

GREENLINK INTERCONNECTOR LIMITED

Greenlink Marine Mammal Mitigation Plan

Wales

Greenlink - an interconnector between
GB and the Republic of Ireland

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1. Introduction

1.1 Purpose of this Plan

This document describes the Marine Mammal Mitigation Plan (MMMP) for use in Welsh Waters during the Greenlink project. It is based on the statutory advice on minimising the impacts of underwater noise generating activities on marine mammals provided by the Joint Nature Conservation Committee (JNCC); and additional mitigation agreed with Natural Resources Wales (NRW).

The MMMP:

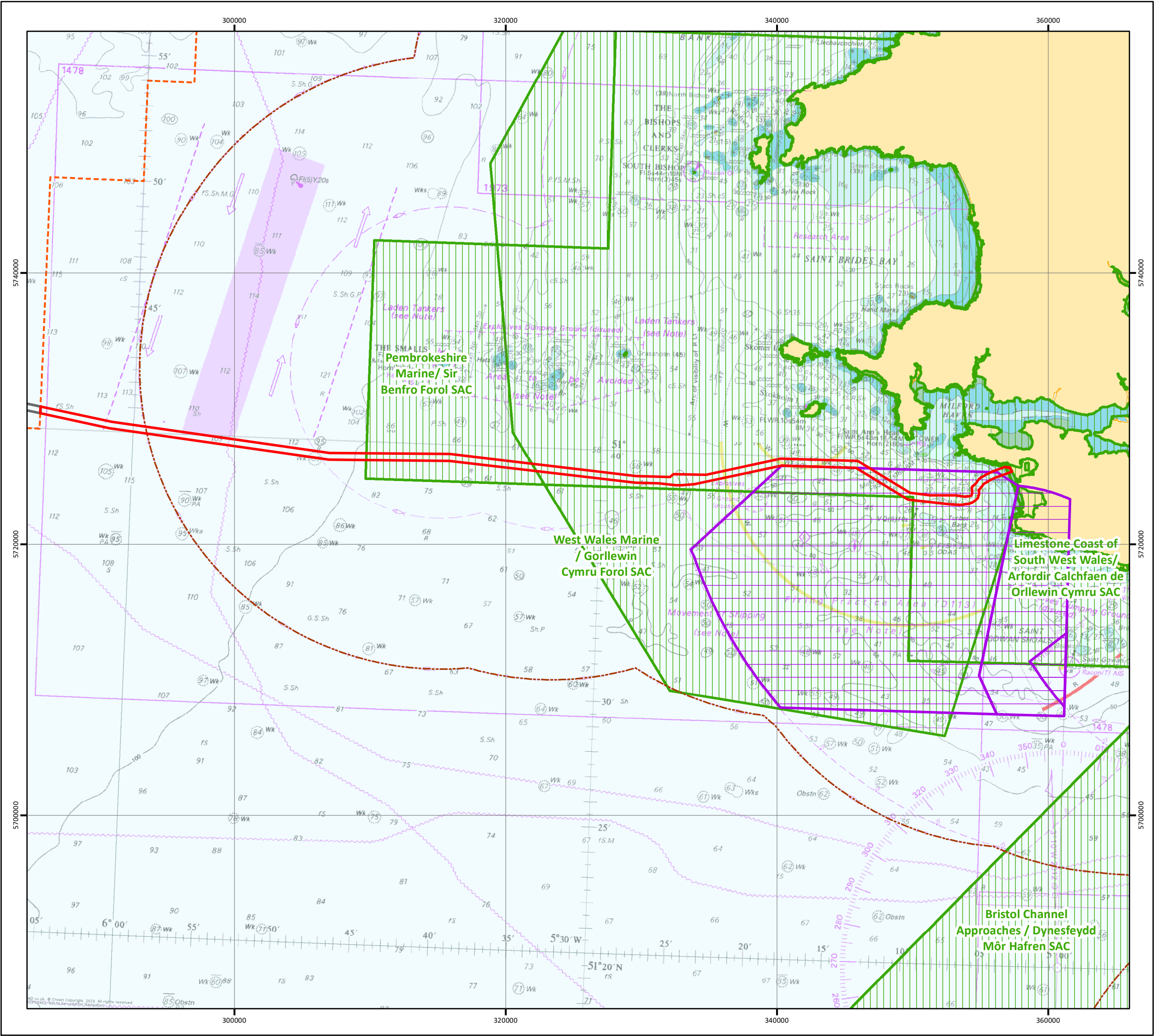
1. Outlines the mitigation measures that will be implemented to avoid or reduce injury and disturbance effects to marine mammals;
2. Provides the procedures to be followed to implement the mitigation measures effectively and in line with current guidelines and best practice;
3. Sets out the roles and responsibilities of key personnel who will implement the MMMP; and
4. Describes the reporting protocol in place to demonstrate that the MMMP has been successfully implemented.

Greenlink Interconnector Limited (GIL) and its contractors are responsible for ensuring this MMMP is implemented.

1.2 Project Background

Greenlink Interconnector Limited (GIL) is proposing to develop an electricity interconnector (Greenlink) linking the existing electricity grids in Ireland and Great Britain. The Greenlink project will consist of two converter stations, one close to the existing EirGrid substation at Great Island in County Wexford (Ireland) and one close to the existing National Grid substation at Pembroke in Pembrokeshire (Wales). The converter stations will be connected by underground cables (onshore) and subsea cables (offshore).

The landfall points for the submarine cables are Freshwater West, Pembrokeshire (Wales) and Baginbun Beach, County Wexford (Ireland); see Figure 1-1 Drawing P1975-INFR-004 for Proposed Development in Welsh Waters.



GREENLINK INTERCONNECTOR

INFRASTRUCTURE
Castlemartin Firing Range & SAC's

Drawing No: P1975-INFR-004

A

Legend

- Proposed Development
- Irish Offshore
- UK 12nm Territorial Sea Limit
- Median Line
- Castlemartin Firing Range
- SAC



NOTE: Not to be used for Navigation

Date	24 March 2020
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	UKHO; CDA; JNCC; MarineFind; Oceanwise; ESRI; OSOD
File Reference	J:\P1975\Mxd\10_INFR\ P1975-INFR-004.mxd
Created By	Chris Dawe
Reviewed By	Emma Langley
Approved By	Stuart McLaren



Co-financed by the European Union
Connecting Europe Facility



0 2.5 5 7.5 10 km

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1.3 *Activities covered by this Plan*

1.3.1 Geophysical Survey

Although detailed engineering surveys have been completed for Greenlink (September to December 2018, and March 2019), there is the potential that the Installation Contractor will conduct further surveys prior to the commencement of cable installation. The objectives of these surveys are:

- To confirm that no new obstructions have appeared on the seabed since the detailed engineering surveys;
- To identify any unexploded ordnance that requires micro-routeing around.
- To confirm the seabed level pre- and post-installation to demonstrate that the required burial depth for the cable has been reached.
- To inform micro-routeing around mobile bedforms and sensitive habitats.

The survey will involve standard geophysical survey techniques as follows:

- **Bathymetry:** Swathe and multi-beam acoustic echo sounder systems are used to record water depth, prepare a 3D digital terrain model of the route and to describe the seabed topography along the Proposed Development. The 3D terrain model built from the bathymetrical data will be used to identify mobile seabed features and, where applicable, to assess the mobility of these mobile seabed features by comparing its location relative to the previous route survey.
- **Side Scan Sonar (SSS):** The sonar signal is emitted from a towfish towed behind the survey vessel along the Proposed Development. Reflections from sediments and other hard objects are received back at the towfish and processed on board the survey vessel to produce an image of the seabed. This technique enables mapping of the seabed surface and identification of sediment types but cannot determine the thickness of sediments. Obstacles lying on the seabed, such as wrecks, trawler debris and telecommunication cables that might impede cable installation can be identified from the SSS image.
- **Sub-Bottom Profiler (SBP):** It is unlikely that this survey is required. In the event that the Installation Contractor chooses to obtain additional data, this technique involves injecting a pulse of acoustic energy into the seabed and detecting the reflections from the sub-surface geological units. From the reflections the thickness of the sediment can be assessed, but the type of sediment can only be inferred until “ground-truthing” geotechnical data is obtained.
- **Ultra Short Baseline (USBL) systems:** It is possible that these systems will be required. USBL utilises high frequency sound which falls within the range of 21-31 kHz to communicate between a vessel-based transceiver and a seabed-based transponder to calculate the transponder’s position. They are

sometimes used to monitor the positions of remotely operated vehicles or towed equipment.

1.3.2 Unexploded Ordnance (UXO) Clearance

The primary objective will be to avoid encountered potential UXO by micro-routeing within the Proposed Development. Typically, a standoff distance of 15-25m relative to potential UXO and depending on the nature of the UXO and installation method, is considered safe for cable installation purposes.

If re-routeing around a particular potential UXO appears not to be possible, this potential UXO will be investigated. If visual inspection confirms a UXO, then if it is safe to do so the UXO will be removed, or as a last resort detonation measures (deflagration) will be undertaken, as outlined in this MMMP in accordance with UK Best Practice.

There is a higher risk of requiring a UXO deflagration within the Proposed Development as it passes through the Castlemartin Firing Range, due to the historic and current activity in the area. However, an initial UXO survey has been undertaken within the Range and GIL are confident that the route is deliverable without deflagration. It is less likely that a UXO deflagration would be required further offshore unless an ordnance is found during the survey process.

1.4 Relevant Legislation

All cetaceans, chelonians and otter are listed on Annex IV of EC Council Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) as European Protected Species (EPS). The Conservation of Habitats and Species Regulations 2017 (CHSR) and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (COMHS) transpose the requirements into UK statute.

It is an offence to deliberately kill, injure or disturb animals classed as EPS. The mitigation measures outlined in the JNCC guidelines^{1,2} are designed to reduce the risk of deliberate injury to marine mammals and relevant measures are incorporated as part of the consenting regimes for geophysical activities and UXO detonation within the United Kingdom Continental Shelf (UKCS).

The JNCC guidelines were originally written with the oil and gas industry (for geophysical survey) and offshore wind industry (for UXO detonation) in mind, however, since their conception the use of geophysical technologies and the requirement for UXO detonation by other marine industries has grown. Any activities that have the potential to result in injury to marine mammals should apply the mitigation measures outlined in these guidelines. Whilst the mitigation measures in these guidelines have some limitations and their effectiveness may not be able to be fully tested, they are based on reasonably conservative assumptions.

¹ JNCC (2017) Guidelines for minimising the risk of injury to marine mammals from geophysical surveys: <https://hub.jncc.gov.uk/assets/e2a46de5-43d4-43f0-b296-c62134397ce4>

² JNCC (2010) Guidelines for minimising the risk of injury to marine mammals from using explosives <https://hub.jncc.gov.uk/assets/24cc180d-4030-49dd-8977-a04ebe0d7aca>

It is considered that compliance with these guidelines constitutes best practice and will, in most cases, reduce the risk of deliberate injury to marine mammals to negligible levels.

GIL are aware that new guidance for the use of explosives is in draft format and is due to be issued in 2020. This MMMP will be reviewed prior to works commencing and updated as necessary in line with Best Practice.

1.5 *Marine Mammal Baseline*

Marine mammals present in the Proposed Development include cetaceans (whales, dolphins and porpoises) and pinnipeds (seals). Most cetaceans and pinnipeds are wide-ranging and individuals encountered within UK waters form part of much larger biological populations; the ranges of which extend into the North Atlantic and North West European waters. As a result, management units (MUs) have been outlined for seven of the common regularly occurring species following advice from the Sea Mammals Research Unit and the International Council for the Exploration of the Sea (ICES)³. These provide an indication of the spatial scales at which effects of anthropogenic activities should be taken into consideration.

1.5.1 *Cetaceans*

Harbour porpoise is the most abundant and commonly sighted species in the area. Most sightings occur during the summer months with peak sightings in August; but animals are likely to be present year-round. The Proposed Development crosses the West Wales Marine / Gorllewin Cymru Forol Special Area of Conservation (SAC) which has been designated to conserve harbour porpoise. Harbour porpoise generally prefer coarser sediments which is the habitat of sandeel, a known prey species⁴.

Four other species are relatively common, namely common bottlenose dolphin; short-beaked common dolphin; Risso's dolphin and minke whale. There are also some cetaceans that are seen occasionally, for example striped dolphin, Atlantic white-sided dolphin, white-beaked dolphin, long-finned pilot whale, killer whale, humpback whale and fin whale.

1.5.2 *Pinnipeds*

Grey seal are present in coastal waters around Wales throughout the year, with pup production highest in Pembrokeshire⁵. The Proposed Development lies within the South West England MU and Wales MU for grey seal. Grey seal are a designating feature of the Pembrokeshire Marine / Sir Benfro Forol SAC (which the Proposed Development crosses), but animals from the Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau SAC and Bae Ceredigion / Cardigan Bay SAC may also be in the

³ ICES (2016) Sea Mammals Research Unit and the International Council for the Exploration of the Sea

⁴ Department of Energy and Climate Change (DECC) (2016). Offshore Energy Strategic Environmental Assessment. Department of Energy and Climate Change. March 2016

⁵ Baines, M.E. and Evans, P.G.H. (2012). Atlas of the Marine Mammals of Wales. CCW Monitoring Report No. 68. 2nd edition. 139pp

region. It is estimated⁶ that the mean number of individuals in the waters along the cable route will vary from five to ten individuals per 5km². The peak pupping season, when animals are most vulnerable to disturbance is September to October.

1.5.3 Conservation sites

The cable route crosses both Pembrokeshire Marine/ Sir Benfro Forol SAC and West Wales Marine/ Gorllewin Cymru Forol SAC which have marine mammals as a Primary or Qualifying feature.

Pembrokeshire Marine/Sir Benfro Forol SAC is the most important breeding site for the grey seal in Wales. Seal pupping season is between August and January, meaning that there will be higher numbers of seals in the area at this time.

West Wales Marine / Gorllewin Cymru Forol SAC has been designated to conserve harbour porpoise. Harbour porpoise is likely to be present within the Proposed Development throughout the year, but densities will be highest during summer months. It is estimated that the European site supports over 5,000 individuals for at least part of the year (summer); representing approximately 5.4% of the population within the UK part of the Celtic and Irish Seas MU⁷. The site's selection assessment document⁸ notes that harbour porpoise within the MU prefer water depths shallower than 40m, and that lower densities are observed in areas with high levels of shipping activity (based on a threshold of approximately 50 ships per day in summer).

⁶ Russell, D.J.F., Jones, E.L. and Morris, C.D. (2017). Updated seal usage maps: The estimated at-sea distribution of grey and harbour seals. Scottish Marine And Freshwater Science Report Vol 8 No 25.

⁷ Estimate based on July 2005 SCANS-II survey data and it is unlikely to be reflective of abundances in other months, especially winter. Therefore, the estimate is merely indicative and cannot be considered as a specific population number for the site.

⁸ JNCC (2017) West Wales Marine Selection Assessment Document, January 2017 [Online] Available at: jncc.defra.gov.uk/pdf/WestWalesMarineSelectionAssessmentDocument.pdf (Accessed August 2018).

2. Marine Mammal Mitigation Plan

2.1 *Monitoring Methods, Roles and Responsibilities*

For Greenlink a Marine Mammal Observer (MMO) is required for any geophysical surveys undertaken along the complete route in Welsh waters and for any UXO deflagration activities.

There are standard techniques available for monitoring marine mammals in the vicinity of geophysical survey and UXO deflagration operations. These include visual monitoring using a MMO and acoustic methods such as using a Passive Acoustic Monitoring (PAM) system. The efficiency of visual and acoustic techniques comes down to several factors. Visual detection of marine mammals can be dependent on the size, surfacing behaviour, group size, weather conditions and visibility. This means that the techniques sometimes will have to be used in conjunction to get the best results.

Where practical, operations should be timed to commence during daylight hours to ensure that visual mitigation by MMOs can be undertaken. If visibility is impaired e.g. due to weather conditions or darkness, depending upon the guidance or (if appropriate) EPS licence conditions, operations may have to be delayed until conditions change or improve; unless an alternative method to visual surveys, such as PAM, is available and can be deployed.

PAM is used as a tool for monitoring marine mammals during the night and poor visibility operations. Where PAM is a condition of the EPS licence, it must be used when soft starts occur during hours of darkness and during periods when day-time conditions are not conducive to visual surveys (e.g. fog).

Where PAM is not a condition on the consent or licence a PAM operator may also be used alongside visual techniques to enhance the findings during daylight hours. The combined technique is especially effective in an area with dolphins and harbour porpoise.

Where day-time conditions are such that visual observations cannot be undertaken and no other form of monitoring is available, best practice would be to delay initiation of soft starts until conditions improve (see Section 2.2.2).

2.1.1 *Marine Mammal Mitigation Team*

The role of an MMO/PAM operative is to detect marine mammals as part of the mitigation procedures and to advise a delay in the commencement of activity should any marine mammals be detected within the mitigation zone (defined as a radius of 500m from the noise source during geophysical survey and 1000m for UXO deflagration). This is to reduce the potential for deliberate injury to occur and ensure that the activity complies with relevant best practice or EPS licence conditions. Ultimately, however it is GIL's and their appointed Contractors responsibility to ensure best practice and EPS licence conditions are adhered to, noting the advice provided by the MMO/PAM operatives.

MMO and PAM operatives should be equipped with an up-to-date copy of the appropriate JNCC guidelines, recording forms (see Appendix A) and if appropriate EPS licence. MMOs should be equipped with binoculars and a tool to estimate distance i.e. range finding stick or binoculars with reticles.

Both the MMO and PAM operative should ensure their efforts are concentrated on the mitigation periods, which for geophysical survey are the pre-survey search and soft-start time periods until the survey line has started and data acquisition has begun and for UXO deflagration the pre-detonation and post-detonation search periods.

It is acceptable under the JNCC guidelines⁹ for an individual to fulfil both the MMO and PAM role during the same activity, but not by the same individual simultaneously. It is essential in this case that personnel are trained and competent in both roles.

2.1.1.1 Marine Mammal Observer(s)

For a MMO to be classified as trained, the individual must have undertaken formal training on a JNCC recognised course¹⁰ plus have some experience of visually spotting marine mammals. An experienced MMO should have a minimum of 20 weeks' experience of implementing JNCC guidelines in UK waters over the previous ten years, and preferably within the last five. They will be experienced at identifying UK marine mammal species (visually and/or acoustically depending on the role) and be familiar with their behaviour.

A dedicated MMO is employed for the sole purpose of undertaking visual observations to detect marine mammals and advising on and monitoring the implementation of JNCC guidelines. They are not normally a member of the vessel crew (i.e. they are sub-contracted professionals).

A non-dedicated MMO may undertake other roles on board the vessel when not conducting their mitigation role. They may be a member of the crew and are usually utilised on short surveys.

All MMOs must be trained by a JNCC accredited trainer and have experience in visually recording marine mammals during offshore survey work. MMO's must be equipped with the most up to date JNCC guidelines and recording forms which will be used to record sightings.

For the Greenlink project a non-dedicated MMO is required for geophysical surveys; unless a dedicated MMO is outlined as a condition on the marine licence.

Two dedicated MMOs will be required for the UXO deflagration activity.

⁹ <https://hub.jncc.gov.uk/assets/e2a46de5-43d4-43f0-b296-c62134397ce4>

¹⁰ Further information on recognised course providers is available at: <http://www.jncc.gov.uk/page-4703>

2.1.1.2 PAM Operator

PAM consists of hydrophones that are in the water to listen out for any noises that are then transferred to specialist software on board. Specialist trained PAM operatives are needed to set up and deploy the equipment and to interpret detected sounds. A PAM operator has to have attended a JNCC accredited MMO training course and be competent in the use of a PAMS software.

A PAM operator will be required for the UXO deflagration activity and may be required for the geophysical survey, although the current assumption is that one will not be needed as survey activities will commence during daylight hours and will continue during night-time operations with no planned breaks in activity.

2.1.1.3 Explosive Ordnance Disposal (EOD) Supervisor

For UXO deflagration-activities an EOD Supervisor will be situated on the explosives vessel and will be the main point of contact with the MMT. The EOD Supervisor is responsible for the safe disposal of ordnance. The MMO/PAM operator will advise the EOD supervisor of the possible presence of marine mammals and whether delay of deflagration is required in accordance with the provisions of the MMMP and JNCC guidelines.

2.1.1.4 Acoustic Deterrent Device (ADD) Operative

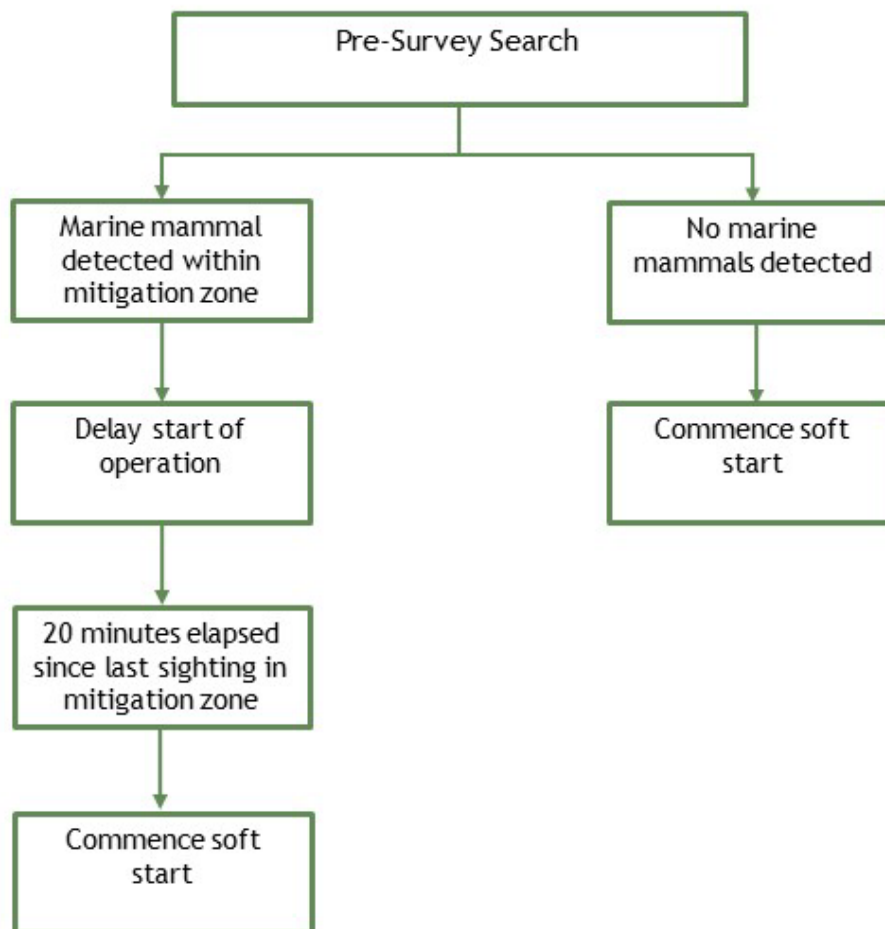
The ADD Operative is responsible for determining the best location for ADD deployment from the vessel (supported if necessary, by the operational manager, the explosives rigger and an electrical supervisor) and ensuring the control unit and power supply are temporarily installed ready for deployment.

The ADD Operative needs to be able to deploy the ADD over the side of the vessel to a depth lower than the draft of the vessel, testing the ADD to make sure it is operational prior to activation.

2.2 *Geophysical Survey*

The marine mammal mitigation protocol to be followed during geophysical survey operations is outlined below:

2.2.1 Procedural summary flow chart - geophysical survey



2.2.2 Monitoring Procedure

A non-dedicated MMO will undertake monitoring prior to any survey work to make sure the geophysical survey can commence. The MMO will monitor the mitigation zone for 30 minutes prior to soft-start commencing, during soft-start and throughout the survey operation. The recordings of any marine mammal sightings must be noted on a reporting form (see Appendix A).

2.2.2.1 Location of MMO & PAM Operator

All monitoring should be undertaken from the source vessel (where the noise source is deployed from).

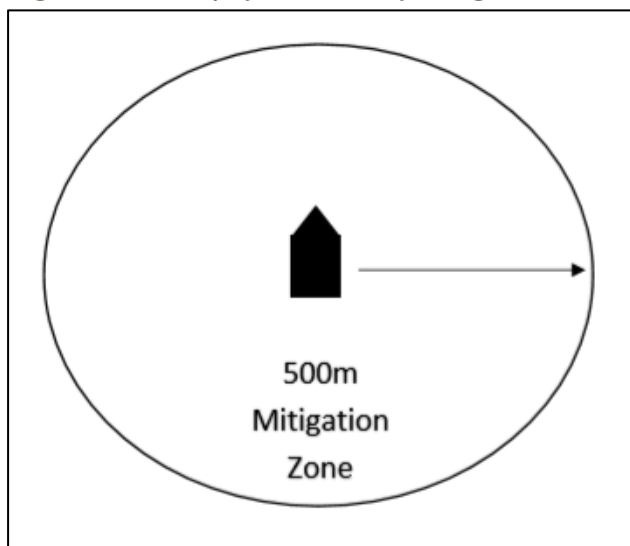
The MMO should be positioned on a high platform with a clear view of the horizon, mitigation zone and ahead of the vessel.

Note for Greenlink surveys an assumption has been made that PAM is not required as survey activities will commence during daylight hours and will continue during night-time operations with no planned breaks in activity. However, should NRW require PAM the PAM operator should be positioned in the most appropriate location to allow them to monitor the PAM equipment for acoustic detections and maintain contact with both the MMO and relevant crew, for both mitigation purposes and ensuring the PAM equipment is deployed correctly.

2.2.2.2 Mitigation zone

The MMO/PAM operative will monitor the mitigation zone (radius 500m, estimated from the centre of the survey noise source location - see Figure 2-1) and advise if any marine mammals are within it.

Figure 2-1 Geophysical Survey Mitigation Zone



2.2.2.3 Duration of search

The MMO must monitor the mitigation zone for the full duration of the pre-survey search and soft-start procedure. Where PAM is being used in conjunction with or in place of visual surveys, acoustic monitoring must also occur for the full duration of the pre-survey search and soft-start procedure. Once the soft start has ended and data acquisition begin, monitoring can cease.

The duration of the pre-survey search will be **30 minutes**¹¹ prior to survey soft-start commencing.

2.2.2.4 Detection of marine mammals in mitigation zone

If marine mammals are detected within the mitigation zone during the pre-survey search (visually or acoustically), the soft-start must be delayed until their passage, or the transit of the vessel, results in them being outside of the mitigation zone. There must be a minimum of a 20-minute delay from the time of the last detection within the mitigation zone and the commencement of the soft-start, to allow animals unavailable for detection (i.e. not re-surfacing in that time) to have moved outside the mitigation zone.

A full soft-start must be undertaken after any delay due to the presence of marine mammals in the mitigation zone.

If marine mammals are detected within the mitigation zone during soft-start or whilst the survey is underway, there is no requirement to stop.

2.2.2.5 Soft-start

Two criteria define the standard duration of a soft-start:

- From the start of the soft-start until full operational power: minimum 15-25 minutes; and
- From the start of the soft-start until the start of the survey line: maximum 40 minutes.

Power should be built up gradually, in uniform stages from a low energy start-up. However, it is acknowledged that this is not possible for some SBP equipment (i.e. it is either on or off). If such equipment is to be used, the Survey Contractor should highlight this to GIL and NRW will be notified.

2.2.2.6 Breaks in operations

- **Unplanned breaks of less than 10 minutes:** There is no requirement for a soft-start provided no marine mammal(s) have been detected in the mitigation zone during the breakdown period. If a marine mammal is detected in the mitigation zone during the breakdown period the MMO/PAM operative will advise to delay survey recommencement until their passage, or transit of the vessel, results in the marine mammals being outside of the mitigation zone. There must be a 20-minute delay from the time of the last

¹¹ Proposed Development is within water depths of less than 200m.

detection within the mitigation zone and a soft-start must then be undertaken.

- **Unplanned breaks of longer than 10 minutes:** If it takes longer than 10 minutes to recommence surveying, a full pre-survey search and soft-start should be carried out before the survey recommences. If an MMO/PAM has been monitoring during the breakdown period, this time can contribute to the pre-survey search time (30 minutes). If the breakdown occurs at night or during daylight conditions not conducive for a visual search, the mitigation zone should be monitored as described above using PAM. If PAM is not available, the survey must be delayed until conditions are suitable for visual observations.
- **Planned breaks:** The same procedures as above (for unplanned breaks) can be applied. However, if the planned break will be less than 10 minutes, the MMO/PAM operatives must begin monitoring 20 minutes prior to the planned break and continue for the duration of the break.

NOTE: Multi-beam surveys in shallow waters (<200m) i.e. complete route in Welsh Waters, are not subject to the monitoring requirements outlined above as it is thought the higher frequencies typically used fall outside the hearing frequencies of cetaceans and the sounds produced are likely to attenuate more quickly than the lower frequencies used in deeper waters. JNCC do not, therefore, advise that mitigation is required for multi-beam surveys in shallow waters.

2.2.3 *Communication Protocol*

There should be clear communication between the MMO/PAM and relevant crew members including contractors and company personnel. This must be outlined prior to any operations taking place. This will make it easier if the MMO requests the job to be stopped or suspended due to a sighting in the work area. The crew must inform the MMO/PAM operators (or nominated lead) sufficiently in advance of survey operations so that full pre-survey search can be completed prior to the soft start commencing.

A toolbox talk will be conducted between the MMO/PAM and relevant crew members to make sure they are aware of the requirements of the MMMP and associated JNCC guidelines. Copies of the Marine Licence and any other relevant documentation (electronic or paper) will be provided to the MMO/PAM by GIL at least 1 week prior to survey mobilisation.

2.2.4 *Reporting*

An MMO report must outline how JNCC guidelines were implemented during the works including any issues for example, crew non-compliance. The report must also include the completed marine mammal sightings forms (Appendix A). Any visual sightings and any difficulties must be reported to NRW and copied to the JNCC. The report should also be accompanied by any raw data that was gathered over the period of observation i.e. the data in the spreadsheets. The report should be

submitted to the JNCC (via e-mail to seismic@jncc.gov.uk) after the survey has been completed within six weeks. It is the responsibility of the consent holder to ensure that the MMO report is sent in a timely manner.

2.3 UXO Deflagration

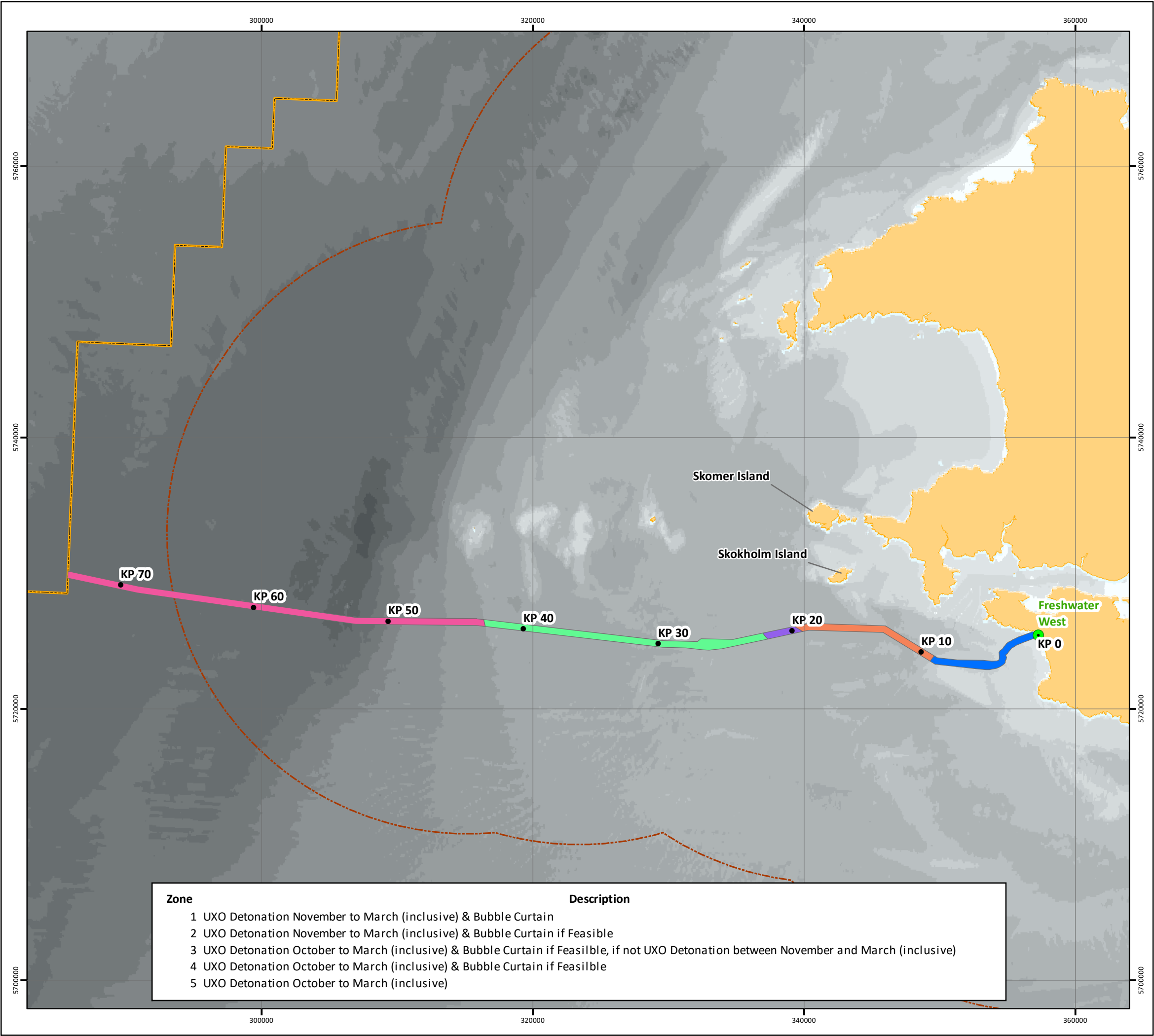
2.3.1 Planning

The following requirements should be noted when planning UXO Deflagration activities:

- Deflagration will be undertaken on all charge sizes (see Section 2.3.3.9).
- The Proposed Development has been split into five mitigation zones as shown in Figure 2-2, Drawing P1975-UWN-013. The following restrictions apply in each zone:
 - **Zone 1**
 - UXO deflagration can only be undertaken between 01 November and 31 March (inclusive).
 - A big bubble curtain (BBC) must be deployed (see Section 2.3.3.7).
 - **Zone 2**
 - UXO deflagration can only be undertaken between 01 November and 31 March (inclusive).
 - Advice should be sought from a BBC supplier as to practicalities and cost of deploying a BBC in winter at the specific location. A BBC will be used if the contractor concludes it will be effective (see Section 2.3.3.7).
 - **Zone 3**
 - Advice should be sought from a BBC supplier as to practicalities and cost of deploying a BBC in winter at the specific location. A BBC will be used if the contractor concludes it will be effective (see Section 2.3.3.7).
 - If a BBC can be used, UXO deflagration can be undertaken between 01 October and 31 March (inclusive).
 - If a BBC cannot be used, UXO deflagration can only be undertaken between 01 November and 31 March (inclusive).
 - **Zone 4**
 - UXO deflagration can only be undertaken between 01 October and 31 March (inclusive).
 - Advice should be sought from a BBC supplier as to practicalities and cost of deploying a BBC in winter at the specific location. A BBC will

be used if the contractor concludes it will be effective (see Section 2.3.3.7).

- **Zone 5**
 - UXO deflagration can only be undertaken between 01 October and 31 March (inclusive).
 - No BBC is required.
- Underwater noise measurements shall be collected prior to, during and after all mitigation and deflagration events.
- The radius of the mitigation zone may be reduced, or increased, from the default 1km if evidence supporting this change is accepted by NRW.
- Explosive detonations should only be commenced during the hours of daylight and good visibility and should be scheduled to reduce the likelihood of encounters with marine mammals.
- Trained MMO/PAM should be used (see Section 2.1.1).
- The amount of explosive required for the deflagration should be accurately determined so that the amount is not excessive.
- The use of acoustic mitigation devices is required in all mitigation zones e.g. Acoustic Deterrent Devices (see Section 2.3.3.6).
- The sequence of multiple explosive charges should be planned so that, wherever possible, the smaller charges are detonated first to maximise the ‘soft-start’ or ‘ramp-up’ effect (see Section 2.3.3.8).



GREENLINK INTERCONNECTOR

UNDERWATER SOUND
UXO Mitigation Zones

Drawing No: P1975-UWS-013

A

Legend

- Landfall
- KP
- 12nm Territorial Sea Limit
- EEZ Boundary

UXO Detonation Zones

Zone

- 1
- 2
- 3
- 4
- 5



NOTE: Not to be used for Navigation

Date	04 November 2020
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	UKHO; MarineRegions; OSOD; EMODnet; ESRI;
File Reference	J:\P1975\Mxd\19_UWS\ P1975-UWS-013.mxd
Created By	Chris Dawe
Reviewed By	Emma Storey
Approved By	Anna Farley



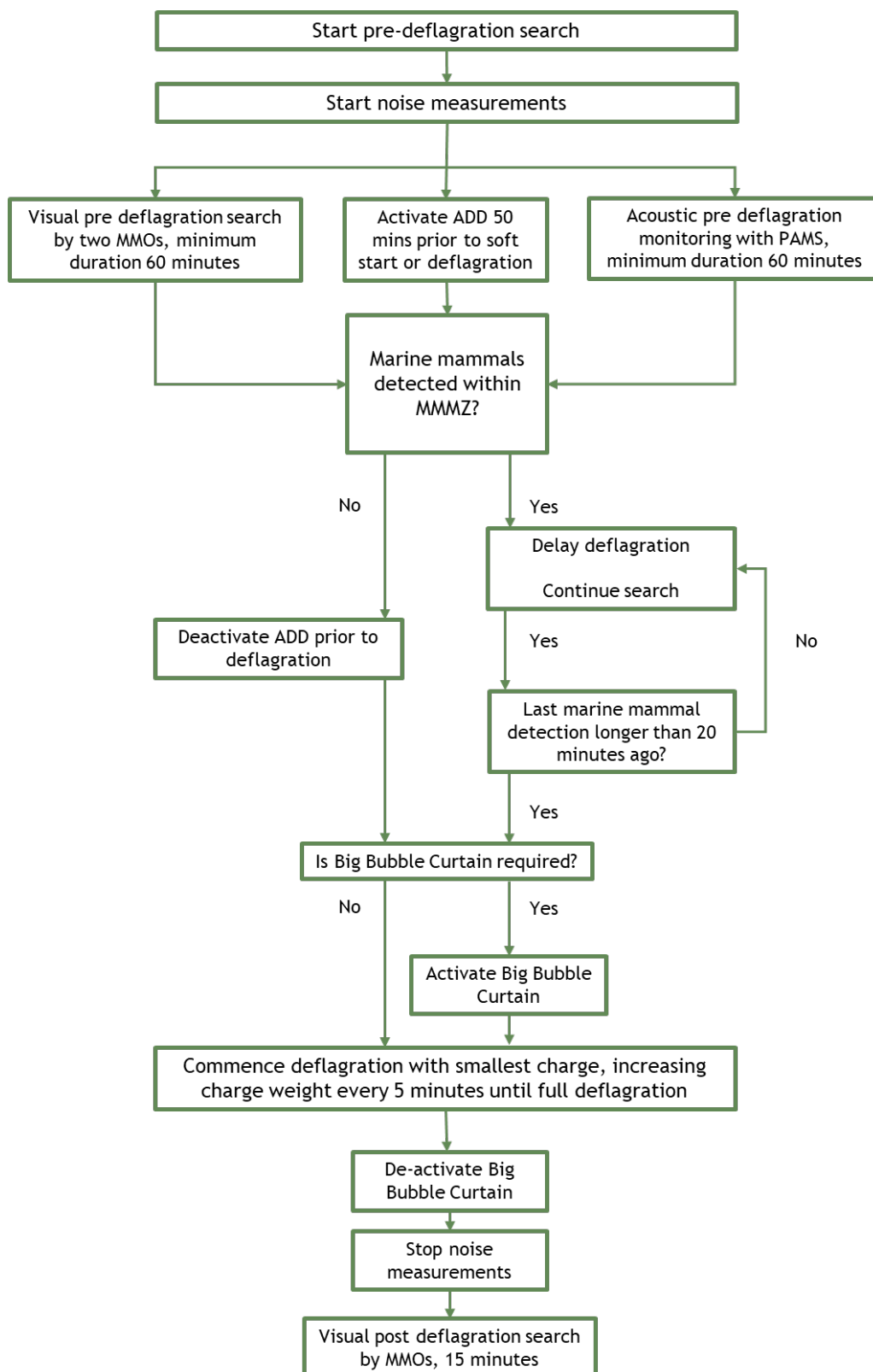
Co-financed by the European Union
Connecting Europe Facility



0 2.5 5 7.5 10 km

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2.3.2 Procedural summary flow-chart - deflagration



2.3.3 Monitoring Procedure

The marine mammal mitigation protocol to be followed during UXO detonation is outlined below:

2.3.3.1 Marine Mammal Mitigation Team (MMMT)

The MMMT will consist of two dedicated MMOs, a PAM Operative, an EOD Supervisor and an ADD Operative. Section 2.1.1.1 defines their roles and required levels of training.

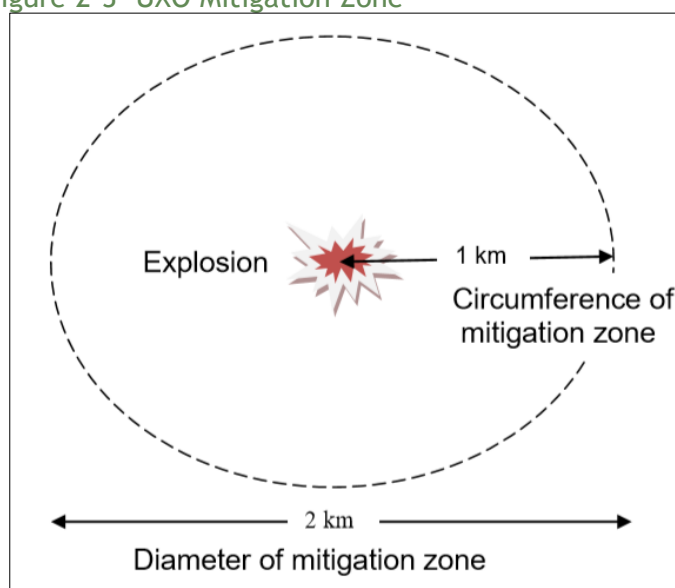
2.3.3.2 Mitigation Vessel

The MMMT will be located onboard the vessel, on which the explosive operation will take place. The vessel will move to a safe distance from the detonation zone once all of the preparation has been completed. MMO/PAM visual and acoustic monitoring will continue up until the point of detonation and then continue as part of a post detonation search for 15 minutes after deflagration. Visual monitoring should be carried out from a suitable platform such as the ships bridge that allows 360° coverage.

2.3.3.3 Marine Mammal Mitigation Zone

The Marine Mammal Mitigation Zone (MMMZ) refers to the radius around the outlined detonation area, where injury/PTS onset may occur. The JNCC requires a default 1km mitigation zone; which is based on previous charges when detonating World War II UXOs (see Figure 2-3). Greenlink underwater noise modelling suggests that the onset of injury/PTS may also occur outside of this mitigation zone, hence why temporal restrictions, noise abatement and acoustic deterrents are also proposed. The EOD Supervisor is responsible for providing the MMMT with the exact position of the UXO so they can assess the location for the MMMZ.

Figure 2-3 UXO Mitigation Zone



2.3.3.4 60-minute Pre-Detonation Search

The UXO deflagration operations should only commence following a full pre explosion monitoring period in good sighting conditions.

Visual and acoustic monitoring will continue for a minimum of 60 minutes prior to the deflagration and consequent detonation of the explosive charges. When the 60-minute pre explosion monitoring period is complete in good sighting conditions, the lead MMO will communicate with the EOD Supervisor that deflagration can take place. If a marine mammal is observed during the 60-minute pre-detonation search period, then the delay procedure outlined in Section 2.3.3.5 should be followed.

2.3.3.5 Delay procedure

Explosive deflagration should be delayed if marine mammals are detected within the mitigation zone. If a marine mammal is detected, operations cannot continue until 20 minutes after the mammal has passed out of the mitigation zone. When a marine mammal is observed or acoustically detected within the mitigation zone it should be tracked until it has moved out of range. The MMO must notify the chain of command of the detection and advise that operations must be delayed. If the mammal has been detected acoustically, the PAM operator should use a range indication and their judgement to determine whether the marine mammal is within the mitigation zone. If an MMO or PAM operative is uncertain whether marine mammals are present within the mitigation zone, they should advise that operations be delayed as a precaution.

2.3.3.6 Use of Acoustic Deterrent Devices

Acoustic Deterrent Devices (ADDs) are designed to emit sound at frequencies that are uncomfortable to marine mammals, so they prevent them from entering a specific area. The aim of using an ADD in the deflagration of a UXO is to reduce the risk of hearing damage and injury to harbour porpoise that may be in the vicinity.

The ADD likely to be used is the Lofitech AS seal scarer¹², although this will be confirmed prior to the deflagration taking place.

ADDs should only be used in conjunction with visual and/or acoustic monitoring and for as short a period as necessary to minimise the introduction of additional noise. They should be positioned in the water in close proximity to the installed explosive source; the vessel with the MMOs and PAM operatives may not be a suitable mooring location for these devices. ADDs should be switched on for a pre-determined number of emissions during the pre-detonation search and turned off immediately once the detonations have commenced.

Herschel *et al.* (2013)¹³ recommend that the ADD should be activated for at least as long as it takes for a marine mammal to swim twice the distance of the mitigation zone at the onset of soft-start detonation. The duration of ADD deployment can be

¹² <http://www.lofitech.no/en/seal-scarer.html>

¹³ Herschel, A., Stephenson, S., Sparling, C., Sams, C. and Monnington, J. (2013) Use of Deterrent Devices and Improvements to Standard Mitigation during Piling. ORJIP Project 4, Phase 1. Xodus Group Ltd. Document L-300100-S00-REPT-002.

calculated using swimming speed assumptions to ensure that marine mammals are outwith the mitigation zone.

A swim speed of 1.5m/s^{14,15} will be assumed for all marine mammals except for minke whale. For minke whale a swim speed of 3.25m/s will be assumed. There is data^{16,17,18} to suggest that animals will flee at much higher speeds e.g. harbour porpoise at 1.9m/s¹⁷, at least initially and that these figures are therefore precautionary.

Once the ADD is deployed and in position, they should be tested for operational efficiency. A low sensitivity hydrophone should be lowered over the side of the vessel near the ADD and the signals tested. The ADD Operative should also ensure that the communications are in place between themselves, the MMOs, the PAM Operative (if present) and the EOD Supervisor.

The ADD will be activated for 50 minutes¹⁹ directly prior to the soft start procedure, during the pre-detonation search. The ADD cannot be used during transit to another deflagration event and must be activated prior to the soft start procedure for any deflagration event or sequence. Once the ADD has been activated for a period of 50 minutes, then the ADD Operative will recover the ADD and undertake routine checks to ensure it is still working correctly, ready for the next deployment and activation. If the MMO/PAM Operative and ADD Operative are the same person, then the ADD should be deployed and tested prior to the 1-hour pre-detonation search and activated at the appropriate time.

2.3.3.7 Use of Big Bubble Curtain (BBC)

Big Bubble Curtains (BBC) are noise abatement techniques designed to change the physical condition of the water and the outward propagation of the acoustic/shock waves. The aim of using a BBC is to reduce the sound energy emitted into the environment, thereby reducing the distance over which injury/PTS onset may occur.

A BBC will be used for deflagration in water depths equal to or less than 40m i.e. between KP0 and KP9.4.

Verfuss et al (2019)²⁰ reports the limiting factors for BBC deployment are:

- Water depths greater than 40m

¹⁴ Otani, S., Naito, Y., Kato, A. and Kawamura, A. (2000). Diving behavior and swimming speed of a freeranging harbor porpoise, *Phocoena phocoena*. Marine Mammal Science 16:811-814.

¹⁵ Lepper, P. A., Robinson, S.P., Ainslie, M.A., Theobald, P.D. and de Jong, C. A. (2012). Assessment of cumulative sound exposure levels for marine piling events. Pages 453-457 The Effects of Noise on Aquatic Life. Springer.

¹⁶ McGarry, T., Boisseau, O., Stephenson, S., Compton, R. (2017) Understanding the Effectiveness of Acoustic Deterrent Devices (ADDs) on Minke Whale (*Balaenoptera acutorostrata*), a Low Frequency Cetacean. ORJIP Project 4, Phase 2. RPS Report EOR0692. Prepared on behalf of The Carbon Trust. November 2017.

¹⁷ Kastelein, R.A. Van de Voorde, S. and Jennings, N. (2018). Swimming Speed of a Harbor Porpoise (*Phocoena phocoena*) During Playbacks of Offshore Pile Driving Sounds. Aquatic Mammals. 44. 92-99. 10.1578/AM.44.1.2018.92.

¹⁸ van Beest, F.M., Teilmann, J., Hermannsen, L., Galatius, A., Mikkelsen, L., Sveegaard, S., Balle, J.D., Dietz, R. and Nabe-Nielsen, J. (2018). Fine-scale movement responses of free-ranging harbour porpoises to capture, tagging and short-term noise pulses from a single airgun. Royal Society Open Science. Volume 5, Issue 1.

¹⁹ Based on calculation that at a swimming speed of 1.5m/s it will take 50 minutes to swim 2km.

²⁰ Verfuss, U.K., Sinclair, R.R. and Sparling, C.E. (2019). A review of noise abatement systems for offshore wind farm construction noise, and the potential for their application in Scottish waters. Scottish Natural Heritage Research Report No. 1070.

- Significant wave heights between 1.5m - 3m.
- Current speeds greater than 1m/s

If a UXO is identified in water depths of 40-70m advice should be sought from a BBC contractor as to practicalities and cost of deploying a BBC in winter at the specific location. A BBC shall be used if the contractor concludes it will be effective.

2.3.3.8 Use of ‘soft-start’

If required, a sequence of small to large charge size in order will be implemented to allow additional time for marine mammals to leave the area of potential impact; this is known as a “soft-start” procedure. Typically, charges of 50g, 100g, 150g and 200g would be deployed 5 minutes after the deactivation of the ADD and would be sequenced to commence at 5-minute intervals, with a further 5-minute interval before the deflagration charge. This allows marine mammals to move further from the site, ensuring they are beyond the increased potential permanent injury onset range.

The introduction of additional small charges must ensure a balance between the deterrence of marine mammals beyond the potential range of injury, and minimizing the additional noise introduced into the environment.

Once the soft-start has commenced, and a marine mammal is detected within the 1 km mitigation zone by the MMO and/or PAM Operative, the soft-start sequence should be paused, the ADD reactivated until the marine mammal is clear of the mitigation zone for a period of 20 minutes. Once the MMO and/or PAM Operative has confirmed that the marine mammal has been clear for 20 minutes, then the soft-start procedure can recommence with the next charge.

Note: Where there is a requirement that groups of charges must be detonated together, consideration should be given to appropriate fusing to fractionally delay the detonation of the second and subsequent charges (only by milliseconds), thus reducing the cumulative effect of the charges and in order to lessen the impact of the shock wave.

2.3.3.9 Use of deflagration

Deflagration, whereby the explosive in the UXO is burnt out rather than blown up, should be utilised for all UXO's requiring in-situ disposal. This is due to the predicted injury ranges for a 1.54kg UXO being greater than the area that can be mitigated using ADD's and other measures.

2.3.3.10 Post-detonation search

A 15-minute post detonation search must be conducted in the mitigation zone by the MMO to look for any evidence of injury to marine life, including fish kills. Any observations should be noted in the MMOs report.

2.3.3.11 Underwater noise measurements

Noise measurements will be undertaken before, during and after the UXO deflagration following a separate Noise Measuring Procedure.

Measurements will be undertaken following the 'Good Practice Guide for Underwater Noise Measurement'²¹ including following best practice for in-situ measurement of underwater sound, for processing the data, and for reporting the measurements using appropriate metrics.

The Noise Measuring Procedure will be agreed with NRW and JNCC and will be appended to this plan.

2.3.4 Communication Protocol

Clear communication channels must exist between MMOs/PAM operators and personnel detonating the explosives. As each explosive use is likely to be different, it is recommended that communication channels should be established and in place before the activity commences. Communication channels will be discussed at a pre-mobilisation meeting so every party knows what to do in case there is an observation in the mitigation zone prior to detonation.

2.3.5 Reporting

Reports detailing the marine mammal mitigation activities should be completed by the MMO and sent to the Greenlink Consents Manager to forward to JNCC by email to seismic@jncc.gov.uk and [NRW trwyddedrhywogaeth@cyfoethnaturiolcymru.gov.uk](mailto:NRW.trwyddedrhywogaeth@cyfoethnaturiolcymru.gov.uk) within six weeks of the explosives operation being completed.

The information to record in the MMO report includes:

- The reference number for the activity provided by the regulatory authority.
- Date and location of the activity.
- A full account of the deflagration operation including all mitigation deployed e.g. ADD, BBC, and start and end times of deployment.
- The start and end times of watches by MMOs and any acoustic monitoring using PAM.
- Any marine mammal sightings, summarised in the completed 'marine mammal recording forms'
- Details of any acoustic deterrent devices used, and any relevant observations their efficiency.
- Details of any problems encountered during the operations including any non-compliance with JNCC regulations or agreed procedure.

²¹ National Measurement Office, Marine Scotland, The Crown Estate, Robinson, S.P., Lepper, P. A. and Hazelwood, R.A. (2014). NPL Good Practice Guide No. 133, ISSN: 1368- 6550, 2014. <https://www.npl.co.uk/special-pages/guides/gpg133underwater>

Appendix A

Reporting Forms

MARINE MAMMAL RECORDING FORM - COVER PAGE

Regulatory reference number (e.g. DECC no., BOEM permit no., OCS lease no., etc.)	Country	Location	Ship/ platform name
Client	Contractor		Survey type ☐ site ☐ 2D ☐ 3D ☐ 4D ☐ OBC ☐ 4C ☐ VSP ☐ WAZ ☐ piling ☐ explosives ☐ other
Start date	End date		

Number of source vessels	Type of source (e.g. airguns)	Number of airguns (only if airguns used)	Source volume (cu. in.)
Source depth (metres)	Frequency (range in which peak energy is emitted, in Hz)	Intensity (primary peak-to-peak amplitude in dB re. 1µPa or bar metres)	Shot point interval (metres)
Method of soft start ☐ increase number of guns ☐ increase frequency (where permitted) ☐ increase pressure (where permitted) ☐ increase number and frequency ☐ increase number and pressure ☐ other			

Visual monitoring equipment used (e.g. binoculars, big eyes, etc.)	Magnification of optical equipment (e.g. binoculars)	Height of eye above water surface (metres)	How was distance of animals estimated? ☐ by eye ☐ with laser rangefinder ☐ with rangefinder stick/ callipers ☐ with reticle binoculars ☐ by relating to object at known distance ☐ other
Number of dedicated MMOs	Training of MMOs ☐ JNCC approved MMO training course for UK waters ☐ PSO training course for the Gulf of Mexico ☐ MMO training course for Irish waters ☐ MMO training course for New Zealand waters ☐ other ☐ none		

Was PAM used? ☐ yes ☐ no	Number of PAM operators	
Description of PAM equipment 		
Range of PAM hydrophones from airguns (metres)	Bearing of PAM hydrophones from airguns (relative to direction of travel)	Depth of PAM hydrophones (metres)

MARINE MAMMAL RECORDING FORM - OPERATIONS

Regulatory reference number

(e.g. DECC no., BOEM permit no., OCS lease no., etc.)

Ship/ platform name

Complete this form every time the airguns are used, including overnight, whether for shooting a line or for testing or for any purpose.

Times should be in UTC, using the 24 hour clock.

[illegible]

MARINE MAMMAL RECORDING FORM - EFFORT

Regulatory reference number
(e.g. DECC no., BOEM permit no., OCS lease no., etc.)

Ship/ platform name

Record the following for all watches, even if no marine mammals are seen.

START A NEW LINE IF SOURCE ACTIVITY OR WEATHER CHANGES. ENTER DATA AT LEAST EVERY HOUR.

Date	Visual watch or PAM (v/ p)	Observer's/ operator's name(s)	Time of start of section of watch (UTC, 24hr clock)	Time of end of section of watch (UTC, 24hr clock)	Source activity (f/ s/ r/ n/ v)	Start position (latitude and longitude)	Depth at start (m)	End position (latitude and longitude)	Depth at end (m)	Speed of vessel (knots)	Wind dir'n	Wind force (B'fort scale)	Sea state (g/ s/ c/ r)	Swell (o/ m/ l)	Vis. (visual watch only) (p/ m/ g)	Sun glare (visual watch only) (n/ wf/ sf/ vf/ wb/ sb/ vb)	Precip. (n/ l/ m/ h/ s)

Visual watch or PAM: v = visual watch; p = PAM

Source activity: f = full power; s = soft start; r = reduced power (not soft start); n = not active; v = variable (e.g. tests)

Sea state: g = glassy (like mirror); s = slight (no/ few white caps); c = choppy (many white caps); r = rough (big waves, foam, spray)

Swell: o = low (< 2 m); m = medium (2-4 m); l = large (> 4 m)

Visibility: p = poor (< 1 km); m = moderate (1-5 km); g = good (> 5 km)

Sun glare: n = none; wf = weak forward; sf = strong forward; vf = variable forward; wb = weak behind; sb = strong behind; vb = variable behind

Precipitation: n = none; l = light rain; m = moderate rain; h = heavy rain; s = snow

MARINE MAMMAL RECORDING FORM - SIGHTINGS

Regulatory reference number (e.g. DECC no., BOEM permit no., OCS lease no., etc.)	Ship/ platform name	Sighting number (start at 1 for first sighting of survey)	Acoustic detection number (start at 500 for first detection of survey)
Date		Time at start of encounter (UTC, 24hr clock)	Time at end of encounter (UTC, 24hr clock)
Were animals detected visually and/ or acoustically? ☐ visual ☐ acoustic ☐ both	How were the animals first detected? ☐ visually detected by observer keeping a continuous watch ☐ visually spotted incidentally by observer or someone else ☐ acoustically detected by PAM ☐ both visually and acoustically before operators/ observers informed each other		
Observer's/ operator's name	Position (latitude and longitude)		Water depth (metres)
Species/ species group		Description (include features such as overall size; shape of head; colour and pattern; size, shape and position of dorsal fin; height, direction and shape of blow; characteristics of whistles/ clicks)	
Bearing to animal (when first seen or heard) (bearing from true north)	Range to animal (when first seen or heard) (metres)		
Total number	Number of adults (visual sightings only)	Number of juveniles (visual sightings only)	Number of calves (visual sightings only)
Photograph taken ☐ yes ☐ no			
Behaviour (visual sightings only)			
Direction of travel (relative to ship) ☐ towards ship ☐ away from ship ☐ parallel to ship in same direction as ship ☐ parallel to opposite direction to ship ☐ crossing perpendicular ahead of ship		Direction of travel (compass points) ☐ N ☐ W ☐ NE ☐ NW ☐ E ☐ variable ☐ SE ☐ stationary ☐ S ☐ unknown ☐ SW	
Airgun (or other source) activity when animals first detected ☐ full power ☐ not firing ☐ soft start ☐ reduced power (other than soft start)	Airgun (or other source) activity when animals last detected ☐ full power ☐ not firing ☐ soft start ☐ reduced power (other than soft start)	Time animals entered mitigation/ exclusion zone (UTC, 24hr clock)	Time animals left mitigation/ exclusion zone (UTC, 24hr clock)
		Closest distance of animals from airguns (or other source) (metres)	Time of closest approach (UTC, 24hr clock)
If seen during soft start give: First distance Closest distance Last distance during soft start (metres)	What action was taken? (according to requirements of guidelines/ regulations in country concerned) ☐ none required ☐ delay start of firing ☐ shut-down of active source ☐ power-down of active source ☐ power-down then shut-down of active source		Length of power-down and/ or shut-down (if relevant) (length of time until subsequent soft start, in minutes)
Estimated loss of production (if relevant) due to mitigating actions (km)			

Appendix B

Noise Measuring Procedure

HOLD - To be agreed with NRW, Cefas and JNCC