Islay Community Demonstration

Decommissioning Programme

March 2022

DRAFT

Flex Marine Power

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 drafted by:

Aquatera Ltd
Old Academy Business Centre
Stromness
Orkney
KW16 3AW

Contact: Shane Quill
Tel: +44 (0) 1856 850 088
Email: shane.quill@aquatera.co.uk

Issue record

Version	Date	Details
001	26 Nov 2021	Draft provided to FMP
002	30 Nov 2021	Draft issued to MSLOT
003	11 Feb 2022	Updated following feedback from MSLOT
004	18 Mar 2022	Submitted to MSLOT in response to s105 notice

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

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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.

Following on from successful trials at a Strangford Lough tidal site, FMP were awarded funding from the UK government via InnovateUK, in order to deliver and deploy in collaboration 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 will mark a significant step toward realising the potential of small-scale community-owned tidal energy.

FMP recently applied for a marine licence under 21(5) of the Marine (Scotland) Act 2010 ("the 2010 Act") which is required to construct, alter or improve any works within the Scottish marine area either a) in or over the sea, or b) on or under the seabed. This triggered the requirement for this Decommissioning Programme which should be read in conjunction with the Environmental Management Plan (EMP) that accompanied the marine licence application.

1.2 THE ENERGY ACT 2004

Section 62 of the Scotland Act 2016 transfers to Scottish Ministers powers under the Energy Act Part II Chapter 3, to require developers of offshore renewable energy projects in Scottish Waters and the Scottish part of a Renewable Energy Zone, to prepare a decommissioning programme. These powers constitute the regulatory functions of decommissioning including: powers for Scottish Ministers to approve such a programme; to require financial security for a programme to be put in place by responsible persons; and, should that responsible party default, to ensure that the decommissioning programme is carried out.

A section 105 notice is a notice served by the Secretary of State in accordance with section 105 of the Act. This notice places an obligation on its recipient to submit a decommissioning programme for approval by the Secretary of State. A section 105 notice was issued to FMP dated 1 March 2022 and set a deadline of 18 March 2022 for the submission of the draft decommissioning programme to Marine Scotland – Licensing Operations Team ("MS-LOT"); the section 105 notice also sets out consultation requirements.

This Decommissioning Programme describes the works required to decommission the SwimmerTurbine™ and associated infrastructure at the deployment site along with the costs of doing so. It further sets out the mechanism for the return of the site to its pre-existing condition. This programme is informed by the 'Decommissioning of Offshore Renewable Energy Installations under the Energy Act 2004'_Guidance notes for industry (England and Wales)[1] (BEIS, 2009).

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/916912/decommissioning-offshore-renewable-energy-installations-energy-act-2004-guidance-industry__1_.pdf

2 PROJECT OVERVIEW

2.1 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 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.

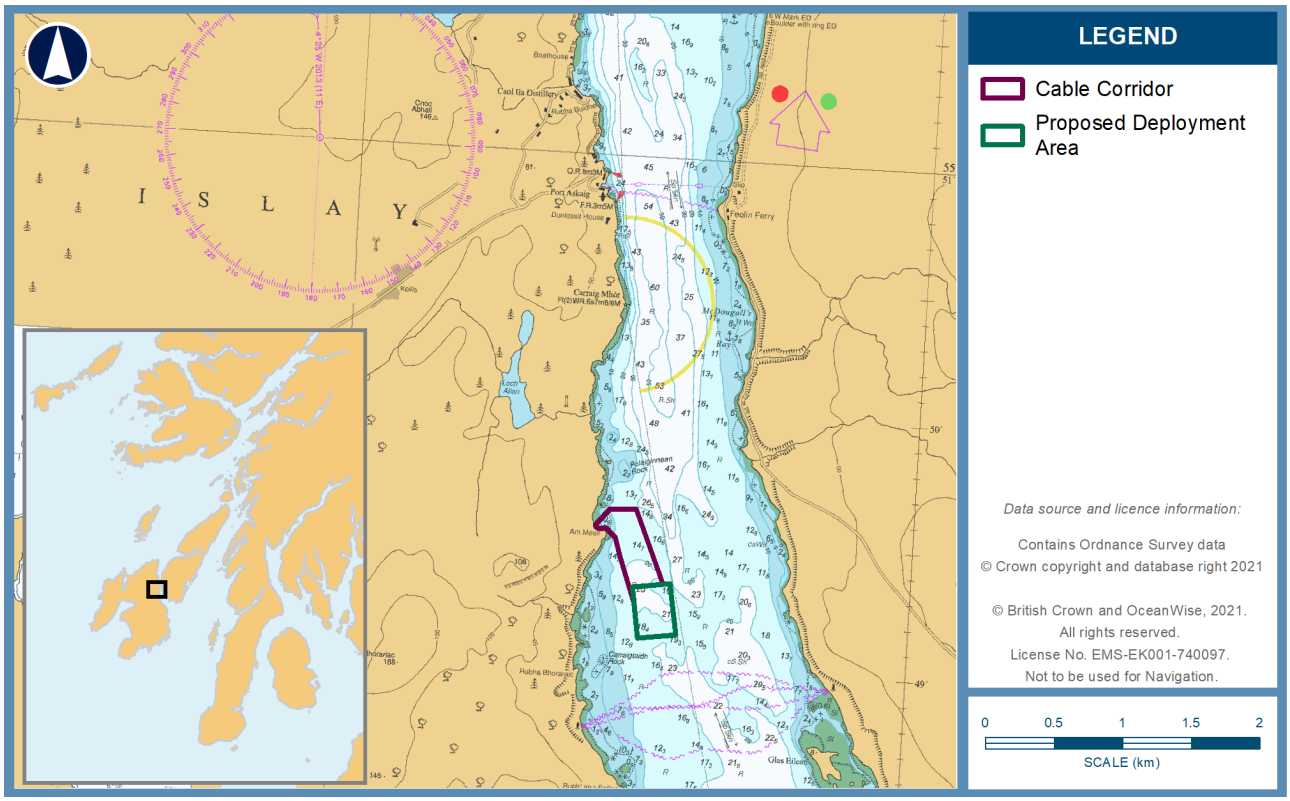

Figure 2-1 Proposed licence and deployment area at Test Site

Table 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**

2.2 PROJECT SCHEDULE, TIMINGS AND COMMENCEMENT DATES

The anticipated date of installation of the SwimmerTurbine and its associated mooring system is June 2022. The operational period is anticipated to last approximately 5 years up to the end of May 2027. Decommissioning would commence thereafter with approximately 7 days required for decommissioning which will commence once a suitable weather window has been identified. It is anticipated that decommissioning would be completed by the end of June 2027.

2.3 TECHNICAL DESCRIPTION OF COMPONENTS

The project includes the following key technical components:

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

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

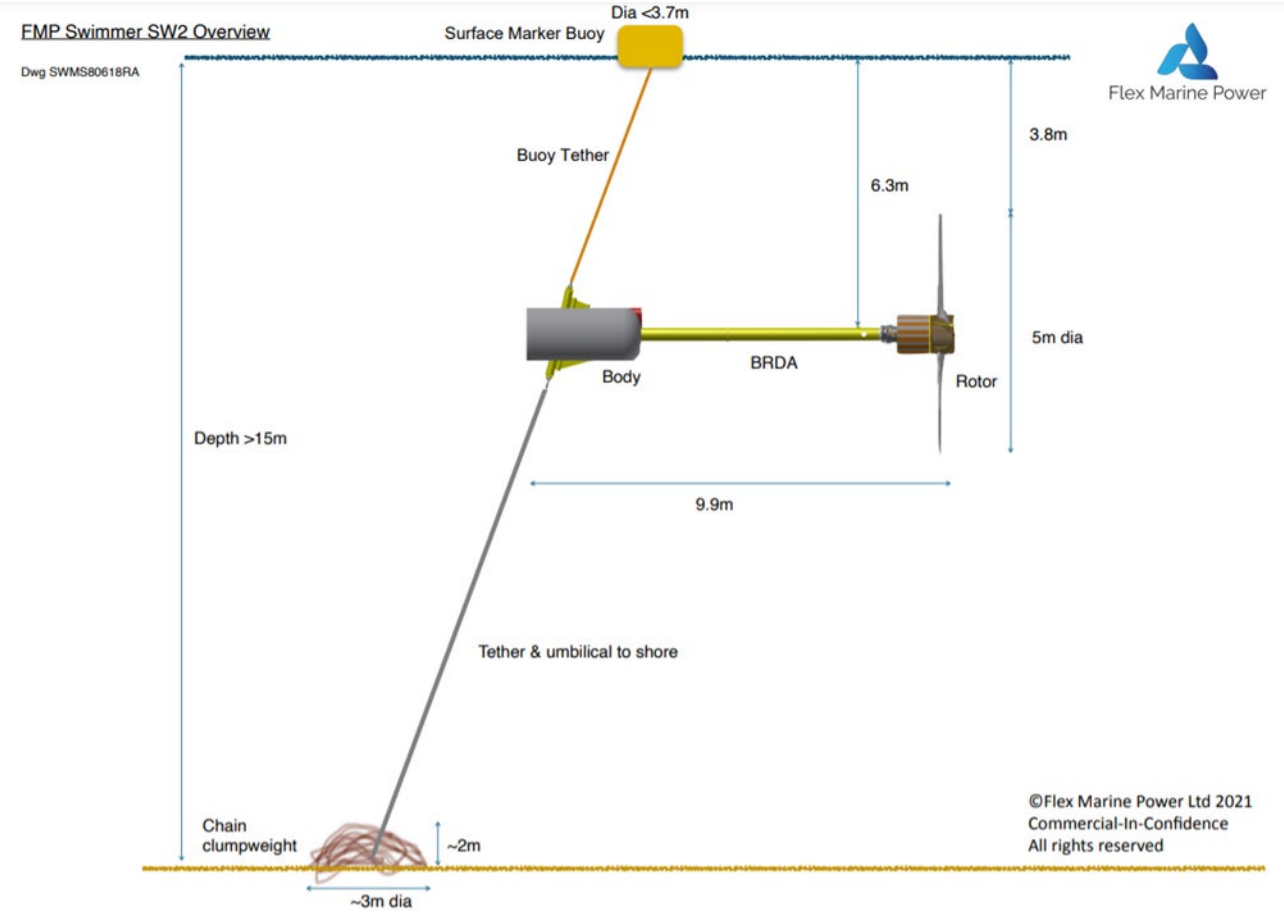

Figure 2-2 Turbine System in the water column

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.

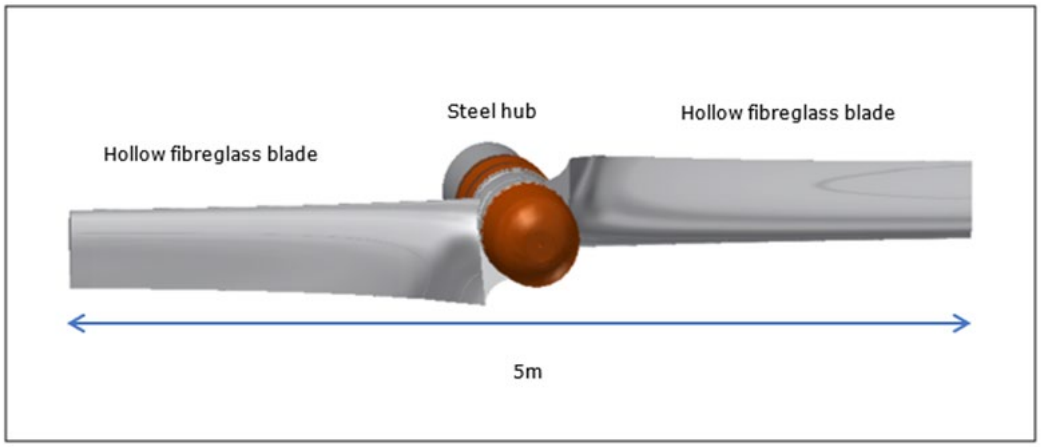

Figure 2-3 SwimmerTurbine™

The key dimensions of the turbine are outlined in Table 2.

Table 2 Key dimensions of the SwimmerTurbine™

Dimension	Units	Value
Length	m	9.9
Rotor diameter	m	5.0

Surface Marker Buoy & 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.

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 fibre optic 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 50 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 fed via attached 3-phase cabling and connectors generates the electrical power. 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 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.

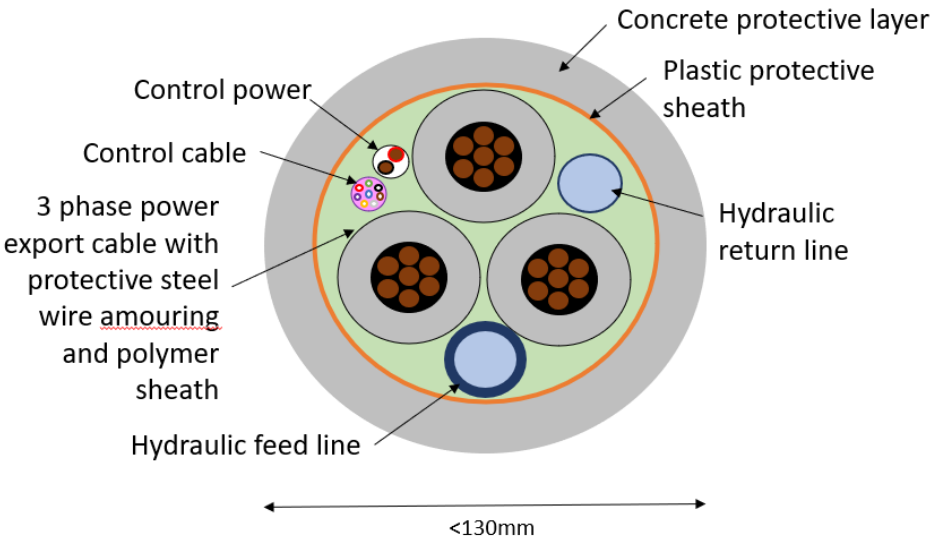

Figure 2-5 Cable with protection cross section

Landfall & 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 3 outlines all key components and materials that comprise the overall system for deployment.

Table 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	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): • Up to 90 liters biodegradable hydraulic oil • Up to 10 liters compressed air • Shoreside batteries and backup power diesel • Subsea small backup battery • Rubber fenders • Generator copper coils and magnets • Hydraulic seal rubber • Brake pads • Electrical circuitry • Foul release coating			

2.4 OPERATIONAL PLANS AND METHODOLOGIES

2.4.1 Decommissioning

The vessel spread required for decommissioning is shown in Table 4.

Table 4 Vessels utilised for decommissioning

Vessel Type	Task
Multi Cat (x1)	Anchor and Mooring decommissioning/removal. Device installation and removal.
Rigid Hulled Inflatable Boat (RHIB) (x1)	Safety boat

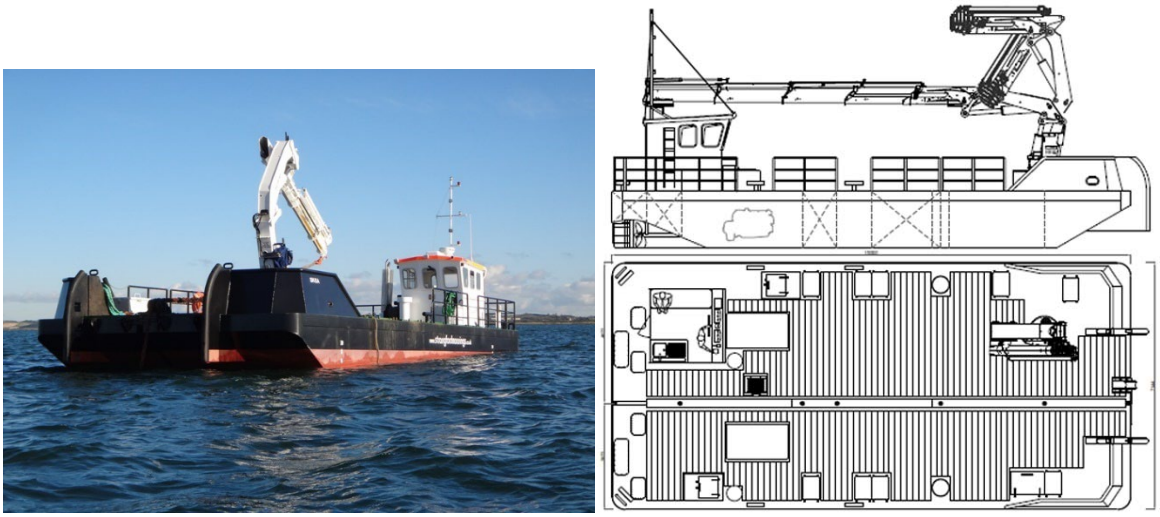

Figure 2-7 Example vessel: Multi Cat used for decommissioning in Strangford, NI

Figure 2-8 Example vessel: RHIB

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 approach will be followed for this project.

The following is only to be undertaken within slack tide periods under conditions assessed to be safe by the qualified skipper with a suitable workboat. Be aware this is an area of fast currents and take suitable precautions. Key steps will be:

A. *Remove rotor and nacelle, then recover cable to vessel, starting at the onshore site and progressing back towards the machine (1 day).*

1. Isolate umbilical from onshore power connection.
2. Use the machine's surfacing controls to raise rotor and nacelle to surface.
3. Disconnect rotor and nacelle, and lift onto deck of vessel.
4. Place jumper hose to connect the inflow and outflow oil lines.
5. Use surfacing controls to return the remaining BRDA tube back to normal submerged operating depth.
6. Carry rotor and nacelle on vessel to Port Askaig quayside and load onto transport for road transit to disposal site.
7. Flush oil lines from the shore, by injecting water and detergent into the lines, thus removing oil from the full system and umbilical into a removable container.
8. Recover umbilical (starting from shore end and finishing at machine) by progressively lifting onto vessel and cutting into deck lengths. Note that removal of the umbilical where it crosses the beach will require shingle there to be lifted and replaced.
9. Carry umbilical lengths on vessel to Port Askaig quayside and load onto transport for road transit to disposal site.

B. *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).*

1. Use surfacing controls to raise BRDA tube to surface.
2. Recover the end of the recovery chain which is furthest away from the machine (Body and BRDA tube), using a Remotely Operated Vehicle (ROV) with a 'happy hooker' recovery line attachment (or similar) to fit a recovery line to the end of the recovery chain.
3. Recover chain end to deck and re-position ROV adjacent to the mooring lock mechanism at the mooring's base.
4. Use the vessel to haul the recovery chain tight to release the subsea machine mooring lock mechanism and then use the ROV to fit its lock retaining pin.
5. From the vessel slowly pay out full length of recovery chain allowing the machine to slowly rise to the surface and float there.
6. With the machine floating on the surface, undo from the machine the shackle retaining the surface marker buoy and buoy tether and recover these onto deck of vessel.
7. Paying out the recovery chain, haul onto the deck of the vessel its full length of mooring line with remaining length of umbilical until its end shackle connecting to the other end of the recovery chain surfaces.

8. Ensuring the machine will not float away from the vessel once separated from its mooring line, disconnect this shackle and stow the mooring line and umbilical length on the vessel for later disposal. If necessary, remove or cut away the mooring line and umbilical where they connect to the machine.
9. Shackle the two opposite ends of the recovery chain together, and connect this shackle to an extension wire fitted with a suitable temporary marker buoy. We will refer to this doubled up chain as the "buoy-mooring" for the purposes of section C below.
10. With the machine suitably secured to the vessel for towing, release the marker buoy and return to Port Askaig quayside.
11. At Port Askaig quayside or slipway, load machine onto transport for road transit to disposal site.

C. *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).*

1. Remove temporary buoy and secure the buoy-mooring to a strong point at the vessel bow, keeping the buoy-mooring upright and taut for the duration of the operation.
2. Use ROV with 'happy hooker' (or similar) to fit a line to, and then recover to deck, the first link of the steel chain clump weight (conspicuously marked with a coloured strop).
3. Progressively recover the clump weight by hauling chain up the buoy-mooring onto deck of vessel, disconnecting any connections to the buoy-mooring as these arrive at deck level.
4. When the final tail of the clump chain is recovered, recover the cast iron base sinker by hauling in the full length of the buoy-mooring onto deck. Then recover any attached side anchor if one is tethered to the base sinker. At this point no equipment will remain on the seabed.
5. Carry recovered chain lengths and mooring components on vessel to Port Askaig quayside, and load onto transport for road transit to disposal site. If work extends over a number of slack periods then ensure to fit the temporary marker buoy to the buoy-mooring each time before departing the site.

D. *Remove onshore equipment cabin and decommission any associated connection infrastructure (1 day).*

1. Make safe, remove, and package for transit all onshore equipment and fencing.
2. Transit all-terrain forklift to beach onboard vessel and unload to shore using suitable ramp.
3. Use all-terrain forklift to carry onshore iso-cube box to edge of beach, where it is picked up by the vessel's crane and loaded onto vessel's deck.
4. Remove posts which the onshore iso-cube was attached to and clear area.
5. Transit all items on vessel to Port Askaig quayside and load onto transport for road transit to disposal site.

Full decommissioning is expected to take no more than 7 days (subject to weather windows).

2.4.2 Waste Management

All components will be re-used where feasible. Any waste will be disposed of in accordance with good practice and statutory requirements.

2.4.3 Post Decommissioning

Flex Marine Power will restore the site (onshore and offshore) to the same condition as it was prior to the commencement of the installation works. No seabed debris will be produced by the decommissioning process. A seabed video survey

will be provided as evidence that restoration has been concluded to the satisfaction of Marine Scotland. A report will be sent to the Marine Scotland within four months of the decommissioning taking place after which there will be no further monitoring.

3 DECOMMISSIONING BUDGET

Detail of costs associated with decommissioning of the device is presented in a separate document which has been provided to MS-LOT.

Please note that these figures must be treated commercial in confidence.

We propose to provide financial security in the form of a cash deposit.