NORTH FALLS

Offshore Wind Farm

Draft Marine Mammal Mitigation Protocol

Document Reference:	7.7
Volume:	7
APFP Regulation:	5(2)(g)
Date:	July 2024
Revision:	0

Project Reference: EN010119

NORTH FALLS
Offshore Wind Farm

Project	North Falls Offshore Wind Farm
Document Title	Draft Marine Mammal Mitigation Protocol
Document Reference	7.7
APFP Regulation	5(2)(a)
Supplier	Royal HaskoningDHV
Supplier Document ID	PB9244-RHD-ES-OF-RP-OF-0277

Revision	Date	Status/Reason for Issue	Originator	Checked	Approved
0	July 2024	Submission	RHDHV	NFOW	NFOW

Contents

Tables

Plates

Glossary of Acronyms

ADD	Acoustic Deterrence Device
DCO	Development Consent Order
DML	Deemed Marine Licence
ELO	Environmental Liaison Officer
EOD	Explosive Ordnance Disposal
JNCC	Joint Nature and Conservation Committee
MMO	Marine Management Organisation
MMObs	Marine Mammal Observers
MMMP	Marine Mammal Mitigation Protocol
OCP	Offshore Converter Platform
OSP	Offshore Substation Platform
PAM	Passive Acoustic Monitoring
SAC	Special Area of Conservation
SIP	Site Integrity Plan
SNCB	Statutory Nature Conservation Bodies
SNS	Southern North Sea
UXO	Unexploded Ordnance
WTG	Wind Turbine Generators

Glossary of Terminology

ADD operator	A trained member of the team who will operate the Acoustic Deterrent Device (ADD)
Array area	The offshore wind farm area, within which the wind turbine generators, array cables, platform interconnector cable, offshore substation platform(s) and/or offshore converter platform will be located.
Array cables	Cables which link the wind turbine generators with each other, the offshore substation platform(s) and/or the offshore converter platform.
Marine Mammal Observers (MMObs)	Trained members of the team who will observe the Monitoring Area.
Mitigation Zone	The area covered by all mitigation measures, including Monitoring Area and ADD activation; this has been designed to ensure all marine mammals are outside of all potential Permanent Threshold Shift (PTS) ranges (including cumulative) prior to piling commencing.
Monitoring Area	The area around each pile location to be monitored in the pre-piling watch, and where practicable during any breaks in piling or soft-start by either MMObs or Passive Acoustic Monitoring Operator (PAM-Op).
Offshore cable corridor	The corridor of seabed from the array area to the landfall within which the offshore export cables will be located.
Offshore converter platform	Should an offshore connection to an HVDC interconnector cable be selected, an offshore converter platform would be required. This is a fixed structure located within the array area, containing HVAC and HVDC electrical equipment to aggregate the power from the wind turbine generators, increase the voltage to a more suitable level for export and convert the HVAC power generated by the wind turbine generators into HVDC power for export to shore via a third party HVDC interconnector cable.
Offshore export cables	The cables which bring electricity from the offshore substation platform(s) to the landfall, as well as auxiliary cables.
Offshore substation platform(s)	Fixed structure(s) located within the array area, containing HVAC electrical equipment to aggregate the power from the wind turbine generators and increase the voltage to a more suitable level for export to shore via offshore export cables.
PAM Operators (PAM-Op)	A trained member of the team who will use the PAM station to undertake acoustic monitoring of the Monitoring Area.
Passive Acoustic Monitoring (PAM)	Use of acoustic sensors to monitor the presence of marine mammals in the Monitoring Area.
Platform interconnector cable	Cable connecting the offshore substation platforms (OSP); or the OSP and offshore converter platform (OCP).
Pre-piling watch	The period prior to piling commencing during which observations are undertaken visually by the MMObs or acoustically by the PAM-Op of the Monitoring Area to determine if marine mammals are present in the Monitoring Area
Ramp-up	Ramp-up forms the second part of the soft-start procedure and follows on from the low-energy blows.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the wind turbine generator foundations and offshore substation platform (OSP) or / and offshore converter platform (OCP) foundations as a result of the flow of water.
Soft-start	The procedure used to commence piling at a lower hammer energy
The Applicant	North Falls Offshore Wind Farm Limited (NFOW).
The Project Or 'North Falls'	North Falls Offshore Wind Farm, including all onshore and offshore infrastructure.

Wind turbine generator	Power generating device that is driven by the kinetic energy of the wind

1 Draft Marine Mammal Mitigation Protocol

1.1 Purpose of this document

1. The purpose of this Draft Marine Mammal Mitigation Protocol (MMMP) is to establish the guiding principles for the final MMMP to be submitted for approval post-consent, as required under the draft Development Consent Order (DCO) for the proposed North Falls Offshore Wind Farm (hereafter 'North Falls' or 'the Project').
2. This outline MMMP details how the Applicant (North Falls Offshore Wind Farm Ltd) would mitigate the risk of auditory injury to marine mammals that could be present in and around the North Falls array area. Both piling and unexploded ordnance (UXO) clearance have the potential to produce underwater noise capable of causing auditory injury to marine mammals.
3. It should be noted that, pre-construction, separate Marine Licences for UXO clearance will be sought, with the necessary information (including the final MMMP for UXO clearance) being provided through the marine licensing process. All UXO clearance campaign activities will adopt the "two-licence" approach, where one licence would be obtained for surveying and a second licence for clearance. A summary of the proposed measures to mitigate potential impacts from UXO clearance have been provided within this outline MMMP for information purposes only, consistent with Natural England's advice that the DCO application includes an assessment of potential UXO clearance.
4. Plate 1.1 sets out how the MMMPs for piling and UXO will be secured.
5. As such, separate MMMPs for piling and UXO clearance will be developed for North Falls at the pre-construction stage. These final MMMPs will take account of the most suitable mitigation measures and up to date scientific understanding at the time of construction. These measures will be consulted upon with the Statutory Nature Conservation Bodies (SNCBs) during the post consent development of the MMMPs, prior to submission of the final MMMPs for approval by the Marine Management Organisation (MMO).

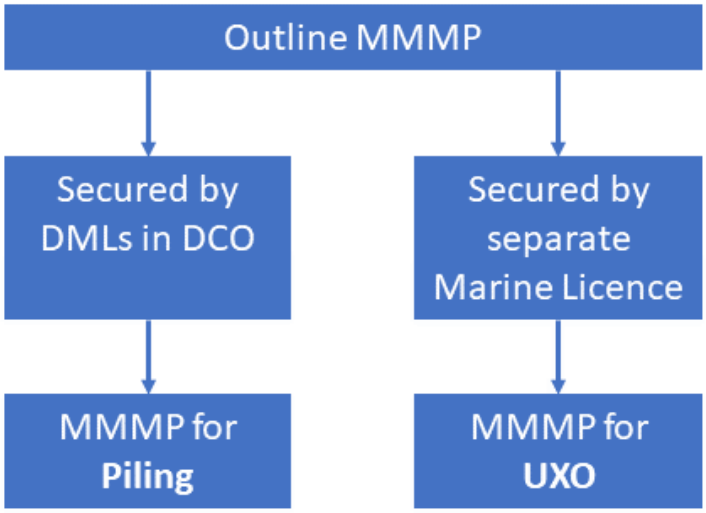

Plate 1.1 Relationship between the outline and final MMMPs for Piling and UXO and how they will be secured

6. In accordance with the draft DCO (Document Reference: 6.1) this Draft MMMP aims to:

   'in the event that driven or part-driven pile foundations are proposed to be used, a marine mammal mitigation protocol for that stage, in accordance with the outline marine mammal mitigation protocol, the intention of which is to prevent injury to marine mammals, including details of soft start procedures with specified duration periods following current best practice as advised by the relevant statutory nature conservation bodies;'

7. This Draft MMMP sets out the piling protocol (Section 1.3) of how North Falls would mitigate impacts to reduce the likelihood of injury to marine mammals as a result of underwater noise during piling operations.

8. In addition, a summary of mitigation to reduce the likelihood of injury to marine mammals as a result of underwater noise during UXO clearance is provided (Section 1.4). A protocol for UXO clearance will be prepared and submitted in the MMMP accompanying the relevant marine licence application.

9. The final MMMPs will be developed in the pre-construction period and will be based upon available information, methodologies, industry good practice, latest scientific understanding, current guidance and detailed project design. Current guidance includes Joint Nature and Conservation Committee (JNCC) guidelines for minimising the risk of injury to marine mammals from using explosives (JNCC, 2010a) and statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise (JNCC, 2010b).

10. Appendix C of the Outline Project Environmental Management Plan (Document reference 7.6) provides further information on the proposed good practice measures that will be undertaken by vessel operators to reduce any risk of collisions with marine mammals.

11. In addition to the Draft MMMP, an outline Site Integrity Plan (SIP) for the Southern North Sea (SNS) Special Area of Conservation (SAC) (Document Reference: 7.8) is submitted with the DCO application. The SIP sets out the approach for delivery of the required mitigation measures for North Falls to

ensure the avoidance of an Adverse Effect on Integrity of the SNS SAC in-combination with other plans and projects.

1.1.1 Description of North Falls

12. The Applicant is seeking a DCO for North Falls which is an extension to the western boundary of the existing Greater Gabbard Offshore Windfarm, located off the East Anglian coastline.

13. The North Falls array area will cover approximately 95km^2. The closest point to the coast is 40km from North Falls. Depths range from 5m to 59m, with a mean depth of 30m relative to Lowest Astronomical Tide (LAT) in the array areas.

14. The majority of the water depths within the offshore cable corridor are less than 30m LAT, mobile sand waves of up to 7m peaks are present in parts of the offshore cable corridor.

15. Once built, North Falls would comprise the following offshore components:

- Up to 57 offshore wind turbine generators (WTGs) and their associated foundations;
- Scour protection around foundations and subsea cables as required;
- Up to two offshore substation platform/s (OSP/s) and/or offshore converter platform (OCP) supporting required electrical equipment; and
- Subsea cables comprising:
    - Array cables between the WTGs and OSP(s)/OCP; and
    - Offshore export cables between the OSP(s) and landfall.

16. The detailed design of North Falls (e.g. final numbers of WTGs, layout configuration, foundation type and requirement for scour protection) will be determined post-consent. Therefore, the key parameters presented in Table 1.1 are indicative based on current information and assumptions. These parameters have formed the worst case scenario for the underwater noise assessment as presented in Chapter 12 Marine Mammal Ecology.

17. The earliest any offshore construction works would start is assumed to be 2027.

18. Offshore construction works would require up to two years (excluding pre-construction activities such as surveys). It should be noted that the construction programme is dependent on numerous factors including consent timeframes and funding mechanisms.

1.1.2 Key relevant parameters

19. Below Table 1.1 shows the key design parameters for the North Falls OWF project that are relevant to the Draft MMMP.

Table 1.1 Key Relevant Parameters

Parameter	Details
Approximate offshore construction duration	2 years

Parameter	Details
Array area	95km^2
Offshore cable corridor length	57km
Array area water depth range	5 to 58m
Distance from array area to coast (closest point)	40km
Maximum number of WTG	57
Maximum number of OSP(s)/OCP	2
WTG foundation type options	• Monopile • Mono-suction bucket • Gravity base system • Jacket with 3 or 4 legs (attached to the seabed by pin piles, suction buckets, or gravity/ ballast legs)
OSP/OCP foundation type options	• Monopile (drilled, driven or gravity base) • Gravity base system • Jacket (with either pin piles, suction buckets, or gravity/ ballast legs)
Maximum number of piles per foundation for WTGs	Monopile – 1 Pin-pile (jacket) - 8
Maximum number of piles for WTGs	Monopile – 57 Pin piles - 456
Maximum number of piles for OSP(s)/OCP	Monopile – 2 Pin pile - 12
Hammer energies (kilojoules) (kJ)	Monopile – 6,000kJ Pin pile – 4,400kJ
Maximum pile diameter (m)	Monopile – 17m Pin pile – 6m

1.2 Consultation

20. A draft of the MMMP has been provided to the Marine Mammal Expert Topic Group pre-consent in order to gain feedback through consultation. This was a request from Natural England made through the PEIR consultation comments. A summary of those comments is provided in Table 1.2.

21. In addition, within the scoping opinion responses received, a comment was made by the MMO to ensure a Marine Mammal Mitigation Plan/ Protocol was produced. The MMO detailed how standard measures include soft start procedures for piling during piling, marine mammal observation and/or temporal restrictions. These points have been addressed within this Draft MMMP.

22. Table 1.2 details further consultation comments received regarding the Draft MMMP.

Table 1.2 MMMP consultation comments

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
Natural England	21/03/2024 Draft MMMP	Natural England acknowledge that the Project has provided an outline MMMP and that the final MMMP is yet to be agreed on and will be submitted post-consent.	Noted.
Natural England	21/03/2024 Draft MMMP	We understand that the measures for Unexploded Ordnance (UXO) clearance in this MMMP are for information purposes only, and that another MMMP for UXO clearance will be submitted under a separate Marine Licence.	Noted.
Natural England	21/03/2024 Draft MMMP	We welcome the consideration of noise abatement systems as a potential mitigation measure.	Noted.
Natural England	21/03/2024 Draft MMMP	We agree that a monitoring area around the pile should be based on the maximum predicted distance for instantaneous Permanent Threshold Shift (PTS) (SPL_{peak}). Thus, we agree that the proposed 700m distance would be acceptable based on the currently presented maximum predicted distance for instantaneous PTS (SPL_{peak}).	Noted.
Natural England	21/03/2024 Draft MMMP	We advise that the acoustic monitoring is conducted alongside visual monitoring during the daylight hours. Please refer to recently published JNCC guidance for the use of Passive Acoustic Monitoring (PAM) in UK waters for minimising the risk of injury to marine mammals from offshore activities (JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities) which states that PAM should supplement visual observations within areas of importance for marine mammals including SACs.	Text has been amended in Section 1.3.2.1.2 stating both acoustic and visual monitoring will be undertaken during daylight hours.
Natural England	21/03/2024 Draft MMMP	We agree that the Acoustic Deterrent Device (ADD) activation period should occur alongside visual/acoustic monitoring and, if ADD is active for more than 30 min, pre-piling monitoring should be extended to cover the entire ADD duration.	Noted.
Natural England	21/03/2024 Draft MMMP	We agree that two Marine Mammal Observers (MMObs) are sufficient to conduct monitoring during daylight hours.	Noted.
Natural England	21/03/2024 Draft MMMP	We agree that the monitoring by MMObs should be conducted in all situations as listed in the paragraph 43 and 44 (Page 13).	Noted.
Natural England	21/03/2024 Draft MMMP	We agree with the proposed duration of ADD activation based on the currently predicted PTS impact ranges.	Noted.
Natural England	21/03/2024 Draft MMMP	We agree with the proposed protocol for extended ADD activation.	Noted.

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
Natural England	21/03/2024 Draft MMMP	We agree with the proposed soft star and ramp up procedure.	Noted.
Natural England	21/03/2024 Draft MMMP	We enquire why two hours break has been chosen as a time frame for a full restart of the procedures.	Two hours has been chosen as the maximum piling break time frame before a full restart of mitigation procedures in line with studies which have noted marine mammals do not return to the piling area within two hours of piling ceasing (van Beest *et al*., 2015; Nabe-Neilson *et al*., 2018, Brandt *et al*., 2009; 2011).
Natural England	21/03/2024 Draft MMMP	It needs to be emphasised that any breaks in piling need to be monitored by MMObs and/or PAM operator to ensure that no marine mammals are present in the monitoring area. This should be captured in the piling mitigation procedure flow chart (Plate 1-2).	Plate 1.2 has been amended to indicate monitoring by MMObs and/or PAM-Ops must be continued throughout breaks in piling.
Natural England	21/03/2024 Draft MMMP	We advise that two MMObs should be conducting visual monitoring in order to sufficiently monitor the 1km area.	Text in Section 1.4.2 has been amended to state two MMObs must be present when conducting the observation of the Monitoring Area.
Natural England	21/03/2024 Draft MMMP	We agree with the hierarchy of options given in Paragraphs 103 and 104.	Noted.
Natural England	21/03/2024 Draft MMMP	We welcome the consideration of additional mitigation options for high order UXO clearance.	Noted.
Natural England	21/03/2024 Draft MMMP	We advise that Plate 1-3 should indicate the length of the pre-detonation watch and include the 15 minutes post-detonation search.	Noted.
Natural England	21/03/2024 Draft MMMP	To note: JNCC explosives mitigation guidelines are currently being updated and are due to be published this year, thus consider the updated version of the guidelines when finalising the UXO MMMP.	Noted.
MMO	28/03/2024 Draft MMMP	The MMO would like to highlight that the MMMP and the cumulative sound exposure during installation should be based on the worst-case number of piles in a 24-hour period. This approach aligns with recommended guidance from NOAA (NMFS, 2018) /Southall et al. (2019), which applies to a 24-hour period for cumulative sound exposure (SEL_{cum}). Therefore, the worst-case scenario represents the maximum amount of noise that could occur within a 24-hour timeframe, rather than just for a single pile. The noise modelling conducted for the Preliminary Environmental Information Report (PEIR) assumed that two monopiles and four pin piles could be installed in a 24-hour period. Consequently, the final MMMP will need to account for the worst-case scenario over a 24-hour period.	The mitigation proposed for piling will be carried out prior to each pile, and therefore mitigation should be based on the potential for effect from each individual pile, rather than the total piles to be installed within 24 hours.

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
MMO	28/03/2024 Draft MMMP	Overall, the document outlines standard measures expected within a MMMP, such as the establishment of a Monitoring Area, deployment of Passive Acoustic Monitoring (PAM) devices, the use of acoustic deterrent devices (ADDs) and soft start (ramp up) procedures, as well as procedures for breaks in piling.	Noted.
MMO	28/03/2024 Draft MMMP	The MMO welcomes the information which indicates that the type and model of ADD will be determined in the final MMMP for piling, based on the latest information and advice. This approach ensures that the chosen ADD is effective at deterring marine mammal species present in the monitoring area and provides sufficient evidence to support its efficiency.	Noted.
MMO	28/03/2024 Draft MMMP	The MMO has noted, that Paragraph 27 confirms that the final MMMP will encompass detailed embedded mitigation strategies, including soft-start and ramp-up procedures, as well as specifications for the monitoring area and any additional mitigation measures necessary to mitigate potential impacts of physical injury or PTS. Possible additional noise mitigation systems comprise bubble curtains, hydro-sound dampers, screens, or tubes. The MMO highly encourages the consideration of noise abatement options.	Noted.
MMO	28/03/2024 Draft MMMP	JNCC (2010) guidance recommends that if there is a pause in piling operations for more than 10 minutes, the pre-piling search and soft-start procedure should be repeated before recommencing piling. If monitoring has been conducted during the piling operation, the Marine Mammal Observer or PAM operative can confirm the presence or absence of marine mammals, potentially allowing for immediate soft-start resumption. However, in the absence of monitoring, the complete pre-piling search and soft-start procedure should be performed. The guidance suggests a soft-start duration of at least 20 minutes, with any deviation from this duration requiring approval from the relevant regulator in consultation with the appropriate agency. It is recommended to adhere to this guidance and implement the full soft-start procedure rather than the proposed 5 to 6 blows at the starting hammer energy outlined in the MMMP.	Procedures have been amended based on Natural England comments to ensure the MA will continue to be monitored during breaks in piling.
MMO	28/03/2024 Draft MMMP	The MMO in consultation with Cefas, notes that table 1.2 in the MMMP outlines the projected impact ranges for PTS across all marine mammal species at the worst-case modelling location (location not specified). It includes data on the instantaneous peak sound pressure level and cumulative sound exposure from a single strike for both monopiles (6,000 kJ) and pin piles (4,400 kJ).	Noted.

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
MMO	28/03/2024 Draft MMMP	The most recent underwater noise modelling/assessment reviewed by the MMO and its consultees occurred during the PEIR consultation last year. This assessment was based on a worst-case scenario involving a 3.5 metre (m) diameter pin pile with a hammer energy of 3,000 kJ. Consequently, the MMO assumes that updated modelling has been conducted post-PEIR to accommodate the increase in hammer energy for pin piles (from 3,000 kJ to 4,400 kJ). The PEIR assessment did, however, predict larger effect ranges for pin piles (compared to monopiles), due to the piling profile and fleeing assumptions. The following maximum PTS (SEL_{cum}) injury ranges in marine mammals are predicted: • 5.1 km for very-high frequency (VHF) cetaceans (i.e., harbour porpoise), • 10 km for low frequency cetaceans (i.e., minke whale), and • < 100 m for phocid pinnipeds (i.e., seals)	The pin pile ramp up procedures have been amended therefore the ranges have now reduced, as seen with the ranges presented in the Draft MMMP.
MMO	28/03/2024 Draft MMMP (in relation to UXO campaigns)	All UXO clearance campaign activities will adopt the “two-licence” approach, where one licence should be obtained for surveying and a second licence for clearance. This approach was set out within the “Short Term Noise Management Measures” workshop held by the MMO in January 2023.	Noted and text referring to the “two licence” approach has been added into Section 1.1.
MMO	28/03/2024 Draft MMMP (in relation to UXO campaigns)	UXO campaigns must propose the following in their applications: • Low order clearance methods to be utilised in the first instance, three attempts should be made before moving to high order clearance methods. High order clearance must only be used by exception with evidence provided to demonstrate low order has not been successful. • The ‘lift and shift’ approach is encouraged in the first instance, to move the UXO to another location further from the activity site. Further discussions on locations and feasibility will take place on a case-by-case basis. • If high order clearance is required, noise abatement systems must be utilised. • A maximum of 3 high order clearances may be consented per campaign, to be used as a last resort and evidence and justification on why high order is required must be provided in support of a marine licence application. This aligns with the UXO Joint Interim Position Statement found here: Marine	Proposed UXO campaign commitments have been added to Section 1.4.2.

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
		environment: unexploded ordnance clearance joint interim position statement - GOV.UK (www.gov.uk).	
MMO	28/03/2024 Draft MMMP (in relation to UXO campaigns)	Any additional high order clearance required may be approved for the winter season and this will be reviewed on a case-by-case basis. These may require further information, evidence, and justification once identification surveys have been completed and may be in the form of a variation (if consent granted).	Noted.
MMO	28/03/2024 Draft MMMP (in relation to UXO campaigns)	Developers undertaking UXO activity will work with all other activity owners as a collaborative approach to ensure other activities can take place when clearance is not actively occurring. Evidence of this collaboration will have to be provided.	Noted.
MMO	28/03/2024 Draft MMMP (in relation to UXO campaigns)	Details of UXO activity schedules for the worst-case scenario must be uploaded to the Marine Noise Registry once a marine licence has been determined (if successful). This must be updated with the finalised programme at the earliest opportunity but prior to the activities beginning and updated regularly, with a final update once the activities are completed.	Noted.

1.3 Draft protocols for piling

23. Depending on the installation method for the installation of the foundations for the WTGs and OSP(s)/OCP, piling could be required.

24. The purpose of this Draft MMMP is to establish the guiding principles for the final MMMP for piling that could be required at North Falls.

25. This Draft MMMP for piling outlines the proposed mitigation to reduce the likelihood of injury, including any Permanent Threshold Shift (PTS), to marine mammals during all piling operations at North Falls.

26. The final MMMP for piling will be developed in the pre-construction period, when there is more detailed information on the North Falls design and will incorporate the most appropriate mitigation measures based upon the latest available information and proven methodologies at that time. The final MMMP will be developed in consultation with the MMO, and relevant SNCBs.

27. The final MMMP will include details of the embedded mitigation, such as the soft-start and ramp-up, as well as details of the Monitoring Area and any additional mitigation measures required to reduce potential effects of any physical injury or PTS. Potential additional noise mitigation systems include bubble curtains, hydro-sound dampers, screens or tubes. Consideration will be given to the requirements following any breaks in piling as well as prior to piling commencing.

28. The mitigation in the final MMMP will be based on current industry practice, guidance and information, including updated underwater noise modelling, if required, and will be updated no later than four months prior to piling operations.

29. The aim of the MMMP for piling is to reduce the risk of PTS during piling for either WTG or OSP/OCP foundations from:

- First strike of the starting hammer energy of the soft start.
- Single strike of the maximum hammer energy.
- Cumulative exposure during installation, based on worst-case for one monopile installation, or one pin-pile installation.

30. Underwater noise modelling will be used to derive the maximum potential PTS ranges.

1.3.1 Potential impact ranges

31. Table 1.3 presents the underwater noise modelling results for the predicted impact ranges and areas for PTS due to the cumulative exposure of monopiles and jacket pin piles at the worst case location. `

Table 1.3 The predicted impact ranges for PTS in all marine mammal species, at the worst case modelling location, for the peak and cumulative exposure of a single strike pile for both monopiles and pin piles

Marine mammal species	Potential impact ranges (and areas) due to cumulative exposure at the maximum hammer energy	
	Monopile (6,000kJ)	Jacket pin pile (4,400kJ)
PTS (SPL_{peak})		
Harbour porpoise	680m (1.40km^2)	630m (1.2km^2)
Minke whale	<50m (0.01km^2)	<50m (<0.01km^2)
Grey seal	60m (0.01km^2)	<50m (<0.01km^2)
Harbour seal		
PTS (SEL_{cum})		
Harbour porpoise	3.30km (22.0km^2)	3.30km (22km^2)
Minke whale	7.0km (94.0km^2)	6.90km (85km^2)
Grey seal	<100m (0.10km^2)	<100m (<0.10km^2)
Harbour seal		

1.3.2 Mitigation

32. The final MMMP would involve the establishment of a Monitoring Area around the pile location before each pile driving activity, based on the maximum predicted distance for instantaneous PTS (SPL_{peak}). The final MMMP for piling will provide details of the maximum predicted impact (PTS) ranges and areas for piling.

33. The Applicant will ensure that the mitigation measures are adequate to reduce the risk of marine mammals being present within the Monitoring Area prior to

piling activity commencing, to reduce the risk of physical or auditory injury (PTS).

34. The methods for establishing the Monitoring Area and reducing the potential impacts of piling operations would be agreed with the MMO in consultation with the relevant SNCBs and would be secured as commitments within the final MMMP.

35. The piling mitigation measures could include:

- Establishment of a Monitoring Area with a minimum 700m radius (see Section 1.3.2.1.
    - Deployment of PAM devices and the observation of the Monitoring Area will be conducted by trained, dedicated and experienced MMObs during daylight hours and when conditions allow suitable visibility (visibility of entire Monitoring Area; sea state 3 or less).
    - Deployment of PAM devices in the Monitoring Area during poor visibility or at night.
- The activation of ADD (see Section 1.3.2.2).
- Soft-start and ramp-up (see Section 1.3.2.3).
- Procedure for breaks in piling (see Section 1.3.2.4).

1.3.2.1 Monitoring Area

36. The MMMP will involve the establishment of a Monitoring Area with a minimum radius of 700m around each WTG location and OSP/OCP location before piling at North Falls.

37. The radius of the Monitoring Area will be greater than the maximum predicted impact range for instantaneous PTS (SPL_{peak}) for marine mammal species that could be present in or around the North Falls array area.

38. The requirement for a minimum radius of 700m is in line with the current JNCC (2010) guidelines, to reduce the risk of PTS.

39. The Monitoring Area will be observed for a minimum of 30 minutes prior to soft-start commencing. Note that the monitoring period would be increased to align with ADD activation period in the case of more than a 30 minute ADD activation period being required. Therefore, currently it is expected that both the pre-piling monitoring period and the ADD activation will commence at approximately 37 minutes prior to soft-start commencing.

1.3.2.1.1 Marine Mammal Observers

40. Marine mammal observations will be undertaken by JNCC trained and dedicated MMObs, in line with requirements set out in the JNCC guidelines.

41. At least two MMObs will conduct surveys to cover the entire Monitoring Area around each pile location. Marine mammal observations will be carried out from vantage points to allow unobstructed observations of the entire Monitoring Area.

42. The MMObs will be equipped with binoculars and a tool to estimate distance i.e. range finding stick or binoculars with reticles and reporting forms. The MMObs will scan the Monitoring Area with the unaided eye and use binoculars when needed to look in detail at an area where a possible sighting has been

made. Binoculars should not be used continually as they restrict peripheral vision and views close to the vessel.

43. Marine mammal observations will be carried out to monitor the Monitoring Area:

- During ADD activation
- During the soft-start and ramp-up procedure
- During any breaks in piling prior to piling recommencing

44. Where practicable, MMObs will continue monitoring during piling to allow for any breaks in piling.

45. The pre-piling monitoring will commence prior to all piling events, or following any break in piling. The visual observations by the MMObs will commence at least 30 minutes prior to the soft-start commencing. This will continue until no marine mammals have been detected within the Monitoring Area within the last 20 minutes; the MMObs will then advise that the soft-start can commence. The ADD will be activated during the monitoring period at a time so that the end of the required ADD activation period coincides with the end of the monitoring period prior to the soft-start.

46. If a marine mammal is detected within the Monitoring Area during the pre-piling monitoring, then the commencement of the soft-start will be delayed. If a marine mammal has been sighted within the Monitoring Area, it will be monitored and tracked until it is clear of the Monitoring Area and the Piling Supervisor notified. Both the full 30-minuted pre-piling search must be completed, and marine mammal(s) must not be detected in the Monitoring Area for at least 20 minutes, before the soft-start commences.

47. During ADD activation, if animals are sighted within the Monitoring Area, they will be tracked and monitored. If, at the end of the ADD activation period, the individual(s) remains within the Monitoring Area, then the extended ADD procedure should be followed (as set out in paragraph 68.

48. If the marine mammal(s) remains clear of the Monitoring Area for at least 20 minutes and the pre-piling monitoring has been completed, and the required ADD activation time has been completed, then the soft-start can commence. A precautionary approach will always be used. Therefore, if the MMObs cannot be sure whether a marine mammal is within the Monitoring Area or not, then the MMObs will take the precautionary approach of assuming a marine mammal is present and act accordingly.

49. The MMObs will record all periods of marine mammal observations, including start and finish time of observations, when soft-start and piling commenced and conditions during observations (e.g. sea state, visibility, weather, etc.). Any sightings of marine mammals around the piling vessel will also be recorded. The MMObs will complete the relevant marine mammal recording form(s) and reporting (see Section 1.3.3).

50. There will be clear communication channels between the MMObs, the ADD operator and the Piling Supervisor (see Section 1.3.4). The communication procedures will be established and agreed prior to any piling to ensure clear communication of any marine mammal observations within the Monitoring Area,

the deployment of ADD, and when the Monitoring Area is clear for the piling soft-start to commence.

1.3.2.1.2 Passive Acoustic Monitoring

51. The use of PAM will be undertaken by trained and dedicated and experienced PAM-Ops during daylight hours alongside the MMObs, and during periods of poor visibility and darkness prior to piling. PAM will be undertaken in accordance with the JNCC guidance for its use (JNCC, 2023b).

52. PAM-Ops will be trained to JNCC standards, with an appropriate level of field experience. The PAM equipment will be appropriate to detect vocalising cetaceans in the Monitoring Area. PAM-Ops will be responsible for deployment, maintenance and operation of the equipment, including spare equipment, in relation to all piling activities.

53. The PAM-Ops will ensure that the equipment and spares are functioning correctly prior to the start of the mitigation. Hydrophones and software should be configured to detect the species relevant to the area (including harbour porpoise and dolphin species). If the PAM equipment is to be deployed from the deck of the piling vessel, a survey of the piling vessel will be conducted, prior to when deployment may be needed, to agree the most appropriate locations for deployment and monitoring. PAM-Ops will assist in preparation and update of risk assessment for hydrophone deployment in collaboration with vessel personnel.

54. PAM will be carried out to monitor the Monitoring Area:

- During pre-piling monitoring period
- During ADD activation
- During the soft-start and ramp-up procedure
- During any breaks in piling prior to piling recommencing

55. Where practicable, PAM-Ops will continue monitoring during piling to allow for any breaks in piling.

56. The PAM-Ops will record and report all periods of PAM, including start and finish time of monitoring, if and when marine mammals were detected, especially in relation to when ADDs were activated and, when soft-start, ramp-up and piling was underway. The PAM-Ops will provide the necessary data and information to be included in the reporting (see Section 1.3.2.6).

57. There will be clear communication channels between the PAM-Ops, MMObs, the ADD operator and the Piling Supervisor (see Section 1.3.4).

1.3.2.2 Acoustic Deterrent Device (ADD)

58. An ADD will be activated prior to the soft start as mitigation to reduce the risk of PTS during piling.

59. The type and model of ADD will be determined in the final MMMP for piling, based on the latest information and advice, and will provide sufficient evidence to demonstrate that it is effective at deterring the marine mammal species that could be present in the Monitoring Area. It is expected that only one ADD will be required.

60. The ADD will be tested prior to the pre-piling monitoring to ensure it is working correctly. If there are any technical problems with the ADD then the soft-start would be delayed until these issues are resolved. A back-up ADD will be present on board, in case there are issues with activation of the primary system.

61. The ADD will be deployed and ready to be activated prior to soft-start commencing.

62. The ADD will be positioned within the water column to ensure that sound can be emitted in all directions. The ADD will be deployed from the piling vessel in close proximity to the piling location, where it is safe to be positioned prior to the commencement of the soft-start.

63. For deployment of the ADD, the transducer part of the device will be lowered over the side of the deck to a water depth that is below the draft of the vessel to ensure the sound can be emitted in all directions and not dampened by the presence of the vessel. The depth for the ADD deployment will be predetermined to ensure it is below the draft of the vessel, and well above the seabed (preferably in the middle of the water column) at the piling location.

64. The ADD will be activated at a time so that the end of ADD activation coincides with the end of the monitoring period, immediately prior to soft-start commencing to allow marine mammals to move beyond the area of potential PTS risk.

65. The duration of the ADD activation time has been determined based on the maximum range for PTS. The maximum duration of the ADD activation time has also been determined to reduce risk of increased disturbance. Based on the indicative noise modelling results presented in Table 1.4, the ADD would be activated for approximately 37 minutes for both jacket pin-piles and for monopiles. The ADD activation period would take place at the same time as the pre-piling watch. Note that this is indicative only, and will be confirmed within the final MMMP post-consent.

66. Further information on ADDs is provided in Section 1.4.3.3.

67. The Monitoring Area will be assessed by MMObs and / or PAM-Ops during the ADD activation period. Once the soft-start proceeds, the ADD will be switched off.

68. If marine mammals are still within the Monitoring Area following the ADD activation, the extended ADD and monitoring procedure should be followed, where initially the ADD can remain active for an additional 10 minutes. If marine mammals are still within the Monitoring Area following the additional 10 minutes (or have been within the previous 20 minutes), soft-start should be delayed, and the ADD switched off. Once the ADD has been off for 10 minutes, then the ADD should be reactivated for a further 10 minutes. If marine mammals remain in the area, the above extended ADD protocol, of cycling the ADD on and off for 10 minutes, should continue until the marine mammal has been clear of the Monitoring Area for at least 20 minutes. Only then can soft-start commence.

69. The procedure for ADD activation for breaks in piling is outlined in Section 1.3.2.4. ADD will not be operated intermittently during any breaks in piling.

70. The ADD will be deployed from the deck of the piling vessel, with the control unit and power supply on board the piling vessel in suitable positions on deck.

Prior to deployment, a survey of the piling vessel will be conducted to agree the location and method of providing power supply and communications. ADD equipment will have sufficient cable from the power point on the vessel to be deployed in the mid-water column.

71. The ADD operator will maintain a detailed record of all ADD deployments and activation. These reports will include a record of all ADD start and stop times, a record of each verification of ADD activation and a record of any issues with ADD deployment and activation.

1.3.2.3 Soft-Start and Ramp-Up

72. Following the activation period of the ADD (being approximately 37 minutes for monopiles and jacket pin-piles based on current assumptions), the soft-start procedure will commence. The soft-start starting hammer energy will be the lowest possible starting hammer energy.

73. A ramp-up period will follow the soft-start, with the energy used per hammer blow gradually increasing so that if any marine mammals are in the area, despite the pre-piling activation of the ADD, they are encouraged to leave by the initial low levels of underwater noise prior to the noise reaching levels which could cause PTS.

74. Each monopiling event would commence with a minimum of 10 minutes at 15% of the maximum hammer energy (900kJ), followed by a gradual ramp-up for at least 30 minutes up to 80% of the maximum hammer energy for all monopile driving activities. Indicative ramp up hammer energies are as follows: 900kJ (15%), 1800kJ (30%), 2700kJ (45%), 3600kJ (60%), 4800kJ (80%) and 6000kJ (100%).

75. This 40 minute soft start and ramp-up procedure is more precautionary than the current JNCC (2010b) guidance, which recommends that the soft-start and ramp-up duration should be a period of not less than 20 minutes.

76. During the 40 minutes for the soft-start and ramp-up, it is estimated that marine mammals would move at least 3.6km from the piling location, based on the following:

- During the 10 minute soft-start it is estimated that marine mammals would move a minimum of 0.9km from the piling (based upon a precautionary marine mammal swimming speed of 1.5m/s (Otani et al. 2000)); and
- During the 30 minute ramp-up it is estimated that marine mammals would move a minimum of 2.7km from the piling location (based upon a precautionary average marine mammal swimming speed of 1.5m/s (Otani et al. 2000)).

77. For each pin-piling event, piling would commence with a minimum of 10 minutes at 15% of the maximum hammer energy (660kJ), followed by a gradual ramp up for at least 20 minutes up to 80% (3520kJ) of the maximum hammer energy for all pin pile driving activities.

78. In the event that the full soft-start and ramp-up procedure is not completed, or that there is a break of more than 10 minutes during the soft-start and ramp-up procedure, the full pre-piling watch, ADD, and soft-start and ramp-up procedure would be restarted. This is different to the break in piling procedures for full

piling, to ensure that the full soft-start and ramp-up process is undertaken as a means of deterrence for any marine mammals in the area.

79. In the event that piling activity is stopped for more than two hours, the Applicant would ensure that a full restart of the procedures as stated above is conducted prior to piling re-commencing.

80. The soft-start and ramp-up procedure would be embedded mitigation for all piling operations.

1.3.2.4 Breaks in Piling

81. The observation of the Monitoring Area during any breaks in piling will be conducted by MMObs and PAM-Ops during daylight hours and suitable visibility, or by PAM-Ops during poor visibility or at night.

82. For any breaks in piling the following mitigation is proposed, depending on the duration of the break:

- For any breaks in piling of less than 10 minutes, piling may continue as required (i.e. as if there was no break).
- For any breaks in piling of more than 10 minutes but less than two hours, then piling can recommence with an altered soft-start procedure (five to six blows of the hammer at starting hammer energy) before continuing as required, provided there are no marine mammals detected within the Monitoring Area[1].
    - If there are marine mammals within the Monitoring Area, then the full mitigation procedure (as outlined above) would be undertaken, including 30 minutes observation of the Monitoring Area by MMObs and / or PAM, ADD deployment and activation for the required time, followed by the soft-start and ramp-up procedure (for a minimum of 20 minutes).
- For any breaks in piling of more than two hours then the full mitigation procedure (as outlined above) is required, including 30 minutes observation of the Monitoring Area by MMObs and / or PAM, ADD deployment and activation for the required time, followed by the soft-start and ramp-up procedure.

1.3.2.5 Piling at Night / Poor Visibility

83. If piling is to commence in poor visibility or at night, the assessment of the Monitoring Area will be done by PAM as outlined in Section 1.4.3.2.2.

84. The deployment and activation of the ADD in poor visibility and at night will follow the same procedure as outlined in Section 1.3.2.5, as will the soft-start and ramp-up procedure as outlined in Section 1.3.2.3.

85. If there are any breaks in piling during poor visibility or at night, the assessment of the Monitoring Area will be done by PAM.

[1]This is based on the evidence that marine mammals do not return to the piling area within two hours of piling ceasing (e.g. van Beest *et al.,* 2015; Nabe-Neilson *et al*., 2018, Brandt *et al*., 2009; 2011).

1.3.2.6 Mitigation for Multiple Pile Locations

86. For multiple pile locations, the mitigation as set out above for single pile locations would apply, and be undertaken at each pile location. The potentially required ADD activation times may be increased to cover an increase in the potential impact ranges, however, this would be confirmed for the multiple pile scenario in the post-consent phase, when finalising the MMMP, and once, the final pile design, and the potential for multiple locations at once, is better understood.

1.3.3 Reporting

87. Reports detailing the piling activity and mitigation measures would be prepared for all piling activity. This would include, but not necessarily be limited to:

- A record of piling operations detailing date, location, times (including soft-starts and ramp-up) and any technical or other issues for each pile.
- A record of mitigation measures such as ADD deployment and activation, detailing date, location, times and any operational issues.
- A record of all occasions when piling occurred, including details of the activities used to ensure the Monitoring Area is established and any occasions when piling activity was delayed or stopped due to presence of marine mammals.
- Any relevant details on the marine mammal behaviour in response to ADD activation.
- A record of marine mammal observations, conditions, description of any marine mammal sightings and any actions taken.
- Details of any problems encountered during the piling process including instances of non-compliance with the agreed piling and / or mitigation protocol.

88. The reporting schedule is to be agreed with the MMO post-consent and may include weekly reports and a final report. Any final report would include information, such as data collected during piling operations, details of ADD deployment and / or other mitigation measures, a detailed description of any technical problems encountered and what, if any, actions were taken. The report would also discuss the protocols followed and put forward any recommendations and lessons learned based on the mitigation measures used that could benefit future construction projects.

1.3.4 Communication and responsibilities

89. The final MMMP for piling will detail the communication protocol to ensure that all marine mammal mitigation measures, including any delays in commencing piling due to marine mammals being present in the area, are successfully undertaken for all piling activity.

90. The final MMMP for piling will also detail all key personnel and their responsibilities to ensure that all marine mammal mitigation measures are successfully undertaken for all piling activity. This will be developed based on

the mitigation measures and personnel required (e.g. ADD operators, MMOs, PAM-Ops, ELO, Piling Supervisor / Offshore Installation Manager) with the titles and responsibilities being refined depending on the contractual agreement.

1.3.5 Summary of draft protocol for piling

91. Plate 1.2 shows a summary flowchart of the proposed mitigation procedures involved with piling.

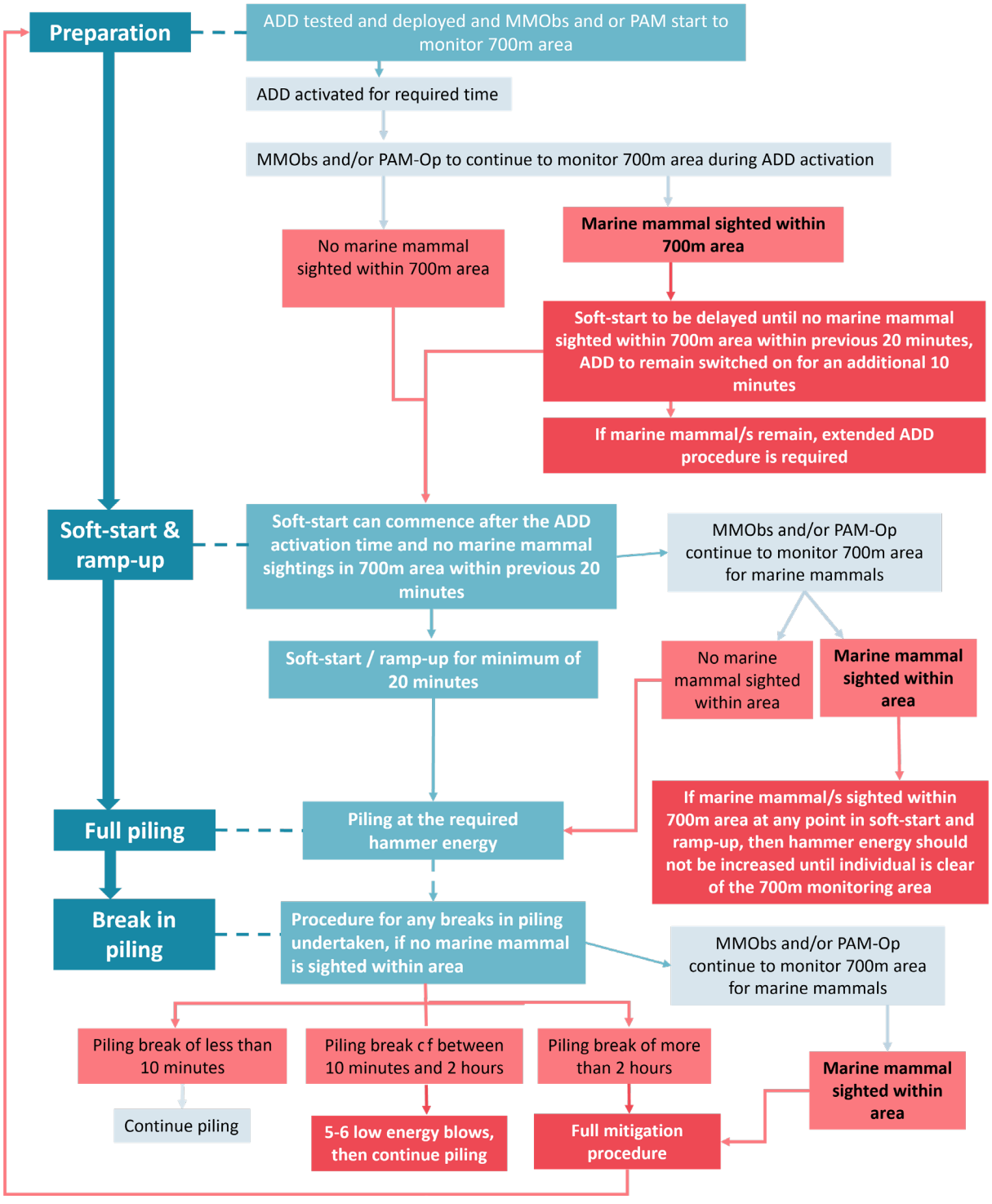

Plate 1.2 Proposed piling mitigation procedures.

1.4 Summary of mitigation for UXO clearance

92. Based on previous experience, there is a likely requirement for UXO clearance prior to construction. Whilst the preference would be to avoid any underwater UXO that are identified, it is necessary to consider the potential for underwater UXO detonation, where retrieval is deemed to be unsafe and avoidance is not possible.

93. As set out in Section 1.1, a MMMP for UXO clearance will be submitted for approval under a future Marine Licence application, separate from the DCO application.

94. The purpose of this section is to establish the guiding principles of the MMMP for any UXO clearance at North Falls, and summarise the mitigation measures that will be considered. A protocol for UXO clearance will be prepared and submitted in the MMMP accompanying the relevant marine licence application.

95. This section summarises the mitigation to reduce the risk of injury, including permanent auditory injury / a permanent shift in hearing sensitivity (Permanent Threshold Shift (PTS)), to marine mammals during any UXO clearance work associated with North Falls (including the wind farm site and offshore cable corridors).

96. The exact number, type or size of UXO and duration of UXO clearance operations is not known at this stage. Therefore, the final detailed MMMP for UXO clearance will be developed pre-construction based on the latest survey information which will provide detailed information on the UXO clearance which could be required. The final MMMP for UXO clearance will provide details of the predicted impact (PTS) ranges and areas from UXO clearance.

97. The final MMMP for UXO clearance will ensure there are embedded mitigation measures, as well as any additional mitigation, if required, to reduce the risk of physical or permanent auditory injury (PTS) to marine mammals. This will incorporate appropriate mitigation measures based upon available information and proven methodologies at that time.

98. The mitigation in the final MMMP will be based on current industry best practice, guidance and information, including updated underwater noise modelling, if required, and will be updated no later than four months prior to UXO clearance activities being undertaken. The current best practice guidance is JNCC (2010a), however, these guidelines are currently being updated[2], therefore the final MMMP will be based on the best available guidance at the time of writing.

1.4.1 Potential impact ranges

99. The results of the underwater noise modelling for low order clearance and maximum high order clearance charge weights are presented in Table 1.4 for

[2] Currently available in draft format (JNCC, 2023a)

PTS. The potential impact ranges have been modelled based on the latest Southall *et al*. (2019) thresholds and criteria.

Table 1.4 Potential maximum impact ranges (and areas) of PTS for marine mammals during UXO clearance from low order clearance and the maximum UXO threshold level.

Marine mammal species	Type of clearance	Potential impact ranges (and areas) due to cumulative exposure at the maximum hammer energy
PTS		
Harbour porpoise	0.5kg (low-order clearance)	1.2km (4.52km^2)
	750kg + donor charge	14km (615.75km^2)
Minke whale	0.5kg (low-order clearance)	0.32km (0.32km^2)
	750kg + donor charge	11km (380.13km^2)
Grey seal and Harbour seal	0.5kg (low-order clearance)	0.24km (0.18km^2)
	750kg + donor charge	2.8km (24.63km^2)

1.4.2 Summary of mitigations

100. The Applicant will ensure that the mitigation measures are adequate to reduce the risk of physical or permanent auditory injury (PTS) during all UXO clearance.

101. The methods for reducing the potential impacts of any UXO clearance will be agreed with the MMO in consultation with the relevant SNCBs and will be secured as commitments within the final MMMP.

102. The UXO clearance mitigation measures that will be adhered to are:

- All UXO clearance taking place in daylight and, when practicable, in favourable conditions with good visibility (sea state 3 or less).
- Establishment of a Monitoring Area with a minimum of 1km radius:
    - The observation of the Monitoring Area will be conducted by trained and dedicated MMObs (two MMObs must be present, with at least one experienced MMOb) during daylight hours and when conditions allow suitable visibility, pre- and post-detonation (see Section 1.4.3.2.1).
    - The Monitoring Area will be observed for a minimum of 1 hour prior to UXO clearance.
    - Deployment of passive acoustic monitoring (PAM) in the Monitoring Area (see Section 1.4.3.2.2), if the equipment can be safely deployed and retrieved.
- The activation of acoustic deterrent device (ADD) (see Section 1.4.3.3) prior to all UXO low-order clearance or high-order detonation (with or without bubble curtains).

- The UXO clearance and disposal will be undertaken by specialist contractors, seeking to minimise the explosives required so far as practicable in order to achieve safe disposal of the device.

103. Where practicable and safe to do so, the preferred options would be as follows, in order of preference:

- UXO will be avoided and left in situ;
- Micro-siting of infrastructure, if practicable, to avoid any potential UXO, so clearance is not required; and
- If the UXO appears structurally sound and there is no risk, the UXO could potentially be relocated to a position that is not in a sensitive area (e.g. a designated site or in close proximity to existing or planned infrastructure) for subsequent clearance, subject to a proportional assessment of the risk posed to the vessel and staff from a health and safety perspective.

104. Where UXO clearance is required, the following options would be considered (in line with the UXO Joint Interim Position Statement (GOV UK, 2022));

- The 'lift and shift' approach will be considered in the first instance, to move the UXO to another location further from the activity site. Further discussions on locations and feasibility will take place on a case-by-case basis.
- Low-order disposal techniques; this would be the preferred method for all UXO clearance (Section 1.4.3).
    - High-order detonation will only be used if low-order clearance was unsuccessful or the UXO device is unsafe for low-order clearance as evidenced by the EOD specialists.
    - Three attempts of low order clearance would be made before using high order clearance methods.
- The potential use of bubble curtains if high-order UXO detonation is required (see Section 1.4.3.5.1), taking into account the environmental conditions within which they could be effective.
- A maximum of three high order clearances to be undertaken and only as last resort. The requirement for high order will be evidenced and justified by EOD specialists.

105. It is important to note these techniques and options are presented as current examples, but the mitigation options will be reviewed and updated based on the latest information and guidance in the final MMMP.

1.4.3 UXO clearance mitigation

1.4.3.1 Low-order UXO clearance

106. Low-order UXO clearance techniques, where the ordnance is disposed of or rendered safe without a high-order detonation, is the preferred option for clearance for this work. Examples of low-order techniques include (NPL, 2020):

- Freezing the munition to render it inactive;

- Water abrasive suspension cutting in order to physically disrupt the munition;
- Disposal in a Static Detonation Chamber;
- Photolytic destruction of the munition; and
- Low-order deflagration.

107. The technique of low-order clearance by deflagration appears to present a viable option to avoid high-order explosive detonation. Deflagration results in substantial noise reduction for low-order clearances over high-order (NPL, 2020; Robinson *et al*., 2020).

108. In the unlikely event that low-order clearance was unsuccessful or deemed unsuitable for a specific UXO (e.g. due to its condition) high-order detonation may need to be undertaken.

1.4.3.2 Pre-clearance monitoring

1.4.3.2.1 Marine Mammal Observers

109. The visual observations by the MMObs will commence at least one hour prior to the clearance event. If the one hour pre-search has been completed, there were no marine mammal sightings within the Monitoring Area within the last 30 minutes, and the required ADD activation time has been completed, then the UXO clearance can commence.

110. If a marine mammal is within the Monitoring Area, or has been in the final 30 minutes, the ADD activation can be extended for a further 10 minutes. Following that, if the marine mammal is still within the Monitoring Area (or has been in the final 30 minutes), the extended ADD procedure, as outlined in paragraph 118 should be followed.

111. A precautionary approach will always be used. Therefore, if the MMObs potentially detect a marine mammal within the Monitoring Area, then the UXO clearance will be delayed accordingly until the MMObs detect no further marine mammal within the Monitoring Area during the final 30 minutes of observations.

112. The ADD will be activated during the monitoring period for the required time, ensuring that the end of ADD activation period coincides with the end of the monitoring period, and is directly prior to the UXO clearance.

1.4.3.2.2 Passive Acoustic Monitoring

113. The use of PAM is unlikely to be required, as all clearances will take place in daylight and in favourable conditions with good visibility (sea state 3 or less).

114. If required, the use of PAM will be undertaken by trained, dedicated and experienced PAM Operators (PAM-Ops). PAM-Ops will be trained to JNCC standards, with an appropriate level of field experience. The PAM equipment will be appropriate to detect vocalising cetaceans in the Monitoring Area. PAM-Ops will be responsible for deployment, maintenance and operation of the equipment, including spare equipment, in relation to all UXO clearance.

1.4.3.3 Acoustic Deterrence Device (ADD)

115. An ADD will be activated prior to any UXO clearance to ensure marine mammals are deterred from the area and reduce the risk of any physical or auditory injury.

116. The ADD will be activated at a time so that the end of the required ADD activation period coincides with the end of the monitoring period, immediately prior to either the bubble curtain activation (if being used) or clearance event to allow marine mammals to move beyond the area of potential PTS risk.

117. Based on the indicative impact ranges provided in Table 1.4, the ADD would be required to be activated for a maximum of 80 minutes prior to a high order clearance, and up to 14 minutes for a low-order clearance. The required ADD activation period for low-order clearance, high-order detonation with bubble curtain (if required) and high-order detonation without bubble curtain, will be determined based on the maximum potential area for PTS impact ranges, and will be confirmed once the final UXO clearance requirements are known.

118. The Monitoring Area will be assessed by MMObs and / or PAM-Ops during the ADD activation period. If marine mammals are still within the Monitoring Area following the ADD activation, the ADD can remain active for an additional 10 minutes. If marine mammals are still within the Monitoring Area following the additional 10 minutes (or have been within the previous 20 minutes), the UXO clearance should be delayed, and the ADD switched off. Once the ADD has been off for 10 minutes, then the ADD should be reactivated for a further 10 minutes. If marine mammals remain in the area, the above extended ADD protocol, of cycling the ADD on and off for 10 minutes, should continue until the marine mammal has been clear of the Monitoring Area for at least 30 minutes. Only then can the UXO clearance commence.

119. It is likely that an ADD alone would not provide sufficient deterrence from the full PTS ranges for harbour porpoise (for the larger UXO sizes, for a high-order clearance), and therefore additional mitigation options would be required for a high-order clearance of a device of 120kg or higher, see Section 1.4.3.4.

1.4.3.4 Post-clearance monitoring

120. The visual observations by the MMObs will continue for a post-detonation search for at least 15 minutes after the UXO detonation. The post-detonation search is to look for any evidence of injury to marine life, including fish kills. Any unusual observations should be noted in the report.

1.4.3.5 Additional mitigation options

121. Prior to high order clearance, the longest ADD activation time to be used is 80 minutes. However, this ADD activation time may not provide sufficient deterrence from the full PTS ranges for harbour porpoise. Therefore additional mitigation options would be required for a high-order clearances (based on current underwater noise modelling results, this would be required for the high-order clearance of a device of 120kg or higher).

122. Additional mitigation options may include:

- Additional pre-clearance monitoring; this can include options such as use of drones or acoustic monitoring to cover the full PTS ranges; or
- The use of a bubble curtain to reduce the PTS impact ranges.

123. These would be used alongside the mitigation described in Section 1.4.2.

1.4.3.5.1 Bubble curtains

124. In line with current industry practice, bubble curtains could be deployed for UXO detonation under the following scenarios:

- Water depths are between approximately 5m and 40m;
- Significant wave heights are less than 1m;
- Maximum wind speed is less than 8m/s; and
- Current speeds are less than 1.5 knots.

125. Once the bubble curtain is in place and prior to the bubble curtain being activated an explosive charge will be attached to, or placed next to, the UXO by a Remotely Operated Vehicle (ROV), and detonation will be undertaken remotely.

126. Once the charge has been detonated, a visual inspection survey using an ROV will be undertaken to confirm that the UXO has been successfully detonated.

1.4.4 Reporting

127. Reports detailing all UXO clearance activity and mitigation measures will be prepared to include details on all UXO clearance operations, mitigation undertaken, and marine mammal sightings.

128. A final report will be submitted to the MMO. The final report will include any data collected during UXO clearance operations, details of all mitigation measures, a detailed description of any technical problems encountered and what, if any, actions were taken. The report will also discuss the protocols followed and put forward any recommendations and lessons learned based on the mitigation measures used that could benefit future projects.

1.4.5 Communication and responsibilities

129. The final MMMP will detail the communication protocol to ensure that all marine mammal mitigation measures are successfully undertaken for all UXO clearance operations.

130. The final MMMP will also detail all key personnel and their responsibilities to ensure that all marine mammal mitigation measures are successfully undertaken. This will be developed based on the mitigation measures and personnel required (e.g. ADD operator, MMObs, PAM-Ops, EOD team / UXO Manager, Environmental Liaison Officer (ELO)) with the titles and responsibilities being refined depending on the contractual agreement.

1.4.6 Indicative mitigation procedures for UXO clearance

131. Plate 1.3 shows a flowchart of the indicative mitigation procedures that would be implemented for UXO clearance.

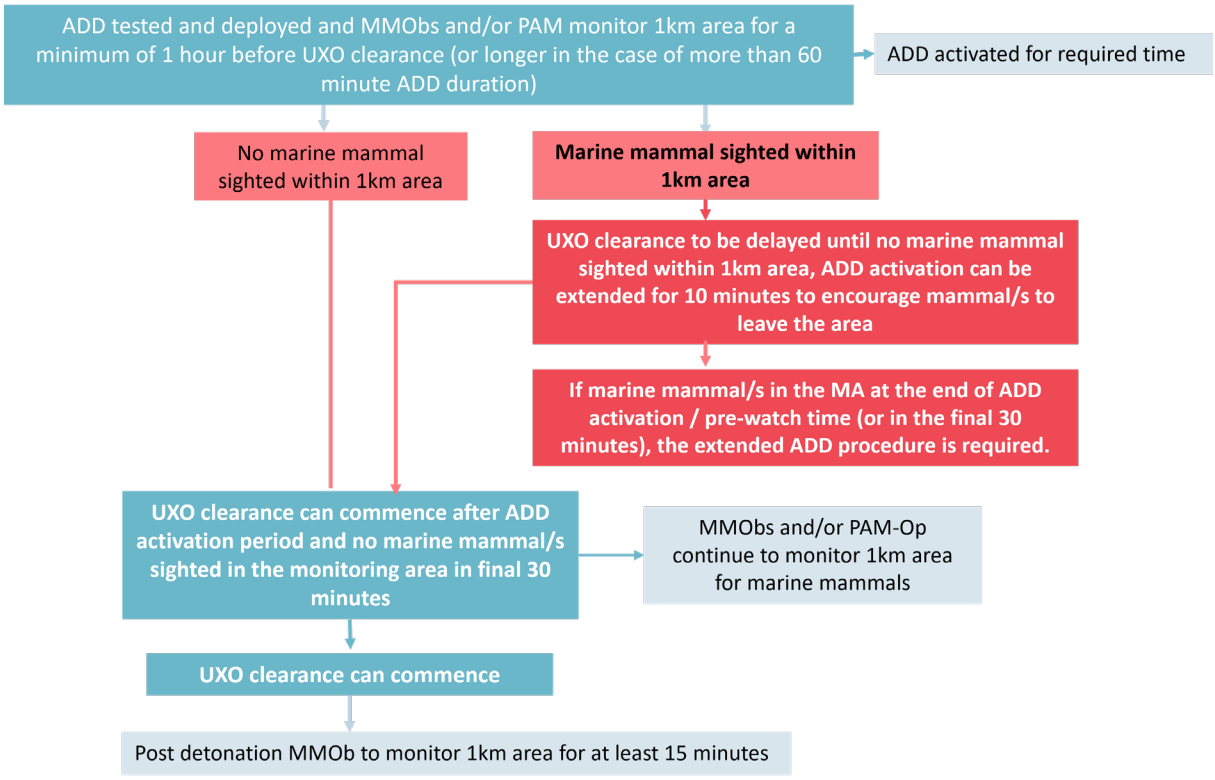

Plate 1.3 Proposed Indicative UXO clearance mitigation procedures

1.5 References

Brandt, M.J., Diederichs, A., Betke, K. and Nehls, G. 2011. Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. Marine Ecology Progress Series, 421, pp.205-216.
Brandt, M. J., Diederichs, A., and Nehls, G. (2009). Investigations into the effects of pile driving at the offshore wind farm Horns Rev II and the FINO III research platform. Report to DONG Energy.
Gov UK. (2022). Marine Environment: unexploded ordnance clearance joint interim position statement. Available at: https://www.gov.uk/government/publications/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement.
JNCC (2010a). JNCC guidelines for minimising the risk of injury to marine mammals from using explosives. August 2010.
JNCC (2010b). Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise. August 2010.
JNCC, (2023a). DRAFT JNCC guidelines for minimising the risk of injury to marine mammals from explosive use in the marine environment. Available from: https://jncc.gov.uk/media/8418/draft-marine-mammal-guidelines-explosive-use-update.pdf
JNCC, (2023b). JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities. Available from: https://data.jncc.gov.uk/data/fb7d345b-ec24-4c60-aba2-894e50375e33/jncc-pam-guidance-in-uk-waters.pdf
Nabe-Nielsen, J., van Beest, F.M., Grimm, V., Sibly, R.M., Teilmann, J. and Thompson, P.M. (2018). Predicting the impacts of anthropogenic disturbances on marine populations. Conserv Lett. 2018;e12563. https://doi.org/10.1111/conl.12563
National Physical Laboratory (NPL), 2020. Final Report: Characterisation of Acoustic Fields Generated by UXO Removal – Phase 2 (BEIS offshore energy SEA sub-contract OESEA-19-107). NPL Report AC 19 June 2020.https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/893773/NPL_2020_-_Characterisation_of_Acoustic_Fields_Generated_by_UXO_Removal.pdf
Otani, S., Naito, T., Kato, A. and Kawamura, A. (2000). Diving behaviour and swimming speed of a free-ranging harbour porpoise (Phocoena phocoena). Marine Mammal Science, Volume 16, Issue 4, pp 811-814, October 2000.
Robinson, S. P., Wang, L., Cheong, S-H., Lepper, P. A., Marubini, F. and Hartley, J. P., 2020. Underwater acoustic characterisation of unexploded ordnance disposal using deflagration. Mar. Poll. Bull. 160, 111646.
Southall B L, Finneran J J, Reichmuth C, Nachtigall P E, Ketten D R, Bowles A E, Ellison W T, Nowacek D P, Tyack P L (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals 2019, 45(2), 125-232, DOI 10.1578/AM.45.2.2019.125.
van Beest, F.M, Nabe-Nielsen, J., Carstensen, J., Teilmann, J. & Tougaard, J. (2015). Disturbance Effects on the Harbour Porpoise Population in the North Sea

(DEPONS): Status report on model development. Aarhus University, DCE – Danish Centre for Environment and Energy, 43 pp. Scientific Report from DCE – Danish Centre for Environment and Energy No. 140 [redacted]

NORTH FALLS

Offshore Wind Farm

sse Renewables | RWE

HARNESSING THE POWER OF NORTH SEA WIND

North Falls Offshore Wind Farm Limited

A joint venture company owned equally by SSE Renewables and RWE.

To contact please email contact@northfallsoffshore.com

North Falls Offshore Wind Farm Limited Registered Address: Windmill Hill Business Park, Whitehill Way, Swindon, Wiltshire, SN5 6PB, United Kingdom

Registered in England and Wales Company Number: 12435947