Leask Marine | Submersible Drill Rig Testing

Project Environmental Monitoring Plan

July 2020

Purpose

Leask Marine propose to test a Submersible Drill Rig (SDR) across EMEC's test sites. Mitigation and monitoring measures have been identified following a review of the project specific environmental impacts, taking into consideration the site environmental description and previous research and monitoring conducted. This document describes the mitigation and monitoring measures associated with the proposed anchor installation project including any statutory reporting mechanisms. For a detailed description of the companies involved, the SDR, and the project, please refer to the Project Information Summary.

Document History

Revision	Date	Description	Originated by	Reviewed by	Approved by
0.1	24/06/20	Originate	EMEC		
1.0	13/07/20	Finalise		EMEC	LM

Contents

1 Technology 1
1.1 Device Overview 1
2 Environmental Monitoring 2
2.1 Disturbance / displacement 2
2.2 Acoustic impact 3
2.3 Collision and entanglement risk 5
2.4 Biofouling and non-native species (NNS) introduction 6
2.5 Habitat Creation 7
2.6 Seabed Clearance 7
2.7 Discharges to the Marine Environment 8
3 Research Opportunities 9

List of Figures

Figure 1. Leask Marine Submersible Drilling Rig (SDR) 1

List of Tables

Table 1. Proposed monitoring and mitigation measures relevant to the impact pathway disturbance/displacement 2
Table 2. Proposed monitoring and mitigation measures relevant to the impact pathway acoustic impact 4
Table 3. Proposed monitoring and mitigation measures relevant to the impact pathway collision and entanglement risk 5
Table 4. Proposed monitoring and mitigation measures relevant to the impact pathway biofouling and introduction of non-native species 6
Table 5. Proposed monitoring and mitigation measures relevant to the impact pathway habitat creation 7
Table 6. Proposed monitoring and mitigation measures relevant to the impact pathway seabed clearance 8
Table 7. Proposed monitoring and mitigation measures relevant to the impact pathway discharges to the marine environment 8

1 Technology

1.1 Device Overview

A Submersible Drilling Rig (SDR) developed by Leask Marine Ltd has the potential to offer new low-cost drilled anchoring opportunities through its development and testing. The SDR, Figure 1, is designed to: accommodate drilling heads up to 600mm diameter drilling hole; provide easy servicing and maintenance; and be workable at depths up to 90m.

Figure 1. Leask Marine Submersible Drilling Rig (SDR)

2 Environmental Monitoring

The following sections describe the potential key environmental impacts considered relevant to the testing of the SDR device and installation, maintenance and decommissioning of the rock anchors at EMEC's test sites, Shapinsay Sound and Fall of Warness. Within the following sections is a summary of the proposed monitoring and mitigation measures relating to each potential impact pathway for the relevant phase of the project. Any key findings from the monitoring will be disseminated to the regulator, Marine Scotland, and appropriate advisors, e.g. Scottish Natural Heritage.

2.1 Disturbance / displacement

Increased anthropogenic activity within the marine environment can potentially cause changes in the behaviour of receptors, particularly sensitive receptors such as cetaceans, seals, basking sharks and marine birds. There is potential to cause spatial displacement of essential activities for certain species due to increased activity in the area. This is likely to be most prevalent during the installation phase when there will be marked increase in vessel traffic accessing the site. Species may be disturbed by the physical presence of the vessels or the acoustic output from the work vessels. In order to determine the significance of such a potential impact, there is a requirement to understand the importance of the habitat, i.e. is it important for essential activity (breeding, foraging, moulting, resting, etc) and the availability of alternative habitat elsewhere. The frequency of the impact in terms of duration will also be crucial in determining the significance of the impact. As the proposed testing location at the Fall of Warness test site is close to the coastline, bird species utilising coastal breeding sites may be affected by the increased vessel traffic in the area. In addition, there is the potential to affect birds foraging success or moulting, if the testing is located within a key foraging area or a moulting site. Vessels are only expected to be onsite for a maximum of 4 days in which mooring installation, anchor drilling and installation and vessel mooring removal should be completed. The temporary nature of the increase vessel traffic onsite, is not expected to cause any significant impacts to seals, cetaceans, basking sharks and marine birds in the vicinity of either test site.

As part of the anchor installation process, drilling will be conducted. The drilling operation is expected to produce an acoustic output. Drilling operation will be completed in a short timescale (2-3 hours per drilling operation), therefore, no long-term significant disturbance is expected.

Similar disturbance effects due to increased vessel traffic and reverse drilling are expected on the decommissioning of the rock anchors.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within disturbance/ displacement.

Table 1. Proposed monitoring and mitigation measures relevant to the impact pathway disturbance/displacement

Impact Pathway	Receptor	Proposed Mitigation/ Monitoring Measure	Reporting Mechanism
Installation			
Vessel activity – noise and presence may cause minor disturbance/ displacement	Cetaceans, seals, basking sharks, marine birds	**Mitigation**: Comply with the Scottish Marine Wildlife Watching Code (SMWWC), including the following measures:	Any non-compliance with the SMWWC will be reported to the regulator as

Impact Pathway	Receptor	Proposed Mitigation/ Monitoring Measure	Reporting Mechanism
(including when transiting to and from site)		• Steady course and speed throughout operation. • Reduction of speed upon sighting of receptor. • Minimum approach distances will be adhered to. • Sudden changes in speed, direction and engine noise will be avoided. • Vessel will maintain at least 50m distance from coast during seabird breeding season. Vessels will only be onsite for the minimum period of time required.	soon as notified by the vessel skipper.
Anchor installation – noise may cause minor disturbance/ displacement	Cetaceans, seals, basking sharks	**Monitoring**: Conduct acoustic monitoring of drilling operation utilising static and drifting passive acoustic recorders. Any marine mammals and basking sharks that are sighted during the operation will be recorded in line with EMEC's marine mammal recording SOP.	Following completion of the acoustic monitoring, a report will be provided to the regulator outlining the key results.
Decommissioning			
Vessel activity – noise and presence may cause minor disturbance/ displacement (including when transiting to and from site)	Cetaceans, seals, basking sharks, marine birds	**Mitigation:** Compliance with the SMWWC. Vessel presence onsite will be kept to a minimum.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Anchor removal – noise may cause minor disturbance/ displacement	Cetaceans, seals, basking sharks	**Mitigation:** Compliance with the SMWWC. No mitigation or monitoring is proposed.	N/A

2.2 Acoustic impact

Noise disturbance can occur from the presence of vessels, drilling activities, anchoring, and survey activities. The creation of noise must be placed in the context of the existing environment, as other anthropogenic sources of marine noise may already be present within the area and mask the impact of any additional acoustic outputs. It is unlikely acute effects such as non-auditory/auditory tissue damage would be experienced as a consequence of the acoustic outputs from this project but behavioural effects due to disturbance are possible.

Noise disturbance effects may cause mobile species, such as cetaceans, seals and fish to move away from the immediate proximity of the installation site over the short term, but the impact is likely to be highly localised and temporary. Currently there is little known regarding importance of hearing underwater and hearing thresholds for diving birds but there is the potential it to cause displacement, avoidance, reduction in foraging success or it may have no effect.

It is anticipated that the drilling operation will be completed in a short timescale (2-3 hours per drilling operation), therefore, due to the temporary nature of the impact, it is not expected that any significant effects to marine mammals, fish or seabirds will result from the drilling operation. In order to fully understand the potential for an impact, acoustic monitoring is planned as part of the project. This monitoring will inform future applications of the anchoring product.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within acoustic impact.

Table 2. Proposed monitoring and mitigation measures relevant to the impact pathway acoustic impact

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Installation			
Anchor installation – drilling may cause minor acoustic impact or auditory injury	Cetaceans, seals, basking sharks and marine birds	**Mitigation**: SWMMC will be adhered to throughout all operations, where possible. **Monitoring**: Acoustic monitoring will be conducted of the operating drill rig utilising both static and drifting passive acoustic recorders.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper. Following completion of the acoustic monitoring, a report will be provided to the regulator outlining the key results.
Vessel activity – noise from increased activity will cause minor acoustic impact	Cetaceans, seals, basking sharks	**Mitigation**: SWMMC will be adhered to throughout all operations, where possible. **Monitoring**: It is anticipated that static hydrophones will be deployed for 3 days which should allow vessel and vessel mooring noise to be captured as part of the assessment.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Decommissioning			
Vessel activity – noise from increased activity will cause minor acoustic impact	Cetaceans, seals, basking sharks, marine birds	**Mitigation**: Compliance with the SMWWC. Vessel presence onsite will be kept to a minimum.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Anchor removal – drilling may cause minor acoustic	Cetaceans, seals, basking sharks	**Mitigation**: SWMMC will be adhered to throughout all operations, where possible.	N/A

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
impact or auditory injury		No monitoring is proposed.	

The methodology for conducting the acoustic characterisation of the SDR will be made available on request.

2.3 Collision and entanglement risk

It is unknown whether the potential exists for cetaceans, seals and basking shark to become entangled in mooring lines of the size and dimensions required to moor multicat vessels that will be used during this operation. Entangled animals may drown or starve because they are restricted by mooring lines. Lines will be used to install the SDR which in themselves could present an entanglement risk. It is assumed the mooring lines utilised within this project will not present a risk to diving seabirds. Marine mammals and basking shark may suffer physical trauma and infections from a striking event. In addition, entangled animals may also be unable to avoid vessels like they normally would, thus increasing the risk of collision.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within collision and entanglement risk.

Table 3. Proposed monitoring and mitigation measures relevant to the impact pathway collision and entanglement risk

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Installation			
Vessel collision	Cetaceans, seals, basking sharks	**Mitigation**: Compliance with the SMWWC. Vessel presence onsite will be kept to a minimum.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Entanglement with temporary vessel moorings	Cetaceans, seals, basking sharks	**Mitigation**: Mooring lines will be kept onsite for as short a period as possible.	N/A
Entanglement with SDR lifting lines	Cetaceans, seals, basking sharks	**Monitoring***:* Cameras and sensors on the SDR device will provide alerts if entanglement event was to occur during installation	Any events will be reported to the regulator as soon as possible on return to shore.
Decommissioning			
Vessel collision	Cetaceans, seals, basking sharks	**Mitigation**: Compliance with the SMWWC. Vessel presence onsite will be kept to a minimum.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Entanglement with temporary vessel moorings	Cetaceans, seals, basking sharks	**Mitigation**: Mooring lines will be kept onsite for as short a period as possible.	N/A

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Entanglement with SDR lifting lines	Cetaceans, seals, basking sharks	**Monitoring**: Cameras and sensors on the SDR device will provide alerts if entanglement event was to occur during removal	Any events will be reported to the regulator as soon as possible on return to shore.

2.4 Biofouling and non-native species (NNS) introduction

Biofouling is the settlement of biological organisms on man-made structures. Fouling is often a gradual accumulation of organisms which develops over time. Biofouling may consist of microorganism such as bacteria or protozoa or macro-organisms such as barnacles or seaweed. Once installed, the anchors will be deployed onsite for an extended period of time. This period is expected to provide fouling species an opportunity to settle and grow to maturity.

The spread of non-native organisms can occur through a variety of means including: shipping, transport of fish or shellfish; scientific research and public aquaria. These invasive non-native species can threaten marine diversity. Various guidelines and standards have been referred to in developing the proposed mitigation and monitoring measures (IMO, 2011). It is anticipated that a certain level of biofouling will accumulate, it is unlikely to pose a risk to introducing non-native species as movements will be limited to UK waters only. However, the introduction of hard substrate into the marine environment may also act as a 'stepping stone' for non-native species, anchors may act as locations for non-native species to grow in the area and thus provide a stepping stone for colonization. Detrimental impacts of non-native species on native biota can occur through competition, predation, herbivory, habitat alteration and disease.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within biofouling and the introduction/transfer of non-native species.

Table 4. Proposed monitoring and mitigation measures relevant to the impact pathway biofouling and introduction of non-native species

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Installation			
Introduction of non-native species (via vessel or drill rig)	Benthic communities (including fish and shellfish)	**Mitigation**: Local vessel and equipment will be used, reducing the potential for introduction of NNS. Compliance with good practice measures.	Any deviance from the good practice measures will be reported.
Operational			
Build-up of biofouling on rock anchors may alter local ecosystem	Benthic communities (including fish and shellfish)	No mitigation is proposed.	
Decommissioning			
Introduction of non-native species (via vessel or drill rig)	Benthic communities (including fish and shellfish)	**Mitigation**: Local vessel and equipment will be used, reducing the potential for introduction of	Any deviance from the good practice measures will be reported.

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
		NNS. Compliance with good practice measures.	

2.5 Habitat Creation

The drilling operation and physical presence of the anchors will inherently result in direct habitat loss within the footprint of the anchors. However, colonisation of the introduced structures may have the potential to function as artificial reefs or fish aggregating devices. The increase in the local reef extent may be limited due to the size of anchors therefore diminishing the significance of this impact. This artificial substrate could alter the nature and composition of the species present and may enable non-native species to colonise and potentially spread to other areas.

Cetacean, seal and seabird distribution may be influenced by prey distribution and associated prey habitat. The physical presence of the anchors may offer enhanced foraging efficiency for some species.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within habitat creation.

Table 5. Proposed monitoring and mitigation measures relevant to the impact pathway habitat creation

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Operational			
Fish aggregation device (FAD) effect and colonisation of fouling organisms due to introduction of hard structure	Benthic communities (including fish and shellfish), benthic community predators (e.g. marine mammals and seabirds)	No significant impacts are expected, therefore no specific monitoring measures are proposed.	N/A
Creation of habitat around installed infrastructure for benthic species	Benthic communities (including fish and shellfish)	**Monitoring**: There is a likelihood of reef effects around the installed anchors. There is no proposed monitoring measure however, when the opportunity arises, any video footage of the moorings will be analysed to quantify the level of reefing taking place.	Findings from analysis will be reported to the regulator as and when available.

2.6 Seabed Clearance

During the installation phase, the deployment of anchors will cause a temporary loss of benthic habitat. The footprint of each device will present a long-term loss of habitat for sub-littoral seabed communities. Small amounts of lost habitat may diminish populations of species that

are recorded as rare. However, as rock anchor technologies tend to have a very small footprint in relation to gravity bases, generally the relative loss in habitat will be at a smaller scale to that typically occurring at the site.

A small level of scouring may occur around the heads of the anchors, this is expected to be more prevalent at the Shapinsay Sound site where more sand is present. The deployment locations at both the Fall of Warness and Shapinsay Sound have been selected due to the presence of bedrock close to the seabed surface.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within seabed clearance.

Table 6. Proposed monitoring and mitigation measures relevant to the impact pathway seabed clearance

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
All project phases			
Seabed clearance and habitat loss from installation of anchor	Benthic communities (including fish and shellfish)	**Mitigation**: Rock anchor technology has much smaller footprint in comparison with other anchor types.	N/A

2.7 Discharges to the Marine Environment

Benthic species may be exposed to materials such as paints, hydraulic fuels and antifouling compounds originating directly from the anchor. Accidental spillages from installation or maintenance vessels could also occur. Spillages pose a risk to marine mammals, fish, seabirds and benthic communities and can cause direct effects at the time of the spill or can result in chemical accumulation in body tissues leading to lagged effects on health and breeding success.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway for discharges to the marine environment.

Table 7. Proposed monitoring and mitigation measures relevant to the impact pathway discharges to the marine environment

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Installation			
Leakage of fuel or chemicals from vessels involved with installation can enter the food-web at any trophic level	Potentially whole ecosystem	**Mitigation:** Vessel crews should follow standard procedures to avoid fuel and chemical spills. Suitable spill kits should be onboard all vessels involved in the project.	Any incidents will be reported to the regulator as soon as possible.
Operation			

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Corrosion of SDR polluting environment	Benthic communities (including fish and shellfish)	**Mitigation**: Cathodic protection using sacrificial anodes will prevent accelerated degradation of metal structure.	N/A
Decommissioning			
Leakage of fuel or chemicals from vessels involved with decommissioning can enter the food-web at any trophic level	Potentially whole ecosystem	**Mitigation:** Vessel crews should follow standard procedures to avoid fuel and chemical spills. Suitable spill kits should be onboard all vessels involved in the project.	Any incidents will be reported to the regulator as soon as possible.

3 Research Opportunities

The impacts from marine renewable development are wide-ranging and encompass a mixture of positive and negative socio-economic impacts, as well as potentially harmful environmental effects. These potential impacts require careful consideration, as the Orkney coastline and inshore areas have a wide range of sites designated to support the conservation of important species and habitats, as well as geological, heritage and aesthetic values. This is highlighted through the recent designation of two proposed Special Protected Areas (SPAs) within Orkney waters, North Orkney pSPA and Scapa Flow pSPA.

There is growing awareness of the potential impacts of anthropogenic noise on the marine environment, as the role of sound in the life cycles of key marine species is increasingly apparent. The generation of underwater noise is common to all forms of marine renewable energy, especially during the construction phase with increased vessel traffic, vibrations and noise.

EMEC recognises this, as anthropogenic noise is a particular concern for marine mammals, given their noise sensitivity associated with employing a wide band of acoustic frequencies for navigation, communication and foraging. A key question is whether exposure to noise results in behavioural changes causing displacement from key habitats or disturbance at breeding or social activity sites that will affect cetacean populations in the long-term.

Therefore, EMEC will take an active role during the testing phase of this new anchoring technology and carry out environmental monitoring of the SDR. This will involve the deployment of static and drifting passive acoustic recorders in a set pattern in order to characterise the acoustic signature of the SDR, relative to different anchoring solutions. This research will allow EMEC to develop an acoustic characterisation for Leask Marine to ease future permitting, as the environmental risk will have been quantified, rather than remaining unknown. This, and future acoustic research will contribute to EMEC's acoustic characterisation portfolio, allowing reliable measurements of anthropogenic noise during construction, operational and decommissioning phases of development.