Magallanes ATIR

EMEC Fall of Warness Test Site

Navigational Risk Assessment Addendum

July 2023

Notes:

(i) This document provides a template which can be used by EMEC developers to create the project-specific addendum to the site-wide EMEC Navigation Risk Assessment (NRA) required to support applications to deploy, operate and remove assets at EMEC test sites.

(ii) This is a generic template, covering EMEC's Fall of Warness test site, and any information not relating to the proposed project should be deleted as appropriate.

(iii) Text in italics within this template provides instructions/examples regarding the level of detail/information that should be included in the NRA annex. This text should be deleted on completion of the document.

Purpose

This document is provided as an addendum to and should be read in conjunction with the document 'Fall of Warness Tidal Site Navigational Risk Assessment (NRA) – REP315'. It describes the key project-specific navigational risks to be addressed in relation to the proposed activities at the European Marine Energy Centre test site at Fall of Warness, Orkney Islands, together with proposed mitigation for reduction/elimination of these risks. Site location navigational risks are covered in the site-wide Fall of Warness NRA produced by EMEC.

This document has been prepared to support a marine licence application for the Magallanes ATIR. For further information regarding the project, please refer to the Project Information Summary.

Document History

Revision	Date	Description	Originated by	Reviewed by	Approved by
1.0	02/08/21	For submission	DL (EMEC)		
2.0	27/07/23	For submission	MI (MR)		

Disclaimer

In no event will the European Marine Energy Centre Ltd or its employees or agents, be liable to you or anyone else for any decision made or action taken in reliance on the information in this report or for any consequential, special or similar damages, even if advised of the possibility of such damages. While we have made every attempt to ensure that the information contained in the report has been obtained from reliable sources, neither the authors nor the European Marine Energy Centre Ltd accept any responsibility for and exclude all liability for damages and loss in connection with the use of the information or expressions of opinion that are contained in this report, including but not limited to any errors, inaccuracies, omissions and misleading or defamatory statements, whether direct or indirect or consequential. Whilst we believe the contents to be true and accurate as at the date of writing, we can give no assurances or warranty regarding the accuracy, currency or applicability of any of the content in relation to specific situations or particular circumstances.

Contents

List of Figures

List of Tables

1 Introduction

The ATIR device has been deployed at EMECs Fall of Warness tidal test site, which has enabled the Company to assess its behaviour in real sea conditions throughout the annual seasonality cycle. This testing has allowed the Company to progress the ATIR towards commercial viability.

The project aims to do the following:

- Demonstrate the operational performance of a grid connected full-scale prototype in a real open sea environment;
- Improve the prototype for cost competitive energy generation;
- Verify and validate the full-scale prototype with an independent electrical power performance assessment, and;
- Develop a business and marketing strategy to assist identification of potential customers.

Data obtained from this period of testing will be crucial for the future ATIR development as it provides valuable information regarding costs of installation, operation, maintenance, and decommissioning, together with electrical performance.

This assessment has been produced as an addendum to the site-wide Navigational Risk Assessment for the Fall of Warness test site (REP315). This document identifies and assesses any project-specific navigational risks and discusses the proposed risk control measures to be implemented in order to reduce the risk associated with the project.

2 Project overview

Further information regarding the project is available in the Project Information Summary.

2.1 Asset information

The full-scale prototype to be tested (at EMEC) can be broken down in the following blocks: upper block, vertical block (or mast) and lower block (or nacelle).

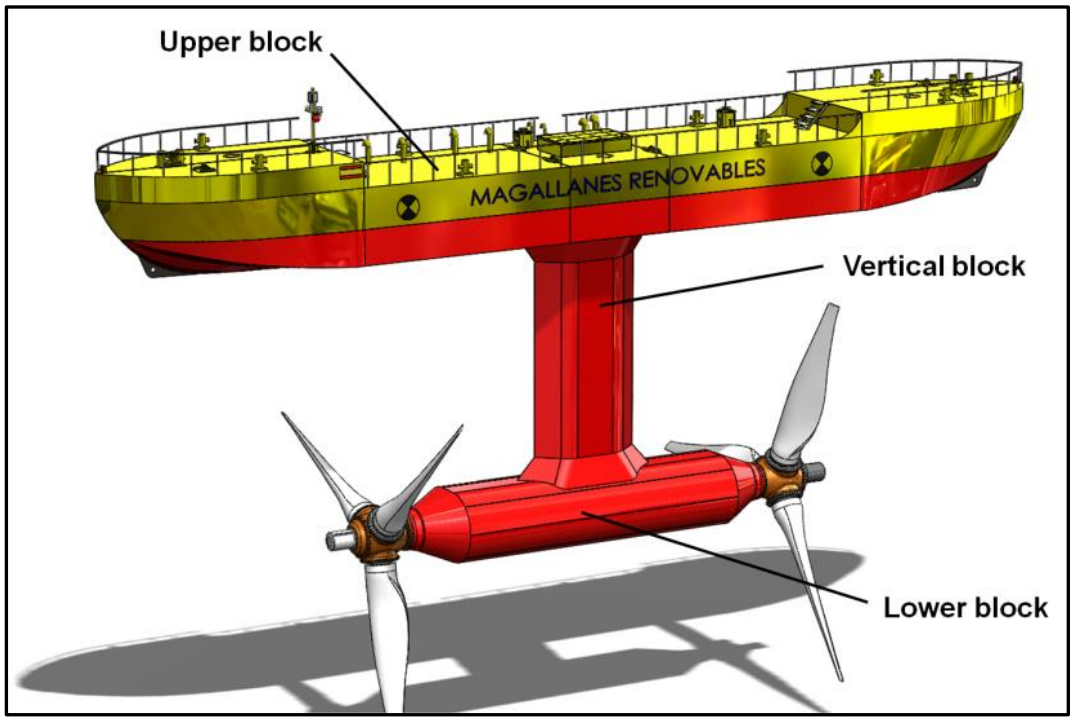

Figure 1. Scheme of block distribution

Upper block

It is the visible block of the platform, as around a half of it is above the waterline. It is the block through which the platform is accessible for maintenance. It is divided into three main rooms: one room is allocated to pumps and emergency power systems, whereas the other two rooms have been designed for accommodating the transformers, converters, switchgears and electrical panels, in addition to other parts of the electrical and electronic systems. Apart from these three main rooms, there are two inaccessible compartments at both ends of the block which are part of the ballast system which employs fresh water treated, as well as several tanks in the centre of the block for environmental acceptable lubricant supply and bilge water

Vertical block (mast)

Fixes the lower block to the upper block. It is a hollow space through which the communication and low-voltage cables connect the equipment housed in the lower block with the parts of the systems within the upper block. Rigid pipes for environmental acceptable lubricant supply and draining, among others, are also installed in the vertical block.

Lower block

It is significantly smaller than the upper block and it is devoted to the mechanical system. The most relevant components placed in this block are the main shafts, ball bearings, gear boxes and generators. As it had been indicated before, the platform is fitted with two counter-rotating rotors. As a result, all components of the mechanical system shall be in duplicate (one for each rotor).

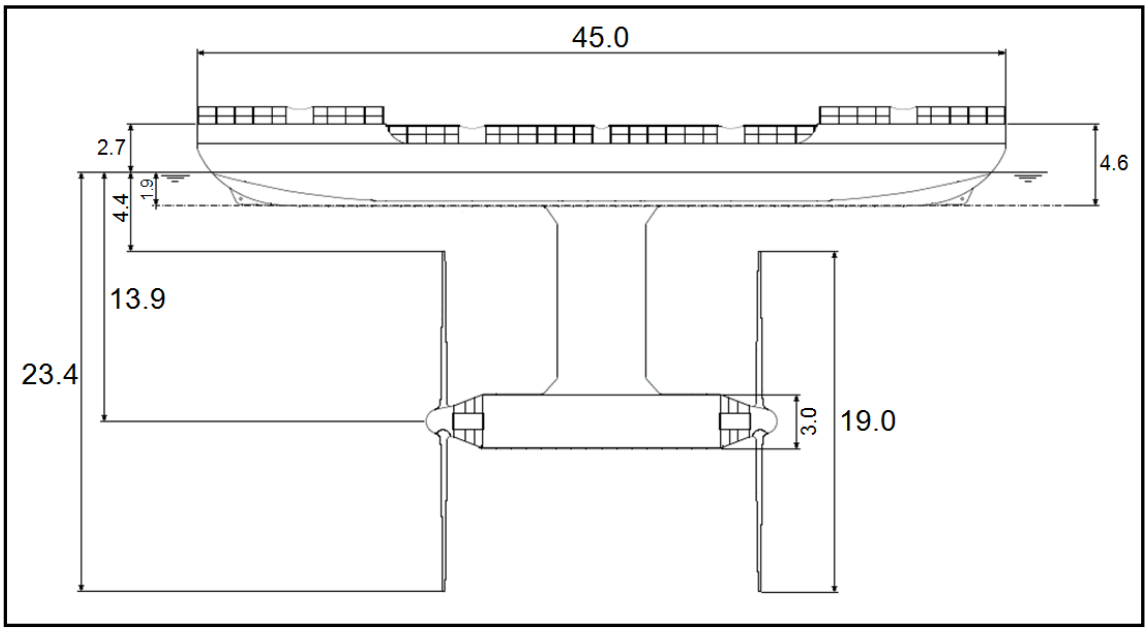

Figure 2. Overall dimensions of the platform

Table 1. Main specifications of the platform

Item	Specification
Scale of the device	Full-scale
Overall length	45 m
Extreme moulded breadth	6 m
Operational draught	23.4 m
Maximum output power	Up to 2 MW
Number of rotors	2
Type of rotor	Open-bladed rotor
Rotor diameter	19 m
Rotor depth	More than 2.5 m clearance from sea surface (4.4 m approx.)
Blade/rotor design	Blades with counter-rotating mechanism
Mooring system	gravity-based anchors with four mooring lines attached (ca. 300 m, each)
Relative position of the device on the water's surface	Not more than 300 m from the berth cable end

2.2 Schedule and test plan

The device is currently deployed at berth 1, Fall of Warness. This applications purpose is to extend deployment. The device may be removed from site during the lifetime of this licence for maintenance and repairs. If the device is removed, a NtM will be issued, and Marine Scotland and all consultees will be notified.

2.3 Deployment location

The platform is deployed at the EMEC Fall of Warness test site, off the island of Eday, Orkney, in the allocated berth. Nevertheless, in certain moments, the platform will make use of EMEC's Shapinsay Sound test site, Scapa Bay anchorage 1 and 2 or Deerness anchorage. The more benign conditions found in the temporary locations will facilitate the assembly and disassembly of the rotor blades, as well as the undertaking of other maintenance works, if needed.

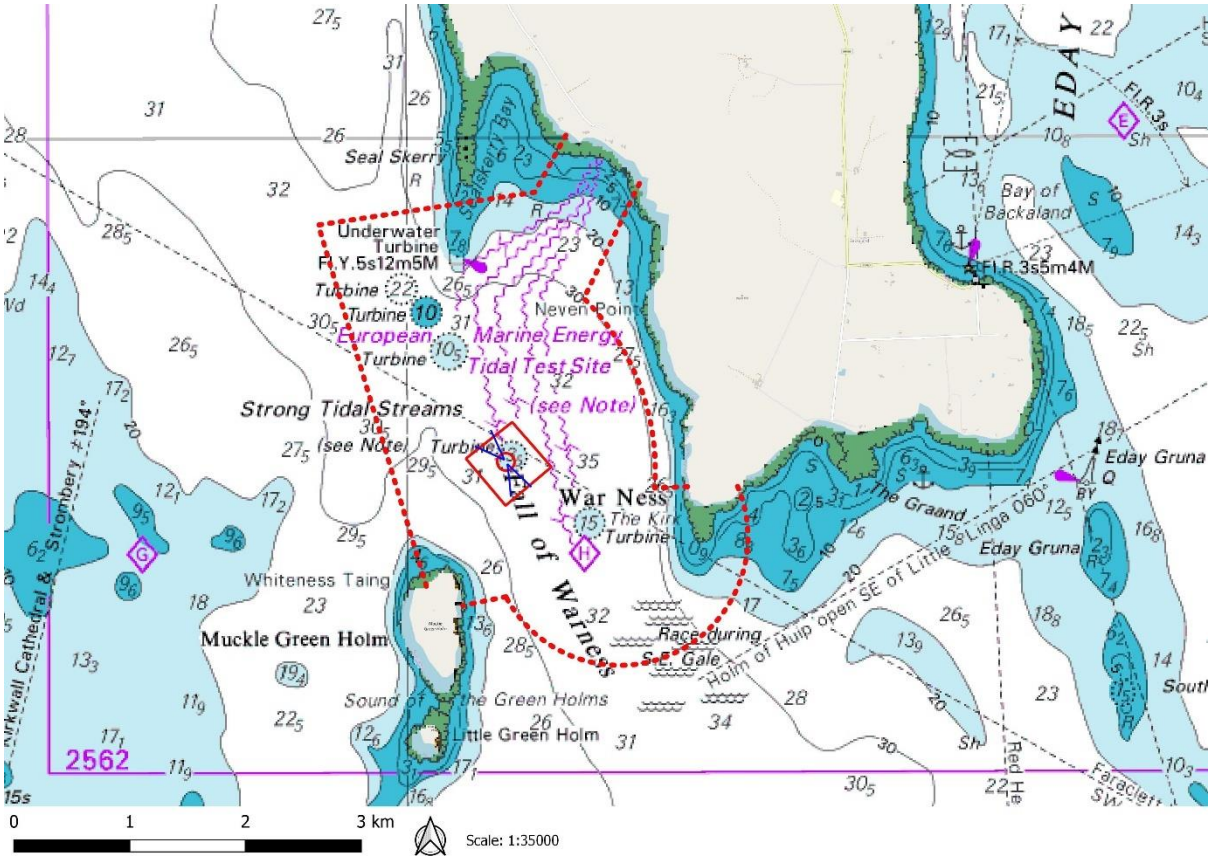

Figure 3. Deployment location, Fall of Warness

Table 2. Deployment location coordinates, Fall of Warness

Test berth	Latitude (WGS84)	Longitude (WGS84)
Berth 1	59° 08.479'N	02° 49.080'W
Points along platform deployment boundary	59º 08.673'N 59º 08.463'N 59º 08.282'N 59º 08.503'N	02º 49.048'W 02º 48.693'W 02º 49.113'W 02º 49.471'W

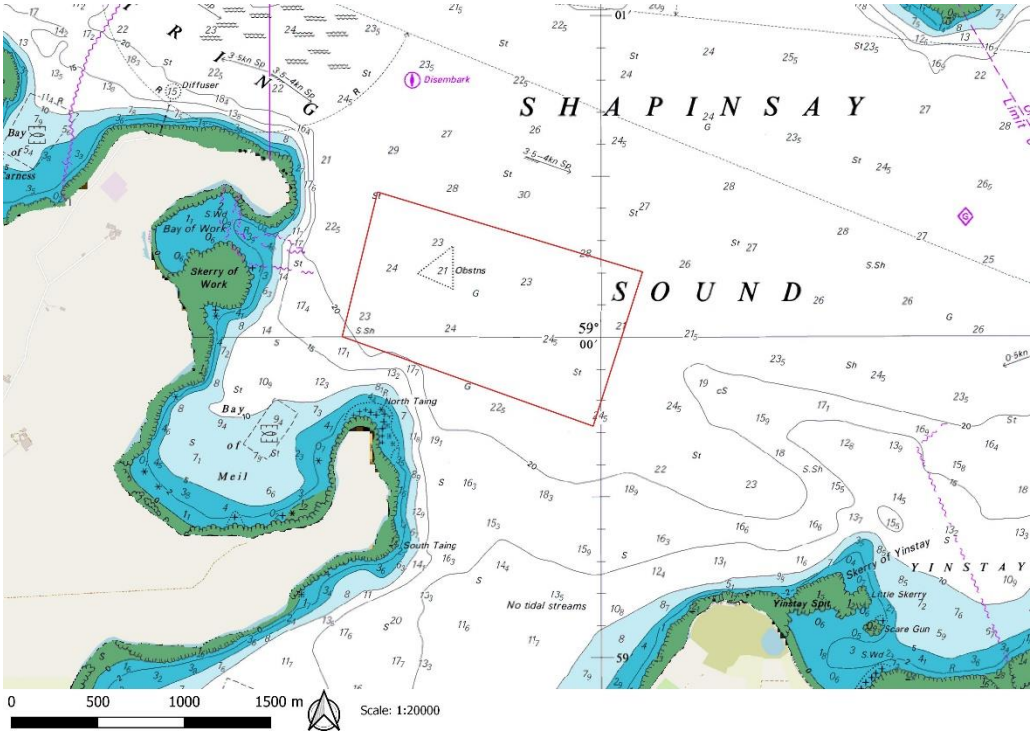

Figure 4. Map showing area of EMEC's scale tidal test site, Shapinsay Sound

Table 3. Attachment points at EMEC's Shapinsay Sound test site

Attachment point	Latitude (WGS84)	Longitude (WGS84)
Anchor A	59º 00.200'N	02º 53.073'W
Anchor B	59º 00.165'N	02º 52.918'W

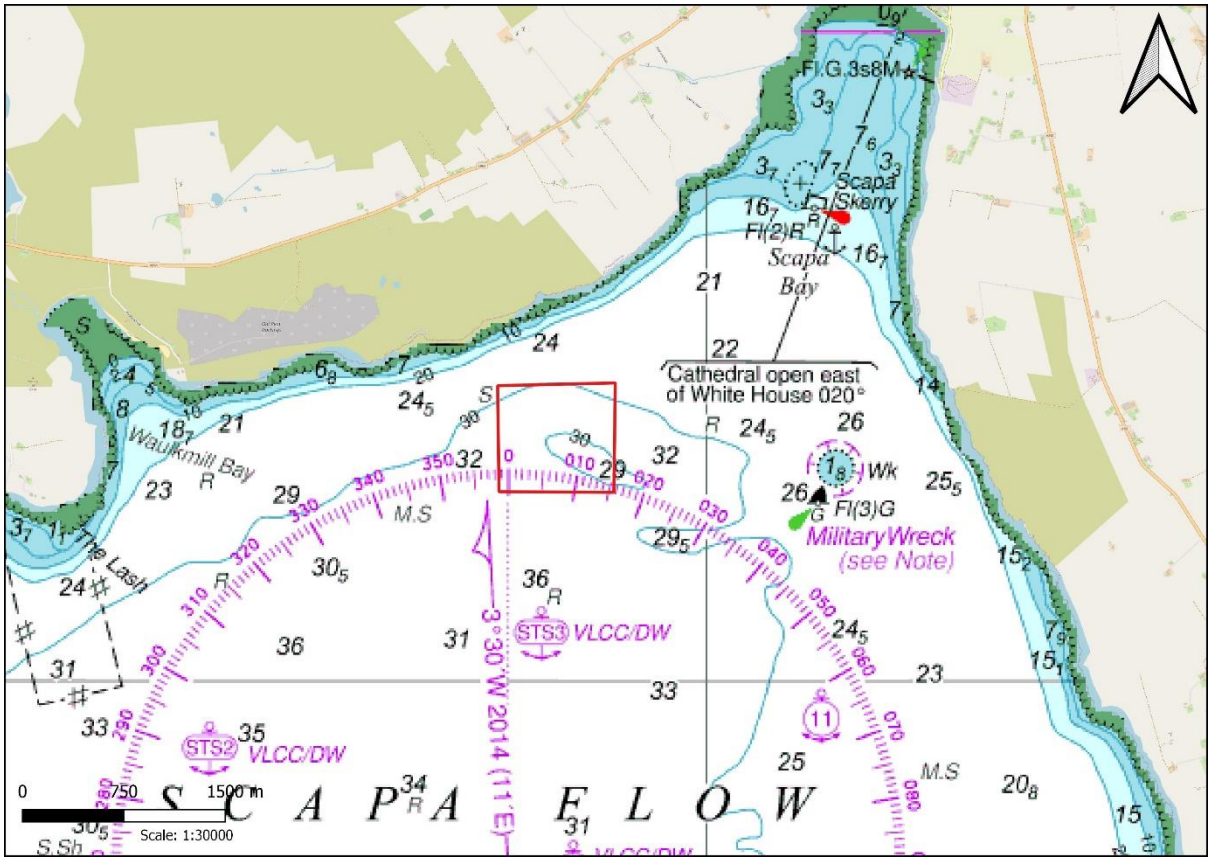

Figure 5. Map showing area of device temporary deployment at Scapa Bay anchorage 1

Table 4. Boundary of lease area for temporary mooring at Scapa Bay anchorage 1

Anchorage	Latitude (WGS84)	Longitude (WGS84)
Proposed temporary deployment boundary	58º 56.17'N	03º 01.61'W
	58º 56.17'N	03º 00.70'W
	58º 55.74'N	03º 00.70'W
	58º 55.74'N	03º 01.61'W

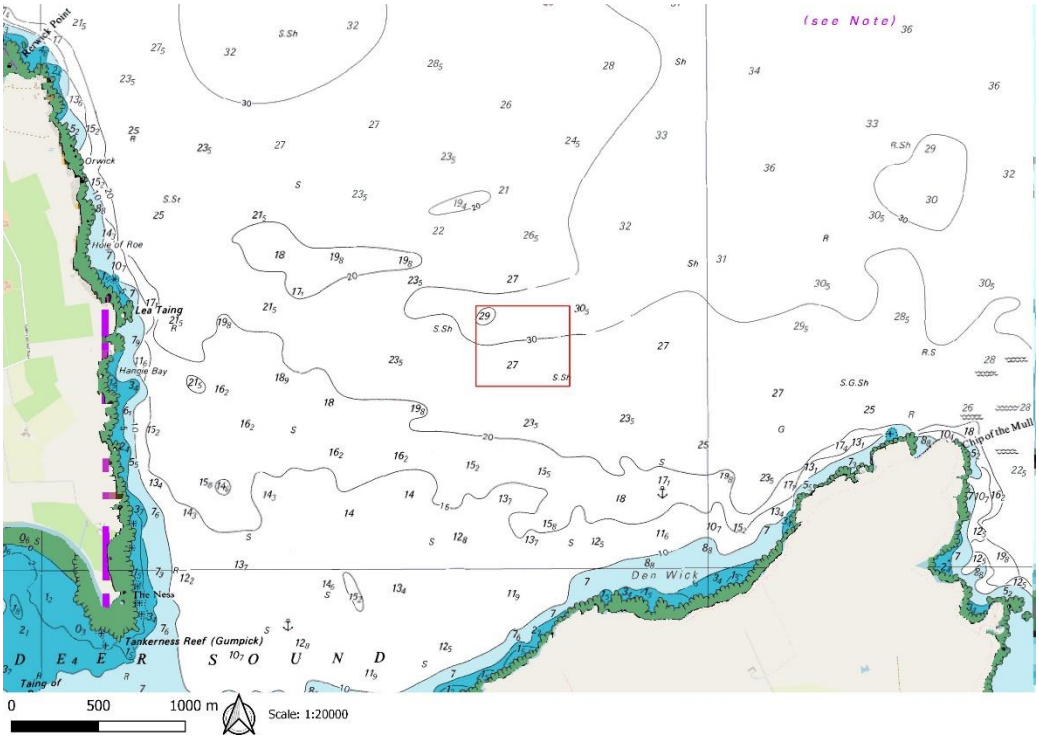

Figure 6. Map showing area of device temporary deployment at Deerness Sound

Table 5. Boundary of lease area for temporary mooring at Deerness anchorage

Anchorage	Latitude (WGS84)	Longitude (WGS84)
Proposed temporary deployment boundary	58º 58.813'N 58º 58.564'N 58º 58.564'N 58º 58.813'N	02º 45.388'W 02º 45.388'W 02º 44.829'W 02º 44.829'W

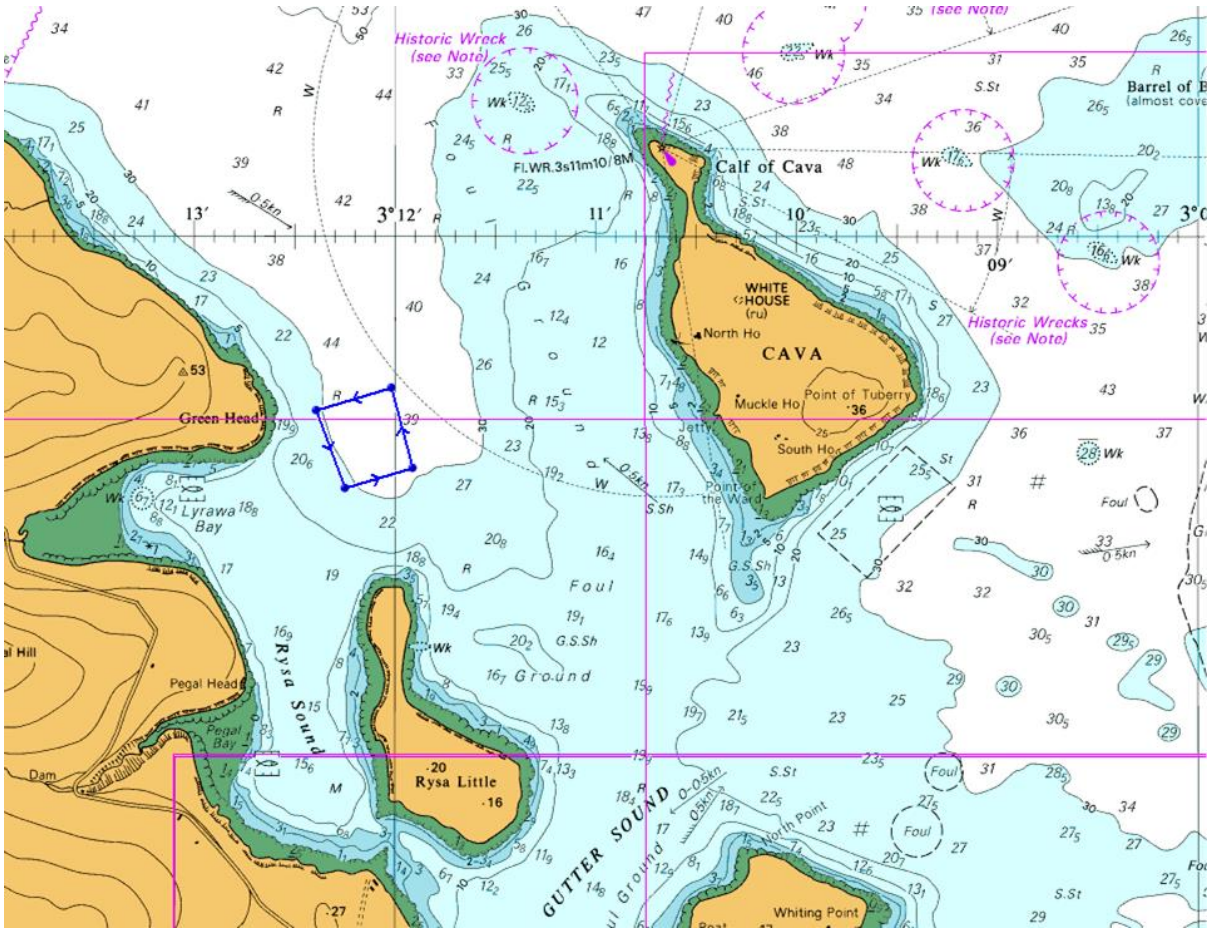

Figure 7. Map showing area of device temporary deployment at Scapa Bay anchorag 2

Table 6. Boundary of lease area for temporary mooring at Scapa Bay anchorage 2

Anchorage	Latitude (WGS84)	Longitude (WGS84)
Proposed temporary deployment boundary	58°52.554'N 58°52.354'N 58°52.406'N 58°52.612'N	3°12.389'W 3°12.245'W 3°11.908'W 3°12.015'W

3 Key navigational themes

In order to complete this project-specific assessment, a comprehensive review of the site-wide NRA for EMEC's Fall of Warness test site was conducted. The following navigational themes have been considered during the assessment.

3.1 Vessel routing

The Fall of Warness test site is clear of major vessel routes and vessels currently transiting the site appear to be well aware of the deployments across the site.

3.2 Contact / allision risk

Few vessels navigate within the site and the use of appropriate marking and lighting to alert other mariners to the assets onsite should mitigate the risk of contact. All assets onsite should

be charted on the United Kingdom Hydrographic Office (UKHO) charts, this information will be promulgated to the UKHO via Notice to Mariners.

3.3 Effects of tide / tidal streams and weather

Vessels take advantage of the lee behind the Muckle Green Holm when the tides are north-westerly. When the flow is from the south-east, vessels keep a wide berth from the Fall of Warness. The tidal streams therefore do not alter the routes of vessels to the area surrounding ATIR platform.

During consultation it was revealed the during bad weather it was common for ferries to come into the Fall of Warness site. During a strong south-easterly wind, significant overfalls, wave heights and a race can be expected to the south of Eday. Ferries would therefore pass to the east of Muckle Green Holm, come into the EMEC site passing to the north of the SR2000, before turning to come in close to the headland to the south-west of Eday. This allows the vessels some degree of shelter and means that they are not exposed beam on to the conditions

3.4 Under keel clearance

The radius of the blades is 9.5 metres and the apex of the swept area is 4.4 metres below the surface. Given the width of the surface platform (6 metres), there are 6.5 metres of swept area either side of the platform.

For a navigating vessel to collide with the blades, the vessel must be within 7 metres of the device and drawing at least 7 metres. It is therefore far more likely that the vessel would collide with the platform than damage the blades, and small vessels would be incapable of contacting the blades. The mooring arrangements are chain and, given the depth of water, will not compromise Under Keel Clearance (UKC) including when taking into account scouring.

3.5 Collision risk and visual navigation

The device is less than five metres high and will therefore ensure that most vessels will be visible over the top when navigating in the area. The exception may be small craft such as open top RIBs or pleasure craft as well as maintenance vessels working on the device. Prudent mariners will provide sufficient clearance from the device when navigating and this will further reduce the chance of a hidden vessel emerging in a collision scenario.

The location is not on the leading line of any navigational aids nor will significantly alter the visibility of other lights or buoyage. It should be marked in accordance with the requirements of the Northern Lighthouse Board and could serve as an additional aid to navigation for navigating vessels.

As the turbines are subsurface, there would be minimal noise generated and so it would not interfere with sound signals used by vessels or aids to navigation.

3.6 Communication, radar and positioning system

The scale of the assets to be installed during this project are not likely to impact on electronic communication or positioning systems.

3.7 Moorings

The Fall of Warness mooring system consists of 4 chain catenary legs, two north and two south, attached to the hull at attachments in the bow and stern. The mooring system holds the platform in line with the current flow.

The anchor size has been supported by a statistical assessment of simulated loads using Orcaflex software, namely that the peaks in anchor tensions are momentary spikes of a few seconds in simulated one in 10 year storms.

3.8 Station keeping

GPS Alerting for movement of the device. Remote monitoring of the device to detect any major movements that might indicate a breakout for immediate response.

3.9 Fishing activity

Relatively little fishing takes place in the study area and fishermen would generally be expected to take precautions in order to avoid any underwater assets that may be present across the test site.

3.10 Recreational activity

There is no racing or small boat sailing at the test site, most recreational vessels are yachts on passage.

3.11 Subsea cables

There is no evidence of anchoring or gear snagging at Fall of Warness historically.

3.12 Search and rescue

The device will not alter the capability of search and rescue operations in the area, or interfere with neither RNLI or helicopter operations.

3.13 Cumulative and in-combination

The Fall of Warness site, as a device test centre, is home to other devices. Of these, most are well clear with the exception of the Orbital O2. For those deep draught vessels whose passage is through the Fall of Warness, it is likely that they would pass to the west of the ATIR platform and SR2000 rather than in between the two devices due to the limited sea room.

4 Risk controls

4.1 Site-wide risk controls

A number of risk controls are embedded by the processes EMEC has implemented in order to operate the site and the layout of the Fall of Warness test site. The embedded risk control measures are detailed in Table 7, with any project-specific actions including any divergence from the specified control discussed.

Table 7. EMEC embedded risk controls for Fall of Warness test site

ID	Embedded risk control	Description	Project-specific actions
1.	PPE Requirement	Maintenance teams to wear suitable PPE when working on the assets, including life jackets.	
2.	Training of staff	Staff to be trained to the required standards for their work and have suitable local knowledge of regulations and operations in the Orkney Islands.	
3.	Emergency Response and Cooperation Plan (ERCoP)	ERCoP for site developed and agreed with the MCA and SAR bodies to be consulted.	
4.	NtM and Promulgation	In addition to NtM, EMEC's Maritime Safety Information Standard Operating Procedures (SOP) ensures that all key navigational consultees are informed prior to any works. Distribution could include HMCG, Orkney Harbours (available via Orkney Islands Council Marine Services website), Orkney Marina noticeboards (as necessary), Orkney Fisheries Association, Scottish Fisheries Federation and UKHO. Stakeholders are targeted with information about relevant assets based on their activities and location.	
5.	Incident monitoring and reporting	EMEC to encourage incident/near miss reporting and monitor any safety issues at the test site. If necessary, risk control to be reviewed. Risk assessments to be reviewed following any incidents.	
6.	EMEC Procedures	EMEC has a number of SOPs and standards in place to reduce navigation risks, such as: • Task risk assessment; • Control of work (permit to access) • Hazard identification reporting; and • Maritime safety information.	
7.	Hydrography	Contractual responsibility for developer to return the site to the original condition post-decommissioning.	
8.	Charting	Site is marked on nautical charts including a chart note.	
9.	Site Monitoring	EMEC's SCADA system provides real-time status information, trends, alarms	

ID	Embedded risk control	Description	Project-specific actions
		and remote-control access to facilitate a safe working environment, comprehensive assessment and safe operation of the sites.	
10.	CCTV	Fall of Warness test site is monitored by CCTV, located at Caldale, EMEC's onshore substation, to satisfy operational requirements for control and monitoring of test site activities, visual checks of the test site environment, monitoring of lone worker safety, effective plant operation and substation security.	
11.	Liaison with local stakeholders	EMEC regularly liaises with key local stakeholders to identify any potential issues as soon as possible. Regular updates include information regarding upcoming deployments and significant operations at the site.	
12.	500m advisory ATBA	A 500m advisory ATBA exists around all test devices located at EMEC test sites.	

4.2 Project-specific risk controls

The following table provides a description of the risk controls that will be implemented during the project.

Table 8. Project-specific risk controls

ID	Project-specific risk control	Description
1.	Radar reflectors	Use of radar reflectors to improve marking during times of poor visibility.
2.	AIS	Use of AtoN AIS (or virtual AIS if permitted) fitted to all surface piercing assets to improve visibility to passing vessels. AIS should be Category 3 with at least 97% up time and use Message 21, or as directed by the Northern Lighthouse Board (NLB).
3.	Heightened monitoring in adverse metocean conditions	During gale force winds, periodic monitoring of the assets is recommended to ensure excessive forces are not acting on the moorings which might cause a breakout.
4.	Inspection and maintenance programme	Regular maintenance regime by developer to check the asset, its fittings and any signs of wear and tear. This should identify any failings which might result in a mooring failure and breakout. Refer to the findings of your third party verification mitigation against device breakage.
5.	Remote shut down including feathering of blades	Devices to be fitted with ability to shut down in an emergency, such as feathering any blades or braking to allow access or prevent contact with a vessel.

ID	Project-specific risk control	Description
6.	GPS alert system for asset moving	Remote monitoring of device to detect any major movements that might indicate a breakout for immediate response. Implement GPS excursion monitoring.
7.	Marking and Lighting	Assets to be lit to the requirements of NLB and marked in line with IALA guidance, IALA Recommendation O-139 (2013)[1]. The following is typically requested by the NLB: • Yellow day marking/painting; • Flashing yellow special mark light (Category 1) (larger devices may require 2 lights at each end which are synchronised; light ranges should be at least 3 nautical miles); • Day top mark (if deemed necessary); • Radar reflector; and • AIS AtoN (mandatory for floating devices at EMEC). Appropriate statutory sanctions must be in place to exhibit, alter or discontinue lighting.
8.	Tow risk assessment and passage plan	As required under Orkney Harbours Pilotage Directions 4(3)[2], prior to conducting a towing operation, a risk assessment and passage plan for the move should be conducted. The plan should account for the size of the tow, maneuverability restrictions, tow arrangements and metocean conditions.
9.	Guard vessels	During major construction or maintenance activities, a guard vessel may be considered to assist in protecting the devices from contacts with passing vessel traffic. Due to the low density of traffic, this is not considered necessary except for extraordinary circumstances. If guard vessels are to be used onsite, it is important that such vessels employed to guard the site follow appropriate guidelines, with clear instructions on when to intervene in a potential incident.

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

It is also recommended that:
- Radar reflectors, retro-reflecting material, Racons and / or AIS transponders should be considered where the level of traffic and degree of risk requires it;
- The lit Aid to Navigation (AtoN) must be visible to the mariner from all relevant directions in the horizontal plane, by day and night;
- Any floating AtoNs should be located outside the moorings of the floating structures; and
- AtoNs should comply with IALA Recommendations and have an appropriate availability, normally not less than 99% (IALA Category 2).

[2] Orkney Islands Council Competent Harbour Authority (2016) The Orkney Pilotage Direction 1988 (as amended 2007, 2010 and 2016).

ID	Project-specific risk control	Description
10.	Liaison with local stakeholders	Consultation should be undertaken with Orkney Marine Services, the MCA and NLB prior to installation of device to confirm that adequate risk controls are in place. EMEC also conducts regular stakeholder consultation events to ensure that local marine users are aware of the pipeline of activity.
11.	Installation, maintenance and removal	All vessels undertaking activities on site should comply with EMEC standard operating procedures. Vessels should be mindful of other navigating vessels and avoid disrupting the activities of others.
12.	ERCoP	Project-specific annex to be incorporated into site-wide ERCoP.

5 Summary and conclusion

This document has been prepared to support a marine licence application for the Magallanes ATIR. This document is provided as an addendum to and should be read in conjunction with the document 'Fall of Warness Tidal Site Navigational Risk Assessment (NRA) – REP315'.

In summary, the NRA has concluded that the deployment of the devices is low risk with suitable risk controls in place.