>-Management of Operations<br>-Emergency Response<br>-Equipment and Vessels<br>-Environmental Management<br>-Stakeholders | EMEC | GUIDE010 v4 28/05/2020 |
| **OPS3** | Control of SimOps | Full assessment of the risks arising from simultaneous operations prior to authorising site access. | EMEC | SOP093 v3 28/11/2019<br>SOP095 v2 31/10/2019 |
| **OPS4** | Vessel Standards | All work vessels accessing an EMEC site require:<br>-MCA Vessel Coding (e.g. SCV)<br>-Appropriate Insurance<br>-Crewed by suitably trained/qualified personnel<br>-AIS (Class A/B) on any vessel operating/installing in EMEC sites.<br>-VHF (Ch16 and EMEC's private channel P1)<br>-Mooring Arrangements (e.g. Minimum spacing or moorings to cables) | Developer | ERP014 v2 14/08/2020<br>GUIDE010 v4 28/05/2020 |
| **OPS5** | PPE | Personnel operating on site are to wear appropriate Personal Protective Equipment (e.g. hard hats, work boats, protective glasses, lifejackets, thermally insulated floatation suits).<br>PLBs are rarely used at EMEC sites, but some of EMECS lifejackets are equipped with GPS PLBs that activate on inflation. | EMEC / Developer | GUIDE010 v4 28/05/2020<br>ERP014 v2 14/08/2020 |

| Number | Title | Description | Responsible | EMEC Reference |
|---|---|---|---|---|
| **OPS6** | Guard Vessels | During major construction or maintenance activities, a guard vessel may be considered to assist in protecting the devices from contacts with passing vessel traffic. Due to the low density of traffic, this is not considered necessary unless for extraordinary circumstances and has been rarely used. If guard vessels are to be used onsite, it is important that such vessels employed to guard the site follow appropriate guidelines, with clear instructions on when to intervene in a potential incident.<br>Required if unlighted, unmarked navigational hazards are present on site as a result of developer activities.<br>Guard Vessels are required to comply with EMEC Vessel requirements. | Developer | GUIDE010 v4 28/05/2020 |
| **OPS7** | Inspection and Maintenance Programme | Regular maintenance regime by developer to check the device, its fittings and any signs of wear and tear. This should identify any failings which might result in a mooring failure and therefore prevent breakout. | Developer | |
| **OPS8** | Task Risk Assessments | To ensure that all activities and operations within the control of EMEC are assessed for the risks they present to staff, suppliers and the public and that those risks are reduced to a level as low as reasonably practicable. Required as part of Control of Work procedures. | Developer | FORM025 v1 08/10/2020<br>SOP004 v6 05/08/2020 |
| **OPS9** | Device Specific NRAs | Each developer is required to create a device specific addendum to the site-wide EMEC NRA to support applications to deploy, operate and remove assets at EMEC test sites. | Developer | FORM292-295 |
| **OPS10** | Tow risk assessment and passage plan | As required under Orkney Harbours Pilotage Directions 4(3), prior to conducting a towing operation, a risk assessment and passage plan for the move should be conducted. The plan should account for the size of the tow, manoeuvrability restrictions, tow arrangements and MetOcean conditions | Developer | |
| **OPS11** | Training | Developers are responsible for ensuring that all staff engaged on operations are competent to carry out the allocated work. | Developer | GUIDE010 v4 28/05/2020 |

| Number | Title | Description | Responsible | EMEC Reference |
|---|---|---|---|---|
| **Promulgation and Awareness (PROM)** | | | | |
| **PROM1** | Notice to Mariners | To ensure that the appropriate authorities are informed of works being carried out in waters within EMEC's test site areas and of the installation of any permanent/semi-permanent structure such that the information is promulgated through appropriate channels to mariners. To include:<br>-UKHO<br>-Orkney Harbour Authority<br>-Orkney Ferries<br>-HMCG Shetland<br>-NLB<br>-Orkney Fisheries Association<br>-Orkney Fisheries Society<br>-Scottish Fishermen's Federation<br>-Marine Scotland<br>-RYA Scotland<br>-The Orcadian (if appropriate) | EMEC / Developer | FORM068A/B v7 19/12/2018<br>SOP063 v18 27/07/2021 |
| **PROM2** | Consultation | Consultation with key stakeholders prior to site installations to ensure effective micrositing. | Developer | |
| **PROM3** | Site Marking and charting | Site is marked on nautical charts including an appropriate chart note. | EMEC / Developer | GOV017/018 |
| **PROM4** | 500 m Advisory Area to be Avoided | A 500 m advisory Area to be Avoided exists around all test devices located at EMEC.<br>Nautical charts indicate that mariners should exercise caution whilst navigating in this area and obtain local knowledge (FoW).<br>Nautical charts indicate that mariners should avoid passing within the test area marked by cardinal buoys (BC). | EMEC | SOP094 v5 03/10/2018 |

| Number | Title | Description | Responsible | EMEC Reference |
|---|---|---|---|---|
| **Site and Device Design (DES)** | | | | |
| **DES1** | Device Marking | Device to be lit to the requirements of NLB and marked in line with IALA guidance. Appropriate statutory sanctions must be in place to exhibit, alter or discontinue lighting. | Developer | |
| **DES2** | AIS | AIS transmitting an Aid to Navigation Type 21 message should be installed on all surface piercing devices. | Developer | |
| **DES3** | Radar Reflectors | Use of radar reflectors to improve marking during times of poor visibility. | Developer | |
| **DES4** | Marking and Lighting | Device to be lit to the requirements of Northern Lighthouse Board and marked in line with IALA guidance. Appropriate statutory Sanctions must be in place to exhibit, alter or discontinue lighting. | Developer | |
| **DES5** | Hydrography | Contractual responsibility to return the site to the original condition post-decommissioning. | Developer | |
| **DES6** | Cable protection | From 15 m depth to shore, cast iron cable protectors are used (Billia Croo/FoW).<br>Buried to 12 m from MLWS (Billia Croo) and "buried" (FoW) | EMEC | |
| **Site Monitoring (MON)** | | | | |
| **MON1** | Site Monitoring: CCTV, Radar and AIS Monitoring | To satisfy operational requirements for control and monitoring of test site activities, visual checks of the test site environment, monitoring of lone worker safety, effective plant operation and substation security.<br>EMEC's SCADA system provides real-time status information, trends, alarms and remote-control access to facilitate a safe working environment, comprehensive assessment and safe operation of the sites. Note – only relevant if test support buoy is deployed<br>Billia Croo monitored from Black Craig/substation<br>FoW monitored from Caldale substation (Eday).<br>Not monitored 24/7 | EMEC | ERP014 v2 14/08/2020 |

| Number | Title | Description | Responsible | EMEC Reference |
|---|---|---|---|---|
| **MON2** | Heightened monitoring in adverse met-ocean conditions | During gale-force winds, periodic monitoring of the devices is recommended to ensure excessive forces are not acting on the moorings which might cause a breakout | EMEC / Developer | |
| **MON3** | GPS alert system for turbine moving | Remote monitoring of device to detect any major movements that might indicate a breakout for immediate response. Implement GPS excursion monitoring. | EMEC / Developer | |

**Table 18 | Embedded risk controls.**

## 6.4 Results

Table 19 show the results of the Fall of Warness risk assessment, with a full hazard log provided in Annex A: Hazard Log.

- 0 hazards are assessed as “High Risk”;
- 0 hazards are assessed as “Significant Risk”;
- 0 hazards are assessed as “ALARP”.
- 8 hazards are assessed as “Low Risk”.
- 3 hazards are assessed as “Negligible Risk”.

Given the frequency at which maintenance vessels transit through the site, in close proximity to the devices, allision incidents were identified as the most significant hazard. These have occurred in other industries and result in minor damage to the vessel and minor injuries to the crew. Other incidents involving maintenance vessels such as grounding or collision whilst on passage are not considered significant given the relatively low density of traffic within the area and the expertise and local knowledge of the skippers.

The second highest scoring hazard relates to passenger ferries contact a device when manoeuvring through the site during adverse weather. These manoeuvres are described in detail in Section 5.2 where it is evident that access to the EMEC site during strong tidal flows and gale force conditions is essential to the safe passage of these vessels. Any incident involving the ferries could potentially result in significant damage to the vessel, sinking and potential loss of life in the worst-case situation. Even a glancing blow could result in the vessel taken out of service and the temporary loss of a lifeline service.

The increased risk of grounding due to the devices at the Fall of Warness was highlighted as a potential issue, were more vessels to choose to avoid the area if more berths were occupied at any one time. Whilst a passage exists to the west of Muckle Green Holm, this is neither specifically marked or described in the Sailing Directions.

Other vessel types are generally less likely to be involved in an incident at the EMEC site, given their low frequency of transits. For example, recreational and fishing vessels infrequently transit through the Fall of Warness (see Section 4.2), although anecdotally are known to pass close to the in-situ devices. Furthermore, commercial shipping and cruise ships rarely utilise this passage. Quantitative collision and grounding modelling (Section 5.3) produced low likelihood values. Breakouts of EMEC devices are scored as of low probability given the significant certification necessary and active monitoring of the devices, and the significant low probability of an adrift device colliding with a navigating vessel (see Section 5.7).

| Hazard ID | Hazard Rank | Hazard title | Overall Risk Score |
|---|---|---|---|
| 5 | 1 | Maintenance vessel contacts a device | 8.9 |
| 2 | 2 | Passenger vessel contacts a device | 8.1 |
| 8 | 3 | Grounding due to avoidance of site | 6.4 |
| 9 | 4 | Collision with site maintenance vessel | 6.3 |
| 4 | 5 | Recreational vessel contacts a device | 6.3 |
| 3 | 5 | Fishing vessel contacts a device | 6.3 |
| 10 | 7 | Grounding of maintenance vessel | 6.1 |
| 1 | 8 | Commercial ship contacts a device | 4.8 |
| 7 | 9 | Collision due to avoidance of site | 3.7 |

| Hazard ID | Hazard Rank | Hazard title | Overall Risk Score |
|---|---|---|---|
| 6 | 10 | Fishing gear interaction with device/cables | 3.6 |
| 11 | 11 | Breakout of a device from moorings | 3.3 |

**Table 19 | Ranked hazard list.**

## 6.5 Possible additional risk controls

### 6.5.1 Facilitating safe transit of commercial vessels

This section considers the two route options to the east and west of Muckle Green Holm used by vessel types as described in Section 4.2. Neither route is marked with AtoNs, however, the Admiralty Sailing Directions promotes the route to the east through the site and this has tended to be used more than the route to the west. The configuration of berths and historical usage of the site has facilitated the safe transit of commercial vessels through the test site. Any proposals which might impact on safe routeing to the east of Muckle Green Holm should be consulted upon, and if appropriate, additional risk controls identified.

#### 6.5.1.1 East of Muckle Green Holm

During consultation, the Chamber of Shipping and NLB requested that a route to the east of Muckle Green Holm remain open for navigation. Therefore, the location of any devices should be such that the safety of this route is maintained. During consultation it was determined that a minimum passing distance both from Muckle Green Holm and any devices would be at least one cable (185 m). With 50 m navigational room and two one cable buffers either side, a minimum corridor width of 420 m could be considered as a suitable basis, which is marked in Figure 27. The berth configuration at Fall of Warness provides sufficient room to support such a corridor. All transits through this passage would be direct without any significant alterations of course. In addition, the prevailing tidal flows would be in line with the direction of transit and therefore the expected leeway would not be significant.

During the data analysis period, the Magallanes device was installed during Spring 2019 at Berth 1 and therefore is representative of the existing limiting width. By way of example, five cruise ship transits in June 2019 are marked, all of which lie within the marked corridor and with the Magallanes device in place.

Additional Aids to Navigation to support safe navigation were discussed during consultation and concluded to not be appropriate at this time. Firstly, the addition of physical AtoNs, such as cardinal marks would be challenging given the extreme tidal conditions and may only serve as additional obstacles for vessels to avoid. Secondly, virtual AtoNs may overcrowd an ECDIS when there are numerous devices, each with their own AIS transponder. Thirdly, given the transient nature of the devices in the site, the marking requirements will change over time and should be tailored to suit what is in place at that time. For example, the NLB had indicated that it might be more suitable to utilise AIS AtoNs only on the most westerly devices to delineate a navigational route, and thereby extinguish AtoNs on other devices within the boundary (not on the periphery) as the site develops. Furthermore, dormant AIS devices might be installed that are only activated when they are moved or the device breaks free from its moorings.

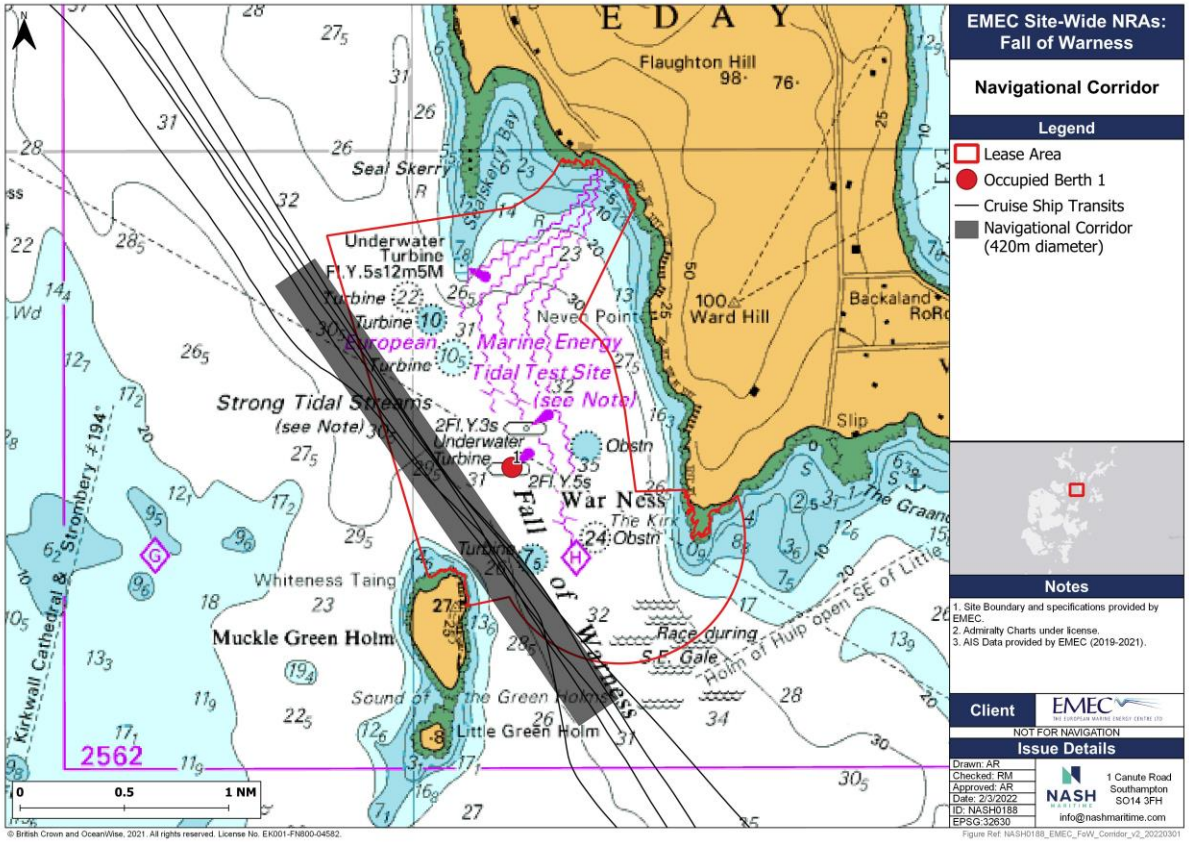



**Figure 27: Vessel routeing options.**

### 6.5.1.2 West of Muckle Green Holm

Alternatively, or for those vessels concerned with making passage to east of Muckle Green Holm, twice the searoom is available to the west of Muckle Green Holm with only a minor increase in distance travelled. It is noted that since the grounding of the Octopus in 2006 (MAIB 18/2007), the nautical charts for the western route have been improved so there is greater confidence in the position of hazards to enable the usage of the western route. This option has been utilised by some cruise ships in the last few years (see Section 4.2.4) as well as more frequently by commercial vessels than the eastern passage. The NLB had suggested during consultation that Muckle Green Holm or the adjacent shoals (such as Benlin Rock) could be marked to assist vessel navigation to the west.

## 6.5.2 Facilitating adverse weather routes for ferries

During consultation, the necessity to maintain a safe passage for Orkney Ferries through the Fall of Warness was emphasised (see Section 5.2.1). Given this, several principal adverse weather/tidal routes were requested to be kept clear of devices as far as possible, these are:

- Maintain a navigational route from north of Muckle Green Holm across to War Ness 10 m contour.
- Maintain a navigational route from east of Muckle Green Holm across to War Ness 10 m contour.
- Maintain a navigational route from west of Muckle Green Holm into the EMEC site and returning along the west coast of Eday and 10 m contour.
- An inshore option at Seal Skerry to keep inshore of Eday when heading north.

Consultation determined that ferries aim to keep a 150 m separation from a device and therefore a minimum of 300 m navigational corridors between the devices would maintain the potential for ferry transits. A review of the berth layouts with Orkney Ferries, determined that at present there was sufficient searoom to maintain routeing options in adverse weather. Any devices proposed in close proximity to the regular ferry routes (see Section 5.2.1) should first be discussed with Orkney Ferries.

### 6.5.3 Improved promulgation

A common question theme raised by stakeholders during consultation was clarification on which devices were at which sites and when. At present promulgation is principally listed on the Orkney Islands Council Harbour Authority website through Notice to Mariners (https://www.orkneyharbours.com/info/notices). However, these provide notice of which devices are being installed or decommissioned, but not what is necessarily in place. The EMEC website offers an online map view of where the sites are located, and consideration should be given to keeping this up to date with which devices are in which berths.

Any changes to the sites should be disseminated to key stakeholders, including:

- Orkney Islands Council Harbour Authority Notice to Mariners.
- Orkney Ferries.
- Orkney Fisheries Association and Scottish Fishermen's Federation.
- Orkney Marinas.
- UKHO.
- NLB.
- HMCG Shetland.
- Site awareness charts which provide information on the berths locations and restrictions on a single chartlet (e.g. https://www.emec.org.uk/?wpfb_dl=51 / https://www.emec.org.uk/?wpfb_dl=164).
- Admiralty Sailing Directions and nautical charts for the sites.
- RYA and Cruising Association.
- Clyde Cruising Club Sailing Directions.

# 7 Conclusions and recommendations

## 7.1 Conclusions

This update to the site-wide NRA for EMEC's Fall of Warness test site, last conducted in 2018-2019, has sought to review the impacts to shipping and navigation operations and safety and determine whether additional risk controls are warranted. The following key conclusions have been reached:

1. The Fall of Warness site was established in 2005 and has successfully served as a grid connected test-site for almost 20 years.
2. The site is exposed to significant tidal, wind and wave conditions. Spring tides exceed 7 knots and in combination with gale force south-easterly and north-westerly winds, the conditions can become hazardous for vessels.
3. The site falls outside of Orkney Islands Council harbour limits and therefore vessels are not under pilotage, nor is the site actively monitored by VTS. The nearest RNLI station is Kirkwall with Shetland Coastguard providing coordination for the area.
4. There are numerous aquaculture sites adjacent to the test site, but no significant cumulative effects associated with the project.
5. Analysis of AIS data collected between 2019 and 2021 and consultation with local operators showed that:
    a. Few large commercial vessels transit through the site, although on occasion up to 235 m cruise ships have been known to use this route from the Islands. Smaller general cargo, cable layers or offshore supply vessels infrequently use this passage.
    b. During periods of adverse conditions, Orkney Ferries conduct specific manoeuvres through the limits of the site in order to prevent damage to vehicles or passenger injuries.
    c. Fishing boats and recreational craft make infrequent transits through the site, and more commonly pass to the west or south from Kirkwall towards the outer islands.
    d. Other small commercial vessels (workboats) supporting the fish farm industry or maintaining the EMEC devices frequently transit through the site but have good local knowledge.
6. Analysis of historical incident data from the MAIB and RNLI, identified relatively few incidents, all of which were of minor consequence.
7. There are no major projects that are likely to significantly alter shipping routes and vessel activities around the Fall of Warness site.
8. Quantitative risk modelling identified that the likelihood of allision and grounding within or adjacent to the test site was very low.
9. Analysis of UKC requirements determined that 95% of vessels would pass clear over a 9 m subsurface device in significant metocean conditions and 99% would pass clear of a 13 m subsurface device.
10. A review of impacts on communications, radar and positioning systems identified that no significant impacts are anticipated for the types of devices proposed for the Fall of Warness.
11. No significant impacts on search and rescue, fishing activities, recreational activities or cumulative impacts were identified.
12. A structured Navigation Risk Assessment in compliance with MGN 654 identified and validated 11 hazards associated with the site.
13. A significant number of risk controls were identified, including:
    a. Emergency Response planning and Incident Investigation.
    b. Operational Management including procedures, training and risk assessment.

c. Promulgation and Awareness including Notice to Mariners and consultation.
d. Site and Device Design including marking and lighting arrangements.
e. Site Monitoring through CCTV, GPS and Radar.

14. With these risk controls in place, all hazards were determined to be low risk.
15. Three additional risk control options were identified:
    a. Maintaining a navigational channel to the east of Muckle Green Holm for large vessel movements.
    b. Maintaining a ferry manoeuvring route to support transits in adverse weather.
    c. Improved promulgation of which devices are in place to key stakeholders.

## 7.2 Key navigational themes for device specific NRAs to consider

This site-wide NRA has identified the baseline conditions at the Fall of Warness test site and key impacts on navigation and shipping within the Orkney Islands. In applying for a marine license, NRA Addendums are required for each individual device that are specific to their operational characteristics and risk profile. In consultation with the MCA, Table 20 items should be addressed within a device-specific NRA.

Based on this, EMEC FORM292 provides a pro-forma for device-specific NRAs.

## 7.3 Summary risk statement

This NRA, conducted in compliance with MGN 654 has identified that the navigational risks at the Fall of Warness test site are managed below ALARP. It is recommended that this NRA is updated periodically (MGN 654 suggests two-yearly) to account for changing activities at the test site, following major incidents or in the context of a step-change in the numbers or types of devices installed.

| Item | Title | Description |
|---|---|---|
| **Project Description** | | |
| 1. | Asset Information | This section should include high-level information about the assets to be installed, timescales and vessels involved, including:<br>• Location including coordinates and chartlets.<br>• Detailed description of the asset (with drawings, including dimensions)<br>• Type of device (where it conforms to one of the conventional technologies, or a full description if it is unconventional)<br>• Area of the water column occupied (surface piercing/surface/sub-surface/water column)<br>• Exact dimensions (expressed clearly, including in drawings)<br>• General arrangement plan, schematic drawings of the asset or other useful layouts<br>• Method of keeping station (attachment to the seabed etc.)<br>• Subsea cables/infrastructure<br>• Detail any variations or similarities to existing devices (if the device to be installed has a predecessor describe improvements/changes to current device or note if similar devices are already in use)<br>• Description of operation of the device and area impacted by the operation. |
| 2. | Schedule and Test Plan | The section should provide an overview of the test programme with detailed information regarding the installation, maintenance and decommissioning phases:<br>• Numbers and types of vessels.<br>• Duration of process.<br>• Frequencies and types of maintenance required.<br>• Tow plans. |
| 3. | Third Party Verification | Details of the verification and certification process the device is undergoing. |
| **Key Navigational Themes** | | |
| 1. | Vessel Routeing | Do the project assets impact the routeing of vessels in the area? If so, please provide further details and describe the actions that may require to be undertaken by other mariners in order avoid the project assets. Please discuss any advisory areas to avoided around assets, typically a 500 m advisory area to be avoided is placed around each device. |

| Item | Title | Description |
|---|---|---|
| 2. | Contact/Allision Risk | Do the project assets pose a risk of contact to navigating vessels? Note any risks to other sea users that are specific to the installation/construction phase too. If so, please describe how such a risk is imposed and any actions that may be taken to mitigate. |
| 3. | Effects of tide/tidal streams and weather | Do the project assets influence the metocean conditions at the site? Are the project assets at risk as a result of the conditions experienced at the site? Please elaborate on the measures taken to ensure the assets are adequately designed for the conditions at the site. |
| 4. | Under keel clearance | Do any of the project assets compromise the under keel clearance (UKC) required for vessels accessing the site or the surrounding area? For seabed mounted infrastructure it may be necessary to conduct a plunge depth analysis to model the actual collision risk at the proposed testing location. This may be required in order to establish if there is adequate under keel clearance above the highest point of the infrastructure, bearing in mind resource characteristics and the deepest draft vessels using the site. |
| 5. | Collision Risk and Visual Navigation | Do the project assets hinder visual identification of other vessels or key landmarks/aids to navigation? Note the proximity to navigational features and mitigation measures taken. This is not expected for any projects accessing EMEC's test sites. |
| 6. | Communication, radar and positioning system | Do the project assets impact the communications, radar and positioning systems on board vessels or on land? |
| 7. | Moorings | Are the mooring systems sufficient for the project assets and the conditions? Please describe the measures taken to verify the mooring arrangements are sufficient for the metocean conditions expected at the site. Detail the expected variation in station (if movement is expected due to fixture type). Given the metocean conditions at Fall of Warness, this should be independently verified as part of the third party verification process, for each asset to be deployed at the site. |
| 8. | Station Keeping | Provide an explanation of the risk to station keeping (possibility of the asset becoming detached from the seabed/moorings etc.). Detail the buoyance of the asset (positive / neutral / negative) and associated infrastructure. If positively buoyant, estimated destination(s) of the asset if it or part of it were to break free, taking into consideration testing location, metocean data etc. Risk of collision between part or all of a detached positively buoyant asset and other sea users or structures should be considered. Detail the alerting / alarming method in the event of loss of station event. Capability for recovery of asset and infrastructure, should it lose station. Refer to any design elements (e.g. negative buoyancy) that may reduce risks to navigation |

| Item | Title | Description |
|---|---|---|
| 9. | Fishing Activity | Do the project assets impact upon the activity of fishing vessels? |
| 10. | Recreational Activity | Do the project assets impact upon the activity of recreational vessels? |
| 11. | Subsea Cables | Do the project assets require cables that may be at risk from snagging, what types of protection will be installed and does this compromise water depth? Within the project-specific assessments, an assessment regarding risk of snagging and contact with currently installed subsea cables at the site should be undertaken. |
| 12. | Search and Rescue | Do the project assets impact search and rescue (SAR) capabilities and has access been considered in the design of the infrastructure? Please provide details. |
| 13. | Cumulative and in-combination | Are there nearby projects which might exacerbate the impacts discussed above? |
| **Risk Controls** | | |
| 1. | Site Wide Risk Controls (see **Section 6.3.2**) | Site wide risk controls should be reviewed to determine that they are adequate for addressing the risks associated with the device. The device should also adhere to the standards laid out by EMEC. |
| 2. | Device Specific Risk Controls (see **Section 6.3.2**) | Any additional risk controls proposed for the device should be clearly stated. |
| 3. | Marking and Lighting (see **Section 6.3.1**) | The device marking and lighting arrangements should be agreed with the MCA and NLB. |

**Table 20 | Device specific NRA criteria (FORM292).**

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# Annex A: Hazard Log

| Hazard ID | Hazard Rank | Hazard title | Hazard type | Designed in Mitigation (Refer to Mitigation Table) | Possible causes | Realistic Most Likely Consequences | Realistic Most Likely Scores | | | | | Realistic Worst Credible Consequences | Realistic Worst Credible Scores | | | | | Overall Risk Score | Overall Risk Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | People | Property | Environment | Business | Frequency | | People | Property | Environment | Business | Frequency | | |
| 1 | 8 | Commercial Ship Contacts a Device | Contact / Allision | EMER (1-5)<br>OPS (2/6/7/9/10/11)<br>PROM (1-4)<br>DES (1-4) | Insufficient Lookout<br>Inadequate Passage Planning<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Poor Visibility in Area<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Failure of Navigational Aids on Device<br>Charts not up to date<br>Confusion on Site Layout | No injuries<br>Minor damage to vessel<br>No pollution<br>Moderate damage to device<br>Moderate adverse publicity | 1 | 2 | 1 | 3 | 2.5 | Multiple major injuries<br>Moderate damage to vessel<br>Tier 2 Pollution Possible<br>Major damage/loss of device<br>Widespread adverse publicity | 4 | 3 | 3 | 4 | 1 | 4.8 | Low Risk - Broadly Acceptable |
| 2 | 1 | Passenger Vessel Contacts a Device | Contact / Allision | EMER (1-5)<br>OPS (2/6/7/9/10/11)<br>PROM (1-4)<br>DES (1-4) | Insufficient Lookout<br>Inadequate Passage Planning<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Poor Visibility in Area<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Failure of Navigational Aids on Device<br>Charts not up to date<br>Confusion on Site Layout | Minor injuries<br>Minor damage to vessel<br>No pollution<br>Moderate damage to device<br>Moderate adverse publicity | 2 | 2 | 1 | 3 | 3 | Multiple fatalities possible<br>Serious damage to vessel<br>Minor pollution<br>Serious damage to device<br>Widespread adverse publicity | 5 | 4 | 2 | 4 | 2 | 8.1 | Low Risk - Broadly Acceptable |
| 3 | 5 | Fishing Vessel Contacts a Device | Contact / Allision | EMER (1-5)<br>OPS (2/6/7/9/10/11)<br>PROM (1-4)<br>DES (1-4) | Insufficient Lookout<br>Inadequate Passage Planning<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Poor Visibility in Area<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Failure of Navigational Aids on Device<br>Charts not up to date<br>Confusion on Site Layout | Minor injuries<br>Negligible damage to vessel<br>No pollution<br>Minor damage to device<br>Minor adverse publicity | 2 | 1 | 1 | 2 | 3 | Single fatality/Multiple injuries<br>Moderate damage to vessel<br>Minor pollution<br>Serious damage to device<br>Widespread adverse publicity | 4 | 3 | 2 | 4 | 2 | 6.3 | Low Risk - Broadly Acceptable |
| 4 | 5 | Recreational Vessel Contacts a Device | Contact / Allision | EMER (1-5)<br>OPS (2/6/7/9/10/11)<br>PROM (1-4)<br>DES (1-4) | Insufficient Lookout<br>Inadequate Passage Planning<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Poor Visibility in Area<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Failure of Navigational Aids on Device<br>Charts not up to date<br>Confusion on Site Layout | Minor injuries<br>Negligible damage to vessel<br>No pollution<br>Minor damage to device<br>Minor adverse publicity | 2 | 1 | 1 | 2 | 3 | Single fatality/Multiple injuries<br>Moderate damage to vessel<br>Minor pollution<br>Major damage to device<br>Widespread adverse publicity | 4 | 3 | 2 | 4 | 2 | 6.3 | Low Risk - Broadly Acceptable |
| 5 | 2 | Maintenance Vessel Contacts a Device | Contact / Allision | EMER (1-5)<br>OPS (1-11)<br>DES (1-4) | Insufficient Lookout<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Poor Visibility in Area<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Failure of Navigational Aids on Device | Minor injuries<br>Negligible damage to vessel<br>No pollution<br>Minor damage to device<br>Minor adverse publicity | 2 | 1 | 1 | 2 | 4 | Single fatality/Multiple injuries<br>Moderate damage to vessel<br>Minor pollution<br>Major damage to device<br>Widespread adverse publicity | 4 | 3 | 2 | 4 | 3 | 8.9 | Low Risk - Broadly Acceptable |

| Hazard ID | Hazard Rank | Hazard title | Hazard type | Designed in Mitigation (Refer to Mitigation Table) | Possible causes | Realistic Most Likely Consequences | Realistic Most Likely Scores | | | | | Realistic Worst Credible Consequences | Realistic Worst Credible Scores | | | | | Overall Risk Score | Overall Risk Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | People | Property | Environment | Business | Frequency | | People | Property | Environment | Business | Frequency | | |
| 6 | 10 | Fishing Gear Interaction with Device/Cables | Obstruction | EMER (1-5)<br>OPS (2/6/7/9/11)<br>PROM (1-4)<br>DES (1-6) | Insufficient Lookout<br>Unawareness of device layout<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Poor Visibility in Area<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Failure of Navigational Aids on Device<br>Charts not up to date<br>Confusion on Site Layout | Minor injuries<br>Damage to fishing gear<br>No pollution<br>Minor damage to device<br>Minor adverse publicity | 2 | 2 | 1 | 2 | 2 | Single fatality/Multiple injuries<br>Moderate damage to vessel<br>Minor pollution<br>Moderate damage to device<br>Widespread adverse publicity | 4 | 3 | 2 | 3 | 1 | 3.6 | Negligible Risk - Broadly Acceptable |
| 7 | 9 | Collision Due to Avoidance of Site | Collision | EMER (1/2/4/5)<br>OPS (2/9)<br>PROM (1-4)<br>DES (1-4) | Reduced searoom with device<br>Increased maintenance traffic<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Poor Visibility | Minor injuries<br>Minor damage to vessel<br>No pollution<br>Minor adverse publicity | 2 | 2 | 1 | 2 | 2 | Single fatality/Multiple injuries<br>Moderate damage to vessel<br>Minor pollution<br>Moderate adverse publicity | 4 | 3 | 3 | 3 | 1 | 3.7 | Negligible Risk - Broadly Acceptable |
| 8 | 3 | Grounding Due to Avoidance of Site | Grounding | EMER (1/2/4/5)<br>OPS (2/9)<br>PROM (1-4)<br>DES (1-4) | Reduced searoom with device<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Poor Visibility | Minor injuries<br>Minor damage to vessel<br>No pollution<br>Minor adverse publicity | 2 | 2 | 1 | 2 | 3 | Single fatality/Multiple injuries<br>Moderate damage to vessel<br>Moderate pollution<br>Moderate adverse publicity | 4 | 3 | 3 | 3 | 2 | 6.4 | Low Risk - Broadly Acceptable |
| 9 | 4 | Collision with Site Maintenance Vessel | Collision | EMER (1/2/4/5)<br>OPS (1-11)<br>PROM (1-4)<br>DES (1-4) | Insufficient Lookout<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Poor Visibility in Area<br>Reduced Seakeeping due to Tidal or Weather Constraints | Minor injuries<br>Negligible damage to vessel<br>No pollution<br>Minor adverse publicity | 2 | 2 | 1 | 2 | 3 | Single fatality/Multiple injuries<br>Moderate damage to vessel<br>Minor pollution<br>Moderate adverse publicity | 4 | 3 | 2 | 3 | 2 | 6.3 | Low Risk - Broadly Acceptable |
| 10 | 7 | Grounding of Maintenance Vessel | Grounding | EMER (1/2/4/5)<br>OPS (1-11)<br>PROM (1-4) | Insufficient Lookout<br>Inadequate Passage Planning<br>Human Error/Fatigue<br>Equipment or Mechanical Failure on Vessel<br>Reduced Seakeeping due to Tidal or Weather Constraints<br>Poor Visibility | Minor injuries<br>Minor damage<br>No pollution<br>Minor adverse publicity | 2 | 1 | 1 | 2 | 3 | Multiple injuries<br>Moderate damage<br>Minor pollution<br>Moderate adverse publicity | 4 | 3 | 2 | 3 | 2 | 6.1 | Low Risk - Broadly Acceptable |
| 11 | 11 | Breakout of a Device from Moorings | Breakout | EMER (1-5)<br>OPS (2/7/8/9/10)<br>DES (1-4)<br>MON (1-3) | Severe metocean conditions<br>Insufficient mooring arrangements<br>Installation failure | Minor injuries<br>Negligible damage<br>No pollution<br>Moderate damage to device<br>Minor adverse publicity | 2 | 2 | 1 | 2 | 2 | Multiple injuries<br>Moderate damage to vessel<br>Minor pollution<br>Major damage to moorings.<br>Moderate adverse publicity | 3 | 3 | 2 | 3 | 1 | 3.3 | Negligible Risk - Broadly Acceptable |

# Annex B: Meeting Minutes

# EMEC SITE-WIDE NRAS

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|---|---|
| **Project Title** | EMEC Site-WIDE NRAs |
| **Project Number** | 21-NASH-0188 |
| **Meeting subject / purpose** | MCA |
| **Revision** | R02-00 |
| **Date of meeting** | 21-Dec-2021 |
| **Start time** | 14:00 BST |
| **Finish time** | 14:30 BST |
| **Client** | European Marine Energy Centre (EMEC) |
| **Location** | MS Teams |

## DOCUMENT CONTROL

| Revision | Date of Issue | Description | Approved |
|---|---|---|---|
| R01-00 | 21-Dec-2021 | Issued to attendees for comment | AR |
| R02-00 | 12-Jan-2022 | Amended following MCA comments | AR |

## ATTENDEES

| Organisation | Attendee | Role | Initial |
|---|---|---|---|
| **NASH Maritime** | | Project Manager<br>Maritime Consultant | AR<br>CC |
| **Maritime and Coastguard Agency (MCA)** | | Offshore Renewables Lead<br>Navigation Policy Advisor | NS<br>VJ |
| **European Marine Energy Centre (EMEC)** | | Senior Environments & Consents Officer | DL |

## NOTES OF MEETING

| 1 | Introductions | Action |
|---|---|---|
| 1.1 | Introductions made between attendees. | |
| **2** | **Agenda** | |

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|---|---|
| 2.1 | AR presented the agenda as follows:<br>• Overview of Sites and NRA Status<br>• Proposed approach and MGN 654 Compliance<br>• Preliminary list of stakeholders<br>• Key issues to be addressed<br>• MCA feedback/identified issues at EMEC sites<br>• AOB<br>AR noted that the process is still in its early stages. The aim is to make sure that updates align with MGN654 guidance and requirements. |
| **3** | **Sites** |
| 3.1 | AR presented a brief overview of sites for which NRAs are required. |
| 3.2 | AR outlined the site details, noting that all sites had previous site-wide NRAs conducted in 2019. It was also noted that Fall of Warness (FoW) will have two NRAs; one with 8 berths and one with 15 berths with an expanded S36 application but site boundary remains the same.<br>DL summarised the license status of all lease areas. Billia Croo S36 has been submitted in 2021 for expansion from 7MW to 20MW. |
| **4** | **Methodology** |
| 4.1 | AR provided an overview of the methodology:<br>• MGN 654 based methodology<br>• AIS Data (2019-2021) – data collection over approximately 3 years for exposure to less frequent site vessel traffic activity and to benchmark periods affected by COVID against.<br>• Consultation<br>• MAIB/RNLI Incident Data<br>• FSA style risk assessment<br>• IALA IWRAP Risk Modelling<br><br>AR noted that the NRA review methodology is in line with previous NRA methodology - the aim is to maintain the same process and to focus on what's changed and whether current mitigation measures still suffice. NS agreed with this approach.<br>AR raised compliance with MGN654 for radar survey requirements, which were not believed to be proportionate for an active, operational site wide NRA update. NS agreed that a radar survey would not be required. |
| **5** | **Consultees** |

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| 5.1 | AR outlined main consultees as follows:<br>• MCA<br>• NLB<br>• Orkney Ferries<br>• Orkney Islands Council Harbour Authority.<br>• Chamber of Shipping<br>• RYA/RYA Scotland<br>• Orkney Fisheries<br>Additional possible consultees:<br>• Northlink Ferries<br>• Cruising Association<br>• Orkney Marinas<br>• Scottish Fisheries Federation<br>• RNLI Stormness/Kirkwall<br>NS commented that the consultee list is extensive and is satisfied that all the important consultees are included. | |
| **6** | **Key Issues to be Addressed** | |
| **6.1** | AR outlined key issues:<br>**Fall of Warness (FoW):**<br>• Vessel Routeing in Fall of Warness (Orkney Ferries)<br>• Passage between Muckle Green Holm and Eday<br>• Site Marking and Lighting<br>**General:**<br>• Risk of contact/collision<br>• Under Keel Clearance<br>• Subsea Cables<br>• Other MGN654 impacts (SAR, Comms./Nav Equipment etc.)<br>AR drew attention to some of the larger vessels (cruise ships) navigating through the site area and suggested that a navigation corridor may need to be considered.<br><br>NS emphasised need to consult and understand impact to ferry operators navigating through FoW site. | |
| **6.2** | NS commented that for the 50MW scenario in FoW, an Under Keel Clearance (UKC) requirement may need to be instigated where deeper draught vessels navigate (such as southwest region of FoW). AR agreed and commented that MGN654 guidance for UKC calculations will be applied (which considers factors such as wave dynamics).<br><br>NS suggested that similar to the Morlais project, a system could be adopted where individual regions have specific UKC or only allow certain types of devices. AR to check what risk controls were agreed for Morlais site marking (e.g. buoyage), noting phased site development arrangements. | AR |
| **6.3** | AR asked whether there are any specific details required from device developers to be included in the template for device specific NRAs. NS replied that the main details to be included are: | |

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| • Device type and design (e.g. sub-surface/platform/rotors);<br>• Dimensions;<br>• Location; and<br>• Any additional mitigations needed such as lighting/AtoNs.<br>DL to pass on previous device specific NRA examples to AR. | DL |

## EMEC SITE-WIDE NRAS

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|---|---|
| **Project Title** | EMEC Site-WIDE NRAs |
| **Project Number** | 21-NASH-0188 |
| **Meeting subject / purpose** | NLB |
| **Revision** | R02-00 |
| **Date of meeting** | 25-Jan-2022 |
| **Start time** | 14:00 BST |
| **Finish time** | 15:00 BST |
| **Client** | European Marine Energy Centre (EMEC) |
| **Location** | MS Teams |

## DOCUMENT CONTROL

| Revision | Date of Issue | Description | Approved |
|---|---|---|---|
| R01-00 | 27-Jan-2022 | Issued to attendees for comment | AR |
| R02-00 | 31-Jan-2022 | Updated following NLB Comments | AR |

## ATTENDEES

| Organisation | Attendee | Role | Initial |
|---|---|---|---|
| **NASH Maritime** | | Project Manager<br>Maritime Consultant | AR<br>CC |
| **Northern Lighthouse Board (NLB)** | | Navigation Manager<br>Coastal Inspector of Aids to Navigation<br>Navigation Officer | PD<br>AL<br>GB |
| **European Marine Energy Centre (EMEC)** | | Senior Environments & Consents Officer | DL |

## NOTES OF MEETING

| 1 | Introductions | Action |
|---|---|---|
| 1.1 | Introductions made between attendees. | |
| **2** | **Agenda** | |
| 2.1 | AR presented the agenda as follows: | |

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| | • Introductions.<br>• Review of EMEC sites and license/device status.<br>• Review of existing and potential impacts to shipping and navigation.<br>• Review of existing and possible risk controls.<br>• AOB. |
| **3** | **Sites and Site Details** |
| 3.1 | AR presented a brief overview of sites for which NRAs are required. |
| 3.2 | AR outlined the site details, noting that all sites had previous site-wide NRAs conducted in 2018-2019. The Fall of Warness (FoW) NRA will include a possible expansion from the existing 8 berths and to 15 berths to support a S36 application.<br>AR summarised the license status of all lease areas. Billia Croo S36 has been submitted in 2021 and an NRA was conducted in 2018/2019 for the expansion. |
| **4** | **Methodology** |
| 4.1 | AR provided an overview of the methodology:<br>• MGN 654 based methodology<br>• AIS Data (2019-2021) – data collection over approximately 3 years for exposure to less frequent site vessel traffic activity and to benchmark periods affected by COVID against.<br>• Consultation<br>• MAIB/RNLI Incident Data<br>• FSA style risk assessment<br>• IALA IWRAP Risk Modelling<br><br>AR noted that the NRA review methodology is in line with previous NRA methodology and has been agreed with the MCA - the aim is to maintain the same process and to focus on what's changed and whether current mitigation measures still suffice.<br>AR emphasised that the NRA review is not looking at individual devices, but at whether the sites themselves are sufficiently marked.<br>PD confirmed that each device requires its own NRA and there are general procedures that are followed, including:<br>• Yellow Day Marking/Painting<br>• Flashing yellow special mark light (Category 1)<br>• Day top mark (if deemed necessary)<br>• Radar Reflector<br>• AIS AtoN |
| **5** | **Billia Croo** |
| 5.1 | AR explained that the Billia Croo site S36 application would expand the site to the northwest and may impact on vessel routeing and require changes to the existing marking arrangements.<br>PD clarified that NLB maintain the cardinals currently marking the site boundary as a commercial activity and there was a discussion about how these could be incorporated into the new site boundary AtoNs:<br>• PD stated that it has yet to be agreed between NLB and EMEC how the site extension will be marked, but it was recognised that the cardinals would need to be moved. |

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| | • DL stated that the S36 application hasn't officially been accepted yet. It's currently with the ministers so will be confirmed within the next few weeks. Discussions with NLB will follow acceptance.<br>• PD noted that the extension changes the shape of the site significantly and may result in spacings between markings of two nautical miles. Special Mark buoys may be necessary to accommodate the new site shape but could cause confusion with devices.<br>• PD questioned how small local craft navigate passed the site. AR explained that the AIS data doesn't capture all vessels, but it does show that smaller vessels keep to the east of the site and navigate along the inshore route.<br>**Western Boundary:**<br>• AR suggested that all vessels will be aware that cardinals on the site boundary will tell them not to navigate through the site and this is clear from the analysis of AIS data.<br>• Positioning the west cardinal to the vertex on the site boundary would maintain traffic flow clear of the site.<br>**Northern Boundary:**<br>• PD explained that either one cardinal to the north of the site boundary (beyond the EMEC lease area limits) or two buoys on the northern east and west corners of the site, would likely be needed.<br>• PD suggested the possibility of having two north cardinals on the two northern corners of the extended site boundary, each with different light characteristics in order to differentiate between them.<br>**Eastern Boundary:**<br>• AR suggested that the current placement of the eastern cardinal is sufficient to mark the eastern side of the site boundary, providing enough searoom between the lee shore and the site for small craft with local knowledge. PD agreed that it would not be necessary to alter the markings.<br>• It was recognised that during strong westerlies, vessels may elect to pass to the west of the site rather the east of the site to avoid the lee shore. | |
| **6** | **Scapa Flow** | |
| **6.1** | AR described that Scapa Flow is a less exposed test site than Billia Croo so supports smaller test projects. The site itself isn't marked but test buoys and devices would be in accordance with NLB requirements.<br><br>PD noted that the site area and yellow buoy is charted. AR questioned whether the yellow buoy is still in place. DL said he would check this but that there were no devices currently in place.<br><br>PD noted that the site hasn't caused any issues in the past but the proposed development of a new site (hydrogen facility) at Deepdale to the north may introduce more vessel traffic to the area in the future. If more devices are added in the future, the placement of more AtoNs may need to be considered. DL noted that the EMEC envelope only accommodates 2 berths.<br><br>It was agreed that given current usage, no additional AtoNs are needed for Scapa Flow. | **DL** |
| **7** | **Shapinsay Sound** | |

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| **7.1** | AR noted that fishing/fish-farm vessels are most likely to transit in the site area, but activity is limited and it is clear of the shipping routes into Kirkwall. There is no need to mark the site with any additional AtoNs given current usage.<br><br>PD agreed with this statement. |
| **8** | **Fall of Warness** |
| **8.1** | AR explained that FoW would require the most discussion:<br>1) The number of devices in situ, along with the growing interest for adding more devices to the location for longer periods of time (10+ yrs). The current design for the layout of device berths is still being drafted but there are aims to increase the range of device types and sizes.<br>2) Vessel traffic through the area – this includes the Orkney ferries that have to maneuver in strong tidal conditions, commercial shipping and cruise ships passing through the west side of the site. |
| **8.2** | AR outlined the issues that arise from this site as follows:<br>1) How to mark numerous devices in one location; and<br>2) How to maintain safe navigation through the site with increasing numbers of devices.<br>These points were discussed as follows:<br>• AR noted that the addition of devices will be incremental and it's important that they don't interfere with navigation on an individual and cumulative basis. It was agreed that devices should continue to be assessed on a case-by-case basis.<br>• AR stated that it would be advantageous to shipping and navigation safety for the channel to stay open for vessels provided it is of sufficient width. AR questioned whether such a channel would be marked with physical buoyage.<br>• AR questioned whether the number of devices in the site area to increase drastically, the site could be cornered off (like Billia Croo).<br>• PD noted that it is difficult to place navigation buoys in strong tidal regions. AR agreed and suggested that there is potential for a buoy to become an additional hazard for vessels.<br>• PD suggested that in areas with strong tides, virtual AtoN can be put in place but there is the issue of overcrowding on ECDIS charts in regions with numerous devices in a small area. This may increase the risk for passing through the site.<br>• PD further suggested the possibility of reducing markings at some stage in the future if some markers become less useful. For example, it could be envisaged that the most westerly devices only would need AIS. EMEC should liaise with the NLB on this matter, and make sure mariners are kept updated through notices.<br>• PD noted that a 500m safety distance from devices is recommended, but this isn't always achievable in FoW. AR suggested that smaller passing distances are common due to the vessels navigating through the site being mostly local ferries which are confident navigators and have good local knowledge.<br>• AR showed that AIS analysis suggests that whilst a number of larger vessels pass to the west of Muckle Green Holm, there are a number of smaller cruise ships which opt to travel a direct passage through the site.<br>• PD noted that the region around Benlin rock was poorly charted 20 years ago resulting in a grounding incident. (AR to look at incident in more detail – Octopus MAIB 18/2007). Since then, the region has supposedly been better charted, so |

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| | vessels will be more confident navigating to the west and south of Muckle Green Holm.<br>• PD explained that for visiting large vessel traffic, either a recognizable route needs to be maintained on the east side of Muckle Green Holm, or there needs to be instructions included in the Sailing Directions indicating that there are obstructions to the east of the island and vessels are advised to go to west of Muckle Green Holm. This may require further consultation and assessment if required<br>• PD suggested that there might be value in placing a light on Muckle Green Holm. If more vessels are expected to navigate to the west side of the island then markings of shoals, such as Benlin Rock, would also be advised.<br>There was discussion of marking the test boundary on charts. AR acknowledged that devices change so frequently that charts wouldn't necessarily be able to keep up to date with device-specific marking.<br>AR recommended that EMEC keep an updated log of the location and details of each device currently in-situ for mariners to access whether this is via a website, notice to mariners etc. PD agreed that this would be beneficial. (AR to check what the admiralty sailing directions currently state for each site). | **AR**<br><br>**AR** |
| **8.3** | PD questioned where the most desirable position is to place devices within the site area (i.e. where the highest tidal flows are). AR responded that the strongest flows are in the centre of the channel between Muckle Green Holm and War Ness which is a region that sees regular ferry traffic. This would be most desirable for established developers such as Orbital. It may be that future small-scale devices would be in their 'nursery' phase and therefore might not be placed in areas of strongest tidal flow.<br><br>There was a discussion on whether the site is moving towards a more commercialized farm situation. DL noted that the length of device licenses is increasing to 10+ years which is motivated by funding. Current devices are installed for shorter periods of time but in the future, companies are expected to keep devices in for longer periods of time. | |
| **9** | **AOB** | |
| **9.1** | It was acknowledged by PD and AR that it's challenging to manage development over varying times and spaces. It was concluded that each development should be judged on its individual aspects, whilst maintaining a watchful eye on the overall site to make sure that the addition of each device doesn't result in a negative cumulative affect to navigation.<br><br>DL noted that the FoW NRA may give some guidance as to the location and number of additional device berths that will be installed.<br><br>AL requested that DL provides a full list of the devices in each site at the moment. | **DL** |

## EMEC SITE-WIDE NRAS

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|---|---|
| **Project Title** | EMEC Site-WIDE NRAs |
| **Project Number** | 21-NASH-0188 |
| **Meeting subject / purpose** | RYA Scotland |
| **Revision** | R01-00 |
| **Date of meeting** | 27-Jan-2022 |
| **Start time** | 14:00 BST |
| **Finish time** | 15:00 BST |
| **Client** | European Marine Energy Centre (EMEC) |
| **Location** | MS Teams |

## DOCUMENT CONTROL

| Revision | Date of Issue | Description | Approved |
|---|---|---|---|
| R01-00 | 31-Jan-2022 | Issued to attendees for comment | AR |
| | | | |

## ATTENDEES

| Organisation | Attendee | Role | Initial |
|---|---|---|---|
| **NASH Maritime** | Andrew Rawson<br>Claire Conning | Project Manager<br>Maritime Consultant | AR<br>CC |
| **Royal Yachting Association (RYA) Scotland** | Graham Russel | Planning and Environment Officer | GR |
| **RYA Scotland / Orkney Marinas** | Brian Kynoch | RYA Coastwatcher<br>Chairman Orkney Marinas | BK |
| **European Marine Energy Centre (EMEC)** | Donald Leaver | Senior Environments & Consents Officer | DL |

## NOTES OF MEETING

| 1 | Introductions | Action |
|---|---|---|
| 1.1 | Introductions made between attendees. | |

| | |
|---|---|
| **2** | **Agenda** |
| 2.1 | AR presented the agenda as follows:<br>• Introductions.<br>• Review of EMEC sites and license/device status.<br>• Review of existing activities around project sites.<br>• Review of existing and potential impacts to recreational users.<br>• Review of existing and possible risk controls.<br>• AOB |
| **3** | **Sites and Site Details** |
| 3.1 | AR presented a brief overview of sites for which NRAs are required. |
| 3.2 | AR outlined the site details and license/lease statuses, noting that all sites had previous site-wide NRAs conducted in 2018-2019.<br>The Fall of Warness (FoW) NRA will include a possible expansion from the existing 8 berths up to 15 berths to support a S36 application.<br>Billia Croo S36 application for an extension to the NW has been submitted in 2021. |
| **4** | **Methodology** |
| 4.1 | AR provided an overview of the methodology:<br>• MGN 654 based methodology<br>• AIS Data (2019-2021) – data collection over approximately 3 years for exposure to less frequent site vessel traffic activity and to benchmark periods affected by COVID against.<br>• Consultation<br>• MAIB/RNLI Incident Data<br>• FSA style risk assessment<br>• IALA IWRAP Risk Modelling<br><br>AR noted that the NRA review methodology is in line with previous assessments - the aim is to maintain the same process and to focus on what's changed and whether current mitigation measures still suffice. Each future device will be assessed on a case by case basis. |
| **5** | **General Recreational Activity** |
| **5.1** | AR showed a plot of recreational AIS tracks across the Orkney Islands and there was a general discussion around cruising and sailing around the Islands. In particular, GR and BK noted:<br>• Peak recreational activity is between May and the end of August.<br>• Approximately ¼ of boats have AIS equipment on board. This is predominantly long-distance cruisers. Local boats are less likely to have AIS and are more likely to use shortcut passages that visitors to the region won't know about or be confident enough to take.<br>• Small recreational vessels are unlikely to carry AIS. Additionally, some vessels have their vessel category set incorrectly on AIS.<br>• Most international visitors have come from Scandinavia (via Shetland) or Northern Europe (via Northumberland/Scottish Mainland).<br>• Covid has affected recreational activity as follows:<br>  ○ Current activity is at a 1/3 of what it was before covid. |

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| | ○ There has been a much high capacity of UK boats, especially around Stromness (traditionally, 50% would be UK boats and 10% would be Scandinavian).<br>○ A rebound in recreational activity is estimated this year and is expected to go back up to 60% of pre-pandemic levels.<br>○ The west coast has seen a large increase in UK originated recreational activity (whether this is due to covid or brexit is uncertain).<br>• It is anticipated that recreational boats may travel further north this year due to growing confidence of visitors, particularly amongst British cruisers.<br>• BK to send visitor activity data to AR. | BK |
| **6** | **Billia Croo** | |
| 6.1 | • AR explained that the Billia Croo site S36 application would expand the site to the northwest and may impact on vessel routeing and require changes to the existing marking arrangements. Discussions with NLB and EMEC regarding how the site extension will be marked are ongoing, but it was recognised that the existing cardinals would need to be moved. GR agreed with this.<br>• BK acknowledged that the route recreational vessels take through/around the site will be very weather/sea condition dependent. However, the majority of recreational users pass inshore of the test site, utilising the East Cardinal Mark to navigate.<br>• It had been reported by some recreational users that the Cardinals at Billia Croo are difficult to see during significant sea states.<br>• GR suggested that it would be worth calculating how much longer it would take a vessel to navigate around the extended site. GR noted that vessels might have tight time schedules to reach their berth due to the strength of tides in the region ("tidal gates").<br>• It was noted that visiting recreational vessels may be less confident mariners and take the offshore route passed the site.<br>• GR stated that the important set to any changes made to the site is that all mariners are notified. This includes not only Notice to Mariners, but distributing the update effectively such as updates to digital charts, notifying sailing clubs, marinas, CCC etc. to ensure that everyone receives the updates and navigation advice.<br>• It was noted that people going further out in small unpowered recreational vessels such as sea kayaks and wind surfers, are often more experienced, have pre-planned their navigation and carry appropriate emergency gear. Additionally, they are also more manoeuvrable and able to avoid hazards. | |
| **7** | **Scapa Flow** | |
| **7.1** | • AR described that Scapa Flow is a less exposed test site than Billia Croo so supports smaller test projects. The site itself isn't marked but test buoys and devices would be in accordance with NLB requirements.<br>• GR stated that St Mary's Bay has facilities and a dinghy club that functions out of it. There is more activity than what is shown in the AIS data (but still less activity than Billia Croo). BK agreed and added that the nearest bays don't lend themselves to long stay anchorages so are not attractive to recreational vessels.<br>• It was agreed no extra AtoNs or additional risk mitigation measures are needed for the site currently. The main emphasis for the NRA is that any future changes are well publicised (see **Section 6** above) | |

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| **8** | **Shapinsay Sound** |
| **8.1** | • AR noted that there appeared to be more substantial recreational traffic through the site due to its close proximity to Kirkwall Marina.<br>• BK explained that there are some visitors to Shapinsay, however, the pier does not offer sufficient comfort or safety for mooring alongside. A restaurant in Balfour used to attract many more visitors, so there is the potential for changes in recreational activity if a new restaurant starts trading.<br>• BK described the sailing from Kirkwall, with occasional racing in the Shapinsay Sound such as the Round Shapinsay Race. These mostly involve yachts less than 12m in length.<br>• It was agreed that there is no need to mark the site with any additional AtoNs. |
| **9** | **Fall of Warness** |
| **9.1** | AR described the proposed changes at the FoW:<br>3) The current design for the layout of device berths is still being drafted but there are aims to increase the number and range of device types and sizes.<br>4) Vessel traffic through the area that have to manoeuvre in strong tidal conditions. |
| **9.2** | • AR noted that the AIS data showed most recreational vessels either pass to the west or southeast of the site.<br>• Some curious recreational craft may enter the site to look at the devices that are in place.<br>• GR and BK noted that sea kayakers are becoming increasingly adventurous and may be found in the site in the future.<br>• There might be more vessels calling at Rousay and Sanday in future which might change vessel routes within the Orkney Islands.<br>• AR explained that there will be an incremental addition of devices so it's important that mariners are made aware of these changes and are kept up to date.<br>• AR also noted that there has been discussion of an alternative (marked) route to the southwest of Muckle Green Holm for larger vessels. Marking arrangements within the site are difficult due to the strong tidal flows and might act as additional obstacles to avoid. |
| **10** | **AOB** |
| **10.1** | GR emphasised the importance of liaising with the Clyde Cruising Club, particularly with regard to marking of the site and any recommended routes through it (e.g. the inshore route for Billia Croo). |

# EMEC SITE-WIDE NRAS

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| **Project Title** | EMEC Site-WIDE NRAs |
| **Project Number** | 21-NASH-0188 |
| **Meeting subject / purpose** | Orkney Ferries |
| **Revision** | R01-00 |
| **Date of meeting** | 27-Jan-2022 |
| **Start time** | 15:00 BST |
| **Finish time** | 16:00 BST |
| **Client** | European Marine Energy Centre (EMEC) |
| **Location** | MS Teams |

## DOCUMENT CONTROL

| Revision | Date of Issue | Description | Approved |
|---|---|---|---|
| R01-00 | 31-Jan-2022 | Issued to attendees for comment | AR |
| | | | |

## ATTENDEES

| Organisation | Attendee | Role | Initial |
|---|---|---|---|
| **NASH Maritime** | | Project Manager<br>Maritime Consultant | AR<br>CC |
| **Orkney Ferries** | | Relief Mate/Master | MP |
| **European Marine Energy Centre (EMEC)** | | Senior Environments & Consents Officer | DL |

## NOTES OF MEETING

| 1 | Introductions | Action |
|---|---|---|
| 1.1 | Introductions made between attendees. | |
| **2** | **Agenda** | |
| 2.1 | AR presented the agenda as follows:<br>• Introductions.<br>• Review of EMEC sites and license/device status. | |

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| | • Review of existing activities around project sites.<br>• Review of existing and potential impacts to Orkney Ferries operations and safety.<br>• Review of existing and possible risk controls.<br>• AOB. |
| **3** | **Sites and Site Details** |
| 3.1 | AR presented a brief overview of sites for which NRAs are required. |
| 3.2 | AR outlined the site details, noting that all sites had previous site-wide NRAs conducted in 2018-2019. The Fall of Warness (FoW) NRA will include a possible expansion from the existing 8 berths and up to 15 berths to support a S36 application. |
| **4** | **Methodology** |
| 4.1 | AR provided an overview of the methodology:<br>• MGN 654 based methodology<br>• AIS Data (2019-2021) – data collection over approximately 3 years for exposure to less frequent site vessel traffic activity and to benchmark periods affected by COVID against.<br>• Consultation<br>• MAIB/RNLI Incident Data<br>• FSA style risk assessment<br>• IALA IWRAP Risk Modelling<br><br>AR noted that the NRA review methodology is in line with previous NRA methodology - the aim is to maintain the same process and to focus on what's changed and whether current mitigation measures still suffice. |
| **5** | **Billia Croo/Scapa Flow/Shapinsay Sound** |
| 5.1 | AR showed traffic plots of the three sites and it was agreed that ferry transits were clear, and none involved Orkney Ferries routes. |
| **6** | **Fall of Warness** |
| **6.1** | AR showed AIS data plots of Orkney Ferries transits through the FoW. Four routes were identified which MP was asked to describe. |
| **6.2** | MP described each route as follows:<br><br>**Route 1 (West/East, passing north of Muckle Green Holm):**<br><br>• During SE gales and flood tide (up to 7kts), the area between War Ness and Muckle Green Holm is a no-go area. The conditions are significant enough to break chains on lorries, move cars and injure passengers.<br>• Conditions can still be significant following a previous gale with the remaining swell.<br>• A tidal eddy (and some shelter) is offered around Muckle Green Holm and therefore ferries stick close in.<br>• Flatter water is experienced around the War Ness headland and therefore ferries stick in close to the 10m contour.<br>• Running north into the site is more comfortable than broadside on to the swell, and flatter water can be found further north. This decision is only made once the master can see the specific conditions on site. |

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| | • On some rare occasions, the master might consider the conditions too severe so chooses to pass to the north of Eday which adds 50/60 minutes onto the journey time.<br><br>**Route 2 (West/East, passing south of Muckle Green Holm):**<br><br>• Vessels loop to keep conditions aft of the beam and improve safety and comfort.<br>• In good weather and strong flood tide, vessels keep in close to War Ness and Muckle Green Holm to minimize tidal drift and take advantage of any tidal eddies. Keeping to the north keeps them uptide for the crossing.<br>**Route 3 (North/South, passing west of Muckle Green Holm):**<br><br>• When bound for Kirkwall (heading south) and a strong ebb tide, keeping tight into the west coast of Eday minimizes the stream and then Muckle Green Holm offers both a lee and a tidal eddy. This is done for maximizing vessel speed when transiting against the tide.<br>**Route 4 (North/South, inshore of OpenHydro):**<br><br>• To minimize the tidal streams further, vessels might pass inshore of OpenHydro and hug the west coast of Eday.<br>• In particular, during strong ebb tides and strong north-westerly winds. |
| **6.3** | MP further commented on ferry operations and metocean conditions, as follows:<br><br>• There are thick fogs in summer (but not in poor weather conditions). The region also experiences large swell.<br>• Radar and AIS are used by all ferries, and they've never had any issues with detecting EMEC devices in restricted visibility.<br>• MP noted that when the tide is really strong, the buoys pull under the surface, so they become much less visible.<br>• It was noted that radar return depends on the size of device. The 2 devices currently installed at the moment are quite easily detectable even in bad weather. However, if smaller devices are installed in the future, they may not show up as clearly, especially in bad weather.<br>• MP stated that he doesn't expect any changes to ferry services in the near future. Ferries are due to be updated, but draught is unlikely to increase due to depth on berths limiting this factor.<br>• It would be unlikely that ferries would be cancelled due to the conditions at the site, but rerouting is possible. |
| **6.4** | AR questioned concerns for subsurface devices:<br><br>• MP state that the ferries have a draught of 3.25m. and a dynamic draught of approximately 8m in poor weather conditions. An additional safety factor would also be required before ferries would pass over a subsurface device.<br><br>AR questioned risks of collision with other vessels, MP had the following comments: |

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| | • There are rarely any yachts going through the site, even during the summer.<br>• Sometimes there are service vessels heading out to the salmon farms.<br>• Commercial vessels hardly ever cut through the site.<br>• Supply boats occasionally come down through site.<br>• Maintenance vessels for the site cause no issues – they put out plenty of notices to local harbour boards in advance and they tend to only work in good weather conditions and at slack water. At these times ferries would be going straight across rather than through the site. | |
| **6.5** | AR questioned whether any additional risk controls at the site might be warranted:<br>• MP noted that Route 1 can necessitate transits to the north of the 2 devices in-situ and therefore this area should be left clear to enable this manoeuvre.<br>• MP suggested that the northern part of the site (around OpenHydro) should be kept as clear as possible - when vessels are going up that north, weather conditions are really bad so it's important that that route option isn't taken away (route 4) and any devices that are placed up there would have to be really well marked.<br>• Additionally, the route around the War Ness headland must be kept open for vessels avoiding bad metocean conditions. Ferries tend to utilize the 10m contour to keep out of the tide.<br>• The vessel track plots clearly demonstrate where ferries would like to keep clear of devices in the future.<br>• MP stated that most ferries aim to keep a 150m separation between a device and their transit.<br>• MP commented that the ferries services are always well informed about changes and new devices/ navigation recommendations being put in place. | |
| **7** | **AOB** | |
| **7.1** | None | |

# EMEC SITE-WIDE NRAS

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| **Project Title** | EMEC Site-WIDE NRAs |
| **Project Number** | 21-NASH-0188 |
| **Meeting subject / purpose** | Chamber of Shipping |
| **Revision** | R01-00 |
| **Date of meeting** | 09-Feb-2022 |
| **Start time** | 13:00 BST |
| **Finish time** | 14:00 BST |
| **Client** | European Marine Energy Centre (EMEC) |
| **Location** | MS Teams |

## DOCUMENT CONTROL

| Revision | Date of Issue | Description | Approved |
|---|---|---|---|
| R01-00 | 10-Feb-2022 | Issued to attendees for comment | AR |
| | | | |

## ATTENDEES

| Organisation | Attendee | Role | Initial |
|---|---|---|---|
| **NASH Maritime** | | Project Manager<br>Maritime Consultant | AR<br>CC |
| **Chamber of Shipping (CoS)** | | Policy Manager (Safety & Nautical) & Analyst | RM |
| **European Marine Energy Centre (EMEC)** | | Senior Environments & Consents Officer | DL |

## NOTES OF MEETING

| 1 | Introductions | Action |
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| 1.1 | Introductions made between attendees. | |
| **2** | **Agenda** | |
| 2.1 | AR presented the agenda as follows:<br>• Introductions. | |

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| | • Review of EMEC sites and license/device status.<br>• Review of existing and potential impacts to shipping and navigation.<br>• Review of existing and possible risk controls.<br>• AOB |
| **3** | **Sites and Site Details** |
| 3.1 | AR presented a brief overview of sites for which NRAs are required. |
| 3.2 | AR outlined the site details and license/lease statuses, noting that all sites had previous site-wide NRAs conducted in 2018-2019.<br>The Fall of Warness (FoW) NRA will include a possible expansion from the existing 8 berths up to 15 berths to support a S36 application.<br>Billia Croo S36 application for an extension to the NW has been submitted in 2021. |
| **4** | **Methodology** |
| 4.1 | AR provided an overview of the methodology (updating the 2018-2019 NRAs):<br>• MGN 654 based methodology<br>• AIS Data (2019-2021) – data collection over approximately 3 years for exposure to less frequent site vessel traffic activity and to benchmark periods affected by COVID against.<br>• Consultation<br>• MAIB/RNLI Incident Data<br>• FSA style risk assessment<br>• IALA IWRAP Risk Modelling |
| 4.2 | AR questioned whether the large fish farm vessels (e.g. Ronja) would be members of the Chamber of Shipping. RM suggested consultation with the Scottish Fisheries Federation instead. |
| **5** | **Billia Croo** |
| 5.1 | • AR explained that the Billia Croo site S36 application would expand the site to the northwest and may impact on vessel routeing and require changes to the existing marking arrangements. Discussions with NLB and EMEC regarding how the site extension will be marked are ongoing, but it was recognised that the existing cardinals would need to be moved.<br>• AR described the vessel traffic plots noting that the inshore route to the east of the site is mostly used by recreational and fishing vessels. Services vessels in general are the main vessel category that travel through/into the site. It was noted that very few large commercial vessels are within the study area, either passing through the Pentland Firth or around the ATBA. Most large vessels recorded are offshore supply vessels but are still several nautical miles from the site.<br>• RM questioned what the extension area size is. AR suggested that it's approximately 1 nautical miles to the northwest. It was agreed that the site extension will not add a significant increase to travel time for vessels circumnavigating the site.<br><br>*[post meeting note: area of site increases from 8.1km$^2$ to 11.2km$^2$]* |
| **6** | **Scapa Flow** |
| 6.1 | • AR described that Scapa Flow has been established for 10 years and is a less exposed test site than Billia Croo so supports smaller test projects. |

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| | • AR described the vessel traffic plots noting that whilst the site is in a busy region, it is offset from the areas of high vessel activity. AR explained that the anchorage locations to the west of the site are charted and well managed, including all vessels being under pilotage. RM questioned the interaction between anchoring activity and the EMEC site. DL explained that there is an exclusion zone in place (approx. 100m) from the nearest anchor chain.<br>• It was agreed no extra AtoNs or additional risk mitigation measures are needed for the site currently. The main emphasis for the NRA is that any future changes are well publicised.<br>• RM noted the proximity of the fish farm to the north. AR considered that these vessels are regular runners, many of which also work with EMEC and therefore are well familiar with any activities taking place at the EMEC test berths. | |
| **7** | **Shapinsay Sound** | |
| 7.1 | • AR explained that similar to Scapa Flow, the site is offset from the areas of high vessel activity. AR also noted that there are sector lights marking the main channel which should prevent larger vessels from straying into the site. Any large vessels recorded in the AIS data are the NLB light tender.<br>• It was agreed that there is no need to mark the site with any additional AtoNs. | |
| **8** | **Fall of Warness** | |
| 8.1 | AR described the proposed changes at the FoW:<br>5) The current design for the layout of device berths is still being drafted but there are aims to increase the number and range of device types and sizes.<br>6) Vessel traffic through the area that have to manoeuvre in strong tidal conditions. | |
| 8.2 | • AR described the vessel traffic plots noting that the vessels usually transiting through the site are local ferries that know the area well and have to take different routes depending on extreme metocean conditions in the area (which have been explained during consultation with Orkney Ferries). Few large commercial vessels navigate the area but some cruise ships (<250m) take this route but this number may vary significantly between 2019 and 2021 due to COVID impacts.<br>• RM requested that the analysis further breaks down vessels over 100m in length to differentiate the various sizes and manoeuvrability characteristics.<br>• AR described the discussions with the NLB regarding lighting and marking arrangements, where it had been discussed that the inclusion of physical AtoNs only served as additional obstacles and hazards for passing vessels. RM was not in disagreement,<br>• AR also noted that there has been discussion of an alternative (marked) route to the southwest of Muckle Green Holm for larger vessels, bypassing the Fall of Warness. These have been taken by larger cruise ships historically. Marking arrangements within the site are difficult due to the strong tidal flows and might act as additional obstacles to avoid.<br>• RM suggested that the Chamber of Shipping would prefer that a navigational corridor be maintained to the east of Muckle Green Holm through the EMEC site. AR noted that in order to keep the navigational corridor open, an offset from hazards would have to be established. AR suggested the PIANC guidance and RM agreed that this would be a good approach.<br>• RM questioned the types of devices proposed for EMEC, and what impacts subsurface devices would have on vessel Under Keel Clearance. RM suggested that the use of zoning (as per Morlais in Holyhead) in which different quadrants allow for different under-keel clearance. AR agreed that this could be a viable option and suggested that the MCA dynamic draught calculation should be used to aid the zoning process. | **AR** |

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| | • It was agreed that there were not anticipated to be a significant change in the size or types of vessels utilising the Fall of Warness given the numerous constraints around the Orkneys. | |
| **9** | **Risk Controls and AOB** | |
| 9.1 | • AR presented a summary of the EMEC risk controls which have been developed over 20 years. RM agreed that the risk controls shown are comprehensive.<br>• It was agreed that effectively circulating updated information about the sites and devices is very important and that the frequency of changing devices may not be filtering through to ships in a timely manner. RM described the S100 ECDIS standard and the possibility of daily updates for chart corrections, although AR suggested that it may take some time for all vessels to adopt this technology. RM considered that the ferries and cruise ships in the Fall of Warness would likely be early adopters.<br>• Additionally, AR suggested an up-to-date information database of current devices in each site should be easily available for mariners to access for use in passage planning.<br>• AR suggested that all sites are included in sailing directions, with Scapa Flow and Shapinsay Sound potentially missing. RM agreed. AR to check which sites aren't included.<br>• RM suggested that seasonal variation in vessel traffic is explored further. | **AR** |

## EMEC SITE-WIDE NRAS

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| **Project Title** | EMEC Site-WIDE NRAs |
| **Project Number** | 21-NASH-0188 |
| **Meeting subject / purpose** | Orkney Fisheries |
| **Revision** | R01-00 |
| **Date of meeting** | 15-Feb-2022 |
| **Start time** | 10:00 BST |
| **Finish time** | 11:00 BST |
| **Client** | European Marine Energy Centre (EMEC) |
| **Location** | MS Teams |

## DOCUMENT CONTROL

| Revision | Date of Issue | Description | Approved |
|---|---|---|---|
| R01-00 | 15-Feb-2022 | Issued to attendees for comment | AR |
| | | | |

## ATTENDEES

| Organisation | Attendee | Role | Initial |
|---|---|---|---|
| **NASH Maritime** | | Project Manager | AR |
| **Orkney Fisheries Association (OFA)** | | Head of OFA | HF |
| **Scottish Fisheries Federation (SFF)** | | Fisheries Policy Officer | MM |
| **European Marine Energy Centre (EMEC)** | | Senior Environments & Consents Officer | DL |

## NOTES OF MEETING

| 1 | Introductions | Action |
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| 1.1 | Introductions made between attendees. | |
| 1.2 | HF provided an overview of the OFA, based in Kirkwall. | |

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| | • There are approximately 60 members and represent 70 boats out of a total of 110 Orkney fishing boats. Principal target species include crab, lobster and scallop.<br>• AR questioned whether aquaculture vessels would be members, which HF responded that they would not be part of OFA. |
| 1.3 | MM provided an overview of SFF which acts as an umbrella body for 8 fisheries associations. SFF acts as a common voice for fisheries interests including spatial management and planning. |
| **2** | **Agenda** |
| 2.1 | AR described the agenda circulated before the meeting.<br>• Introductions.<br>• Review of EMEC sites and license/device status.<br>• Review of existing activities around project sites.<br>• Review of existing and potential impacts to the fishing community.<br>• Review of existing and possible risk controls.<br>• AOB |
| **3** | **Sites and Site Details** |
| 3.1 | AR presented a brief overview of sites for which NRAs are required. |
| 3.2 | AR outlined the site details and license/lease statuses, noting that all sites had previous site-wide NRAs conducted in 2018-2019.<br>• The Fall of Warness (FoW) NRA will include a possible expansion from the existing 8 berths up to 15 berths to support a S36 application.<br>• Billia Croo S36 application for an extension to the NW has been submitted in 2021 and AR had previously consulted with Fiona Matherson in 2018 for, who has subsequently retired. |
| **4** | **Methodology** |
| 4.1 | AR provided an overview of the methodology:<br>• MGN 654 based methodology<br>• AIS Data (2019-2021).<br>• Consultation<br>• MAIB/RNLI Incident Data<br>• FSA style risk assessment<br>• IALA IWRAP Risk Modelling |
| **5** | **Overview of Orkney Fisheries** |
| 5.1 | AR presented MMO 2019 AIS data for the Orkneys and noted that it significantly under-represented small fishing boats and this was agreed by HF. The general fishing activity in the Orkney Islands was discussed.<br>• HF noted that the majority of local boats were under 10m and therefore would not carry AIS and that fishing activity was across the entire Orkneys. The principal catches in the Orkneys were shellfish, concentrated in shallower, inshore waters. Most boats were creel fishing (e.g. crab) or diving for scallops.<br>• HF highlighted Kirkwall, Stromness and Pierowall (Westray) are the principal fishing harbours. |

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| | • Some larger boats fish to the west in the Atlantic (6nm) and are based in, or utilize, Stromness as a base. These vessels are larger >15m and generally carry AIS so are shown in the plots.<br>• MM highlighted the tracks from the SE-NW passing through the Orkneys.<br>• AR questioned the seasonality of fishing. HF noted that whilst there are some seasonality patterns, fishing is conducted all year round, driven by both environmental constraints and markets.<br>• HF noted that catches are exported including having been processed locally (e.g. Stromness facility) or live export. For example, scallops often are sold in London and crab is sold in Europe or Asian market.<br>• AR questioned the fisheries management in Orkneys. HF stated that whilst grounds are not managed specifically, individually fishermen will let areas rest to ensure the sustainability of fishing. Crabs are not subject to landing/catch quotas. | |
| **6** | **Billia Croo** | |
| 6.1 | • AR explained that the Billia Croo site S36 application would expand the site to the northwest and may impact on vessel routeing and require changes to the existing marking arrangements. Discussions with NLB and EMEC regarding how the site extension will be marked are ongoing, but it was recognised that the existing cardinals would need to be moved.<br>• AR described the AIS plots (noting the under-representation of small boat fishing).<br>• HF explained the fishing activities along the west coast of the Mainland, inshore of Billia Croo. These include crab and lobster fishing from local boats in Stromness as well as vessels on transit. | |
| 6.2 | HF noted concerns from members on the site, including:<br>• Dangers of lee shore for fishermen, particularly due to the narrow passage between EMEC and the coast.<br>• Debris and devices hazardous to fishing gear and vessel propellors (e.g. discarded rope).<br>• Going to the west of EMEC is potentially hazardous for small boats with a narrow freeboard given the wave conditions.<br>• Potential changes in fishing over time e.g. historic fin fish fisheries could return in the future of the quota is increased. | |
| 6.3 | AR questioned what could be improved at Billia Croo.<br>• HF noted that whilst everyone was aware of the site and had good local knowledge, the Notice to Mariners (NtM) were excessive, highly detailed and often not relevant. For example, OFA sometimes receive NtM for activities in Cornwall which need to be reviewed before they can be discounted. A summary page would be better to include the device position, dates and description to enable filtering of the key information.<br>• AR questioned the NtM process and HF and MM both indicated that they were sent directly and then disseminated to members through their organisations.<br>• AR suggested that EMEC have dedicated space on their website for displaying which devices are located at which berths across all the sites to support passage planning. | |
| **7** | **Scapa Flow** | |
| 7.1 | AR showed the vessel traffic plots for Scapa Flow, noting the significant commercial activities. HF provided more detail on fishing activities here: | |

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| | • Some creel fishing and scallop diving takes place with boats based in Stromness, Scapa Flow or Longhope.<br>• During the summer there are often a couple of trawlers based in Scapa Flow and fishing this area. | |
| 7.2 | DL described the AWS device about to be installed to the north of the site (see link) and HF questioned the marking and lighting arrangements:<br>• DL described the device and that a special yellow mark and Test Support Buoy (TSB) would be installed to mark the device.<br>• Any device arrangements would be signed off by the Northern Lighthouse Board before installation.<br>• AR explained that this NRA update considers the site as a whole rather than any individual device, but recommendations on device marking will be made. | |
| **8** | **Shapinsay Sound** | |
| 8.1 | HF described the principal fishing activities around Shapinsay Sound:<br>• Kirkwall is a major fishing harbour with numerous boats based.<br>• Target catches are principally scallops and lobster.<br>• In general, fishing is conducted away from the EMEC site to avoid conflicts or gear damage.<br>AR added that the shipping channel to the north also limits fishing area within Shapinsay Sound. | |
| **9** | **Fall of Warness (FoW)** | |
| 9.1 | AR described the proposed changes at the FoW. The current design for the layout of device berths is still being drafted but there are aims to increase the number and range of device types and sizes. | |
| 9.2 | AR asked HF to describe the activities around the FoW site:<br>• FoW lies on the margin of the Kirkwall fleet and Westray fleet but is active for both fleets.<br>• Most of the fishing is inshore on Eday with fishermen giving the devices a wide berth.<br>• Most vessels would fish sensibly in and around the significant adverse conditions which can be experienced, sticking inshore when appropriate.<br>HF also noted that the site was busy with other vessel traffic and maintenance vessels. | |
| 9.3 | AR noted the SE-NW through route of fishing vessels:<br>• MM suggested that it may be for the Herring fishery to the west of the Orkneys.<br>• Most of these vessels are likely to have come from mainland Scotland.<br>• Vessels are likely palagic trawlers up to 90m in length and an 11m draught. | |
| 9.4 | AR and MM discussed issues around underkeel clearance:<br>• AR noted that some devices in FoW could be mid-water column (e.g. tidal kites) that might pose a risk to navigating vessels.<br>• MM drew attention to MCA guidance e.g. 5% rule.<br>• AR felt that this was more applicable to cable corridors inshore and that calculating the necessary clearances given vessel draughts and dynamic action was more appropriate for deep water. | |
| 9.5 | HF questioned what the site changes would do to vessel movements for maintenance.<br>DL described that: | |

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| | • Each device would have at least one maintenance trip per month.<br>• The design envelope of the site was still under development and the NRA would feed into determining it.<br>• Further consultation opportunities would be available as the application progressed. | |
| 9.6 | AR questioned if any other concerns had been raised for FoW:<br>• AR noted concerns on visibility of site from Orkney Ferries (e.g. tidal conditions pulling mooring buoys underwater). HF was not aware of concerns from fishermen but understood this could be a hazard.<br>• HF was not aware of any incidents involving fishing boats at EMEC sites, nor was her predecessor. Were an incident to occur they would discuss with EMEC. AR noted that risk management is a continuous process, NRA updates are periodic to account for changing conditions, but any risk assessment should be reviewed following incidents. | |
| **10** | **AOB** | |
| 10.1 | HF reiterated concerns with assessments not properly accounting for inshore fisheries due to overreliance on AIS data. In particular the Scotmap datasets developed 10 years ago were not comprehensive and are no longer relevant. There may be a need to develop fisheries maps to fill this data gap and represent fisheries in marine spatial planning.<br>• MM noted that some recent work has been done on the east coast through the Inshore Fisheries Group to map fishing activity.<br>• AR also described some previous work he had been involved in Washington State USA where dozens of fishermen were asked to draw on charts where they fished which catches and when to develop spatial intensity maps. This might be an appropriate method.<br>• HF and DL agreed that there may be opportunities to collaborate on identifying fishing/environmental impacts and activities in the Orkney Islands.<br>• AR noted that there is significant funding for tidal and wave energy that could be used to support this collaboration, offering benefits such as mapping inshore fisheries. | |

# Annex C: MGN 654 Checklist

**MGN 654 (M+F) Safety of Navigation: Offshore Renewable Energy Installations – Guidance on UK Navigational Practice, Safety and Emergency Response**

| MGN Section | Yes/No | Comments |
|---|---|---|
| **4. Planning Stage – Prior to Consent** | | |
| **4.5 Site and Installation Co-ordinates:** Developers are responsible for ensuring that formally agreed co-ordinates and subsequent variations of site perimeters and individual OREI structures are made available, on request, to interested parties at relevant project stages, including application for consent, development, array variation, operation and decommissioning. This should be supplied as authoritative Geographical Information System (GIS) data, preferably in Environmental Systems Research Institute (ESRI) format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided with latitude and longitude coordinates in WGS84 (ETRS89) datum. | | |
| **4.6 Traffic Survey** – includes | | |
| All vessel types | ✓ | Section 4.2 |
| At least 28 days duration, within either 12 or 24 months prior to submission of the Environmental Impact Assessment Report | ✓ | Section 4.2 |
| Multiple data sources | ✓ | Section 4.1 – AIS and stakeholder consultation. |
| Seasonal variations | ✓ | Section 4.1 – multiple years of data. |
| MCA consultation | ✓ | Section 4.1.3 and Annex B. |
| General Lighthouse Authority consultation | ✓ | Section 4.1.3 and Annex B. |
| Chamber of Shipping and shipping company consultation | ✘ | Section 4.1.3 and Annex B. |
| Recreational and fishing vessel organisations consultation | ✓ | Section 4.1.3 and Annex B. Discussions held with RYA Scotland, Orkney Marinas, Orkney Fisheries and Scottish Fisheries Federation. |
| Port and navigation authorities consultation, as appropriate | ✓ | Section 4.1.3 and Annex B. |
| **4.6.d Assessment of the cumulative and individual effects of (as appropriate):** | | |
| i. Proposed OREI site relative to areas used by any type of marine craft. | ✓ | Sections 4.2 and 5 |

| MGN Section | Yes/No | Comments |
|---|---|---|
| ii. Numbers, types and sizes of vessels presently using such areas | ✓ | Sections 4.2 |
| iii. Non-transit uses of the areas, e.g. fishing, day cruising of leisure craft, racing, aggregate dredging, personal watercraft etc. | ✓ | Sections 4.2 |
| iv. Whether these areas contain transit routes used by coastal, deep-draught or international scheduled vessels on passage. | ✓ | Sections 4.2 |
| v. Alignment and proximity of the site relative to adjacent shipping routes | ✓ | Sections 4.2 and 5.2 |
| vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas | ✓ | Section 3.2. |
| vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas. | ✓ | Section 3.2 and 3.4. |
| viii. Whether the site lies within the jurisdiction of a port and/or navigation authority. | ✓ | Section 3.2.1. |
| ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds. | ✓ | Section 4.2. |
| x. Proximity of the site to offshore firing/bombing ranges and areas used for any marine military purposes. | ✓ | Section 3.4.6. |
| xi. Proximity of the site to existing or proposed submarine cables or pipelines, offshore oil / gas platform, marine aggregate dredging, marine archaeological sites or wrecks, Marine Protected Area or other exploration/exploitation sites | ✓ | Section 3.4. |
| xii. Proximity of the site to existing or proposed OREI developments, in co-operation with other relevant developers, within each round of lease awards. | ✓ | Section 3.4.2. |
| xiii. Proximity of the site relative to any designated areas for the disposal | ✓ | Section 3.4. |

| MGN Section | Yes/No | Comments |
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| of dredging spoil or other dumping ground | | |
| xiv. Proximity of the site to aids to navigation and/or Vessel Traffic Services (VTS) in or adjacent to the area and any impact thereon. | ✓ | Section 3.2. |
| xv. Researched opinion using computer simulation techniques with respect to the displacement of traffic and, in particular, the creation of 'choke points' in areas of high traffic density and nearby or consented OREI sites not yet constructed. | ✓ | Section 5. |
| xvi. With reference to xv. above, the number and type of incidents to vessels which have taken place in or near to the proposed site of the OREI to assess the likelihood of such events in the future and the potential impact of such a situation. | ✓ | Section 4.3. |
| xvii. Proximity of the site to areas used for recreation which depend on specific features of the area | | Section 4.2 |
| **4.7 Predicted Effect of OREI on traffic and Interactive Boundaries –** where appropriate, the following should be determined: | | |
| a. The safe distance between a shipping route and OREI boundaries. | ✓ | Section 5.2. |
| b. The width of a corridor between sites or OREIs to allow safe passage of shipping. | ✓ | Section 5.2. |
| **4.8. OREI Structures – the following should be determined:** | | |
| a. Whether any feature of the OREI, including auxiliary platforms outside the main generator site, mooring and anchoring systems, inter-device and export cabling could pose any type of difficulty or danger to vessels underway, performing normal operations, including fishing, anchoring and emergency response. | ✓ | Section 5 considers impacts to navigation. Specifically, impacts to fishing and recreational activity are considered in Section 5.10. |

| MGN Section | Yes/No | Comments |
|---|---|---|
| b. Clearances of fixed or floating wind turbine blades above the sea surface are *not less than 22 metres (*above MHWS for fixed). Floating turbines allow for degrees of motion. | ✓ | The project does not include any wind turbines. A description of the devices is provided in Section 2. |
| c. Underwater devices<br>i. changes to charted depth<br>ii. maximum height above seabed<br>iii. Under Keel Clearance | <br>✓<br>✓<br>✓ | A description of the project and mooring system is provided in Section 2. |
| d. Whether structure block or hinder the view of other vessels or other navigational features. | ✓ | Impacts on visual navigation and collision avoidance are considered within Section 5.4. |
| **4.9 The Effect of Tides, Tidal Streams and Weather:** It should be determined whether: | | |
| a. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| b. The set and rate of the tidal stream, at any state of the tide, has a significant affect on vessels in the area of the OREI site. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| d. The set is across the major axis of the layout at any time, and, if so, at what rate. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| e. In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream, including unpowered vessels and small, low speed craft. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| f. The structures themselves could cause changes in the set and rate of the tidal stream. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |

| MGN Section | Yes/No | Comments |
|---|---|---|
| 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 wind farm area or adjacent to the area | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| h. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to craft, including sailing vessels, which might pass in close proximity to it. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| 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. | ✓ | Impacts of the tides, tidal stream and weather are considered in Section 5.2. |
| **4.10 Assessment of Access to and Navigation Within, or Close to, an OREI**<br><br>To determine the extent to which navigation would be feasible within the OREI site itself by assessing whether: | | |
| a. Navigation within or close to the site would be safe:<br><br>i. for all vessels, or<br>ii. for specified vessel types, operations and/or sizes.<br>iii. in all directions or areas, or<br>iv. in specified directions or areas.<br>v. in specified tidal, weather or other conditions | ✓ | Impacts are discussed in Section 5 and hazards are scored in Section 6. |
| b. Navigation in and/or near the site should be prohibited or restricted:<br><br>i. for specified vessels types, operations and/or sizes.<br>ii. in respect of specific activities, | ✓ | Embedded risk controls are outlined in section 6.3. |

| MGN Section | Yes/No | Comments |
|---|---|---|
| iii. in all areas or directions, or<br>iv. in specified areas or directions, or<br>v. in specified tidal or weather conditions. | | |
| c. Where it is not feasible for vessels to access or navigate through the site it could cause navigational, safety or routeing problems for vessels operating in the area e.g. by preventing vessels from responding to calls for assistance from persons in distress | ✓ | Impacts to search and rescue are considered within Section 5.8. |
| d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered | ✓ | Impact on vessel routeing is contained in Section 5.2. |
| **4.11 Search and rescue, maritime assistance service, counter pollution and salvage incident response.** | | |
| The MCA, through HM Coastguard, is required to provide Search and Rescue and emergency response within the sea area occupied by all offshore renewable energy installations in UK waters. To ensure that such operations can be safely and effectively conducted, certain requirements must be met by developers and operators. | | |
| a. An ERCoP will be developed for the construction, operation and decommissioning phases of the OREI. | ✓ | Impacts to search and rescue are considered within Section 5.8. Embedded risk controls are outlined in section 6.3. |
| b. The MCA's guidance document *Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response* for the design, equipment and operation requirements will be followed. | ✓ | Impacts to search and rescue are considered within Section 5.8. Embedded risk controls are outlined in section 6.3. |
| c. A SAR checklist will be completed to record discussions regarding the requirements, recommendations and considerations outlined in the above document (to be agreed with MCA) | | Impacts to search and rescue are considered within Section 5.8. Embedded risk controls are outlined in section 6.3. |
| **4.12 Hydrography -** In order to establish a baseline, confirm the safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are included or acknowledged for the following stages and to MCA specifications: | | |
| i. Pre-construction: The proposed generating assets area and proposed cable route | ✓ | Embedded risk controls are outlined in section 6.3. |

| MGN Section | Yes/No | Comments |
|---|---|---|
| ii. On a pre-established periodicity during the life of the development | ✓ | Embedded risk controls are outlined in section 6.3. |
| ii. Post-construction: Cable route(s) | ✓ | Embedded risk controls are outlined in section 6.3. |
| iii. Post-decommissioning of all or part of the development: the installed generating assets area and cable route | ✓ | Embedded risk controls are outlined in section 6.3. |
| **4.13 Communications, Radar and Positioning Systems -** To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether: | | |
| a. The structures could produce radio interference such as shadowing, reflections or phase changes, and emissions with respect to any frequencies used for marine positioning, navigation and timing (PNT) or communications, including GMDSS and AIS, whether ship borne, ashore or fitted to any of the proposed structures, to:<br><br>i. Vessels operating at a safe navigational distance<br><br>ii. Vessels by the nature of their work necessarily operating at less than the safe navigational distance to the OREI, e.g. support vessels, survey vessels, SAR assets.<br><br>iii. Vessels by the nature of their work necessarily operating within the OREI. | ✓ | Impact on communications, radar and positioning systems are considered within Section 5.6. |
| b. The structures could produce radar reflections, blind spots, shadow areas or other adverse effects:<br><br>i. Vessel to vessel;<br><br>ii. Vessel to shore;<br><br>iii. VTS radar to vessel<br><br>iv. Racon to/from vessel | ✓ | Impact on communications, radar and positioning systems are considered within Section 5.6. |
| c. The structures and generators might produce sonar interference affecting fishing, industrial or military systems used in the area. | ✓ | Impact on communications, radar and positioning systems are considered within Section 5.6. |

| MGN Section | Yes/No | Comments |
|---|---|---|
| d. The site might produce acoustic noise which could mask prescribed sound signals. | ✓ | Impact on communications, radar and positioning systems are considered within Section 5.6. |
| e. Generators and the seabed cabling within the site and onshore might produce electro-magnetic fields affecting compasses and other navigation systems. | ✓ | Impact on communications, radar and positioning systems are considered within Section 5.6. |
| **4.14 Risk mitigation measures recommended for OREI during construction, operation and decommissioning.**<br><br>Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the Environmental Impact Assessment (EIA).The specific measures to be employed will be selected in consultation with the Maritime and Coastguard Agency and will be listed in the developer's Environmental Statement (ES). These will be consistent with international standards contained in, for example, the Safety of Life at Sea (SOLAS) Convention - Chapter V, IMO Resolution A.572 (14)[3] and Resolution A.671(16)[4] and **could include any or all** of the following: | | |
| i. Promulgation of information and warnings through notices to mariners and other appropriate maritime safety information (MSI) dissemination methods. | ✓ | Embedded risk controls are outlined in Section 6.3. |
| ii. Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC). | ✓ | Embedded risk controls are outlined in Section 6.3. |
| iii. Safety zones of appropriate configuration, extent and application to specified vessels[17] | ✓ | Embedded risk controls are outlined in Section 6.3. |
| iv. Designation of the site as an area to be avoided (ATBA). | ✓ | Embedded risk controls are outlined in Section 6.3. |
| v. Provision of AtoN as determined by the GLA | ✓ | Embedded risk controls are outlined in Section 6.3. |
| vi. Implementation of routeing measures within or near to the development. | ✓ | Embedded risk controls are outlined in Section 6.3. |
| vii. Monitoring by radar, AIS, CCTV or other agreed means | ✓ | Embedded risk controls are outlined in Section 6.3. |
| viii. Appropriate means for OREI operators to notify, and provide | ✓ | Embedded risk controls are outlined in Section 6.3. |

[17] As per SI 2007 No 1948 "The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007.

| MGN Section | Yes/No | Comments |
|---|---|---|
| evidence of, the infringement of safety zones. | | |
| ix. Creation of an Emergency Response Cooperation Plan with the MCA's Search and Rescue Branch for the construction phase onwards. | ✓ | Embedded risk controls are outlined in Section 6.3. |
| x. Use of guard vessels, where appropriate | ✓ | Embedded risk controls are outlined in Section 6.3. |
| xi. Update NRAs every two years e.g. at testing sites. | | Embedded risk controls are outlined in Section 6.3. |
| xii. Device-specific or array-specific NRAs | ✓ | Full NRA is contained in Section 6. |
| xiii. Design of OREI structures to minimise risk to contacting vessels or craft | ✓ | Embedded risk controls are outlined in Section 6.3. |
| xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders. | ✓ | Embedded risk controls are outlined in Section 6.3. |

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