# Islay Community Demonstration Project

# Environmental Management Plan (EMP)

**FINAL V3**

**P981 – February 2024**

**Issued by Aquatera Ltd on behalf of**

Flex Marine Power

This report was completed for:


Flex Marine Power Ltd

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 |
| 003 | 10 Feb 22 | Revised following consultation feedback |
| 004 | 16 Mar 22 | Revised following MSLOT feedback |
| 005 | 24 Jun 22 | Updated VMP included |
| 006 | 30 Oct 2023 | FMP issued draft (minor changes reflecting detailed design) to Aquatera for review |
| V2 | 02 Nov 2023 | Final version issued to client |
| V3 | 28 Feb 2024 | Update due to design change – removal of marker buoys |

# Contents

# List of Figures



# List of Tables

# 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 SwimmerTurbine™, rated up to 70kW, 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 0).

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.

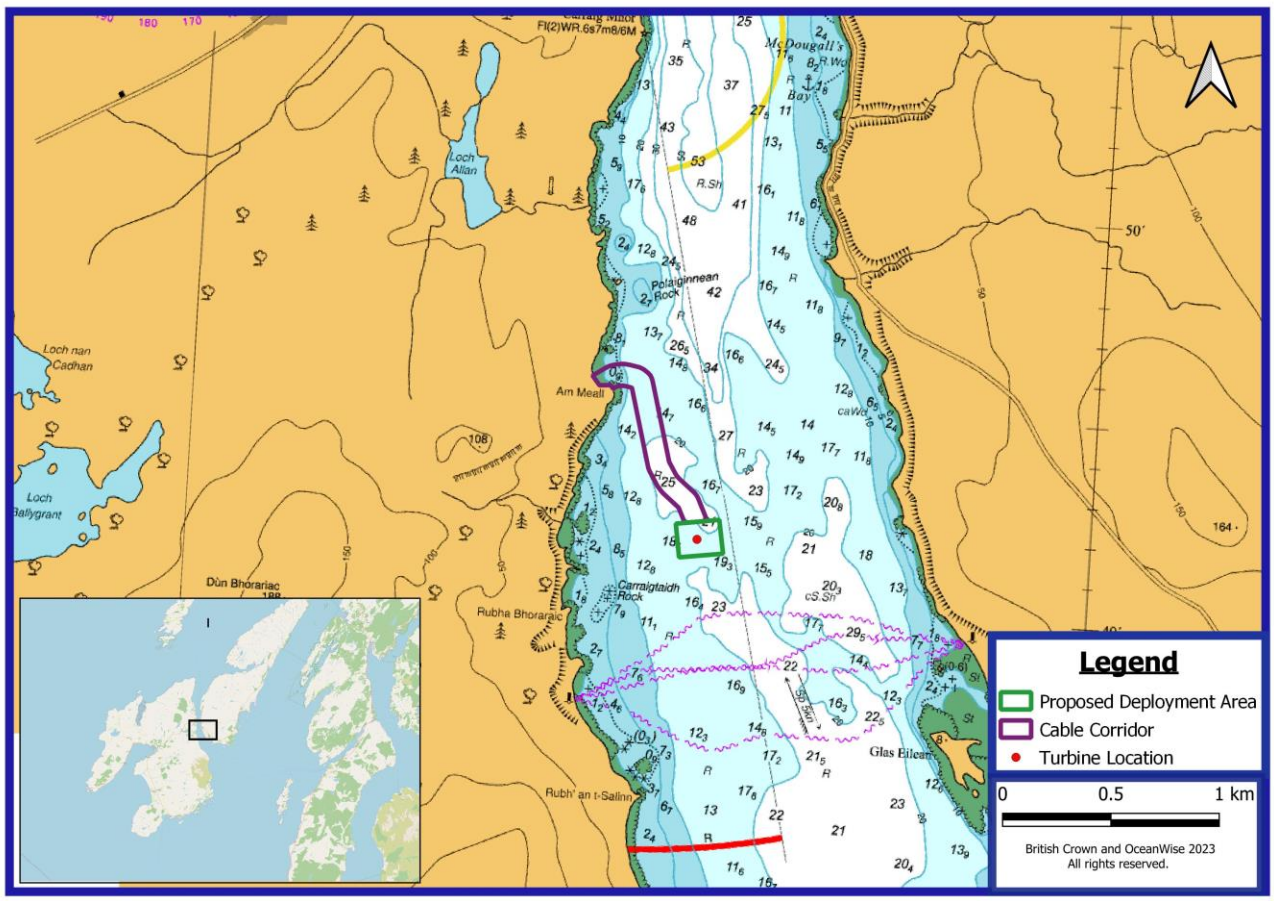


Figure 2-1 Proposed licence and deployment area at Test Site

**Table 2.1 Coordinates of licence boundary**

| Area | Latitude | Longitude |
|---|---|---|
| | **Deployment Area** | |
| NW | 55°49.205'N | 6°5.834'W |
| NE | 55°49.221'N | 6°5.644'W |
| SE | 55°49.137'N | 6°5.618'W |
| SW | 55°49.122'N | 6°5.811'W |
| | | |
| | **Cable Corridor** | |
| **Western Extents** | | |
| 1 | 55°49.531'N | 6°6.145'W |
| 2 | 55°49.537'N | 6°6.130'W |
| 3 | 55°49.538'N | 6°6.120'W |
| 4 | 55°49.539'N | 6°6.105'W |
| 5 | 55°49.536'N | 6°6.064'W |
| 6 | 55°49.339'N | 6°5.970'W |
| 7 | 55°49.332'N | 6°5.965'W |
| 8 | 55°49.293'N | 6°5.921'W |
| 9 | 55°49.279'N | 6°5.899'W |
| 10 | 55°49.245'N | 6°5.826'W |
| 11 | 55°49.208'N | 6°5.795'W |
| **Eastern Extents** | | |
| 1 | 55°49.540'N | 6°6.157'W |
| 2 | 55°49.538'N | 6°6.206'W |
| 3 | 55°49.560'N | 6°6.236'W |
| 4 | 55°49.584'N | 6°6.176'W |
| 5 | 55°49.588'N | 6°6.162'W |
| 6 | 55°49.591'N | 6°6.137'W |
| 7 | 55°49.593'N | 6°6.113'W |
| 8 | 55°49.593'N | 6°6.101'W |
| 9 | 55°49.587'N | 6°6.035'W |
| 10 | 55°49.583'N | 6°6.016'W |
| 11 | 55°49.575'N | 6°5.996'W |
| 12 | 55°49.569'N | 6°5.985'W |
| 13 | 55°49.562'N | 6°5.978'W |
| 14 | 55°49.357'N | 6°5.880'W |

| | | |
|---|---|---|
| **15** | **55°49.326'N** | **6°5.846'W** |
| **16** | **55°49.318'N** | **6°5.835'W** |
| **17** | **55°49.284'N** | **6°5.760'W** |
| **18** | **55°49.280'N** | **6°5.753'W** |
| **19** | **55°49.276'N** | **6°5.748'W** |
| **20** | **55°49.271'N** | **6°5.743'W** |
| **21** | **55°49.216'N** | **6°5.696'W** |

## 2.3 PROJECT SCHEDULE, TIMINGS AND COMMENCEMENT DATES

The anticipated date of installation of the SwimmerTurbine™ and its associated mooring system is Q3 2024. The operational period is anticipated to last approximately 5 years up to the end of August 2029. 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;
- Mooring and Anchor System; and
- Umbilical.

The turbine system as it will sit in the water column is illustrated in Figure 2-2.

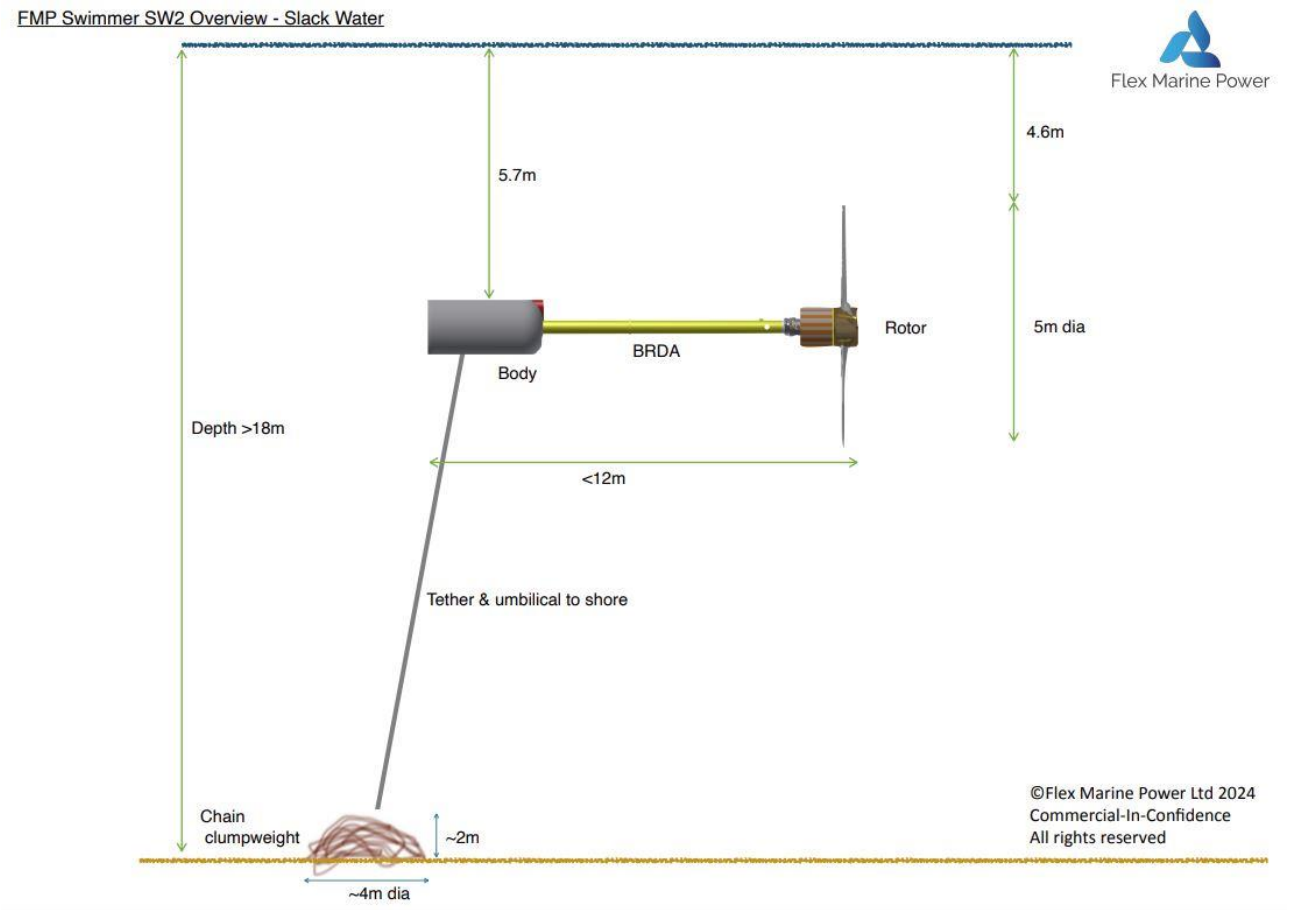


**Figure 2-2 Turbine System in the water column**

Each key component is described in the following sections.

## Turbine

The turbine comprises 2 hollow fibreglass blades attached to a steel hub and nacelle and connects to a mooring connection structure described below. The clump weight anchor lies on the seabed. The mooring runs from the anchor to the steel mooring connection structure which has a steel float (Body) to hold the mooring up and to house electrical, powertrain and monitoring equipment within a dry equipment capsule, plus the Buoyant Rotor Drive Assembly (BRDA). The turbine rotates and is mounted on the end of the BRDA steel assembly. There is a hydraulically actuated brake assembly at the turbine. Hydraulic pipes run along the BRDA tube. The BRDA comprises carbon steel tube with <10mm wall thickness and polymer material resulting in a tube diameter of <500mm. The turbine has a powertrain within its body, 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$^2$.

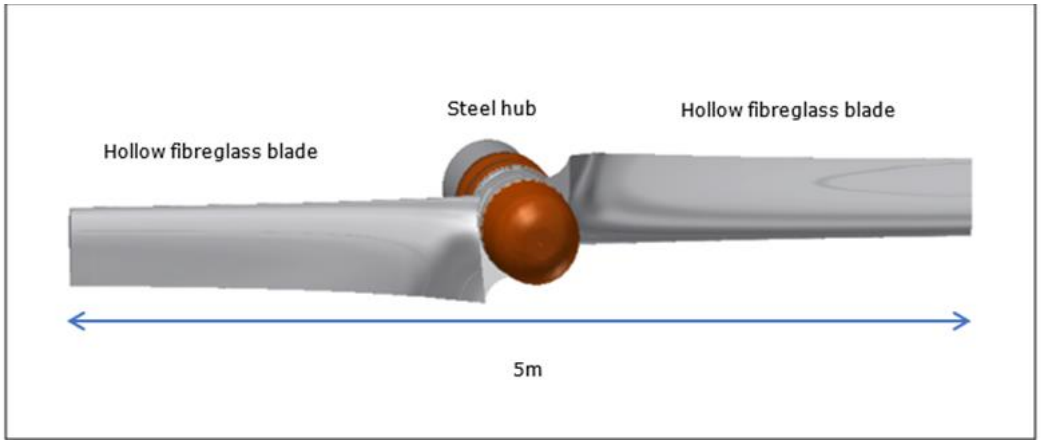


**Figure 2-3 SwimmerTurbine™**

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 | <12 |
| Rotor diameter | m | 5.0 |

## Mooring and Anchor System

The device is mid-water buoyant, attached to a mooring tether which will be steel rope of approximately 38mm diameter and chain of approximately 130mm in diameter. The mooring tether is attached to a single gravity anchor at the seabed. This allows the turbine to yaw into the direction of the tidal current. The machine is never less than 4.6m below the water surface at any tidal state. During the diurnal tidal cycle, the top of the turbine's rotor fluctuates between 4.6m and 8.3m depth (at maximum excursion- See Appendix B for more details).

The seabed attachment proposed is a clump weight made up of <90mm bar diameter steel chain and will also incorporate a cast iron or steel sinker of <3 tonnes. The clump weight comprises up to 70 tonnes of recycled chain, forming a clump approximately 4 meters in diameter and 2 meters high when sitting on the seabed. The function of the sinker is to provide a base mass and attachment point within the clump. The sinker has a mooring attachment ring on the top. There are three recovery chains each laid on the seabed and attached to the clump weight. At the end of each of these recovery chains will be a weight, small cable and polymer float sitting <1m above the sea bed. Additionally there will be a side anchor (approximately 1 tonne) attached to the clump weight by chain. All would be within the licence area. No drilling, concrete or any seabed modification is required for this mooring.

## Umbilical

A <70kW generator connected via an attached multicore cable and connectors generates the electrical power. This includes a fibre optic core as well as auxiliary power and hydraulic return lines. Electricity is generated at the machine at <1000v and exported to the shore along the armoured umbilical laid along the seabed following the natural contours to reduce potential for movement. At the turbine end of the cable will be an end stop weight to prevent the turbine lifting the cable during operation and maintenance. 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 F. 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 2-4.

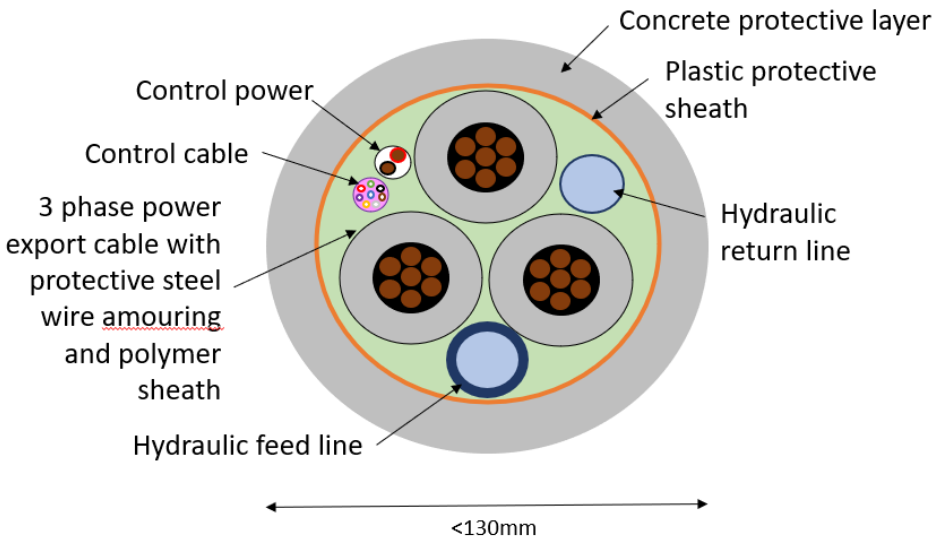


**Figure 2-4 Cable with protection cross section**

## Virtual Automatic Identification System (AIS) Aid to Navigation (AtoN)

A virtual aid to navigation is digital information, broadcast from an Automatic Identification System (AIS) station, to display an aid to navigation that does not physically exist in the water. Virtual aids to navigation are visible on vessels' AIS Minimum Keyboard and Display (MKD), or as a symbol on appropriate display system. A virtual AtoN will be 'located' approximately 25m to the east of the turbine and be broadcast to vessels as a virtual East Cardinal Buoy (see Figure 2-5). All vessels with an AIS system will see this cardinal marker. It is worth noting that the proposed AtoN location is approximately ~130m within the red sector of the Carraig Mhor light and so outwith the main shipping channel.

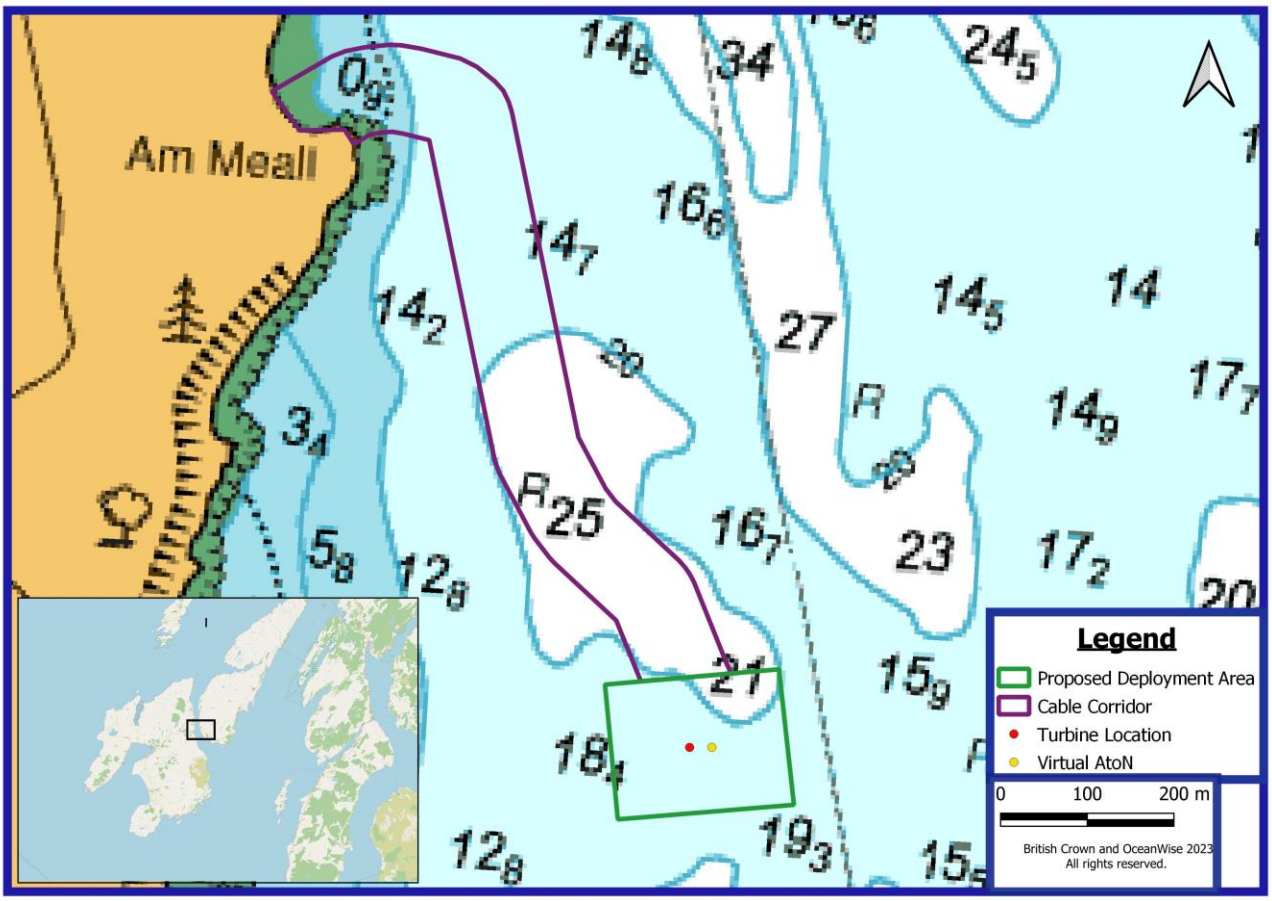


**Figure 2-5 Showing the Virtual (Cardinal Buoy) AtoN location**

## Landfall and Onshore infrastructure

Permission is being requested from Dunlossit Estate to site a single equipment cabin (up to 7m long and 2.5m wide) behind the beach, clad in wood to fit in with the natural environment – the appearance being much like a garden shed (see Figure 2-6). The box will sit on top of 6 posts, to which it will be securely bolted. No significant civil works will be required unless ground conditions do not allow for post installation. Quick set concrete will be applied around the posts to set. A stand-alone diesel generator and fuel tank for backup power will be secured beside the cabin. A fence will be erected to maintain a 2m gap around the cabin and generator. A separate onshore planning application process is underway with Argyll and Bute Council.

**Figure 2-6 Representative image of the onshore equipment cabin**

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 3 tonnes |
| Anchor Systems | Steel/Cast Iron | P | Up to 75 tonnes |
| Umbilical | Copper, polymer, steel | P | Approximately 1000 m |
| Umbilical protection | Concrete | P | Up to 8 $m^3$ |
| Body and BRDA | Steel, rubber, composite polymer, zinc, lead | P | Up to 8 tonnes |
| **Other (detailed below):**<br>• Up to 90 litres biodegradable hydraulic oil<br>• Shoreside batteries and backup power diesel and solar panels.<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.

si

**Table 2.4 Vessels utilised for installation**

| Vessel Type | Task |
|---|---|
| Multi Cat (up to 2) | Anchor and Mooring installation/removal.<br>Device installation and removal. |
| Rigid Hulled Inflatable Boat (RHIB) (x1) | At-sea visual inspection.<br>Safety boat |

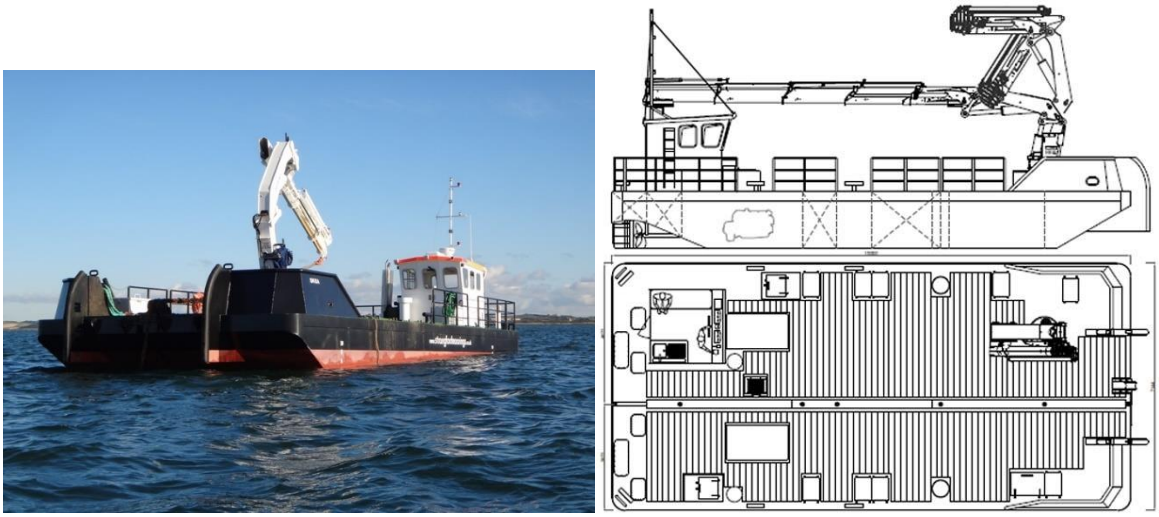

**Figure 2-7 Example vessel of Multi Cat used for deployment in Strangford, NI**


**Figure 2-8 Example vessel of RHIB**

The installation process for the full-scale SwimmerTurbine™ with anchors and mooring system was successfully demonstrated at Strangford Narrows (NI) during 2020 using a multi-at vessel operating during slack water periods, and the same approach will be adopted for this project. The key objectives 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) (1-2 days);
- Carry the gravity clump weight and other mooring components on the multi-cat 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 4-5 days depending on sea conditions);
- Tow/carry 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) (1-3 days).

The total time for installation is expected to be approximately 7-12 days (subject to weather conditions). If installation is halted due to bad weather a retrieval buoy will be attached to the mooring chain, and the mooring chain may be temporarily laid on the seabed in line with the flow. If this period becomes longer than a month then the buoy will be removed and an acoustic release or remote operated vehicle (ROV) will be deployed to allow retrieval of the mooring chain.

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/excavator for the beach area. A shallow trench will be pre-dug across the beach by the tractor/excavator 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 equipment cabin will be transported to site via sea from Port Askaig, offloading using a small landing craft at the beach. The cabin will be positioned using a tractor/excavator, 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. It is anticipated that 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. In this case a retrieval buoy will be attached to the mooring chain and the mooring chain may be temporarily laid on the seabed in line with the flow. If this period becomes longer than a month then the buoy will be removed and an acoustic release or remote operated vehicle (ROV) will be deployed to allow retrieval of the mooring chain. There may also be a requirement for additional removal operations during the 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 | Up to 70kW |
| 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 | 18m/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 an inertial/GPS system, the movement of the device will be monitored, and an alert will be triggered if the system moves outside of operational space or parameters. 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 inertial/GPS sensors are used to identify location or movement; and
- Cameras at the onshore equipment cabin will allow site monitoring by remote access when personnel are not on-site.

Following a collision detection by the sensors, part of the response would be immediate review of operational and performance parameters (which can be assessed remotely). If these were considered sufficiently adverse, the device will be shut down.

### 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 (~3 days);

- 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 (~4 days); and
- Remove onshore equipment cabin and decommission any associated connection infrastructure (~2 days).

Full decommissioning is expected to take no more than ~10 days (subject to weather windows). If decommissioning is halted due to bad weather a retrieval buoy will be attached to the mooring chain and the mooring chain may be temporarily laid on the seabed in line with the flow. If this period becomes longer than a month then the buoy will be removed and an acoustic release or remote operated vehicle (ROV) will be deployed to allow retrieval of the mooring chain.

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.

### 2.5.5 Third Party Verification

Third Party Verification (TPV) was undertaken by Lloyds Register as recorded in IEC certificate IECRE.ME.FS.23.0001-R0 issued May 2023 (See Appendix J).

# 3 ENVIRONMENTAL ASSESSMENT AND MANAGEMENT PLAN

## 3.1 INTRODUCTION

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 0).

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

## 3.2 POLLUTION PREVENTION

Hydraulic oil will be required for certain equipment comprising of piping, manifolds, connectors and rams. There is a low risk of a hydraulic leak and would only occur if external piping along the BRDA tube were to be severed during installation. The following mitigation measures will be implemented to ensure any risk of hydraulic oil leak remains low:

- All installation method statements will be followed to ensure the turbine and its hydraulic components are protected and isolated from collisions and/or sharp objects during the installation process.
- Any leak during this process would be minor because the turbine is not in operation. However, if any hydraulic equipment is damaged during installation, then the installers will remove the turbine from the water and place it on the Multi Cat deck for inspection.
- Readily biodegradable, low ecotoxicity oil (OECD 301B carbon dioxide evolution test) will be used such that any escaped oil will break down in the environment quickly and is classified as not harmful to bacteria, algae, freshwater, marine invertebrates and fish (Shell, 2015).

In addition, FMP will ensure prevention of potential diesel, oils and hydraulic fluid spills to the environment by following appropriate Pollution Prevention Guidelines as follows:

- https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/
- https://www.sepa.org.uk/regulations/water/guidance/.

[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 |
|---|---|---|---|
| **Pre-Construction** | | | |
| Underwater noise from pre-construction surveys leading to disturbance | Cetaceans<br>Seals<br>Basking sharks | There is an increased risk of anthropogenic noise from the use of geophysical survey equipment prior to deployment. This potential effect could occur where the frequency range of the equipment overlaps with the hearing range of the different functional hearing groups of cetaceans. However, as set out in the European Protected Species (EPS) Risk Assessment (see Appendix I) only the Sub-Bottom Profiler (SBP) survey method has the potential to evoke either a behavioural or Permanent Threshold Shift for cetaceans and pinnipeds.<br><br>The Ultra Short Baseline (USBL) also has the potential to evoke a behavioural response. Using a precautionary approach to the assessment, behavioural responses may be displayed by up to 16 harbour porpoise, 4 common dolphin, 3 bottlenose dolphin and 1 minke whale. However, the percentage of the reference populations these numbers represent is very small (mostly < 0.01%), the duration of the proposed survey is short (2 days) and suitable alternative local habitat is available. Therefore, any disturbance will not be detrimental to the maintenance of the population and an EPS licence (covering use of USBL and SBP equipment) can be awarded for this aspect of the proposed work. | At least one Marine Mammal Observer (MMO) will be available to undertake 30-minute pre-work searches of a 500 m radius mitigation zone prior to use of the SBP. Surveys will be conducted in daylight hours only. If marine mammals, turtles or basking sharks are detected within the mitigation zone during a pre-work search, or during a search after an unplanned break, the start of the work will be delayed until their passage, or the transit of the vessel, results in them being outside the mitigation zone. There will be a minimum of 20 minutes from the time of the last detection within the mitigation zone to the commencement of the work. As per the 2017 JNCC guidelines, unplanned breaks refer to instances where the SBP ceases pinging unexpectedly during operations. In these instances:<br><br>Work will resume without a pre-work search after unplanned breaks of 10 minutes or less provided that no animals are detected in the mitigation zone during the breakdown period; and<br><br>A full pre-work search will be conducted before work resumes after unplanned breaks of longer than 10 minutes. Any time the MMO has spent observing prior to the breakdown period will contribute to the pre-work search time.<br><br>Clear channels of communication between the MMO and relevant crew will be established prior to commencement of any operations. The MMO will be informed sufficiently in advance of any proposed work so that a full pre-work search can be completed prior to work commencing. There is |

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | | therefore no potential for offence for this aspect of the proposed work (and no licence required). |
| **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 SwimmerTurbine™ and its mooring and anchor system and umbilical cable will be installed using up to two standard multi-cat work vessels, assisted by a RHIB.<br><br>It is anticipated that installation activities will be completed in a total of approximately seven to twelve 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 16 km 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 approximately 9 km (to the North) and 11 km (to the East) from the Inner | Adherence to SMWWC<br>Relevant measures from the Scottish Marine Wildlife Watching Code (SMWWC) (NatureScot, 2017a; NatureScot, 2017b) will be implemented by Flex Marine Power and all marine contractors. These will include:<br>• Vessel 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 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 |

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | 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.<br><br>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 3km 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. | from shore in the vicinity of cliff-nesting seabirds to avoid disturbance.<br><br>**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. | 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 |
|---|---|---|---|
| | | All maintenance will be carried out locally using local vessels.<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 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 installation of the mooring system. The anchors that will be in contact with the seabed consist of a gravity clump weight, chain and cast-iron or steel sinkers which will be lowered onto the seabed. The footprint of the clump weight anchor is calculated to cover approximately 16m$^2$ at most. In addition, there will be a side anchor weighing up to 1 tonne and three recovery chains.<br><br>The deployment site is within an area in which the priority marine feature (PMF) 'kelp and seaweed communities on | FMP will deploy an underwater drone with camera capability at the site of the clump weight anchor prior to installation. The clump weights will then be microsited accordingly to minimise impact on PMFs.<br><br>All materials deposited on the seabed will be installed in a controlled manner. The umbilical will be microsited following a sonar survey, positioned so as to follow natural contours thus reducing potential for movement.<br><br>Vessels will only use engines to hold position during construction works. |

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | sublittoral sediment' is known to occur[3]. NatureScot also have records of maerl in the vicinity of the proposal.<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 anchors and immediate vicinity. All equipment will be removed from the seabed upon completion of the project.<br><br>If installation is halted due to bad weather the mooring chain will be temporarily laid on the seabed in line with the flow with a retrieval buoy attached. If this period becomes longer than a month then the buoy will be removed and an acoustic release or remote operated vehicle (ROV) will be deployed to retrieve the mooring chain.<br><br>Potential disturbance to benthic habitats and species is therefore considered to be highly localised and temporary with 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. |

[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 |
|---|---|---|---|
| **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 SwimmerTurbine™ tidal device, rated up to 70kW, which has two blades with a rotor diameter of 5m.<br><br>Collision risk modelling was undertaken by Natural Power, in accordance with NatureScot guidance[4] - See Appendix G (Natural Power, 2024)<br>The predicted annual collision rate for each species using a 98% avoidance rate is:<br>• Harbour porpoise: 0.23 (C.I: 0.05 – 0.44) collisions per year.<br>• Harbour seal: 0.13 (C.I: 0.06 – 0.23) collisions per year.<br>• Grey seal: 0.02 (C.I: 0.01 – 0.03) 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 | 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/professional-advice/planning-and-development/environmental-assessment/habitats-regulations-appraisal-hra

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| | | MU is 28,936 (21,140 – 39,608) (IAMMWG, 2023). The predicted collision risk of 0.23 harbour porpoise fatalities per year would represent less than 0.001 % of the total population within the West Scotland MU.<br><br>The Permitted Biological Removal (PBR) value for harbour seals for the West Scotland Seal Management Unit (SMU) is 936 (SCOS, 2022). The predicted collision risk of 0.13 harbour seals per year constitutes just 0.014 % of the allowable take suggested by the PBR value.<br>The Permitted Biological Removal (PBR) value for grey seals for the West Scotland Seal Management Unit (SMU) is 933 (SCOS, 2022). The predicted collision risk of 0.02 grey seals per year constitutes just 0.002 % of the allowable take suggested by the PBR value.<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 small-scale tidal turbine at this coastal location is unlikely to result in significant adverse effects to these populations. | |

| Potential impact | Receptor | Assessment of residual effect(s) | Proposed mitigation/monitoring measure(s)/reporting |
|---|---|---|---|
| Entanglement in mooring lines or cables leading to injury or death. | Cetaceans<br>Seals<br>Basking shark | The device mooring will comprise a single mooring line that attaches the device, which is mid-water buoyant, to a single gravity anchor on the seabed. The device mooring is a combination of steel rope (38 mm diameter) and chain (up to 130 mm diameter). The chain section will be attached to the clump weight and fixed onto the steel rope which will in turn be attached to the device.<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 an inertial/GPS system, the movement of the device will be monitored, and an alert will be triggered if the system moves outside of operational parameters.<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 1,450m$^2$.<br><br>The Project volume 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™ rated up to 70kW 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. (2023). Review of Management Unit boundaries for cetaceans in UK waters (2023). JNCC Report 734, JNCC, Peterborough, ISSN 0963-8091.

Natural Power (2024) Marine Mammals Collision Risk Modelling Sound of Islay. Report for FMP.

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

NatureScot (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

Special Committee on Seals (SCOS) (2022). Scientific Advice on Matters Related to the Management of Seal Populations: 2022.

Shell, 2015, Naturelle *HF-E 32*, available at: https://shop.sclubricants.com/pub/media/pds/shell/Shell-Naturelle-Fluid-HF-E-32-datasheet.pdf.

# 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.

**Figure A.1 Example multi-cat vessel**


**Figure A.2 Example RIB vessel**

Vessels will only use engines to hold position during construction works to avoid potential damage to recorded PMF habitats in the vicinity. This includes kelp and seaweed communities along with maerl.

## A.3 VESSEL ROUTES

All Project vessels will use the port of Port Askaig within the Sound of Islay, which is approximately 3km to the north of the deployment site. The vessel transit route to the site is illustrated in Figure A.3 below. Please refer to Section 2.5.2 Operations and Maintenance in the EMP for an outline of the anticipated activity between Port Askaig and the deployment site.

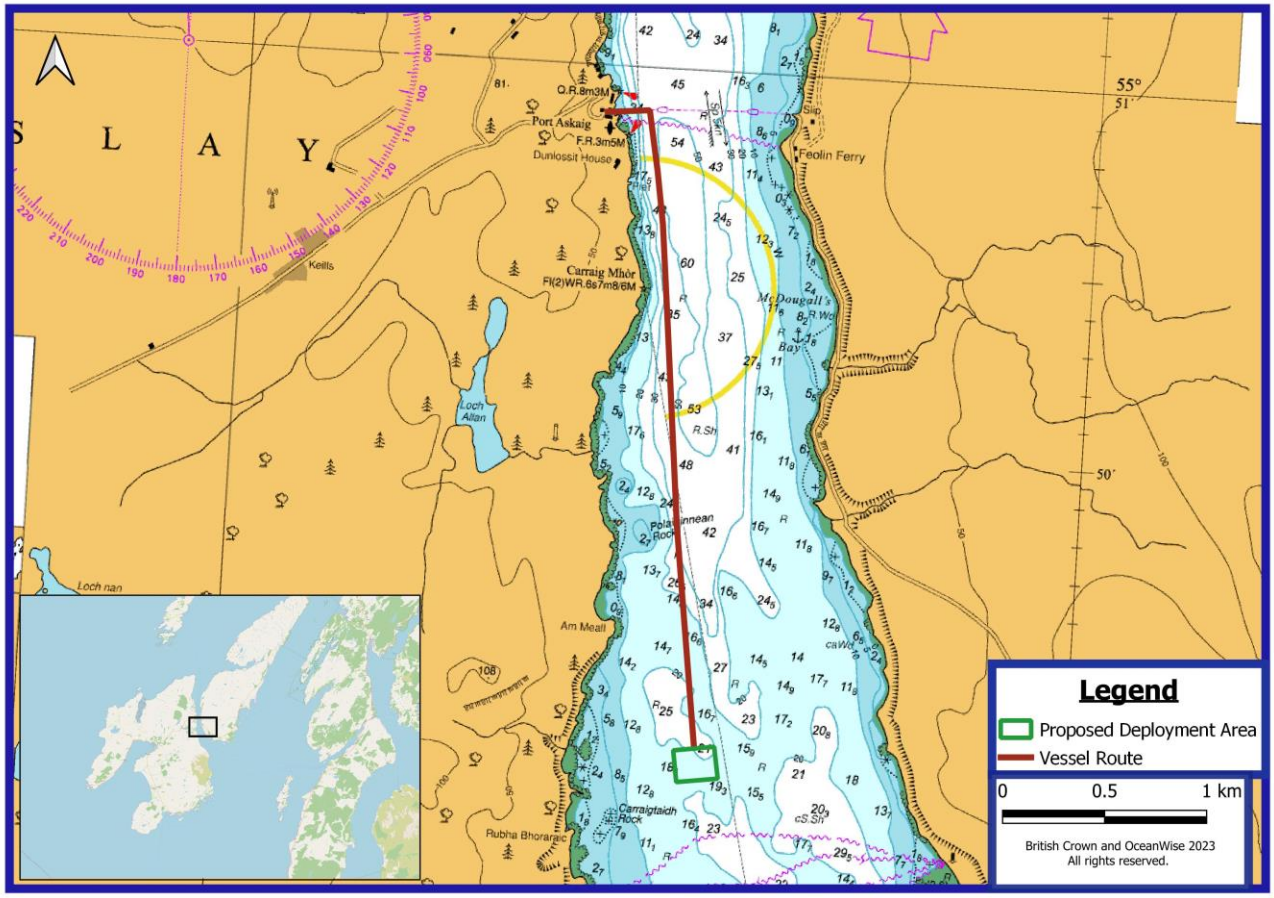


**Figure A.3 Transit Route**

### Navigation warnings and communications

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

Navigation warnings will be communicated through Notices to Mariners (NtoM) to inform mariners of circumstances which affect the safety of navigation. 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

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.

## Collision Risk from Vessels

Relevant measures from the Scottish Marine Wildlife Watching Code (SMWWC) (NatureScot, 2017a; NatureScot, 2017b) will be implemented by Flex Marine Power and all marine contractors. These will include:

- Vessel 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.
- A steady speed and course will be maintained where possible if a marine mammal approaches a project vessel.
- Care will be taken to avoid splitting up groups, or mothers and young.
- 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 implemented.
- Sudden unpredictable changes in speed, direction and engine noise will be avoided to avoid disturbance to any marine mammals in the vicinity.
- Rafts of birds will not be intentionally broken up or flushed.
- 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.

# APPENDIX B NAVIGATIONAL RISK ASSESSMENT

- *See standalone document*

# APPENDIX C NAVIGATION PLAN

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

1. A virtual AtoN will be 'located' approximately 25m to the east of the turbine and be broadcast to vessels as a virtual East Cardinal Buoy. All vessels with an AIS system will see this Cardinal Marker. It is worth noting that the proposed AtoN location is approximately ~130m within the red sector of the Carraig Mhor light and so outwith the main shipping channel.
2. The virtual East Cardinal mark will be defined on AIS systems by two black cones pointing away from each other underneath which is a yellow horizontal band on a black body.
3. An inertial/GPS system will be located in the turbine. Using this, the movement of the device will be monitored, and an alert will be triggered if the system detects movement outside of operational parameters.

## 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 (FMP have identified relevant local mariners/fishermen through engagement with their local project partner Islay Energy Trust. These parties were consulted with separately by FMP).

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 | Flex Marine Power's Compliance Officer | 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. |

## D.6 VESSEL TYPES USED ON THE PROJECT

Appendix table D.1 will be updated by the Biosecurity Manager (role held FMP's Compliance Officer) 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.

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

**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™ and mooring system |

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

- All subsea materials will be immersed only in Scottish waters.
- Implementation of biosecurity mitigation and management will ensure the risk remains low.

## 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 Flex Marine Power's Compliance Officer.

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

| Mitigation or good practice measure | Responsible person |
|---|---|
| The SwimmerTurbine™ mooring system and associated infrastructure will be transported to Port Askaig by road rather than sea to minimise potential transfer of INNS. | FMP Compliance Officer |
| Western Scotland or Northern Ireland-based vessels will be used for marine operations, to minimise potential for transfer of INNS. | FMP Compliance Officer |
| Operators used for marine operations will follow their own biosecurity good practice policies. | FMP Compliance Officer |
| 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. 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. | FMP Compliance Officer |
| 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. | FMP Compliance Officer |
| 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 | FMP Compliance Officer |

| Mitigation or good practice measure | Responsible person |
|---|---|
| contaminated material entering the marine environment. Any INNS identified will be reported to Argyll and Bute Council, Marine Scotland and NatureScot. | |
| 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. | FMP Compliance Officer |
| Approved foul-release coating only will be used on relevant turbine components. | FMP Compliance Officer |
| 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. | FMP Compliance Officer |

## 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 an inertial/GPS system, the movement of the device will be monitored, and an alert will be triggered if the system moves outside of the operational parameters. 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 equipment cabin will allow site monitoring by remote access when personnel are not on-site.

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 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).

# APPENDIX G  COLLISION RISK ASSESSMENT

*-See standalone document*

# APPENDIX H HABITAT REGULATIONS APPRAISAL

- *See standalone document*

# APPENDIX I EUROPEAN PROTECTED SPECIES RISK ASSESSMENT

*- See standalone document*

# APPENDIX J IEC CERTIFICATE

Document No.

**IECRE.ME.FS.23.0001-R0**

IECRE - IEC System for Certification
to Standards relating to Equipment
for use in Renewable Energy Applications

## FEASIBILITY STATEMENT

## Technology Qualification Plan

## Tidal Energy Converter

| | |
|---|---|
| This document is issued to: | Flex Marine Power Ltd. |
| Registered address: | 91 Clober Road, Milngavie,<br>Glasgow<br>G62 7LS<br>United Kingdom |
| Device: | SwimmerTurbineTM SW2 - Tidal Energy Converter |

This document attests compliance with the requirements of IEC TS 62600 series, applicable Operational Documents and International Standards, and is issued based on the following documents*:

| | |
|---|---|
| Technology Qualification Plan: | DV02-00003-Rev.01 |
| Dated: | 2023-04-17 |

The evaluation was conducted in accordance with the Rules and Procedures of the IECRE System www.iecre.org

Changes to the approved system design, components, configuration and layout, operational envelope or the manufacturer's quality system are to be approved by Lloyd's Register in accordance with applicable Operational Documents and Standards.

Without approval of any such changes, this document loses its validity.

Approved for issue on behalf of the IECRE
Certification Body: [Redacted]

Name: Winston D'Souza
Position: Lead Marine Energy Specialist
Location: Aberdeen, United Kingdom

Issued on: 2023-05-30

Lloyd's Register EMEA
Prime Four Business Park
Kingswells Causeway
Aberdeen AB15 8PU
United Kingdom

*the basis for the abovementioned documents remains the property of the technology developer and considered confidential

OD-310-T01 Ed.3.0