# Islay Community Demonstration

# Environmental Management Plan (EMP)

**Final**

**P981 – November 2021**

**Issued by Aquatera Ltd on behalf of**

Flex Marine Power

ISO 9001 CERTIFIED

UKAS MANAGEMENT SYSTEMS 8289

British Assessment Bureau

www.aquatera.co.uk

This report was completed for:


Flex Marine Power Ltd
91 Clober Road
Glasgow
G62 7LS
Scotland

Contact: Mark Spybey
Tel: [Redacted]
Email: mark.spybey@flexmarinepower.com


This report was completed by:


Aquatera Ltd
Old Academy Business Centre
Stromness
Orkney
KW16 3AW

Contact: Shane Quill
Tel: 01856 850 088
Email: shane.quill@aquatera.co.uk


**Issue record**

| Version | Date | Details |
|---|---|---|
| 001 | 26 Nov 21 | Draft issued to FMP |
| 002 | 30 Nov 21 | Final issue |
| | | |
| | | |

Members of:

OREF ORKNEY RENEWABLE ENERGY FORUM
ADEMAR
poet PACIFIC OCEAN ENERGY TRUST
APPA Asociación de Empresas de Energías Renovables
SCOTTISH Hydrogen & Fuel Cell ASSOCIATION
AUSTRALIAN OCEAN ENERGY GROUP

# Contents

CONTENTS ..... II
LIST OF FIGURES ..... III
LIST OF TABLES ..... III
1 INTRODUCTION ..... 1
1.1 BACKGROUND ..... 1
1.2 CONTENTS OF THE EMP ..... 1
2 CONSTRUCTION METHOD STATEMENT ..... 2
2.1 PROJECT OVERVIEW ..... 2
2.2 PROJECT LOCATION ..... 2
2.3 PROJECT SCHEDULE, TIMINGS AND COMMENCEMENT DATES ..... 3
2.4 TECHNICAL DESCRIPTION OF COMPONENTS ..... 4
2.5 OPERATIONAL PLANS AND METHODOLOGIES ..... 8
3 ENVIRONMENTAL ASSESSMENT AND MANAGEMENT PLAN ..... 12
4 REFERENCES ..... 21
5 APPENDICES ..... 22
APPENDIX A VESSEL MANAGEMENT PLAN (VMP) ..... 22
APPENDIX B NAVIGATIONAL RISK ASSESSMENT ..... 24
APPENDIX C NAVIGATION AND LIGHTING PLAN ..... 25
APPENDIX D BIOSECURITY AND MARINE INVASIVE NON-NATIVE SPECIES ("INNS") PLAN ..... 26
APPENDIX E PROJECT ENVIRONMENTAL MONITORING PLAN (PEMP) ..... 30
APPENDIX F COMMITMENTS TABLE/REGISTER ..... 31
APPENDIX G GCCM CONCRETE CASING SPEC ..... 32
APPENDIX H RELEVANT MARINE LICENCE CONDITIONS ..... 33

# List of Figures


Figure 2.1 Proposed licence and deployment area at Test Site ..... 2
Figure 2.2 Turbine System in the water column ..... 4
Figure 2.3 SwimmerTurbine™ ..... 5
Figure 2.4 Surface marker buoy and dry equipment capsule (Strangford, NI 2020) . 6
Figure 2.5 Cable with protection cross section ..... 7
Figure 2.6 Representative image of the onshore isocube ..... 7
Figure 2.7 Example vessel of Multi Cat used for deployment in Strangford, NI ..... 9
Figure 2.8 Example vessel of RHIB ..... 9


# List of Tables


Table 2.1 Coordinates of licence boundary ..... 3
Table 2.2 Key dimensions of the SwimmerTurbine™ ..... 5
Table 2.3 Key Components and Materials ..... 8
Table 2.4 Vessels utilised for installation ..... 8
Table 2.5 SwimmerTurbine™ operational parameters ..... 10
Table 3.1 Residual effects and mitigation measures ..... 13

# 1 INTRODUCTION

## 1.1 BACKGROUND

Flex Marine Power Ltd (FMP) are a tidal technology developer based in Scotland (www.flexmarinepower.com). FMP, in association with the Islay Energy Trust, propose to install a single 50kW SwimmerTurbine™ in the Sound of Islay, Scotland, with the power being transmitted to Islay for private connection. A key objective of the project is to demonstrate FMP's core model of delivering technology and methods which safely integrate with local skills and infrastructure.

The technology has undergone a number of scaled-up trials, including in collaboration with Queens University at Strangford Lough, NI. The project has been awarded funding to deploy a full-scale device as a demonstrator of community cooperation.

Following on from the successful trials at Strangford Lough tidal site, FMP were awarded funding from the UK government via InnovateUK, in order to deliver and deploy with a first customer, a single unit of the small community-focused tidal turbine technology. In this regard, FMP has built a strong relationship with the community on Islay and has signed a Memorandum of Understanding with Islay Energy Trust, to install the first turbine in this location.

This Islay Community Demonstration project will be a key step in demonstrating FMP's core model of delivering technology and methods which safely integrate with local skills and infrastructure. Achieving this deployment with a first customer will mark a significant step toward realising the potential of small-scale community-owned tidal energy.

This Environmental Management Plan (EMP) has been produced to support a Marine Licence application under Part 4, Section 54 of the Marine (Scotland) Act 2010 for this deployment. This should be read in conjunction with the Project Environmental Monitoring Plan (PEMP) (see Appendix E).

Table 3.1 presents the results from the environmental assessment of the Project; a process which draws together, in a systematic way, an assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope for reducing any adverse effects through mitigation, are fully understood by the public and the competent authority. This was informed by formal feedback from Marine Scotland and NatureScot to FMP dated 13 October 2021.

## 1.2 CONTENTS OF THE EMP

The EMP details the proposed mitigation and management measures for all stages of the project including installation/construction, operation and maintenance (O&M) and decommissioning.

FMP are committed to updating and improving this EMP through consultation and as more data, information and experience is gathered. In addition, they are committed to working closely with stakeholders and other developers to ensure that all mitigation and management activities are conducted in line with best practice and best available knowledge at all times. FMP will also strive to actively engage with other developers and stakeholders to address the key issues and uncertainties, and maximise opportunities associated with tidal energy development through targeted strategic research initiatives.

# 2 CONSTRUCTION METHOD STATEMENT

## 2.1 PROJECT OVERVIEW

The following activities are proposed:

- Construction and installation;
- Operation and maintenance; and
- Decommissioning/final removal of all equipment.

## 2.2 PROJECT LOCATION

The turbine system will be installed in the southern end of the Sound of Islay (See Figure 2.1). The licence boundary required for installation of the device is specified in Table 2.1. The precise location of the device and anchors (within the licence boundary provided) will be determined prior to anchor installation and will be confirmed (post-installation) with Marine Scotland Licensing Operations Team (MS-LOT) upon submission of the formal Table of Deposits (Form FEP5). This flexibility in the installation location is required to ensure that no obstructions exist in proximity of the anchoring locations on the seabed.

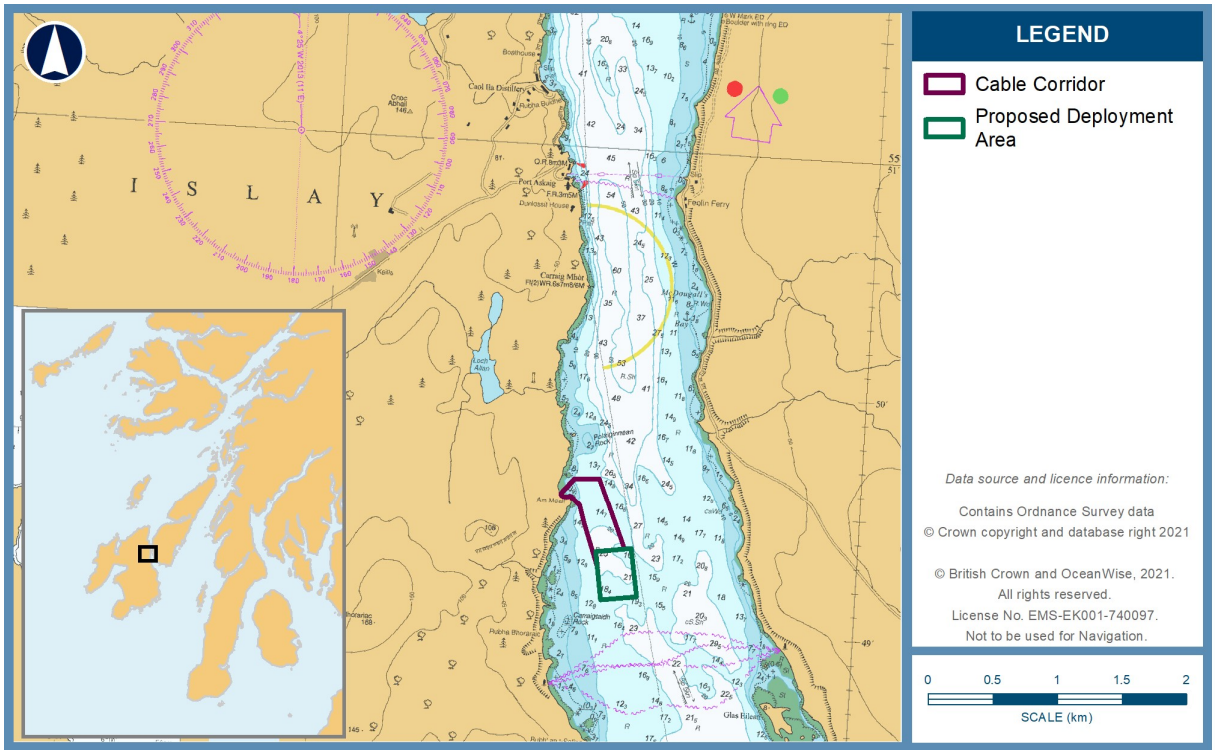



**Figure 2.1 Proposed licence and deployment area at Test Site**

**Table 2.1 Coordinates of licence boundary**

| Area | Latitude | Longitude |
|---|---|---|
| **Deployment Area** | | |
| **NW** | **55°49.314'N** | **6°5.940'W** |
| **NE** | **55°49.337'N** | **6°5.679'W** |
| **SE** | **55°49.137'N** | **6°5.618'W** |
| **SW** | **55°49.116'N** | **6°5.882'W** |
| | | |
| **Cable Corridor** | | |
| **1** | **55°49.248'N** | **6°5.921'W** |
| **2** | **55°49.314'N** | **6°5.940'W** |
| **3** | **55°49.332'N** | **6°5.727'W** |
| **4** | **55°49.620'N** | **6°5.944'W** |
| **5** | **55°49.614'N** | **6°6.126'W** |
| **6** | **55°49.548'N** | **6°6.224'W** |
| **7** | **55°49.546'N** | **6°6.221'W** |
| **8** | **55°49.543'N** | **6°6.215'W** |
| **9** | **55°49.540'N** | **6°6.208'W** |
| **10** | **55°49.537'N** | **6°6.200'W** |
| **11** | **55°49.535'N** | **6°6.179'W** |
| **12** | **55°49.538'N** | **6°6.170'W** |
| **13** | **55°49.540'N** | **6°6.155'W** |
| **14** | **55°49.538'N** | **6°6.147'W** |
| **15** | **55°49.533'N** | **6°6.141'W** |
| **16** | **55°49.534'N** | **6°6.136'W** |
| **17** | **55°49.506'N** | **6°6.081'W** |

## 2.3 PROJECT SCHEDULE, TIMINGS AND COMMENCEMENT DATES

The anticipated date of installation of the SwimmerTurbine™ and its associated mooring system is the beginning of May 2022. The operational period is anticipated to last approximately 5 years up to the end of May 2027. Thereafter, all equipment will be completely removed from site. A draft decommissioning plan will accompany the Marine Licence application.

## 2.4 TECHNICAL DESCRIPTION OF COMPONENTS

The project includes the following key technical components:

- Turbine;
- Surface Marker Buoy and Ancillary Equipment;
- Mooring and Anchor System; and
- Umbilical.

The turbine system as it will sit in the water column is illustrated in Figure 2.2.

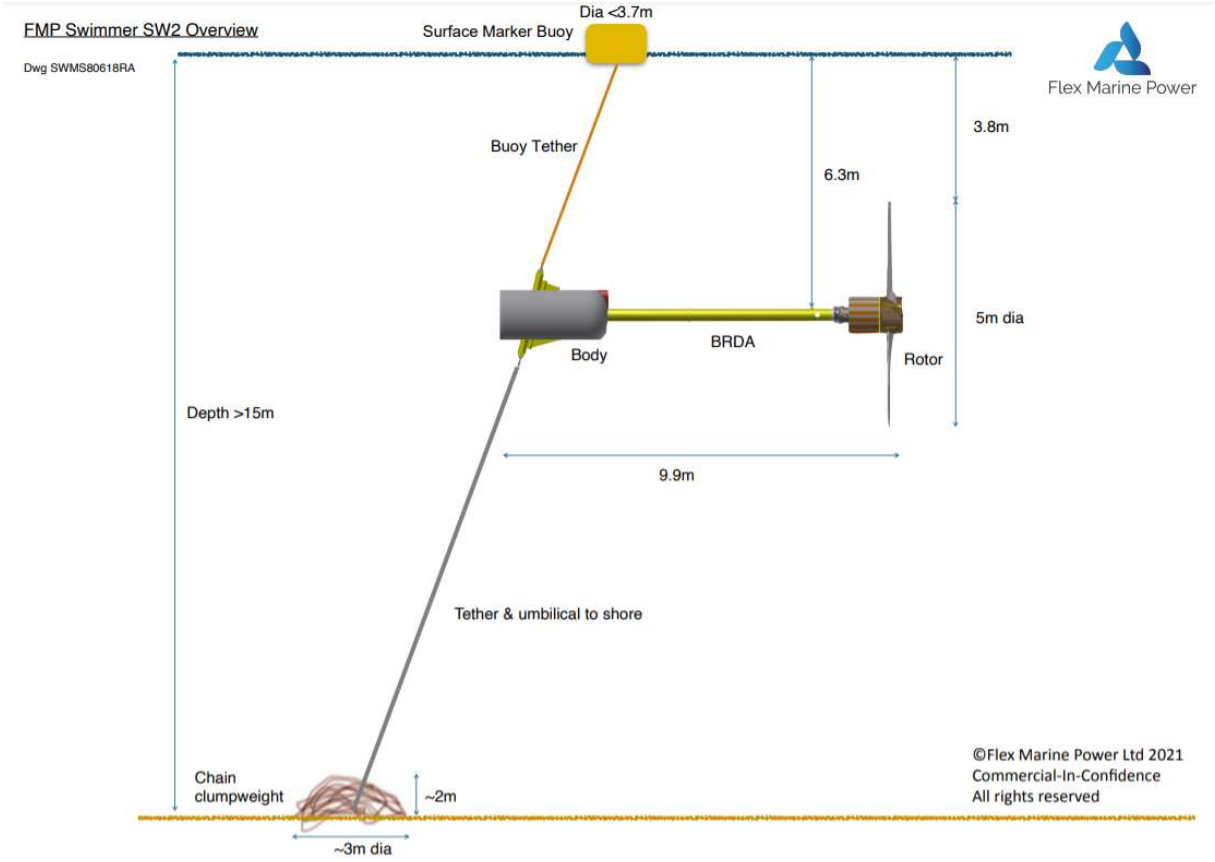



**Figure 2.2 Turbine System in the water column**

Each key component is described in the following sections.

### Turbine

The turbine comprises 2 hollow fibreglass blades attached to a steel hub and nacelle which houses the electrical and monitoring equipment within a dry equipment capsule, and connects to a tubular mooring connection structure. The anchor connects to the seabed. The mooring runs from the anchor to a steel assembly which comprises a steel float (Body) to hold the mooring up, plus the Buoyant Rotor Drive Assembly (BRDA). The turbine rotates and is mounted on the end of the protruding BRDA tube of the steel assembly. The BRDA comprises carbon steel with 8mm wall thickness and 273mm diameter. The turbine has a powertrain within its nacelle, which is connected to the shore via an umbilical

routed down the mooring. As the turbine rotates it generates electricity which is sent to the shore via the umbilical. The rotor diameter is 5m (a 3.28m rotor will be used for the commissioning phase as part of a gradual step-up of operations). The blade and hub components are illustrated in Figure 2.3. The rotor swept area is approximately 20m$^2$.

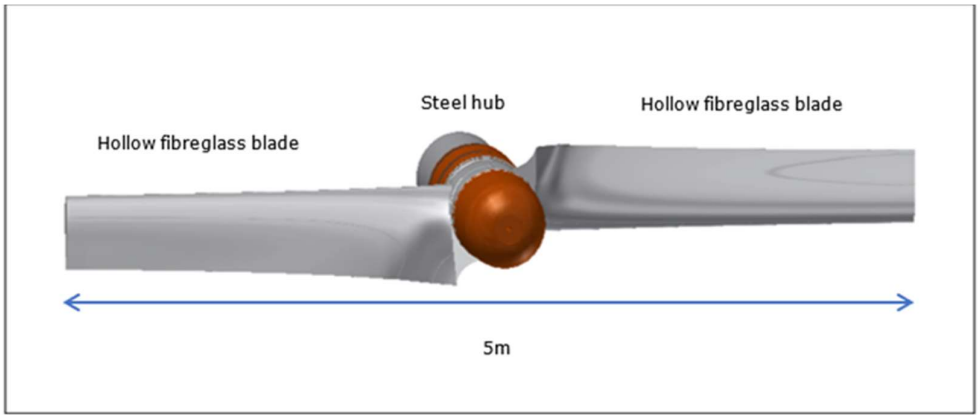



**Figure 2.3 SwimmerTurbine™**

The key dimensions of the turbine are outlined in Table 2.2.

**Table 2.2 Key dimensions of the SwimmerTurbine™**

| Dimension | Units | Value |
|---|---|---|
| Length | m | 9.9 |
| Rotor diameter | m | 5.0 |

## Surface Marker Buoy and Ancillary Equipment

The Surface Marker Buoy is connected to the Body by the Buoy Tether. The Buoy Tether is designed to remain taut; it is approximately 32mm in diameter. Lighting and marker requirements have been determined via consultation with the Northern Lighthouse Board (NLB) and are specified in Appendix C.

For our deployment at Strangford Narrows in 2020, a dry equipment capsule was secured atop the Surface Marker Buoy. The watertight equipment capsule housed various electrical and other equipment in a dry environment. The capsule dimensions were a 2m x 2m x 2m cube. Equipment housed within the capsule was a 55kW generator, various electrical and comms equipment, high pressure hydraulic and control equipment. A PLC unit receiving comms signal via a data connection and with attached low voltage electrical sensors and control actuators controlled the machine and communicated data to the shore.

The hydraulic equipment comprises piping, manifolds, connectors, valving and sensors. A rotary hydraulically actuated brake and bearing assembly supports and stops the rotor.

Also included are various small batteries, a small backup generator, hydraulic oil and compressed air.

An illustration of the surface marker buoy and associated equipment capsule as deployed in Strangford NI in 2020 is provided in Figure 2.4.

**Figure 2.4 Surface marker buoy and dry equipment capsule (Strangford, NI 2020)**

Flex Marine Power are currently updating the design such that a portion of the power and control unit which was located in the above dry equipment capsule will be located into the nacelle and a portion into the onshore iso-cube box. The basic functionality of the Surface Marker Buoy will remain the same, as a surface marker with navigation and lighting requirements.

### Mooring and Anchor System

The device is mid-water buoyant, attached to a mooring cable which will be steel rope of approximately 38mm diameter. The mooring cable is attached to a single gravity anchor at the seabed. This allows the turbine to yaw into the direction of the tidal current.

The seabed attachment proposed is a clump weight anchor made up approximately 56mm diameter steel chain and will also incorporate a cast iron sinker of approximately 3tonnes, a recovery chain and cable laid on the seabed, and may be additionally secured by a side anchor within the licence area (approximately 1 tonne). The function of the sinker is to provide a base mass and attachment point for the clump. It will be an Admiralty sinker made of cast iron and weighs approximately 3 tonnes and has a mooring attachment ring on the top. The chain clump comprises up to 45 tonnes of recycled chain and forms a clump approximately 3 meters in diameter and 2 meters high when sitting on the seabed. No drilling, concrete or any seabed modification is required for its installation.

### Umbilical

A 55kW generator connected via attached 3-phase cabling and connectors generates the electrical power. This includes a fibre optic cable as well as auxiliary power and hydraulic return lines. Electricity is generated at the machine at 400-690v and exported to the shore along an armoured umbilical laid along the seabed following the natural contours to reduce potential for movement. The cable has an earthed screen to prevent EMF release into the environment. The umbilical is clad in an 8 - 16mm thick layer of underwater setting BBA certified concrete. This provides a layer of amour protection and also stabilises the umbilical on the seabed. A specialist high early strength concrete with a limited alkaline reserve is used. The manufacturers specification is included in Appendix G. The cable is secured by virtue of this concrete cladding which makes it stiff and resistant to movement. This provides protection in the near shore zone. A cross-section of the proposed cable and protection is illustrated in Figure 2.5.

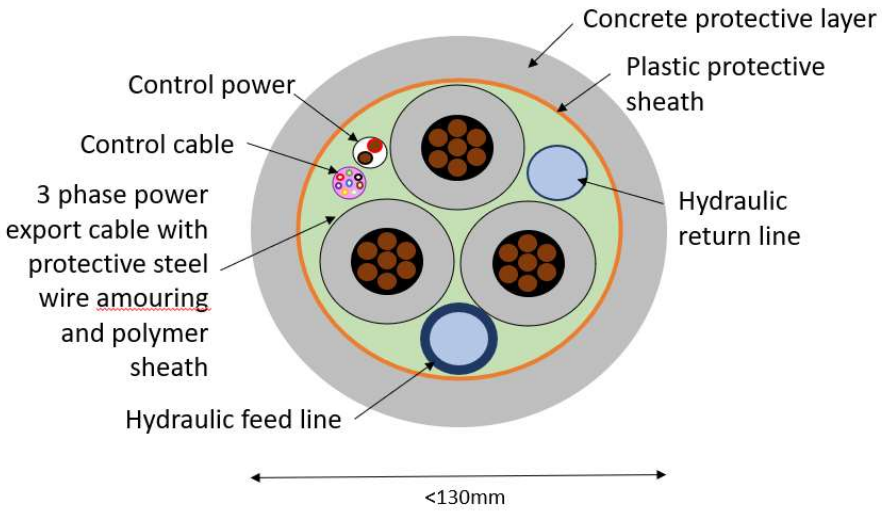



**Figure 2.5 Cable with protection cross section**

## Landfall and Onshore infrastructure

Permission is being requested from Dunlossit Estate to site a single iso-cube box (2.5m x 2.6m x 2.6m) just behind the beach, clad in wood to fit in with the natural environment – the appearance being much like a modest garden shed (see Figure 2.6). The box will sit on top of 4 x 30cm posts, to which it will be securely bolted. No civil works will be required. A fence will be erected to maintain a 2m gap around the box. A separate onshore planning application process is currently underway with Argyll and Bute Council.

**Figure 2.6 Representative image of the onshore isocube**

Table 2.3 outlines all key components and materials that comprise the overall system for deployment.

**Table 2.3 Key Components and Materials**

| Component | Type of Deposit | Nature of Deposit (P = Permanent, T = Temporary) | Deposit Quantity (Tonnes, $m^3$, etc.) |
|---|---|---|---|
| Rotor and nacelle | Steel, paint, polymer, rubber, 10 litre biodegradable oil, Aluminium, zinc | P | Up to 2 tonnes |
| Mooring System | Steel, polymer, zinc | P | Up to 2 tonnes |
| Anchor System | Steel/Cast Iron | P | Up to 50 tonnes |
| Umbilical | Copper, polymer, steel | P | Approximately 1000 m |
| Umbilical protection | Concrete | P | Up to 8 $m^3$ |
| Surface Marker Buoy | Steel, polymer composite | P | Up to 7 tonnes |
| Body and BRDA | Steel, rubber, composite polymer, zinc, lead | P | Up to 6 tonnes |
| **Other (please detail below):**<br>• Up to 90 liters biodegradable hydraulic oil<br>• Up to 10 liters compressed air<br>• Shoreside batteries and backup power diesel<br>• Subsea small backup battery<br>• Rubber fenders<br>• Generator copper coils and magnets<br>• Hydraulic seal rubber<br>• Brake pads<br>• Electrical circuitry<br>• Foul release coating | | | |

## 2.5 OPERATIONAL PLANS AND METHODOLOGIES

### 2.5.1 Construction and Installation

The vessel spread required for installation is shown in Table 2.4. Further details of the vessels likely to be used for the deployment are provided in the Vessel Management Plan in Appendix A.

**Table 2.4 Vessels utilised for installation**

| Vessel Type | Task |
|---|---|
| Multi Cat (x1) | Anchor and Mooring installation/removal.<br>Device installation and removal. |
| Rigid Hulled Inflatable Boat (RHIB) (x1) | At-sea visual inspection.<br>Safety boat |

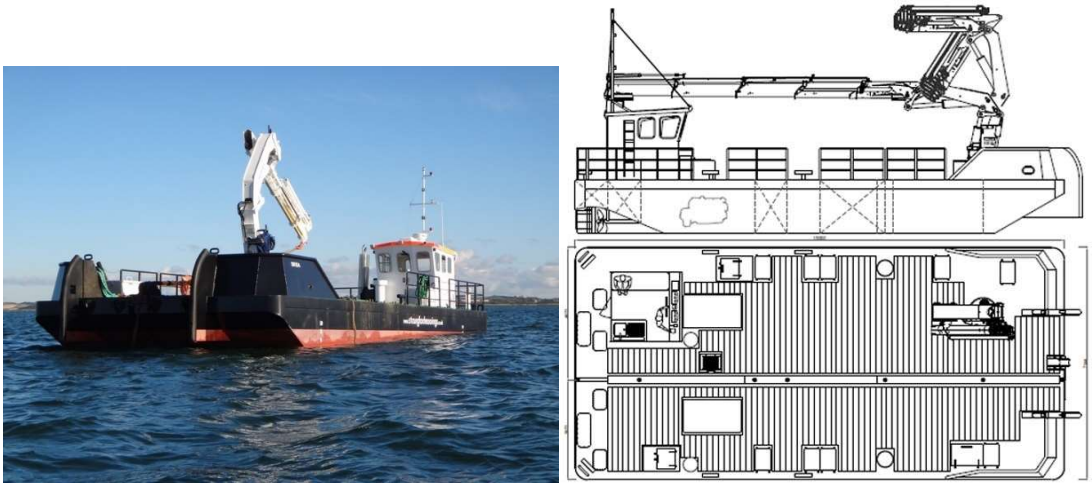


**Figure 2.7 Example vessel of Multi Cat used for deployment in Strangford, NI**


**Figure 2.8 Example vessel of RHIB**

The installation process for the full-scale SwimmerTurbine™ with all anchors and moorings was successfully demonstrated at Strangford Narrows (NI) during 2020 using a Multi Cat vessel operating during slack water periods, and the same approach will be adopted for this project. Key steps will be:

- Establish onshore infrastructure (equipment cabin can be transported via road to Port Askaig and onwards by sea and lifted into position on level ground without requiring prior groundworks) (1 day);
- Carry the gravity clump weight and other mooring components on the multicat vessel to site; lift and lower into the water using the vessel's winch/crane (this mooring installation operation is undertaken during a number of slack water intervals over a period of 3-4 days depending on sea conditions);
- Tow/carry Surface Marker Buoy, Buoy Tether and Turbine Assembly to site and install at the mooring (1 day); and
- Lay seabed umbilical from turbine site to onshore infrastructure (for minimal seabed disturbance this will be a gravity-retained reeled cable lay operation) (1 day).

The total time for installation is expected to be approximately 7 days (subject to weather conditions).

The cable will be laid using the same multi-cat vessel. The cable is transported to site wound on a drum on deck and reeled over the side as the vessel moves from the machine towards the shore. Positioning of the cable on the seabed may be assisted by an ROV if required and it will be held in place by natural seabed features and its concrete casing which allows the cable to mould to the seabed and then sets rigid making it almost impossible to move the cable without having to move the weight of its entire length - making it very stable on the seabed.

The cable will be laid up the beach utilising a RHIB for the shallow water area and the tractor for the beach area. A shallow trench will be pre-dug across the beach by the tractor where ground conditions allow; the cable will then be covered by replacing the material to achieve a discrete final positioning – ensuring safety and minimal visual impact. The cable is secured by virtue of its concrete cladding which makes it stiff and resistant to movement. This also provides added protection in the near shore zone.

The onshore isocube will be transported to site via sea from Port Askaig, offloading using a small landing craft at the beach. The box will be positioned using a tractor, also to be transported to the site via sea, and again offloading using a small landing craft at the beach.

### 2.5.2 Operations and maintenance

Maintenance offshore will be scheduled within 30-minute slack water windows. Daily maintenance visits will be required during commissioning. Weekly maintenance visits will be required during the initial 16-week period following commissioning. Maintenance visits will be monthly thereafter during normal operations.

There is also the likelihood that the turbine needs to be towed to Port Askaig for quarterly inspections and maintenance. There may also be a requirement for approximately 5 additional removal operations during early-stage operations period. If detailed maintenance/inspection work is required, it may then be removed from the water for workshop operations locally.

The SwimmerTurbine™ has been developed to allow operations and maintenance routines to be achieved locally. Control and monitoring and safety systems are built in to allow remote controlled startup, running and shutdown. The turbine can easily be raised if required to facilitate inspection or servicing. A suitably qualified local electrician will be contracted to deliver servicing of equipment in the shoreside cabin. The key operational parameters of the SwimmerTurbine™ are outlined in Table 2.5.

**Table 2.5 SwimmerTurbine™ operational parameters**

| Parameter | Metric |
|---|---|
| Rated power | 50kW |
| Rated current speed | 2.3m/s |
| Cut in current speed | 0.7m/s |
| Maximum operating speed | 3.6m/s |
| Extreme current speed | 4.3m/s |
| Maximum rotor diameter | 5m |
| Maximum tip speed | 17m/s |

### 2.5.3 Device Monitoring Systems

Outputs from the SwimmerTurbine™ will be monitored in real time using cloud-based communications. Cloud technology enables full control to be passed to a trained local operator, or offsite centralised operator, as and when required. Through the use of a GPS system, the movement of the device will be monitored, and an alert will be triggered if the system moves outside of the predefined operational area. The following device specific monitoring will be undertaken by FMP:

- The control system will have a shock sensor for the purpose of giving indication if an object strikes the device;
- Pitch and roll are monitored and accelerometers are used to identify any movement. A GPS will record location; and
- Cameras at the shoreside box will allow site monitoring by remote access when people are not present.

### 2.5.4 Decommissioning

Full decommissioning of SwimmerTurbine™ was demonstrated in 2021 at Strangford NI, using a Multi Cat operating during slack tides. Machine removal was achieved in one slack tide window. Full mooring and anchoring removal were then successfully demonstrated during two further days of vessel operations. Nothing remained on the seabed following this. The same procedure will be followed for this project. Key steps will be:

- Remove nacelle then recover cable to a vessel mounted reel, starting at the onshore site and progressing back towards the machine (1 day);
- Detach the Surface Marker Buoy and Buoy Tether; raise and unclip the Turbine Assembly from the mooring and tow/carry all items to shore (1 day);
- Recover the gravity clump weight and other mooring components over a number of slack tide windows using the vessel's winch/crane (up to 4 days); and
- Remove onshore equipment cabin and decommission any associated connection infrastructure (1 day).

Full decommissioning is expected to take no more than 7 days (subject to weather windows). A full decommissioning plan will be prepared prior to the commencement of this project, circulated for consultation, and the responses to this consultation will inform the final plan. A draft decommissioning plan will accompany the Marine Licence application.

### 2.5.5 Third Party Verification

Third Party Verification (TPV) is currently underway and being undertaken by Lloyds Register.

# 3 ENVIRONMENTAL ASSESSMENT AND MANAGEMENT PLAN

NatureScot advised during consultation that a project of this type and scale within the Sound of Islay is unlikely to raise significant natural heritage concerns given the small-scale coastal nature of the deployment, the existing knowledge of tidal turbine deployments and the natural heritage features in the Sound of Islay and the limited impact pathways. This is in accordance with previous draft guidance issued by Marine Scotland – Survey, Deploy and Monitor[1].

NatureScot also advised that baseline characterisation surveys were not needed.

The potential environmental impacts and residual effects that could arise from the Project have been considered and where appropriate, mitigation measures have been proposed (Table 3.1). Details of the environmental monitoring activities proposed for the Project are outlined in the Project Environmental Monitoring Plan (PEMP) (see Appendix E).

Information to inform a Habitats Regulations Appraisal (HRA) has been presented in a separate document that accompanies the marine licence application.

[1] https://tethys.pnnl.gov/sites/default/files/publications/Survey-Deploy-Monitor-Licensing-Policy-Guide.pdf

**Table 3.1 Residual effects and mitigation measures**

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| **All phases including construction and installation, operation and maintenance and decommissioning** | | | |
| Disturbance from support vessel activity – vessel noise and presence | Cetaceans<br>Seals<br>Basking sharks<br>Marine birds | The SwimmerTurbineTM and its mooring and anchor system, umbilical cable and surface marker buoy will be installed using one standard multi-cat work vessel, assisted by a RHIB.<br>It is anticipated that installation activities will be completed in a total of approximately seven days.<br><br>Maintenance and inspection will be performed on a daily basis during commissioning. Weekly maintenance visits will be required during the initial 16-week period following commissioning. Maintenance visits will occur monthly thereafter during normal operations. There is also the likelihood that the turbine will need to be towed to Port Askaig for quarterly inspections and maintenance. There may also be a requirement for approximately five additional removal operations during the early-stage operations period. It is possible that unplanned onsite maintenance will occur.<br><br>The deployment site is located approximately 17km from South-East Islay Skerries SAC and is therefore within the foraging range (50km) of its harbour seal feature. There are no designated seal haul-outs within the Sound of Islay.<br><br>The deployment site is located 8.6km (to the North) and 10.7km (to the East) from the Inner Hebrides and the Minches SAC designated for its harbour porpoise qualifying feature. The Sound of Islay is thought to function as a transit route for this species. | Adherence to SMWWC<br>Relevant measures from the Scottish Marine Wildlife Watching Code (SMWWC) (SNH, 2017a; SNH, 2017b) will be implemented by Flex Marine Power and all marine contractors. These will include:<br>• Speed will be reduced to 6 knots when any marine mammals or birds are sighted within or near to transit routes, where consistent with crew and navigational safety and the completion of constrained operations.<br>• A steady speed and course will be maintained where possible if a marine mammal approaches a project vessel.<br>• Care will be taken to avoid splitting up groups, or mothers and young.<br>• Minimum approach distances (as stated in the SMWWC) for vessels on approach to marine mammals and birds will be adhered to, although this may be varied according to species and circumstance. Specifics will be agreed with NatureScot and listed in the updated EMP and implemented.<br>• Sudden unpredictable changes in speed, direction and engine noise will be avoided to avoid disturbance to any marine mammals in the vicinity.<br>• Rafts of birds will not be intentionally broken up or flushed.<br>• During the seabird breeding season (April to August inclusive) vessel transit corridors will be at least 50 m from shore in the vicinity of cliff-nesting seabirds to avoid disturbance. |

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | There are no SPAs with marine bird interests present within the vicinity of the Project.<br><br>All Project vessels will use the port of Port Askaig within the Sound of Islay, which is approximately 2km to the north of the deployment site. The vessel transit route to the site is therefore a relatively short distance and does not pass through any designated sites.<br><br>Adherence to relevant measures from the Scottish Marine Wildlife Watching Code (SMWWC) which will be incorporated into the Vessel Management Plan (VMP) will ensure that no significant effects on any sensitive species are expected from this localised, low level of vessel activity. | **Vessel Management Plan**<br>A Vessel Management Plan has been developed (refer to draft VMP in Appendix A).<br>**Reporting**<br>The Vessel Management Plan will be maintained throughout the project. Any changes will be agreed in advance with Marine Scotland. |
| Introduction of marine invasive non-native species (INNS) (via vessels, device or other equipment) | Various | Vessels from Scotland or Northern Ireland will be used; therefore, there is no potential for introduction of INNS via vessels. The entire system will be assembled in Dumbarton in West Dunbartonshire, prior to transportation to Port Askaig via road. The entire system will be towed from the pier in Port Askaig to the site for final deployment using a local multi-cat vessel operator. The risk of introduction of INNS is considered to be very low and no likely significant effects are anticipated.<br><br>All maintenance will be carried out locally using a local vessel.<br><br>Decommissioning will follow the same process for installation and the same vessels likely to be employed.<br><br>Adherence to 'Check Clean Dry' principles as part of a biosecurity plan for the project will ensure that the risk | A biosecurity plan (Appendix D) incorporating the Check Clean Dry principles[2] to minimise the transfer of invasive non-native species has been submitted as part of the marine licence application. The plan includes details of biofouling management practices including the use of antifouling and/or foul-release systems and any other operational management practices to reduce the development of biofouling. |

[2] http://www.nonnativespecies.org/checkcleandry/

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | associated with the potential introduction and/or spread of INNS is minimised. | |
| Habitat creation and Fish Aggregation Device (FAD) effects due to introduction of new structures | Benthic species and habitats<br>Fish and shellfish (gadoids and crustaceans) | It is likely that fish will aggregate around the deployed system during slack water and periods of lower tidal flow.<br><br>No significant effects are anticipated from the deployment of a single tidal device of this type of this scale or its associated infrastructure/equipment. | No specific mitigation is proposed in relation to this impact during the deployment and operation of the SwimmerTurbine™ system. |
| **Construction and installation** | | | |
| Seabed disturbance from installation of the mooring system. | Benthic species and habitats<br>Demersal fish and shellfish | No drilling is proposed with respect to the mooring system installation. The anchor that will be in contact with the seabed consists of a gravity clump weight chain and cast-iron sinker which will be lowered onto the seabed. The footprint of the clump weight anchor is calculated to cover approximately 8m$^2$ at most.<br><br>The deployment site is within an area in which the priority marine feature (PMF) 'kelp and seaweed communities on sublittoral sediment' is known to occur[3].<br><br>Placement of the clump weight anchor on the seabed has the potential to cause disturbance to a relatively small area of seabed within the footprint of the anchor and immediate vicinity. All equipment will be removed from the seabed upon completion of the project.<br><br>Potential disturbance to benthic habitats and species is therefore considered to be highly localised and temporary with | No specific mitigation is proposed in relation to this impact during the deployment and operation of the SwimmerTurbine™ system. |

[3] Scottish Natural Heritage Commissioned Report No. 406 'Descriptions of Scottish Priority Marine Features (PMFs)'

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | no likely significant effects anticipated and recovery expected following removal. | |
| Underwater noise from mooring system installation leading to disturbance | Cetaceans<br>Seals<br>Basking sharks | The turbine mooring system comprises a single clump weight anchor placed on the seabed with a single mooring cable attached therefore no drilling is required to install the mooring system.<br><br>Installation of the mooring system will not result in noise that could lead to disturbance to marine mammals or basking shark. | No specific mitigation is proposed in relation to this impact during the deployment and operation of the SwimmerTurbine™ system. |
| **Operation and maintenance** | | | |
| Collision with turbine blades leading to injury or death. | Cetaceans<br>Seals<br>Basking shark | The deployment and operation of a tidal device in the water column presents a potential collision risk for marine mammals and basking sharks that may be present in the area.<br><br>During consultation, NatureScot requested that collision risk modelling be undertaken for three species of marine mammals: harbour porpoise, harbour seal and grey seal to inform the Marine Licence application process.<br>The Project comprises a single 50kW SwimmerTurbineTM tidal device which has two blades with a rotor diameter of 5m.<br><br>Collision risk modelling was undertaken by Natural Power, in accordance with NatureScot guidance4 (Marine Mammal Collision Risk Modelling Sound of Islay, Natural Power Nov 2021)<br>The predicted annual collision rate for each species using a 98% avoidance rate is: | The predicted collision risk estimates for this Project are very low for the three species assessed with no adverse effects on the species populations.<br><br>FMP acknowledge that monitoring and analysis to date has not yet reached a level to completely reduce uncertainty around this perceived risk and are therefore keen to engage in strategic research projects to collect data and information to reduce uncertainty around this issue. This could include contacting ORJIP Ocean Energy to engage the programme's Steering Group and Network to identify other/additional potential opportunities to undertake strategic research around the device. FMP would welcome any support in these endeavours from Marine Scotland and NatureScot. |

[4] https://www.nature.scot/doc/assessing-collision-risk-between-underwater-turbines-and-marine-wildlife

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | • Harbour porpoise: 0.17 (C.I: 0.05 – 0.28) collisions per year.<br>• Harbour seal: 0.07 (C.I: 0.04 – 0.13) collisions per year.<br>• Grey seal: 0.04 (C.I: 0.01 – 0.07) collisions per year.<br><br>For harbour porpoise, the site lies within the West Scotland cetacean Management Unit (MU). The population estimate for harbour porpoise within the West Scotland MU is 28,936 (21,140 – 39,608) (IAMMWG, 2021). The predicted collision risk for harbour porpoise (0.17 fatalities per year for the 5m diameter rotor) would represent 0.0006 % of the total population within the West Scotland MU.<br><br>For harbour seal, the predicted collision risk (0.07 harbour seals for the 5 m diameter rotor) constitutes just 0.007 % of the allowable take suggested by the Potential Biological Removal (PBR) value (936; SCOS, 2020).<br><br>For grey seal the predicted collision (0.04 grey seals for the 5m diameter rotor) constitutes just 0.004 % of the allowable take suggested by the PBR (966; SCOS, 2020).<br><br>The percentage of the reference population estimated for harbour porpoises and percentage of PBR levels for seal species which have the potential for collision is less than 1% for the three species assessed. Therefore, collision risk is unlikely to have an adverse effect on the species populations.<br><br>Other species of cetaceans such as minke whale may also be present occasionally within Sound of Islay and basking sharks may occasionally be present during the summer months. However, the risk of collision from deployment of a single | |

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | small-scale tidal turbine at this coastal location is unlikely to result in significant adverse effects to these populations. | |
| Entanglement in mooring lines or cables leading to injury or death. | Cetaceans<br>Seals<br>Basking shark | The mooring system for the SwimmerTurbine™ comprises a single taut mooring line connecting the device to the clump weight anchor on the seabed and a surface buoy. The mooring line is steel rope of approximately 38mm diameter.<br><br>A study commissioned by Scottish Natural Heritage (SNH) concluded that moorings associated with marine renewable energy devices are unlikely to pose a major threat in terms of entanglement risk to cetaceans and basking sharks due to the size and mass of the moorings (Benjamins et al., 2014).<br><br>A relative risk assessment for entanglement has been undertaken as outlined in Benjamins et al., 2014. A taut mooring system with accessory buoy presents the greatest relative risk to large and medium-sized baleen whales (e.g., minke whale); moderate risk to basking shark and medium-sized cetaceans and low risk to seals and small cetaceans such as harbour porpoise. | Technical monitoring of the SwimmerTurbine™ will be undertaken for operational purposes using equipment installed on the device with outputs monitored in real time using cloud-based communications. Remote sensors on the device will be used to monitor pitch and roll and accelerometers will be used to identify any movement. Using a GPS system, the movement of the device will be monitored, and an alert will be triggered if the system moves outside of the predefined operational area.<br><br>The control system will have a shock sensor for the purpose of giving indication should an object strike the device.<br><br>These systems would allow FMP to detect any changes or failings in the moorings or any entanglement event should it occur and enable any necessary inspections or retrieval operations to be actioned as soon as possible. In the highly unlikely event that any of the key device components should become detached from their substructure, an alarm will immediately be sent to the operator on duty who will co-ordinate retrieval operations.<br><br>**Reporting**<br>Any notable events will be recorded and reported to Marine Scotland no later than 24 hours after observation. |

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| Displacement of marine mammals, basking sharks and seabirds due to the presence of the turbine system | Marine mammals, basking shark and seabirds | The introduction of new structures into the marine environment has the potential to result in displacement of marine mammals, basking sharks and seabirds from the immediate vicinity of the device and surrounding area. The overall footprint of the Project is approximately 2,330m$^2$.<br><br>The Project footprint is a relatively small area compared to the extensive area of habitat available to these wide-ranging species.<br><br>The presence and operation of a single SwimmerTurbine™ within the Sound of Islay is not anticipated to result in any likely significant effects as a result of displacement. | No specific mitigation is proposed in relation to this impact during the deployment and operation of the SwimmerTurbine™ system. |
| Underwater noise from turbine operation leading to disturbance | Cetaceans<br>Seals<br>Basking sharks | No likely significant effects on marine mammals or basking shark are anticipated from disturbance as a result of underwater noise generated by the operation of a single tidal turbine. | No specific mitigation is proposed in relation to this impact during the deployment and operation of the SwimmerTurbine™ system.<br><br>FMP are willing to engage in any strategic research initiatives recommended by Marine Scotland and NatureScot in relation to this issue. |
| Presence of turbine and associated infrastructure leading to barrier effects | Cetaceans<br>Seals<br>Basking sharks | Marine mammals and basking sharks may transit through the Sound of Islay however the presence of a single SwimmerTurbine™ and associated infrastructure is not expected to result in any significant barrier effects for marine mammals or basking sharks. | No specific mitigation is proposed in relation to this impact during the deployment and operation of the SwimmerTurbine™ system. |
| Changes to hydrodynamics and sediment regime | Hydrodynamic and physical processes | The presence of a single SwimmerTurbine™ and associated infrastructure is not expected to result in any changes that would result in likely significant effects to hydrodynamics and sediment regime. | No specific mitigation is proposed in relation to this impact during the deployment and operation of the SwimmerTurbine™ system. |

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| Electromagnetic Field (EMF) effects | Diadromous fish, marine fish and benthic species | Electricity is generated at the SwimmerTurbine™ device at 400-690v and exported to the shore along an armoured umbilical laid along the seabed. The umbilical is clad in an 8-16mm thick layer or concrete cladding.<br>The deployment and operation of a single SwimmerTurbine™ device and a single umbilical cable with concrete cladding is not anticipated to result in EMF effects that would be considered significant for any fish or benthic species present.<br>The total length of cable for the project is anticipated to be approximately 1,000m. | No specific mitigation is proposed in relation to this impact during the deployment and operation of the SwimmerTurbine™ system. |

# 4 REFERENCES

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. Scottish Natural Heritage Commissioned Report No. 791.

IAMMWG. (2021). Updated abundance estimates for cetacean Management Units in UK waters. JNCC Report No. 680, JNCC Peterborough, ISSN 0963-8091.

Marine Mammal Collision Risk Modelling Sound of Islay, Natural Power Nov 2021.

SCOS. (2020). Scientific Advice on Matters Related to the Management of Seal Populations: 2020.

Scottish Natural Heritage (2017a). The Scottish Marine Wildlife Watching Code – Part 1. Scottish Natural Heritage. Available at: https://www.nature.scot/doc/scottish-marine-wildlife-watching-code-smwwc-part-1.

Scottish Natural Heritage (2017b). A Guide to Best Practice for Watching Marine Wildlife SMWWC – Part 2. Available at: https://www.nature.scot/doc/guide-best-practice-watching-marine-wildlife-smwwc-part-2.

# 5 APPENDICES

## APPENDIX A VESSEL MANAGEMENT PLAN (VMP)

### A.1 INTRODUCTION

This VMP details the anticipated type and number of vessels that will be used during the construction and installation, maintenance and decommissioning of the SwimmerTurbine™ system and associated infrastructure at the deployment site. It also highlights the likely ports and transit routes that will be used during all phases of the deployment.

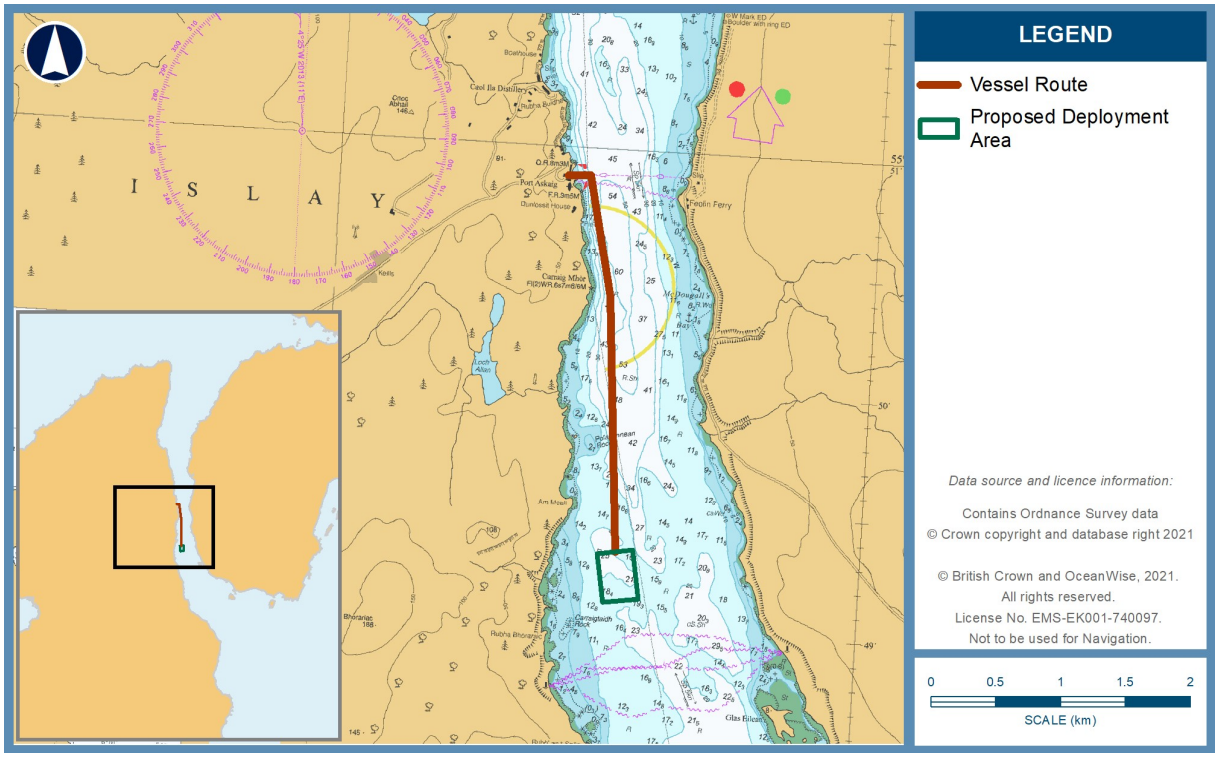
### A.2 VESSEL DETAILS

The selection and contracting of vessels is primarily driven by market conditions, vessel availability and ultimately, cost. Therefore, the actual vessels will be selected near to the time of works. The developer will confirm the project vessel spread at the earliest possible opportunity prior to works commencing as required (as per normal maintenance activities). The vessels presented in the following figures are indicative of the vessels likely to be used.

**Appendix Figure A.1 Example Multi Cat vessel**


**Appendix Figure A.2 Example Rib vessel**

## A.3 VESSEL ROUTES




**Appendix figure A.3 Transit Route**

A designated Marine Operations Manager/Marine Superintendent is responsible for the discharge of relevant licence conditions whilst at sea. This will be FMP's Jose Diaz.

# APPENDIX B NAVIGATIONAL RISK ASSESSMENT

ORCADES MARINE
Management Consultants Ltd

# Navigation Safety and Risk Assessment

Flex Marine Power

**Document Number OP 416.001**

| This report is issued to: | |
|---|---|
| **Company** | Flex Marine Power Ltd |
| **Address** | 91 Clober Road |
| | Glasgow |
| | G62 7LS |
| **Contact Name** | Mark Spybey |
| **Position** | |
| **Telephone** | [Redacted] |
| **Email** | mark.spybey@flexmarinepower.com |

| This report was issued by: | |
|---|---|
| **Company** | Orcades Marine Management Consultants Ltd. |
| **Address** | Unit 3, Warness Park |
| | Hatston Pier Road, Kirkwall |
| | KW15 1ZL |
| **Contact Name** | David Thomson |
| **Position** | Managing Director |
| **Telephone** | +44 (0) 1856 874884 |
| **Email** | david.thomson@orcadesmarine.co.uk |

| Prepared by | Checked by | Authorised by | Date |
|---|---|---|---|
| Jonathan Poynter | David Thomson | David Thomson | 17.11.2021 |
| **Revision Number** | Issue Date | Revision Details | Distribution List Index Number |
| 0.1 | | Draft | internal |
| | | | |
| | | | |
| | | | |

| Distribution List Key | | |
|---|---|---|
| **Company** | Responsible Person | Distribution List Index Number |
| Aquatera | Shane Quill | 1 |
| | | |
| | | |
| | | |

## Table of Contents

**1 Project Summary** ..... 5
**2 Risk Claim** ..... 5
**3 Description of the Marine Environment** ..... 5
**4 Description of the OREI Development and how it changes the Marine Environment** ..... 6
4.1 Under Keel Clearance ..... 8
**5 Analysis of the Marine Traffic** ..... 8
**6 Status of the Hazard and Risk Register** ..... 9
**7 Navigation Risk Assessment** ..... 10
7.1 Base Case ..... 10
7.2 Future Case ..... 10
7.3 Base Case with OREI Device Installed ..... 10
7.4 Future Case with OREI Device Installed ..... 10
7.5 Future Options ..... 11
7.6 Summary of other Navigation Safety Risks from Hazard Log & Controls. ..... 11
**8 Search and Rescue Overview and Assessment** ..... 11
**9 Emergency Response Overview and Assessment** ..... 11
**10 Major Hazards Summary** ..... 11
**11 Navigation Marking and Lighting** ..... 12
**12 Statement of Limitations** ..... 13
**13 Through Life Safety Management** ..... 13
**14 Annex A – Traffic Survey Data** ..... 13
**15 Annex B – Risk and Mitigation Register** ..... 21

Figure 3-1 Sound of Islay Admiralty Chart ..... 5
Figure 3-2 Site Location ..... 6
Figure 4-1 Profile of OREI device installed ..... 8
Figure 7-1 Location of deployment area relative to traffic routes ..... 10
Figure 11-1 Navigation buoy marking the OREI device when deployed in Strangford Loch NI ..... 13

| Table of Abbreviations | |
|---|---|
| **ALS** | Accidental Limit State |
| **BP** | Bollard Pull |
| **CD** | Chart Datum |
| **CHA** | Competent Harbour Authority |
| **DHSE Rep** | Designated Health and Safety Representative |
| **DSA** | Dynamic Systems Analysis |
| **EMEC** | European Marine Energy Centre |
| **ERP** | Emergency Response Plan |
| **ETA** | Estimated time of arrival |
| **HAT** | Highest Astronomical Tide |
| **HIRA** | Hazard Identification and Risk Assessment |
| **HSE** | Health and Safety Executive |
| **IMO** | International Maritime Organisation |
| **ISM** | International Safety Management Code |
| **KN** | Kilo Newtons |
| **KW** | Kilo Watt |
| **LAT** | Lowest Astronomical Tide |
| **LOLER** | Lifting Operations and Lifting Equipment Regulations 1998 |
| **MAIB** | Marine Accident Investigation Branch |
| **MBL** | Minimum Breaking Load |
| **MCA** | Maritime and Coastguard Agency |
| **MHWN** | Mean High Water Neaps |
| **MLWN** | Mean Low water Neaps |
| **MHWS** | Mean High Water Springs |
| **MLWS** | Mean Low Water Springs |
| **MWS** | Marine Warranty Surveyor |
| **MRCC** | Maritime Rescue Coordination Centre |
| **m/s** | Metres per second |
| **NRA** | Navigation Risk Assessment |
| **OMMC** | Orcades Marine Management Consultants Ltd |
| **OREI** | Offshore Renewable Energy Installation |
| **PTW** | Permit to Work |
| **PPE** | Personal Protective Equipment |
| **RA** | Risk Assessment |
| **RHIB** | Rigid Hull Inflatable Boat |
| **RIDDOR** | Reporting Injuries & Diseases & Dangerous Occurrences Regulations 1995 |
| **ROV** | Remotely Operated Vehicle |
| **SWL** | Safe Working Load |
| **TSS** | Traffic Separation Scheme |
| **ULS** | Ultimate Limit State |
| **WEC** | Wave Energy Converter |
| **WLL** | Working Load Limit |

# 1 Project Summary

Flex Marine Power Ltd (FMP) are a tidal technology developer based in Scotland (www.flexmarinepower.com). FMP, in association with the Islay Energy Trust, now propose to install a single 50kW SwimmerTurbine in the Sound of Islay, Scotland, with the power being transmitted to Islay for private connection. The anticipated date of installation of the SwimmerTurbine™ and its associated mooring system is the beginning of May 2022. The operational period is anticipated to last approximately 5 years up to the end of May 2027. Thereafter, all equipment will be completely removed from site. This document follows the guidance contained in MGN 654 Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response.

# 2 Risk Claim

A proportionate approach has been taken to assess the risks and preserve the safety of navigation. The developer has local stakeholder engagement and is carrying out the development in association with the local organisation, the Islay Energy Trust. This includes engagement with local fishermen and the RNLI. Traffic analysis has been undertaken over two periods of 14 days in the summer and 14 days over the winter. A Navigation Risk Assessment has been undertaken based on qualitative techniques and "expert judgement". The qualitative risk assessment has been undertaken where the initial risks are assessed as low and with further mitigations are assessed as "As Low As Reasonably Practicable" (ALARP). This development is assessed to be a "Low Risk Small Scale Development".

# 3 Description of the Marine Environment

The Islay Sound is a narrow channel between the islands of Islay and Jura, on Scotland's west coast and is used by mariners to avoid the open sea route to the west of Islay. Transit through the sound is limited by a rocky bank extending 2.5'nm in the northern entrance which has a least depth of 9.1m. It has strong tidal streams.

The tidal stream generally follows in the direction of the channel. The rates at spring tides in the area of the sound are in the order of 5kn as indicated on Admiralty Chart 2481.

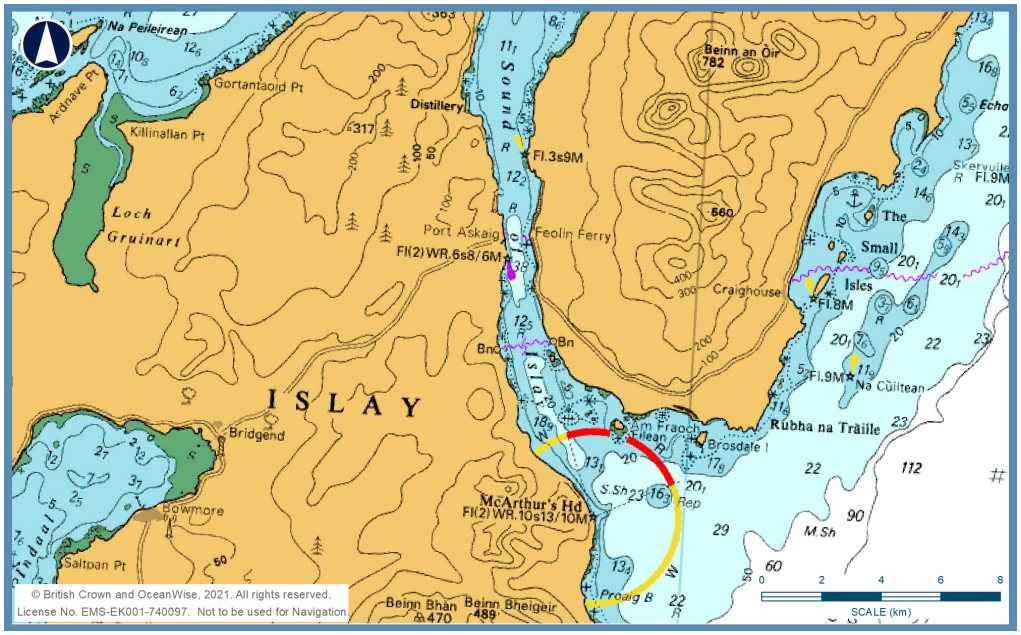



*Figure 3-1 Sound of Islay Admiralty Chart*

Admiralty Tide Tables / Admiralty TotalTideRecords tidal height data for Port Askaig indicate a mean range of 0.5m for neaps and 1.7m for springs. The height of tide in the sound is greatly affected by the wind and barometric pressure with certain conditions having the potential to raise the level by up to 1m.

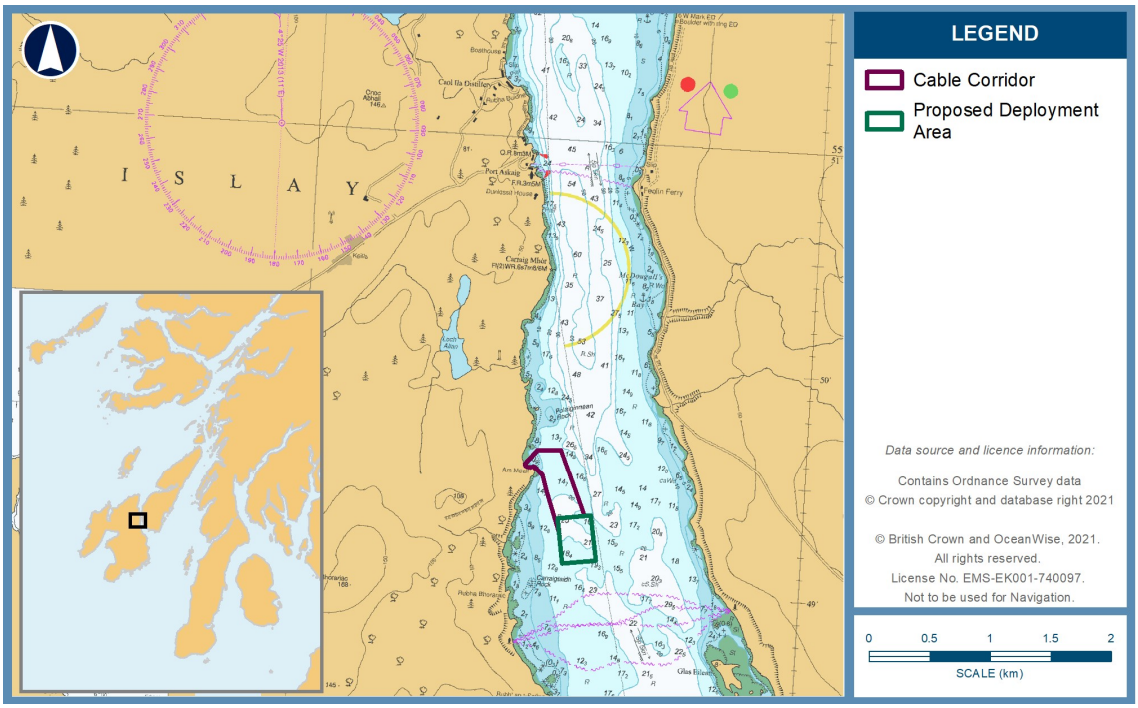



*Figure 3-2 Site Location*

*Table 1 Site Coordinates*

| Area | Latitude | Longitude |
|---|---|---|
| **Deployment Area** | | |
| **NW** | **55°49.314'N** | **6°5.940'W** |
| **NE** | **55°49.337'N** | **6°5.679'W** |
| **SE** | **55°49.137'N** | **6°5.618'W** |
| **SW** | **55°49.116'N** | **6°5.882'W** |
| | | |
| **Cable Corridor** | | |
| **1** | **55°49.25'N** | **-6°5.92'W** |
| **2** | **55°49.31'N** | **-6°5.94'W** |
| **3** | **55°49.33'N** | **-6°5.73'W** |
| **4** | **55°49.62'N** | **-6°5.94'W** |
| **5** | **55°49.61'N** | **-6°6.13'W** |
| **6** | **55°49.55'N** | **-6°6.22'W** |

| | | |
|---|---|---|
| 7 | 55°49.546'N | 6°6.221'W |
| 8 | 55°49.543'N | 6°6.215'W |
| 9 | 55°49.540'N | 6°6.208'W |
| 10 | 55°49.537'N | 6°6.200'W |
| 11 | 55°49.535'N | 6°6.179'W |
| 12 | 55°49.538'N | 6°6.170'W |
| 13 | 55°49.540'N | 6°6.155'W |
| 14 | 55°49.538'N | 6°6.147'W |
| 15 | 55°49.533'N | 6°6.141'W |
| 16 | 55°49.534'N | 6°6.136'W |
| 17 | 55°49.506'N | 6°6.081'W |

# 4 Description of the OREI Development and how it changes the Marine Environment

The device is a submerged bladed turbine held in position by a clump weight and tether. A Surface Marker Buoy is visible at the surface.

The armoured power cable runs down the tether to the seabed and then along the seabed to the shore substation. The device rotates around its anchor in response to the change of direction and speed of the tidal flow in an elliptical fashion. The footprint of the ellipse at its longest axis is approximately 70 metres in line with the tidal flow and on its shortest axis is approximately 40 metres. The OREI device will be installed by a multicat type vessel and a RHIB operating from Port Askaig. The additional risk to navigating traffic is minimal on the passage to and from the site of the intended deployment location. During the operating phase additional traffic is expected to be a weekly transit by RHIB from Port Askaig to the device. The device will create only very limited changes to the marine environment. The proposed area of deployment is situated to the west of the typical passage for vessels passing through the sound or bound for the ports within the Sound of Islay.

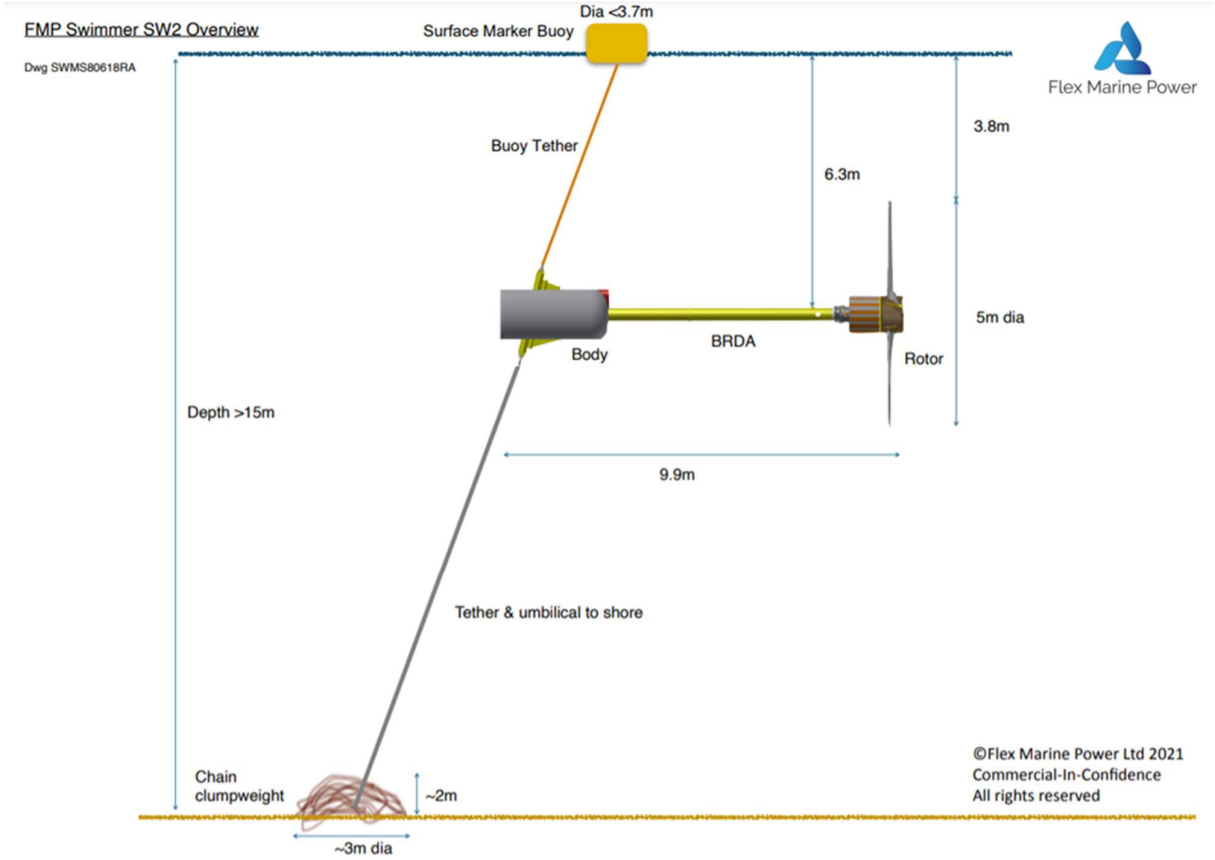



*Figure 4-1 Profile of OREI device installed*

### 4.1 Under Keel Clearance

The water depth between the extreme tip of the blade and a calm sea surface is approximately 3.8 metres when the turbine is streamed but the turbine is in close proximity to the marker buoy at all states of the tide.

## 5 Analysis of the Marine Traffic

Marine Traffic data was sourced from AIS data over two 14-day periods during winter 2020 and summer 2021. This data was compared with an analysis for the area presented in 2013 and found to be similar, thereby allowing a reasonable assumption that traffic densities and types have not changed over the intervening period and are not likely to change within the duration of the deployment period.

The most frequent use of the channel is ferry traffic running to Port Askaig, and this accounts for the majority of the passenger vessel traffic through the study area. It can be seen that there is notably more traffic during the summer period which includes the scheduled ferry service and small cruise vessels. During the winter period the traffic reduces to just the scheduled ferry service.

Cargo vessel traffic was shown to be seasonal, with slightly more traffic during the summer than the winter. Local fishing traffic may occasionally impinge on the OREI area, this is constant throughout the year.

Recreational traffic may occasionally impinge on the OREI area, this is only during the summer period.

The table below summarises the recorded AIS data into vessel categories and movements per day.

| Vessel Type | Period | | | |
|---|---|---|---|---|
| | **Summer 2021 (15th-29th Jul)** | Movements per day (appx) | **Winter 2020 (1st-15th Dec)** | Movements per day (appx) |
| **Cargo** | 26 | 1.9 | 17 | 1.1 |
| **Fishing** | 9 | 0.6 | 10 | 0.7 |
| **Other** | 3 | 0.2 | | 0.0 |
| **Passenger** | 102 | 7.3 | 62 | 4.1 |
| **Pleasure Craft** | 18 | 1.3 | | 0.0 |
| **Sailing Vessel** | 42 | 3.0 | | 0.0 |
| **Search and Rescue** | 7 | 0.5 | 3 | 0.2 |
| **Special Craft** | 7 | 0.5 | 4 | 0.3 |
| **Tug** | | 0.0 | 4 | 0.3 |
| **Unspecified** | 1 | 0.1 | | 0.0 |
| Total | | 15.4 | | 6.7 |

## 6 Status of the Hazard and Risk Register

The Hazard Risk Register will be kept as an active document amended and updated with any new hazards or changes to existing hazards to ensure that the risks remain low. The mitigations and controls will be put in place and maintained by Flex Marine Power.

A graphical representation hazard matrix is below; the ALARP level being considered a score of 9 or below.

| | CONSEQUENCE | | | | |
|---|---|---|---|---|---|
| Descriptive Word | **Minor** | **Significant** | **Moderate** | **Major** | **Catasrophic** |
| Hazard Severity | **1** | **2** | **3** | **4** | **5** |
| Actual/Potential Illness or Injury | Single First Aid | Medical attention or multiple first | LTI or multiple medical attention | Single Fatality | Multiple fatality |
| Environmental | Limited harm to the environment | Limited harm to the environment | Potential harm to employees and environment | Potential harm to employees and environment | Harms public, employees, and environment. Widespread concern of companies operations. |
| Cost of loss | <10,000 | >10,000 | >50,000 | >250,000 | >1m |
| **LIKELIHOOD** | | | | | |
| Very Unlikely | **1** | **2** | **3** | **4** | **5** |
| Unlikely | **2** | **4** | **6** | **8** | **10** |
| Possible | **3** | **6** | **9** | **12** | **15** |
| Quite Likely | **4** | **8** | **12** | **16** | **20** |
| Certain or very likely | **5** | **10** | **15** | **20** | **25** |

# 7 Navigation Risk Assessment

The routes followed by the majority of vessel traffic runs parallel and to the east of the OREI site. The closest point of approach (CPA) is approximately 250metres, which is a safe distance given the narrow confines of the passage at the OREI site.

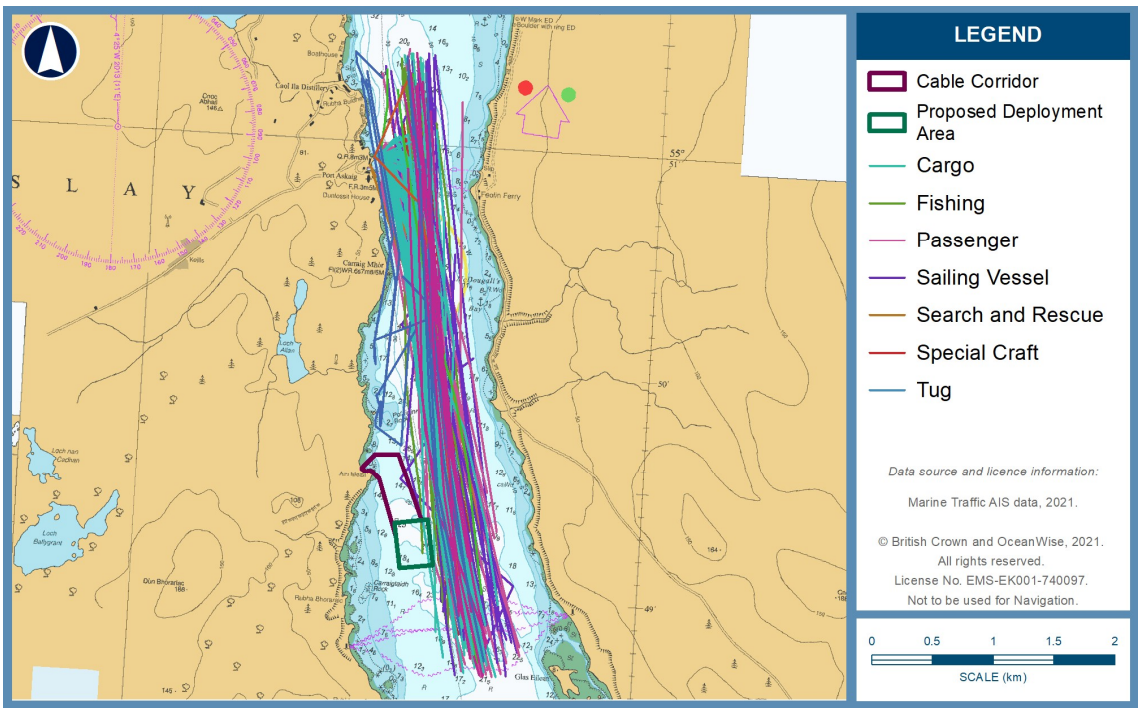



*Figure 7-1 Location of deployment area relative to traffic routes*

## 7.1 Base Case

The current risks to navigation are identified from charts and navigational publications. Vessels transiting or calling at ports in the sound should be well aware of the conditions within it.

## 7.2 Future Case

There is no indication that there are any planned, significant changes to the level and types of traffic currently experienced. Neither is it envisaged that there will be any changes to the vessel types or size. Vessel draughts are constrained by the limiting depths in the northern area of the sound.

## 7.3 Base Case with OREI Device Installed

Within the expected operation period of the OREI the impact to the navigational risk is minimal.

There is a slight increase in risk of collision associated with the use of Port Askaig as a base for project vessels. This, however, is mitigated through design and operational procedural controls.

Similarly, there is a slight increase in the risk of accidental collision or entanglement with the device by fishing or leisure vessels on passage off the normal lines of navigation, mitigated by procedural controls.

## 7.4 Future Case with OREI Device Installed

The OREI device is to be installed for a limited period. There are no expected significant changes expected in the period of deployment from that of the Base Case with the OREI in position.

### 7.5 Future Options

Should the OREI remain in service beyond the currently expected end date of May 2027, then a further projection of traffic densities may be necessary to maintain the risk register.

### 7.6 Summary of other Navigation Safety Risks from Hazard Log & Controls.

The main risks are those associated with a collision with project vessels and or OREI components with 3rd party vessels. This would most likely result in asset damage and may result in injury or fatality. As described in the risk matrix the mitigations for these are by procedural controls limiting proximity of vessels e.g., verification of vessel suitability, crew training, visibility of device, promulgation of hazard information.

## 8 Search and Rescue Overview and Assessment

The site falls within the coverage the UK Maritime Search and Rescue operational area administered by the Clyde Maritime Rescue Co-ordination Centre (MRCC) based at Greenock.

MRCC – It is not expected that the presence of the OREI will cause any difficulty to SAR Operations planning at the MRCC or additional capacity requirements.

Helicopter operations – The OREI does not present a risk to SAR helicopter operations as it is below the surface.

Port Askaig Lifeboat – The OREI presents a minor risk to the operation of the RNLI Severn Class lifeboat. The risk of collision or entanglement with the surface buoy and moorings exists; however, this is mitigated by the promulgation of notices to mariners and the surface marker buoy being marked and lit accordingly.

It is considered that the installation do not present an unacceptable risk to SAR activities above the background risks of operating in the close inshore area of Islay Sound.

## 9 Emergency Response Overview and Assessment

An Emergency Response Plan (ERP) will be prepared by Flex Marine Power or their contractors for each of the operational phases to provide a clear command and control structure and communications plan together with clear definitions of roles and responsibilities. This will cover all unplanned events including major accidents, evacuation escape and rescue and casualty evacuation.

## 10 Major Hazards Summary

An analysis of risks during installation, operation, and decommissioning phases of the OREI were considered and risks identified as tolerable or as low as reasonably practical after application of prevention measures and additional controls.

- Project vessels in transit to/from the site.
- Installation in unfavourable weather conditions.
- Project vessels on DP or a mooring system.
- Project vessels working in close proximity to the tether.
- Fishing gear/abandoned fishing gear potentially in the area.
- Uncertified equipment
- Deep drafted 3rd party vessel incompetence - for example the bridge team not sighted NTM, or does not have appropriate watch posted
- Device not visible

- Components floating free due to failure of connections during operations
- 3rd party vessel manoeuvring to avoid the device, its tether and anchoring system
- Navigation near to device
- Vessels navigating over the device, its tether, and its anchoring system
- Vessels anchoring near to site.
- Project vessels in close proximity to the device its tether and anchoring system.
- Vessels on DP when carrying out maintenance on the bottom joint or cable
- Decommissioning in unfavourable weather conditions.
- 3rd party vessels navigating close to the site
- Entanglement of tether in propeller of project vessels

## 11 Navigation Marking and Lighting

Lighting and marker requirements have been determined via previous consultations with the Northern Lighthouse Board (NLB). The buoy marking the device will be painted bright yellow and be fitted a yellow St Andrews Cross and flashing yellow light with a character not to be confused with any similar aids to navigation in the area.

There will be sufficient warning signs placed on the Surface Marker Buoy which will alert people to the need to keep clear, noting a potential underwater hazard. A Notice to Mariner will be issued to the relevant interested parties for the duration of the deployment including to UKHO so that the device can be charted. This will notify mariners of the location of the device prior to navigating in the area.

Outputs from the device will be monitored in real time using cloud-based communications. Cloud technology enables full control to be passed to a trained local operator, or offsite centralised operator, as and when required. Through the use of a GPS system, the movement of the device will be monitored, and an alert will be triggered if the system moves outside of the predefined operational area. The following device specific monitoring will be undertaken by FMP:

- The control system will have a shock sensor for the purpose of giving indication if there was a collision;
- Pitch and roll are monitored and accelerometers are used to identify any movement. A GPSwill record location.
- Cameras at the shoreside box will allow site monitoring by remote access when people are not present.

*Figure 11-1 Navigation buoy marking the OREI device when deployed in Strangford Loch NI*

## 12 Statement of Limitations

This Navigation Safety and Risk assessment is only valid on the basis of the following assumptions:

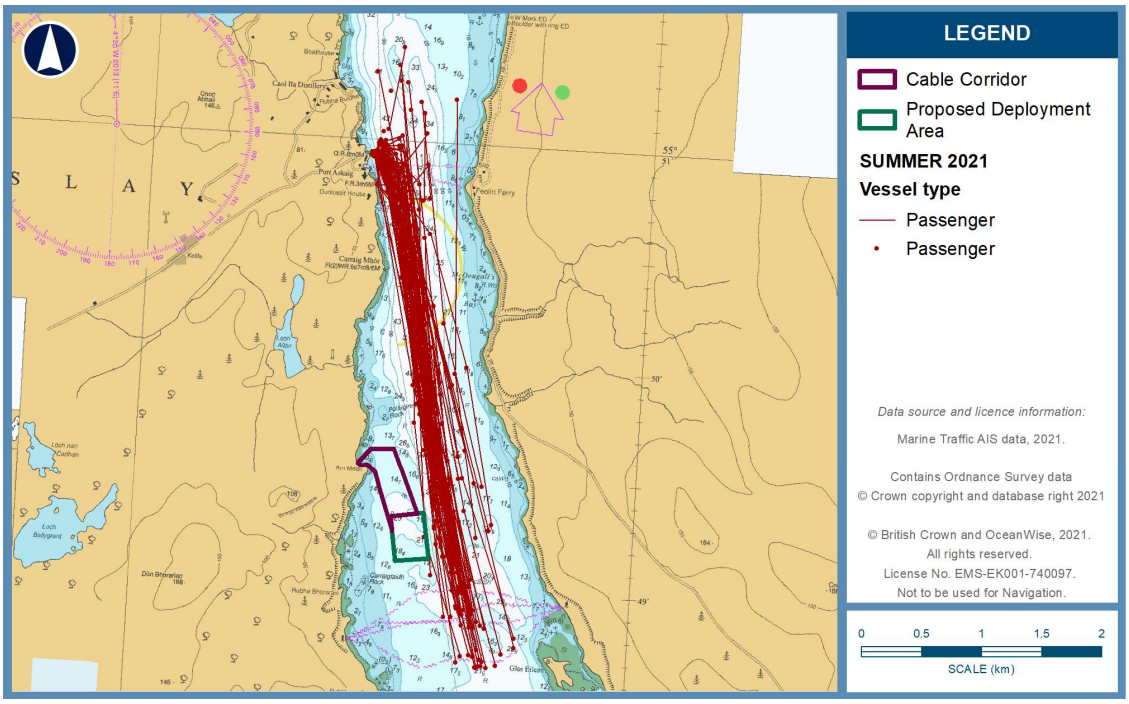
- There are no significant changes to the specifications, layout, and location of the OREI device as given in this document
- The risk register is continuously maintained and updated throughout the lifetime of the project
- The risk mitigations are applied in their entirety

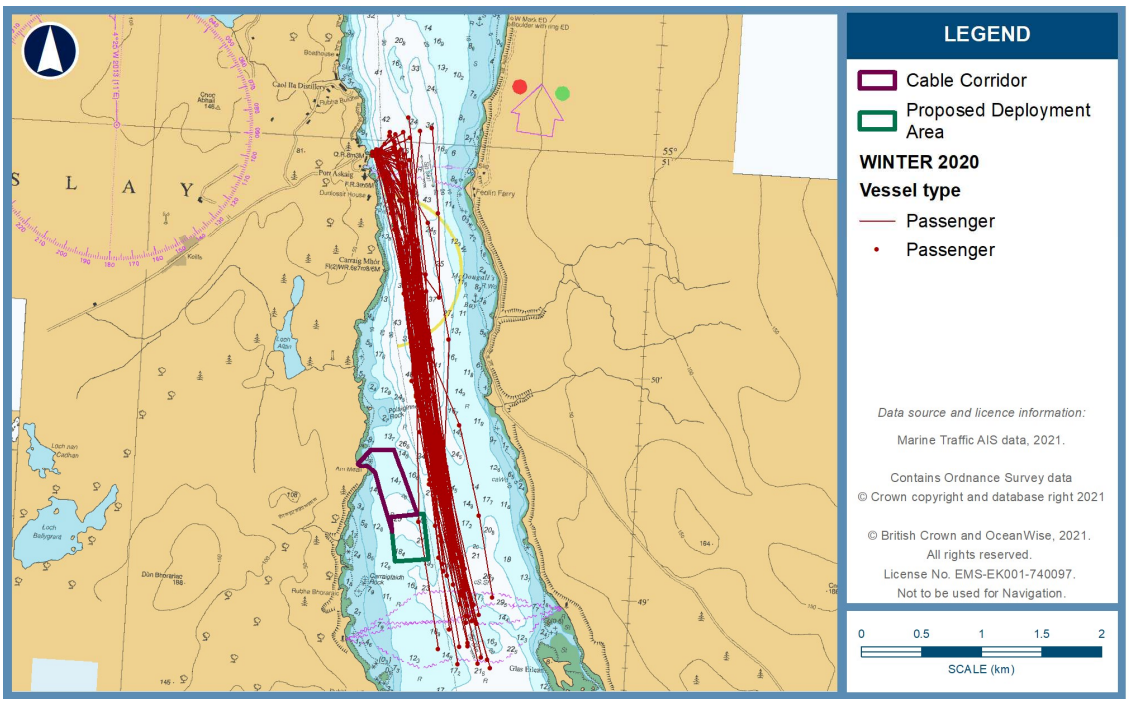
## 13 Through Life Safety Management

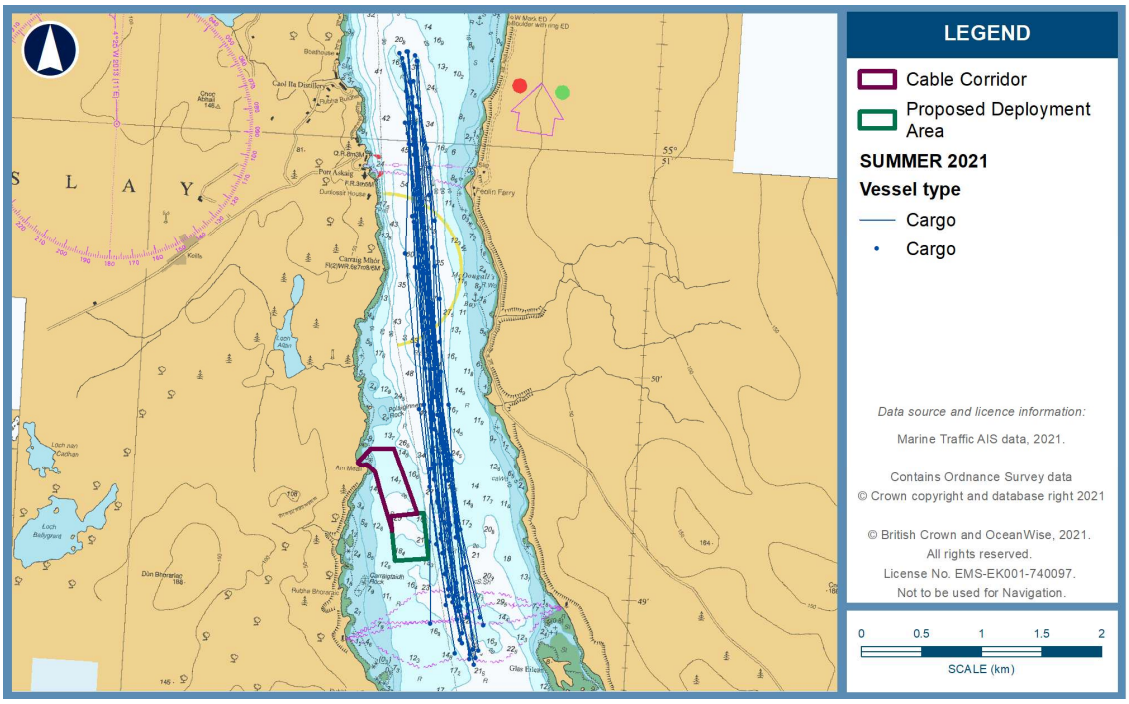
The risks identified and mitigations required to keep the risks As Low As Reasonably Practicable will be managed by the Flex Marine Power through their project safety management system which will maintain and update the Hazard Risk Register as appropriate.

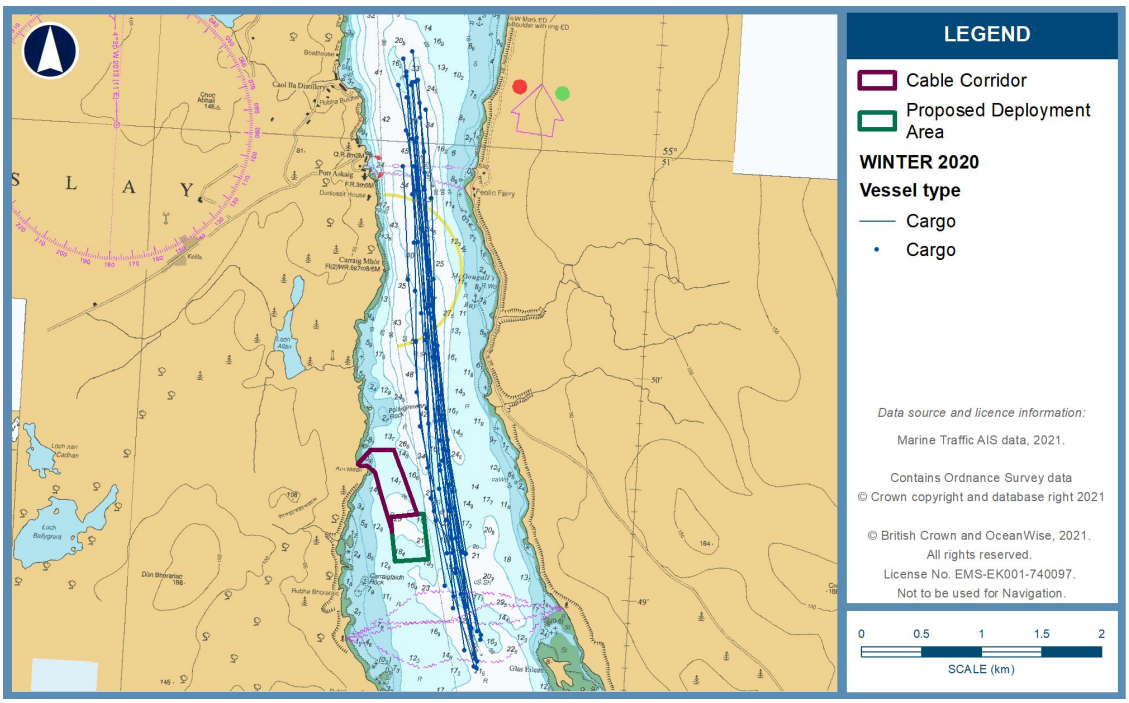
## 14 Annex A – Traffic Survey Data

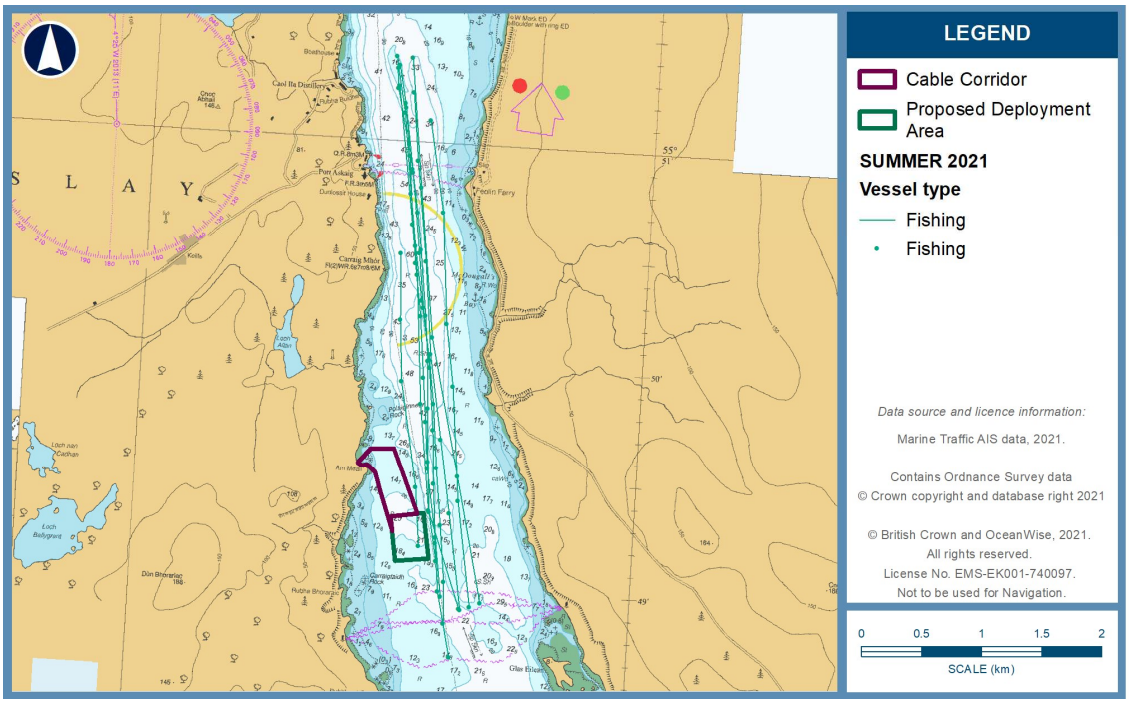
The following AIS data covers four weeks; one two week period in the summer and one two week period in the winter with vessel tracks defined by vessel type.

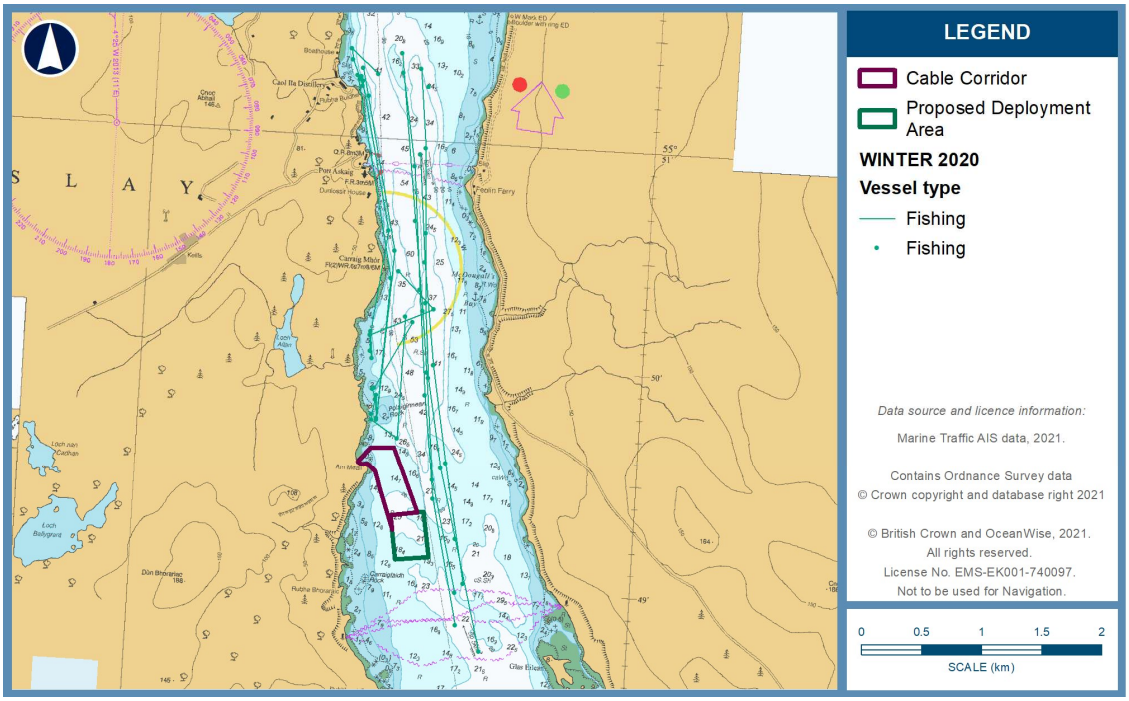

S L A Y
LEGEND
Cable Corridor
Proposed Deployment Area
SUMMER 2021
Vessel type
Passenger
Passenger
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

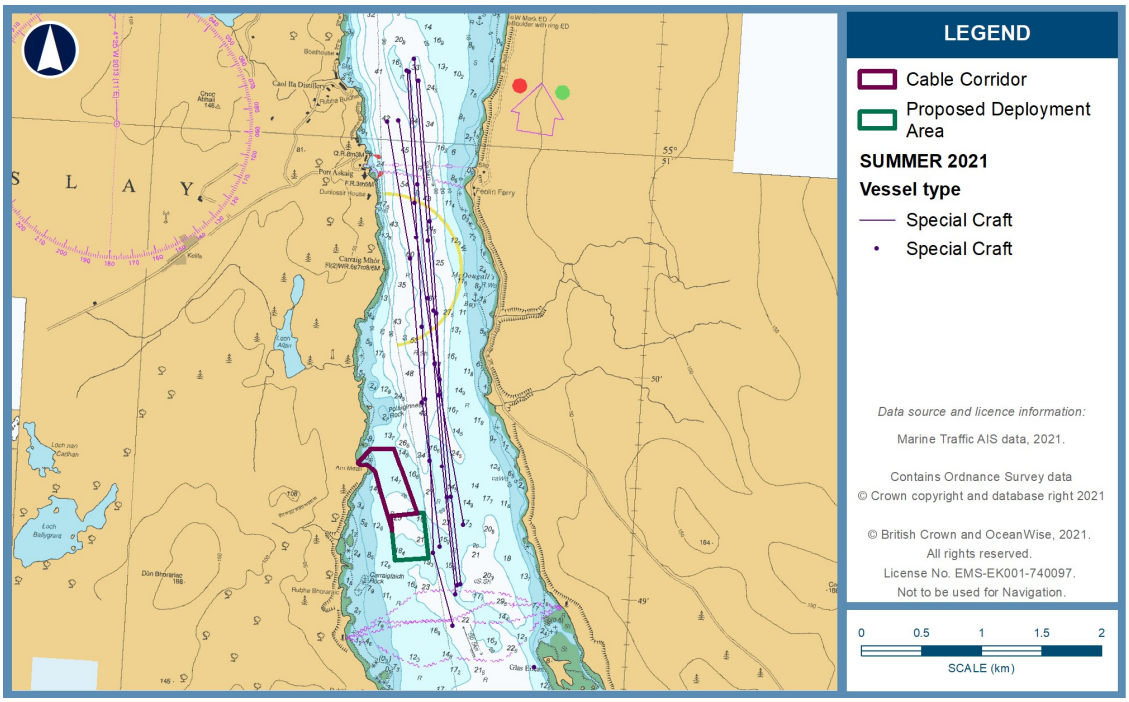

S L A Y
LEGEND
Cable Corridor
Proposed Deployment Area
WINTER 2020
Vessel type
Passenger
Passenger
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

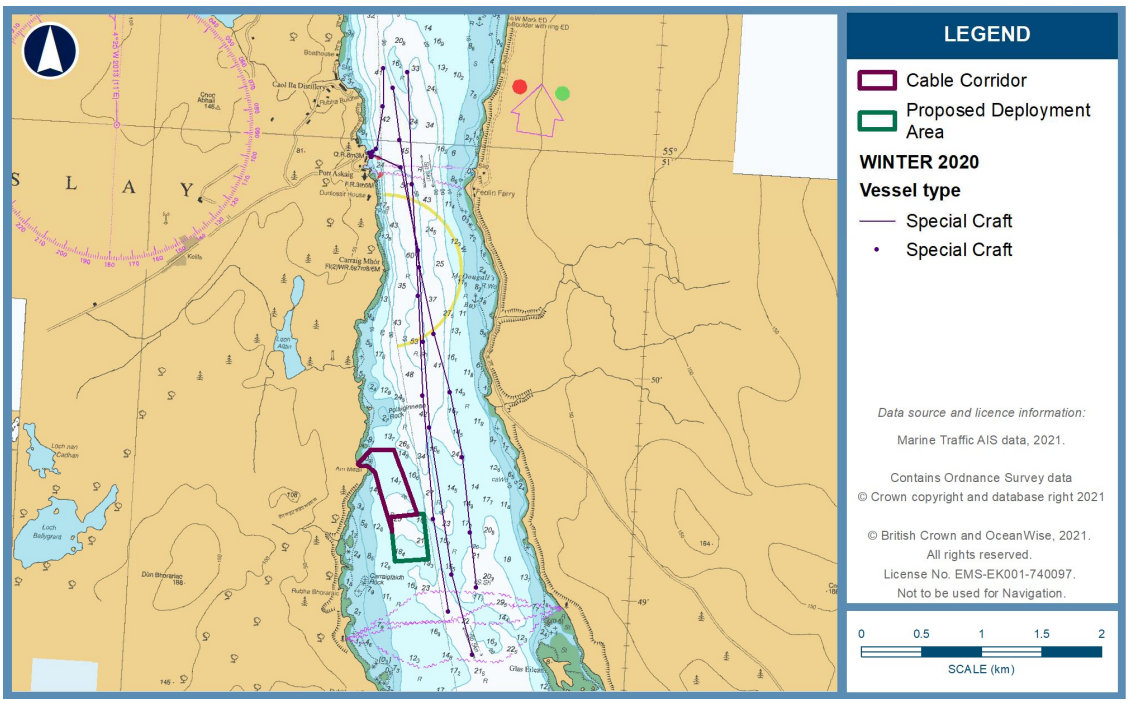

LEGEND
Cable Corridor
Proposed Deployment Area
SUMMER 2021
Vessel type
Cargo
Cargo
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

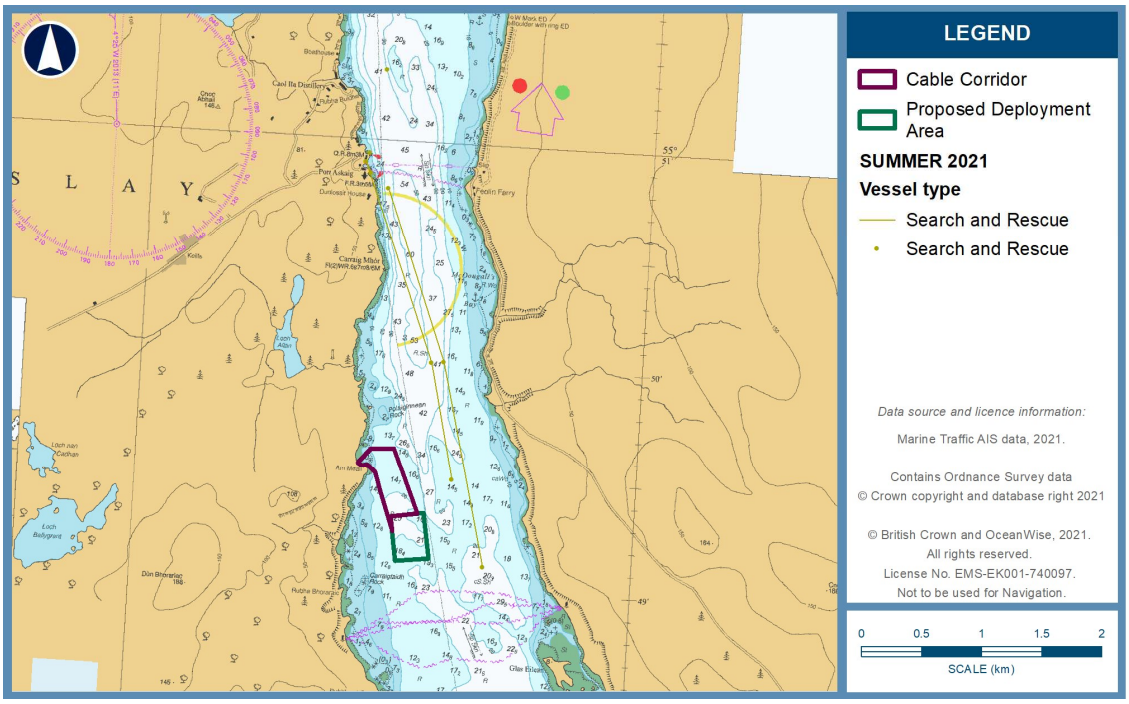

LEGEND
Cable Corridor
Proposed Deployment Area
WINTER 2020
Vessel type
Cargo
Cargo
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

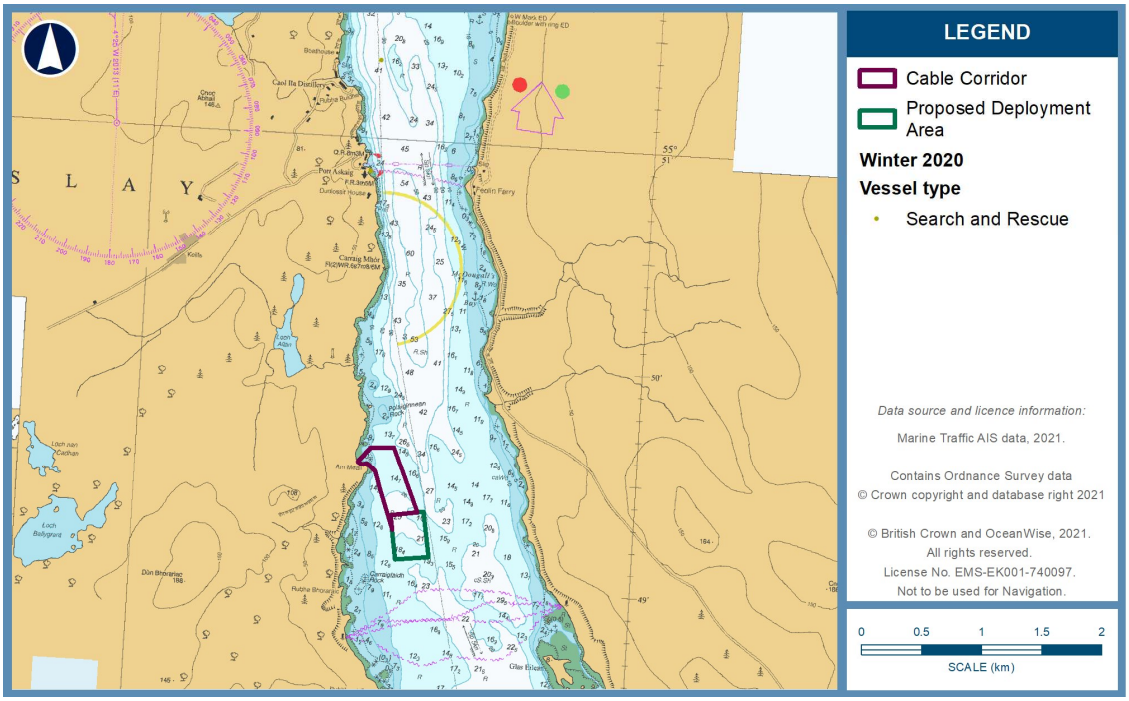

LEGEND
Cable Corridor
Proposed Deployment Area
SUMMER 2021
Vessel type
Fishing
Fishing
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

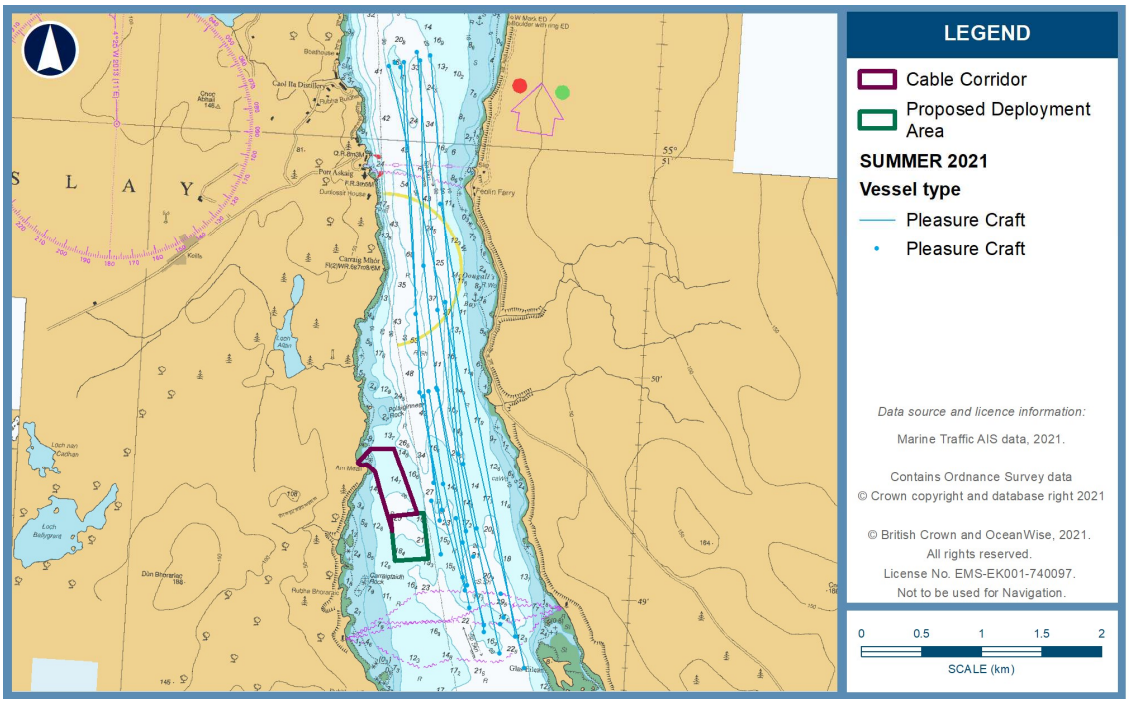

LEGEND
Cable Corridor
Proposed Deployment Area
WINTER 2020
Vessel type
Fishing
Fishing
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

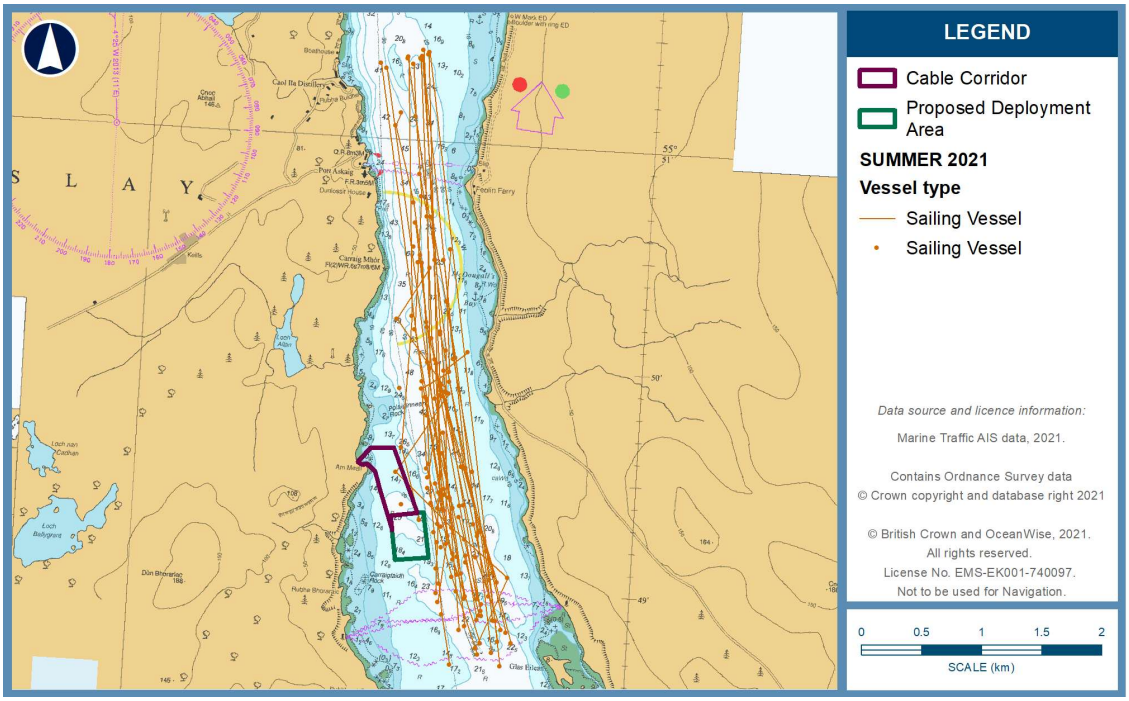

LEGEND
Cable Corridor
Proposed Deployment Area
SUMMER 2021
Vessel type
Special Craft
Special Craft
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

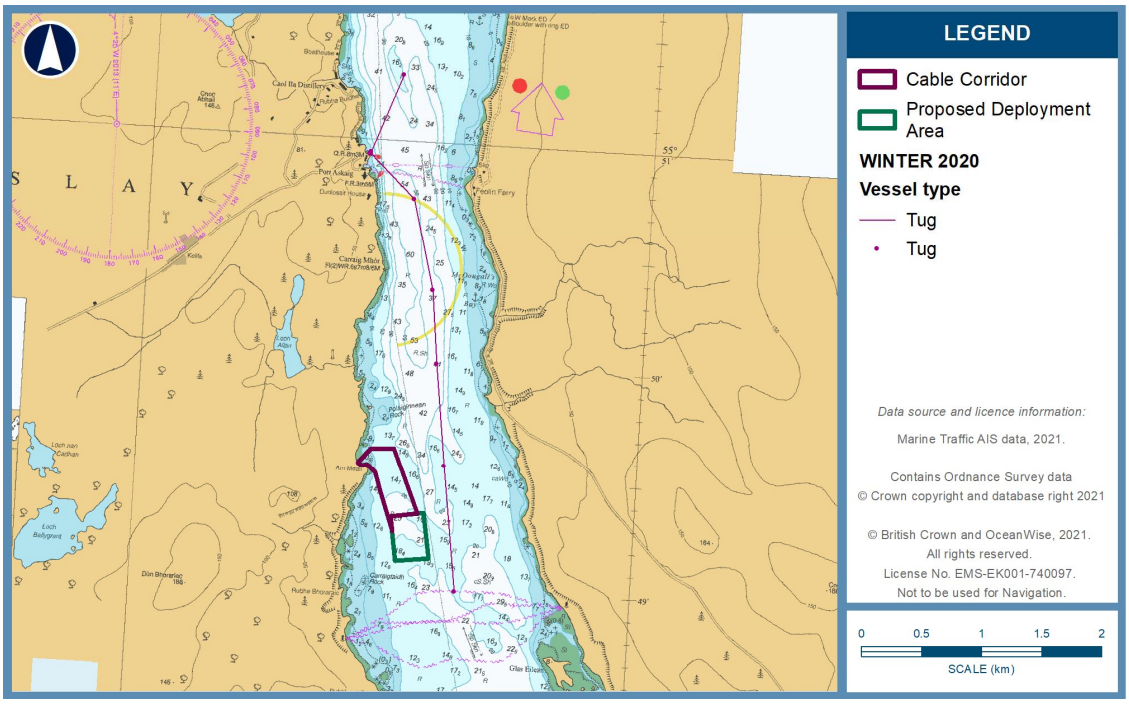

LEGEND
Cable Corridor
Proposed Deployment Area
WINTER 2020
Vessel type
Special Craft
Special Craft
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

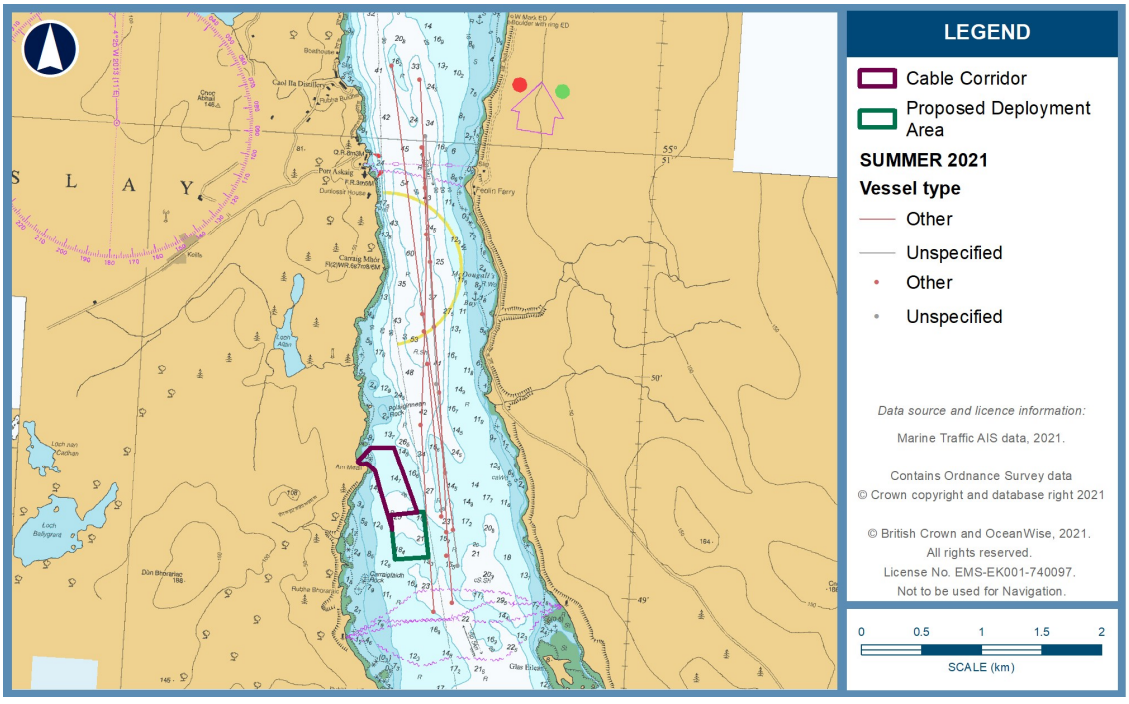

LEGEND
Cable Corridor
Proposed Deployment Area
SUMMER 2021
Vessel type
Search and Rescue
Search and Rescue
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)


LEGEND
Cable Corridor
Proposed Deployment Area
Winter 2020
Vessel type
Search and Rescue
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)


LEGEND
Cable Corridor
Proposed Deployment Area
SUMMER 2021
Vessel type
Pleasure Craft
Pleasure Craft
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)


LEGEND
Cable Corridor
Proposed Deployment Area
SUMMER 2021
Vessel type
Sailing Vessel
Sailing Vessel
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)


S L A Y
LEGEND
Cable Corridor
Proposed Deployment Area
WINTER 2020
Vessel type
Tug
Tug
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)


S L A Y
LEGEND
Cable Corridor
Proposed Deployment Area
SUMMER 2021
Vessel type
Other
Unspecified
Other
Unspecified
Data source and licence information:
Marine Traffic AIS data, 2021.
Contains Ordnance Survey data
© Crown copyright and database right 2021
© British Crown and OceanWise, 2021.
All rights reserved.
License No. EMS-EK001-740097.
Not to be used for Navigation.
0 0.5 1 1.5 2
SCALE (km)

# 15 Annex B – Risk and Mitigation Register

# OP416 Flex Tidal Risk Register

| | |
|---|---|
| **Risk Register Name** | **Flex Tidal Risk Register** |
| **Project** | **OP416** |
| **Revision** | **1** |
| **Attendees** | |
| **Author** | **J.Poynter** |

| | CONSEQUENCE | | | | |
|---|---|---|---|---|---|
| Descriptive Word | **Minor** | **Significant** | **Moderate** | **Major** | **Catasrophic** |
| Hazard Severity | **1** | **2** | **3** | **4** | **5** |
| Actual/Potential Illness or Injury | Single First Aid | Medical attention or multiple first | LTI or multiple medical attention | Single Fatality | Multiple fatality |
| Environmental | Limited harm to the environment | Limited harm to the environment | Potential harm to employees and environment | Potential harm to employees and environment | Harms public, employees, and environment. Widespread concern of companies operations. |
| Cost of loss | <10,000 | >10,000 | >50,000 | >250,000 | >1m |
| **LIKELIHOOD** | | | | | |
| Very Unlikely | **1** | **2** | **3** | **4** | **5** |
| Unlikely | **2** | **4** | **6** | **8** | **10** |
| Possible | **3** | **6** | **9** | **12** | **15** |
| Quite Likely | **4** | **8** | **12** | **16** | **20** |
| Certain or very likely | **5** | **10** | **15** | **20** | **25** |

| Task | Hazards | Risks | Consequence | Existing Prevention Measures | Existing recovery/emergency response measurements | Frequency | Severity | Initial Risk | Additional Prevention Measures | Additional recovery/emergency response measurements | Frequency | Severity | Residual Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| During installation | Project vessels in transit to/from the site. | Collision with 3rd party vessel (commercial, fishing or recreational) | Injury/Fatality<br>Asset Damage | Project vessels in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 2 | 4 | 8 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published<br>Schedule movements apart from ETA/ETD of ferry traffic. | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| During Installation | Project vessels in transit to/from the site. | Components floating free due to becoming unsecured from the deck and going overboard in unfavourable weather conditions. Subsequently causing a danger to navigation due to the likelihood of collision of the components with a 3rd party vessel | Injury/Fatality<br>Asset Damage | Project vessels in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 3 | 9 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published<br>Schedule movements apart from ETA/ETD of ferry traffic. | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| During Installation | Installation in unfavourable weather conditions. | Components floating free due to becoming unsecured from the deck and going overboard in unfavourable weather conditions. Subsequently causing a danger to navigation due to the likelihood of collision of the components with a 3rd party vessel | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement - weather planning included in method statements.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 3 | 9 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| During installation | Project vessels on DP or a mooring system. | Project vessel colliding with 3rd party vessel while installing device (commercial, fishing or recreational) | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 2 | 6 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by vessels | 3 | 2 | 6 |
| During installation | Project vessels working in close proximity to the tether. | Entanglement of tether in propeller of project vessels potentially leading the project vessel becoming Restricted in its Ability to Manoeuvre. | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 2 | 6 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariner | Emergency Services including coastguard<br>Assistance from near by vessels | 3 | 2 | 6 |
| During installation | Fishing gear/abandoned fishing gear potentially in the area. | Entanglement of fishing gear/abandoned fishing gear on project vessel potentially leading to the project vessel becoming Restricted in its Ability to Manoeuvre | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 4 | 2 | 8 | Task Risk Assessments<br>Toolbox Talks for operations<br>Promulgation of information of installation to local fishermen.<br>Notice to Mariner | Emergency Services including coastguard<br>Assistance from near by vessels | 4 | 2 | 8 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| During installation | Uncertified equipment | Components floating free due to malfunction of project vessels equipment. | Injury/Fatality<br>Asset Damage | Compliance with Vessels Operators Safety Management System.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels. | 2 | 3 | 6 | Task Risk Assessments<br>Toolbox Talks for operations . | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 2 | 4 |
| During installation | Uncertified equipment | Components floating free due to malfunction of the connections of the device and its associated equipment creating a risk of collision between 3rd party vessels and the components | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels. | 2 | 3 | 6 | Task Risk Assessments<br>Toolbox Talks for operations<br>Continual monitoring of device with onboard tracker system | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 2 | 4 |
| Operation | Fishing gear/abandoned fishing gear potentially in the area. | Device entangled in fishing gear/abandoned fishing gear, the fishing equipment may cause an additional hazard If it trails further into the navigable channel. | Injury/Fatality<br>Asset Damage | Device Monitoring and planned maintenance programme. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures | 4 | 2 | 8 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published and promulgated locally | Emergency Services including coastguard<br>Assistance from near by vessels | 4 | 2 | 8 |
| Operation | 3rd party vessel incompetence - for example Master/Skipper not sighted NTM, or does not have appropriate watch posted | 3rd party vessel (commercial, fishing or recreational) colliding with device | Injury/Fatality<br>Asset Damage | AtoN at surface (Approved By NLB). Suitably marked surface buoy attached to device | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures | 2 | 4 | 8 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published | Emergency Services including coastguard<br>Assistance from near by vessels<br>IALA buoyage | 2 | 3 | 6 |
| Operation | Device not visible | 3rd party vessel (commercial, fishing or recreational) colliding with device | Injury/Fatality<br>Asset Damage | AtoN at surface (Approved By NLB). Suitably marked surface buoy attached to device | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures | 3 | 4 | 12 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published | Emergency Services including coastguard<br>Assistance from near by vessels<br>IALA buoyage | 3 | 3 | 9 |
| Operation | Components floating free due to failure of connections during operations | 3rd party vessel (commercial, fishing or recreational) colliding with components | Injury/Fatality<br>Asset Damage | Device Monitoring and planned maintenance programme. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures | 2 | 3 | 6 | Task Risk Assessments<br>Toolbox Talks for operations . GPS fitted to monitor position with alert triggered if the system moves outside of the predefined operational area | Emergency Services including coastguard<br>Assistance from near by vessels<br>IALA buoyage | 2 | 2 | 4 |
| Operation | 3rd party vessel manoeuvring to avoid the device , its tether and anchoring system | Collision between two 3rd party vessels | Injury/Fatality<br>Asset Damage | AtoN at surface (Approved By NLB)<br>Device Monitoring and planned maintenance programme. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 4 | 12 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 4 | 8 |
| Operation | Navigation near to device | Entanglement of tether in propeller of 3rd party vessels potentially making the vessel Restricted in its Ability to Manoeuvre. | Injury/Fatality<br>Asset Damage | AtoN at surface (Approved By NLB)<br>Device Monitoring and planned maintenance programme. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures | 4 | 3 | 12 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| Operation | Vessels navigating over the device, its tether and its anchoring system | Entanglement of tether in propeller of 3rd party vessels potentially making the vessel Restricted in its Ability to Manoeuvre. | Injury/Fatality<br>Asset Damage | AtoN at surface (Approved By NLB)<br>Device Monitoring and planned maintenance programme. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 4 | 12 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published | Emergency Services including coastguard<br>Assistance from near by vessels<br>IALA buoyage | 2 | 3 | 6 |
| Operation | Vessels anchoring near to site. | Anchor of 3rd party vessel being dragged over electrical cable to shore | Injury/Fatality<br>Asset Damage | AtoN at surface (Approved By NLB)<br>Device Monitoring and planned maintenance programme. Area is not suitbale for normal anchoring activity due to high tidal flow. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures | 2 | 4 | 8 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Maintenance | Project vessels navigating to and from the site | Project vessel colliding with 3rd party vessel in transit to site (commercial, fishing or recreational) | Injury/Fatality<br>Asset Damage | Project vessels in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement and passage plans.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 2 | 4 | 8 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published<br>Schedule movements apart from ETA/ETD of ferry traffic. | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| Maintenance | 3rd party vessel incompetence - not sighted NTM, does not have appropriate watch posted | Project vessel colliding with 3rd party vessel while carrying out maintenance work on the device (commercial, fishing or recreational) | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 2 | 4 | 8 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| Maintenance | Project vessel in close proximity to the device its tether and anchoring system. | Entanglement of tether in propeller of project vessel potentially leading to the project vessel being Restricted in its Ability to Manoeuvre | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 3 | 9 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by vessels | 3 | 2 | 6 |
| Maintenance | Vessel on DP when carrying out maintenance on the bottom joint or cable | Collision between project vessel and 3rd party vessel | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 2 | 4 | 8 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| Maintenance - ashore | If maintenance is required ashore then it was be uninstalled and installed again. The hazards associated with this will be the same as detailed in the Installation section of this risk register. | | | | | | | 0 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by vessels | | | 0 |
| Decommissioning | Project vessels in transit to and from the site. | Project vessel colliding with 3rd party vessel in transit to and from site (commercial, fishing or recreational) | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 2 | 4 | 8 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published<br>Schedule movements apart from ETA/ETD of ferry traffic. | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| Decommissioning | Decommissioning in unfavourable weather conditions. | Components floating free due to becoming unsecured from the deck and going overboard in unfavourable weather conditions. Subsequently causing a danger to navigation due to the likelihood of collision of the components with a 3rd party vessel | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement - weather planning included in method statements.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 3 | 9 | Task Risk Assessments<br>Toolbox Talks for operations<br>Continual monitoring of device with onboard tracker system | Emergency Services including coastguard<br>Assistance from near by vessels | 2 | 3 | 6 |
| Decommissioning | 3rd party vessels navigating close to the site | Project vessel colliding with 3rd party vessel while recovering device (commercial, fishing or recreational) | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 3 | 2 | 6 | Task Risk Assessments<br>Toolbox Talks for operations<br>Notice to Mariners published | Emergency Services including coastguard<br>Assistance from near by vessels | 3 | 2 | 6 |
| Decommissioning | Entanglement of tether in propeller of project vessel | Entanglement of tether in propeller of project vessel potentially leading to the project vessel being Restricted in its Ability to Manoeuvre | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures<br>Competent vessel masters and crew on project vessel due to pre planned selection criteria of vessels | 4 | 2 | 8 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by vessels | 4 | 2 | 8 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Decommissioning | Fishing gear/abandoned fishing gear potentially in the area. | Entanglement of fishing gear/abandoned fishing gear on project vessel. Leading the project vessel being Restricted in its Ability to Manoeuvre. Increasing the likelihood of collision with 3rd party vessels. | Injury/Fatality<br>Asset Damage | Compliance with project method statement. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures | 4 | 2 | 8 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by vessels | 4 | 2 | 8 |
| Decommissioning | Uncertified equipment | Components floating free due to malfunction of project vessels equipment - creating a risk of collision between 3rd party vessels and the components | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement.<br>Compliance with Vessels Operators Safety Management System. | Comply with vessels emergency response procedures.<br>Comply with project emergency response procedures. | 3 | 3 | 9 | Task Risk Assessments<br>Toolbox Talks for operations<br>Continual monitoring of device with onboard tracker system | Emergency Services including coastguard<br>Assistance from near by vessels | 3 | 2 | 6 |
| Decommissioning | Uncertified equipment | Components floating free due to malfunction of project vessels equipment - creating a risk of collision between 3rd party vessels and the components | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement. | Comply with vessels emergency response procedures.<br>Comply with project emergency response procedures. | 3 | 3 | 9 | Task Risk Assessments<br>Toolbox Talks for operations<br>Continual monitoring of device with onboard tracker system | Emergency Services including coastguard<br>Assistance from near by vessels | 3 | 2 | 6 |
| Decommissioning | Project vessel working in close proximity to the tether. | Entanglement of tether in the propeller of project vessel potentially leading to the project | Injury/Fatality<br>Asset Damage | Project vessel in compliance with the International Regulations for Preventing Collisions At Sea.<br>Compliance with project method statement. | Comply with vessels emergency response procedures<br>Comply with project emergency response procedures. | 3 | 3 | 9 | Task Risk Assessments<br>Toolbox Talks for operations | Emergency Services including coastguard<br>Assistance from near by | 3 | 2 | 6 |
| | | | | | | | | 0 | | | | | 0 |

| | CONSEQUENCE | | | | |
|---|---|---|---|---|---|
| Descriptive Word | **Minor** | **Significant** | **Moderate** | **Major** | **Catasrophic** |
| Hazard Severity | **1** | **2** | **3** | **4** | **5** |
| Actual/Potential Illness or Injury | Single First Aid | Medical attention or multiple first aid | LTI or multiple medical attention | Single Fatality | Multiple fatality |
| Environmental | Limited harm to the environment | Limited harm to the environment | Potential harm to employees and environment | Potential harm to employees and environment | Harms public, employees, and environment. Widespread concern of companies operations. |
| Cost of loss | <10,000 | >10,000 | >50,000 | >250,000 | >1m |
| **LIKELIHOOD** | | | | | |
| Very Unlikely | **1** | **2** | **3** | **4** | **5** |
| Unlikely | **2** | **4** | **6** | **8** | **10** |
| Possible | **3** | **6** | **9** | **12** | **15** |
| Quite Likely | **4** | **8** | **12** | **16** | **20** |
| Certain or very likely | **5** | **10** | **15** | **20** | **25** |

# APPENDIX C NAVIGATION AND LIGHTING PLAN

The navigation and lighting arrangements have been informed by previous consultation with the NLB and are as follows:

1. The Surface Marker Buoy will be of a special mark design, yellow in colour and fitted with a yellow 'X' topmark.
2. The Surface Marker Buoy will be lit with an all-round yellow light. We propose to use light character FL.Y.5s i.e., a single flash of yellow light once every 5 seconds.
3. A passive radar reflector will be fixed to the surface buoy to increase the visibility of the device to marine radar.
4. There will be sufficient warning signs placed on the Surface Marker Buoy which will alert people to the need to keep clear, noting a potential underwater hazard.
5. GPS will be located on the surface buoy. Using this, the movement of the device will be monitored, and an alert will be triggered if the system moves outside of the predefined operational area.

## Navigation warnings and communications plan

Navigation warnings will be communicated through Notices to Mariners (NtoM) to inform mariners of circumstances which affect the safety of navigation. It is the responsibility of the developer (Flex Marine Power) to ensure that Notices to Mariners (NtoM) are issued. NtoM's will be disseminated as widely as possible and should include at least the following recipients:

- UK Hydrographic Office
- Maritime and Coastguard Agency (MCA) through the local MRCC (Shetland)
- Northern Lighthouse Board (NLB)
- Kingfisher Fortnightly
- Local Council Harbour Authority
- RYA
- Local fishermen (where identified)

The NtoM should contain the following information:

- Details of works program including period and purpose
- Duration and start and stop dates
- Positions of maximum extent of projected works
- Details of lights, buoys and other navigational aids
- Proposed routes of vessels involved in installation (from port to site)
- Changes to existing routing measures/vessel movement
- Details of any areas to be avoided
- Vessels not involved in works with the device should avoid the area.
- Proposed positions of devices and other associated features on completion of works
- Instructions to vessels
- That vessels involved in the works will keep a listening watch on VHF Channel 16

The NtoM will be specific and kept concise bearing in mind that the information will be broadcast on radio by the local Harbour Authority. NtoM's will be issued prior to the commencement of marine works. Once the installation is completed then the NtoM will be cancelled and an amended NtoM will be issued simultaneously to cover the operating period. Any further significant changes which may affect navigation will be dealt with by cancelling and re-issuing a NtoM such as the decommissioning phase. On completion of decommissioning and the site is cleared the NtoM will be cancelled.

# APPENDIX D BIOSECURITY AND MARINE INVASIVE NON-NATIVE SPECIES ("INNS") PLAN

## D.1 INTRODUCTION

The purpose of this Biosecurity Plan is to provide a useful and practical guidance framework for reducing the potential for marine invasive non-native species (INNS) introduction and minimising their associated impacts. This Biosecurity Plan provides information on best practice procedures for Flex Marine Power activities as part of their deployment that will contribute to the effective management of marine INNS. The overall objectives of the biosecurity plan are to:

- Ensure INNS monitoring and management is efficient and follows relevant advice and guidelines;
- Reduce the potential for INNS introduction and establishment in the Sound of Islay;
- Reduce the threat to Argyll and Bute's marine biodiversity from INNS;
- Conserve the natural habitats and ecosystems that are of local, national, and international importance; and
- Ensure all project staff are aware of codes of best practice for reducing the introduction and spread of INNS.

The Biosecurity and Marine INNS Plan should be read in conjunction with the Vessel Management Plan (VMP) in Appendix A. This plan is informed by NatureScot's Marine Biosecurity Planning – Guidance for producing and operation-based plans for preventing the introduction of non-native species (February 2014)[5].

## D.2 BACKGROUND

Invasive non-native species in our seas can have significant impacts on both biodiversity and the economy. Renewable devices provide clean surfaces for the settlement of native and non-native species, potentially providing 'stepping-stones' around our coast. The movement of vessels, barges, equipment and the devices themselves, both around the UK coast and internationally, could also allow the accidental transfer of fouling organisms. Marine biosecurity planning is therefore a critical step in creating a framework to reduce the risk of introduction.

## D.3 LEGISLATION AND GUIDANCE

There are two key pieces of legislation in Scotland which specifically place personal responsibility directly onto all marine users to prevent the spread and introduction of INNS, the Wildlife and Countryside Act (1981) and the Wildlife and Natural Environment (Scotland) Act 2011 (WANE Act). The WANE Act makes a number of amendments to the 1981 Act, which now states that 'any person who (a) releases, or allows to escape captivity any animal (i) to a place outside its native range; or (ii) of a type the Scottish Ministers by order specify; or (b) otherwise causes any animal outside the control of any person to be at a place outside its native range, is guilty of an offence.'

The WANE Act also details specific changes to the release of INNS, based on a 'general no-release approach', as well as additional sections on keeping, notification, and control of INNS. In accordance with this legislation, Marine Scotland are responsible for the control of marine and coastal waters, which grants them access to 'carry out investigations or control work and the ability to recover costs, if appropriate'.

To encourage individuals, businesses, and public bodies to act responsibly, the Scottish Government has issued a 'Code of Practice on Non-Native Species[6]', which sets out a guidance on how to act responsibly within the law to ensure that non-native species under ownership, care, and management do not cause harm to the environment.

[5] https://www.nature.scot/sites/default/files/2019-02/Marine%20Biosecurity%20Planning.pdf

[6] https://www.gov.scot/publications/non-native-species-code-practice/

## D.4 SPECIES OF CONCERN

These marine INNS have become widespread and well established in Scotland, including[7]:

- Green sea fingers (Codium fragile subsp. tomentosoides);
- Common cordgrass (*Spartina anglica*);
- A red alga (*Dasysiphonia japonica*);
- Wireweed (*Sargassum muticum*);
- Acorn barnacle (*Austrominius modestus*);
- Japanese skeleton shrimp (*Caprella mutica*); and
- Leathery sea squirt (*Styela clava*).

Other marine INNS can only be found in isolated or sporadic locations within Scotland, including:

- American lobster (*Homarus americanus);*
- Carpet sea squirt10 (*Didemnum vexillum*); and
- Pacific oyster (*Crassostrea gigas*).

## D.5 ROLES AND RESPONSIBILITIES

The following individuals are responsible for ensuring that the requirements of this Marine Invasive Non-Native Species and Biosecurity Management Plan are implemented at the deployment site.

| Job Title | Name | Responsibility |
|---|---|---|
| Biosecurity Manager | Jose Diaz (Flex Marine Power) | Main point of contact relating to INNS. Responsible for the undertaking of biosecurity surveillance, monitoring, recording, and updates to this plan as required.<br><br>They will ensure that:<br>• All relevant staff, including sub-contractors, will receive a copy of the site/ operation biosecurity plan summary and instructions sheet<br>• All relevant staff will receive training in INNS identification<br>• All staff encouraged to report any 'suspect' marine plant or animal.<br>They will also consult with regulators in the event of an INNS incident. |

[7] https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/marine-non-native-species

## D.6 VESSEL TYPES USED ON THE PROJECT

Appendix table D.1 will be updated by the Biosecurity Manager once vessel sub-contractors have been procured/confirmed. Please refer to Vessel Management Plan (Appendix A) for the types of vessels likely to be used.

**Appendix table D.1 Vessel risk assessment**

| Vessel type | Risk factors: | Risk: High/Medium/Low |
|---|---|---|
| TBC (Multi-cat) | Slow moving, from outside local water body | Scottish or NI provider |
| TBC (RHIB) | From outside local water body | Scottish or NI provider |

## D.7 ACTIVITIES THAT POSE A RISK OF INTRODUCING OR SPREAD OF INNS

Site Activities which have a risk of introducing or spreading non-native species:

**Appendix table D.2 Activities that pose a risk to introduction or spread of INNS**

| Activity | Description |
|---|---|
| 1 | Use of multi-cat vessel (slow-moving and potentially form outside local water body) |
| 2 | Biofoul removal and disposal from the SwimmerTurbine™, surface buoy and mooring system |

The risk of introducing marine non-native species in this project are considered very low:

- All project operations will be conducted by workboats based in UK waters.
- All subsea materials will be immersed only in Scottish waters.

## D.8 BIOSECURITY MITIGATION AND MANAGEMENT

Appendix table D.3 sets out the project-specific mitigation and management measures proposed for the Sound of Islay deployment. These will be overseen by Jose Diaz (Flex Marine Power).

**Appendix table D.3 Biosecurity Control Measures**

| Mitigation or good practice measure | Responsible person |
|---|---|
| The SwimmerTurbine™, surface buoy, mooring system and associated infrastructure will be transported to Port Askaig by road rather than sea to minimise potential transfer of INNS. | Jose Diaz |
| Western Scotland or Northern Ireland-based vessels will be used for marine operations, to minimise potential for transfer of INNS. | Jose Diaz |
| Operators used for marine operations will follow their own biosecurity good practice policies. | Jose Diaz |
| Turbine equipment and associated infrastructure to be deployed in the Sound of Islay will not have been deployed subsea outside of UK waters previously. Some components e.g. surface buoy, clump weight may be recycled from the previous deployment in Strangford Lough, Northern Ireland. All other key components e.g. blades, cable will be newly fabricated so never deployed subsea prior to this project. | Jose Diaz |
| Components that are being re-deployed from the deployment in Northern Ireland will be pressure washed / air dried prior to use in the Sound of Islay. | Jose Diaz |

| Mitigation or good practice measure | Responsible person |
|---|---|
| Turbine and associated infrastructure will undergo visual inspections when removed from the water. INNS ID cards will be used by operatives during inspections. Biological material will be removed as standard (on Port Askaig Pier or in Dumbarton), to avoid dangerous handling conditions. If inspections identify INNS species, care will be taken to avoid contaminated material entering the marine environment. Any INNS identified will be reported to Argyll and Bute Council, Marine Scotland and NatureScot. | Jose Diaz |
| Check, Clean, Dry Principles[8] will be implemented to minimise the transfer of INNS. They are:<br>• **Check** your equipment, boat, and clothing after leaving the water for mud, aquatic animals or plant material. Remove anything you find and leave it at the site.<br>• **Clean** everything thoroughly as soon as you can, paying attention to areas that are damp or hard to access. Use hot water if possible.<br>• **Dry** everything for as long as you can before using elsewhere as some invasive plants and animals can survive for over two weeks in damp conditions. | Jose Diaz |
| Approved foul-release coating only will be used on relevant turbine components. | Jose Diaz |
| Biofoul material will be removed periodically from certain components as follows:<br>• Blades: blades will be raised out of the water during maintenance intervals and cleaned on site.<br>• Clump weight: An ROV or similar will be deployed periodically to remove build-up of material during the course of the deployment.<br>• Other components: Larger components will be cleaned on the dock at port Askaig when removed from the water. | Jose Diaz |

## D.9 LOCATION OF BIOSECURITY LOGBOOK

The location of the logbook once site operations commence will be confirmed by the Biosecurity Manager. Regular review, for example once a year, will ensure that the plan stays up to date and relevant. Example of the information to be contained in the logbook is as follows:

- Routine inspections of equipment and vessels for INNS and biosecurity;
- Measures taken if INNS found at site or on equipment;
- Application of antifouling or cleaning of equipment or vessels at site;
- Inspection of any high 'risk' vessels; including any details of when biosecurity manager has been informed of a potential 'high risk' vessel and the additional biosecurity measures that have been undertaken; and
- Awareness raising events.

All records entered in the logbook should be given a date and signed by the biosecurity manager.

## D.10 KEY CONTACTS (ENQUIRIES AND REPORTS)

SEARS (Scottish Environment and Rural Services)
08452 30 20 50 (24/7 customer service number)
Email: info@sears.scotland.gsi.uk

[8] http://www.nonnativespecies.org/checkcleandry/

# APPENDIX E PROJECT ENVIRONMENTAL MONITORING PLAN (PEMP)

## E.1 INTRODUCTION

This Project Environmental Monitoring Plan (PEMP) outlines the environmental monitoring activity proposed for the Flex Marine Power Sound of Islay Project. This is an initial draft to support the Marine Licence application and will be updated in consultation with Marine Scotland and NatureScot in advance of deployment.

## E.2 SCOPE

Pre-application consultation with NatureScot and Marine Scotland informed the scope of this draft PEMP. NatureScot noted that device monitoring for operational purposes may be sufficient to detect entanglement. NatureScot also noted that consideration of EMF effects would be better addressed through collaborative strategic projects rather than part of any project-specific monitoring for this project.

The requirement for a benthic survey was also scoped out by NatureScot.

## E.3 TURBINE MONITORING DEVICES

The SwimmerTurbine™ will be monitored directly and remotely following deployment. Visual monitoring will occur periodically during maintenance visits (See Section 0 for more detail).

Outputs from the SwimmerTurbine™ will be monitored remotely in real time using cloud-based communications. Cloud technology enables full control to be passed to a trained local operator, or offsite centralised operator, as and when required. Through the use of a GPS system, the movement of the device will be monitored, and an alert will be triggered if the system moves outside of the predefined operational area. The following device-specific monitoring will be undertaken by FMP:

- The control system will have a shock sensor for the purpose of giving indication if an object strikes the device;
- Pitch and roll are monitored and accelerometers are used to identify any movement.
- Cameras at the shoreside box will allow site monitoring by remote access when people are not present.

At any point in time, it will be possible to rapidly and securely shut down the turbine – either remotely, or manually on-site.

## E.4 CONTINGENCY PLANNING

In the highly unlikely event that any of the key device components should become detached from their substructure, an alarm is immediately sent to the operator on duty who will co-ordinate retrieval operations.

# APPENDIX F COMMITMENTS TABLE/REGISTER

| Ref | Issue | Commitment or action | Responsibility | Timescales | Status |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

# APPENDIX G GCCM CONCRETE CASING SPEC

# CC SPEC SHEET TO ASTM D8364

## (CC) Classification Properties to ASTM D8364 'Standard Specifcation for GCCM Materials'

2103.01.EN

| GCCM Property | Test Method | State of GCCM | Unit | Minimum Values Unless Specified | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Type I Specification | CC5™ | Type II Specification | CC8™ | Type III Specification | CC13™ |
| **Thickness** | ASTM D5199 | uncured | mm | 4.5 | >5.0 | 7.0 | >7.5 | 7.0 | >11.5 |
| **Thickness** | ASTM D5199 | cured - 24 hrs | mm | 4.5 | >5.0 | 7.0 | >7.5 | 7.0 | >11.5 |
| **Mass per Unit Area** | ASTM D5993 | uncured | $kg/m^2$ | 6.5 | >6.5 | 10.5 | >10.5 | 10.5 | >16.5 |
| **Density** | ASTM D5993/D5199 | uncured | $kg/m^3$ | 1250 | >1250 | 1250 | >1250 | 1250 | >1250 |
| **Flexural Strength - Initial Breaking Load *** (1st crack in cementitious material) | ASTM D8058 | cured - 24 hrs | N/m | 625 | >625 | 1500 | >1500 | 3750 | >3750 |
| **Flexural Strength- Initial Flexural Strength *** (1st crack in cementitious material) | ASTM D8058 | cured - 24 hrs | MPa | 3.5 | >3.5 | 3.5 | >3.5 | 3.5 | >3.5 |
| **Flexural Strength- Final Flexural Strength *** | ASTM D8058 | cured - 24 hrs | MPa | 4 | >4 | 4 | >4 | 4 | >4 |
| **Compressive Strength of Cementitious Mix** (water/cementitious materials ratio to ASTM D8329) | ASTM D8329 | cured - 28 days | MPa | 40 | >70 | 50 | >70 | 60 | >70 |
| **Pyramid Puncture Resistance** | ASTM D5494 Type B | cured - 28 days | kN | 2.0 | >3.5 | 3.5 | >8.0 | 4.5 | >10 |
| **Abrasion Resistance** (cementitious barrier depth of wear - maximum value) | ASTM C1353 | cured - 28 days | mm/1000 Cycles | 0.3 | <0.25 | 0.3 | <0.25 | 0.3 | <0.25 |
| **Tensile Strength - Final *** | ASTM D6768 | uncured | kN/m | 8 | >8 | 8 | >8 | 8 | >8 |
| **Tensile Strength - Initial *▲** (1st crack in cementitious material) | ASTM D4885 | cured - 28 days | kN/m | 3.5 | >6 | 6.5 | >7 | 9 | >9 |
| **Tensile Strength - Final *▲** | ASTM D4885 | cured - 28 days | kN/m | 10 | >17 | 19 | >19 | 19 | >19 |
| **Freeze - Thaw** (residual Initial Flexural Strength to ASTM D8058 after 200 cycles) | ASTM C1185 | cured - 28 days | % | 80 | >80 | 80 | >80 | 80 | >80 |
| **GCCM Classification** | ASTM D8364 | | Type | CC5™ = Type I GCCM | | CC8™ = Type II GCCM | | CC13™ = Type III GCCM | |

* GCCM materials are non-isotropic and the values for flexural strength, tensile strength, and initial breaking load are reported as the lower of the material machine production direction (length of roll) or material cross-machine production direction (width of roll).

For independent laboratory test results please consult the CC5™ ASTM D8364 Type I, CC8™ ASTM D8364 Type II and CC13™ ASTM Type III reports by BICS Laboratories Ltd

# APPENDIX H RELEVANT MARINE LICENCE CONDITIONS

TO BE COMPLETED FOLLOWING ISSUE OF LICENCE