



NORTH FALLS

Offshore Wind Farm

Draft Marine Mammal Mitigation Protocol (Clean)

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Glossary of Acronyms

ADD	Acoustic Deterrence Device
Cefas	Centre for Environment, Fisheries and Aquaculture Science
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
ELO	Environmental Liaison Officer
EOD	Explosive Ordnance Disposal
JNCC	Joint Nature and Conservation Committee
LAT	Lowest Astronomical Tide
m	Metre
MA	Monitoring Area
MMO	Marine Management Organisation
MMObs	Marine Mammal Observers
MMMP	Marine Mammal Mitigation Protocol
NAS	Noise Abatement System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCP	Offshore Converter Platform
OSP	Offshore Substation Platform
PAM	Passive Acoustic Monitoring
PAM-Ops	PAM Operators
PEIR	Preliminary Environmental Information Report
PTS	Permanent Threshold Shift
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SEL	Sound Exposure Level
SIP	Site Integrity Plan
SNCB	Statutory Nature Conservation Bodies
SNS	Southern North Sea
SPL	Sound Pressure Level
UK	United Kingdom
UXO	Unexploded Ordnance
VHF	Very-high frequency
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).
Noise Abatement System (NAS)	A secondary noise mitigation method aimed to reduce sound propagation during pile driving. Example methods include (but are not limited to) casings, resonators or bubble curtains (big and small bubble curtains).
Noise reduction measures	Noise reduction measures which use of primary and / or secondary noise reduction methods. Primary noise reduction methods aim to decrease noise emission at source, such as modifying the piling process. Secondary noise reduction methods aims to reduce sound propagation, such as the use of NAS.
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 Draft 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 Draft 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).

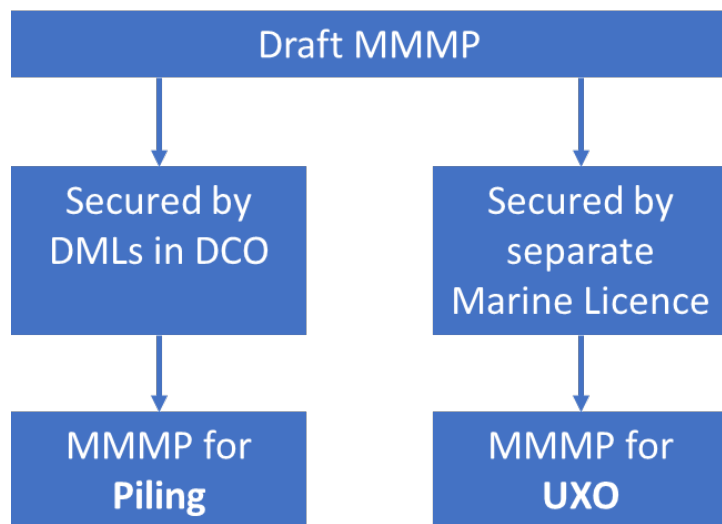


Plate 1.1 Relationship between the draft and final MMMPs for Piling and UXO and how they will be secured

6. In accordance with the draft DCO [**Document Reference: 6.1, Rev 9**] 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. The latest guidance and policy papers were reviewed and taken into consideration for this draft MMMP (Defra, 2025; Gov UK, 2025; JNCC, Natural England, Cefas (2025)). Current guidance includes Joint Nature and Conservation Committee (JNCC) guidelines for minimising the risk of injury to marine mammals from unexploded ordnance (UXO) clearance in the marine environment (JNCC, 2025) and statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise (JNCC, 2010).
10. Appendix C of the Outline Project Environmental Management Plan [**Document reference: REP6-027**] 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 this Draft MMMP, an outline Site Integrity Plan (SIP) for the Southern North Sea (SNS) Special Area of Conservation (SAC) [**Document Reference:**

REP5-014] was 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 Updates to the Draft MMMP

12. The Draft MMMP (Revision 2), has been updated to take into account comments and Relevant Representations during the Examination Process (further details are provided in Appendix A). It also updated text to clarify the Applicant's approach on the use of noise reduction measures and / or Noise Abatement System (NAS) has been added to Section 1.3.2.8.
13. The Draft MMMP (Revision 3) includes updates to Plate 1.2 to ensure it matches the text regarding soft-start and ramp up procedures, and to make clear that piling will only continue after a break if there are no marine mammals present.
14. This version of the Draft MMMP (Revision 4) has been updated to take into account Natural England's comments during the examination process regarding Appendix E7 **[REP7-088]**. Section 1.4.3.2.2 has been amended to ensure, if required, PAM will be used in conjunction with the MMObs for the UXO clearance mitigation procedures. Text has also been added to Section 1.3.2.1.2 indicating how alternative monitoring strategies will be considered in the final MMMP post consent.

1.1.2 Description of North Falls

15. 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.
16. The North Falls array area will cover approximately 95km². 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.
17. 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.
18. 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.
19. 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.

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

21. 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.

1.1.3 Key relevant parameters

22. Table 1.1 shows the current key design parameters for the North Falls project that are relevant to this Draft MMMP.

Table 1.1 Key Relevant Parameters

Parameter	Details
Approximate offshore construction duration	2 years
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	<ul style="list-style-type: none"> • Monopile • Mono-suction bucket • Jacket with 3 or 4 legs (attached to the seabed by pin piles, or suction bucket legs)
OSP/OCP foundation type options	<ul style="list-style-type: none"> • Monopile (drilled or driven) • Jacket (with either pin piles or suction bucket 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

23. 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 Preliminary Environmental Information Report (PEIR) consultation comments. A summary of those comments is provided in Appendix A.
24. In addition, within the scoping opinion responses received, a comment was made by the MMO to ensure a MMMP 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.
25. Table 1.4 in Appendix A provides details of consultation comments received regarding the Draft MMMP and how they have been addressed in this Draft MMMP.
26. Comments and Relevant Representations received during the Examination Process are presented in Table 1.5 in Appendix A outlining how they have been addressed in this Draft MMMP.

1.3 Draft protocols for piling

27. Depending on the installation method for the installation of the foundations for the WTGs and OSP(s)/OCP, piling could be required.
28. 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.
29. 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.
30. 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.
31. 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 (MA) and any additional mitigation measures required to reduce potential effects of any physical injury or PTS. Potential additional noise mitigation measures include bubble curtains, hydro-sound dampers, screens or tubes. All suitable, effective and available mitigation measures will be considered during preparation of the final MMMP. Consideration will also be given to the requirements following any breaks in piling as well as prior to piling commencing.
32. 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.
33. 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 sequential monopile installation (3 monopiles), or pin-pile installation (6 pin-piles).

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

1.3.1 Potential impact ranges

35. Table 1.2 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. It must be noted the Very-High Frequency (VHF) PTS modelling was undertaken at a higher resolution to determine the impact ranges; a lower resolution was used for the predictions at specific distances, which leads to small discrepancies. The results from the modelling undertaken at a higher resolution specifically for the VHF PTS impact ranges has been used to provide a robust assessment of PTS on VHF cetaceans.

Table 1.2 The predicted impact ranges for PTS in all marine mammal species, at the worst-case modelling location, for the peak and cumulative exposure of sequential pile installation 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 (Sound Pressure Level (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 (Sound Exposure Level (SEL) _{cum})		
Harbour porpoise	3.30km (22.0km ²)	3.40km (23km 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

36. The final MMMP would involve the establishment of a MA 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 PTS impact ranges and areas for piling.

37. The Applicant will ensure that the mitigation measures are adequate to reduce the risk of marine mammals being present within the MA prior to piling activity commencing, to reduce the risk of physical or auditory injury (PTS).

38. The methods for establishing the MA 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.

39. The piling mitigation measures could include:

- Establishment of a MA with a minimum 700m radius (see Section 1.3.2.1).
 - Deployment of Passive Acoustic Monitoring (PAM) devices and the observation of the MA will be conducted by trained, dedicated and experienced Marine Mammal Observers (MMObs) during daylight hours and when conditions allow suitable visibility (visibility of entire MA; sea state 3 or less).
 - Deployment of PAM devices in the MA during poor visibility or at night.
- The activation of Acoustic Deterrence Device (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

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

41. The radius of the MA 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.

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

43. The MA 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 38 minutes prior to soft-start commencing.

1.3.2.1.1 Marine Mammal Observers

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

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

46. The MMObs will be equipped with binoculars and a tool to estimate distance i.e. range finding stick, binoculars with reticles and reporting forms. The MMObs will scan the MA 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.

47. Marine mammal observations will be carried out to monitor the MA:

- During ADD activation
- During the soft-start and ramp-up procedure

- During any breaks in piling prior to piling recommencing

48. Where practicable, MMObs will continue monitoring during piling to allow for any breaks in piling.
49. 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 MA 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.
50. If a marine mammal is detected within the MA during the pre-piling monitoring, then the commencement of the soft-start will be delayed. If a marine mammal has been sighted within the MA, it will be monitored and tracked until it is clear of the MA 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 MA for at least 20 minutes, before the soft-start commences.
51. During ADD activation, if animals are sighted within the MA, they will be tracked and monitored. If, at the end of the ADD activation period, the individual(s) remains within the MA, then the extended ADD procedure should be followed (as set out in paragraph 73).
52. If the marine mammal(s) remains clear of the MA 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 MA or not, then the MMObs will take the precautionary approach of assuming a marine mammal is present and act accordingly.
53. 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).
54. 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 MA, the deployment of ADD, and when the MA is clear for the piling soft-start to commence.

1.3.2.1.2 Passive Acoustic Monitoring

55. The use of PAM will be undertaken by trained and dedicated and experienced PAM Operators (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).
56. 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 MA. PAM-Ops will be responsible for deployment, maintenance and

operation of the equipment, including spare equipment, in relation to all piling activities.

57. The PAM-Ops will ensure that the equipment and spares are functioning correctly prior to the start of the mitigation. Hydrophones and software would 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.
58. PAM will be carried out to monitor the MA:
- 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
59. Where practicable, PAM-Ops will continue monitoring during piling to allow for any breaks in piling.
60. 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 1.3.2.7).
61. There will be clear communication channels between the PAM-Ops, MMObs, the ADD operator and the Piling Supervisor (see Section 1.3.4).
62. Alternative monitoring strategies will be considered in the final MMMP post-consent. MMObs and PAM techniques are developing and changing, and technologies are already available including night vision binoculars and cameras that are regularly used for research and mitigation purposes, and alternative visual strategies could be considered. All options will be considered, and this will be developed in consultation with relevant stakeholders, including Natural England, post-consent.

1.3.2.2 Acoustic Deterrent Device

63. An ADD will be activated prior to the soft-start as mitigation to reduce the risk of PTS during piling.
64. 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 MA. It is expected that only one ADD will be required.
65. 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.
66. The ADD will be deployed and ready to be activated prior to soft-start commencing.

67. 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.
68. 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.
69. 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.
70. 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 1.2, the ADD would be activated for approximately 38 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 in the final MMMP post-consent.
71. Further information on ADDs is provided in Section 1.4.3.3.
72. The MA 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.
73. If marine mammals are still within the MA following the ADD activation, the extended ADD and monitoring procedure will be followed, where initially the ADD can remain active for an additional 10 minutes. If marine mammals are still within the MA following the additional 10 minutes (or have been within the previous 20 minutes), soft-start would be delayed, and the ADD switched off. Once the ADD has been off for 10 minutes, then the ADD can 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, would continue until the marine mammals are clear of the MA for at least 20 minutes. Only then can soft-start commence.
74. 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.
75. The ADD will be deployed from the deck of the piling vessel, with the control unit and power supply on board of 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.
76. 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

77. Following the activation period of the ADD (being approximately 38 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.
78. 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.
79. Each monopile installation 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%).
80. This 40 minute soft-start and ramp-up procedure is more precautionary than the JNCC (2010) guidance, which recommends that the soft-start and ramp-up duration should be a period of not less than 20 minutes.
81. 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)).
82. 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.
83. 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.
84. 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.
85. The soft-start and ramp-up procedure would be embedded mitigation for all piling operations.

1.3.2.4 Breaks in Piling

86. The observation of the MA 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.

87. 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) as long as no marine mammals have been detected within the MA during this time.
- 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 MA¹. Continuous monitoring of the MA will be ensured to cover full breaks in piling, monitoring operatives will confirm no marine mammals have been detected before the altered soft-start procedures commence.
 - If there are marine mammals within the MA, then the full mitigation procedure (Plate 1.2) would be undertaken, including 30 minutes observation of the MA 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 (Plate 1.2) is required, including 30 minutes observation of the MA 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 Summary of Procedures for Detection of Marine Mammal

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

89. During ADD activation, if animals are sighted within the MA, they will be tracked and monitored. If, at the end of the ADD activation period, the individual(s) remains within the MA, then the extended ADD procedure should be followed (as set out in Section 1.3.2.2).

90. If the marine mammal(s) remains clear of the MA 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.

¹This 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).

91. If marine mammals are still within the MA 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 MA 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 would 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, would continue until the marine mammal has been clear of the MA for at least 20 minutes. Only then can soft-start commence.
92. If a marine mammal enters the MA during the soft-start period, where possible there will be no increase in the hammer energy until the marine mammal is observed to move out of the MA.
93. If there are marine mammals within the MA during a break of more than 10 minutes but less than two hours, then the full mitigation procedure (as outlined above, Section 1.3.2.4) would be undertaken, including 30 minutes observation of the MA 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).

1.3.2.6 Piling at Night / Poor Visibility

94. If piling is to commence in poor visibility or at night, the assessment of the MA will be done by PAM as outlined in Section 1.4.3.2.2.
95. 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.
96. If there are any breaks in piling during poor visibility or at night, the assessment of the MA will be done by PAM.

1.3.2.7 Mitigation for Multiple Pile Locations

97. 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.

1.3.2.8 Additional Mitigation Options

98. An additional mitigation option which could be considered to mitigate potential effects, if required, is the use of noise reduction measures and / or NAS). Noise reduction measures rely on the use of primary and / or secondary noise mitigation (Bellmann *et al.*, 2018).
99. Primary noise reduction methods can be achieved through impact piling modification such as adjusting the piling energy, or use of alternative installation techniques (e.g. vibro piling, blue piling, High frequency low-impact (HiLo) piling and drilling).
100. NAS, also known as secondary noise mitigation, are currently being developed and improved that enable a reduction of pile driving noise (decibels) at source. These methods currently include various types of bubble curtain, hydro-sound dampers, screens or tubes.

101. A reduction in the noise at source would reduce the total area of potential disturbance to marine mammals. However, it should also be noted that many of these measures may increase the total duration of disturbance from underwater noise during foundation installation and this should be a consideration in an assessment of their efficacy.
102. It should be noted that suitability of any NAS will be dependent on a number of factors including pile diameter and length, ground conditions, and water depth. These factors will be considered in any assessment of the efficacy of the measure. The information to inform this selection will be contingent on the selection of the chosen foundation type and supplier which will only be available once contracts are being finalised post consent.
103. Other methods to reduce the risk of injury to marine mammals will also be considered based on the latest research and guidance during preparation of the of the final MMMP. For example, this could include changes to strike rate and increased gaps between strikes during pile installation (as outlined in ORJIP, 2024), if practicable and proven to reduce risk of injury to marine mammals.
104. If it is deemed necessary to apply noise reduction measures and/or a NAS for piled foundations, in order to comply with Government policy on underwater sound or it is identified (during discussions with the MMO on the final MMMP following the final scheme design freeze post consent) as necessary mitigation to manage any predicted significant effects due to underwater sound from piling, then North Falls will be in a position (from a programme execution perspective) to implement such measures.

1.3.3 Reporting

105. 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 MA 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.
106. 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

107. 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.

108. 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, Environmental Liaison Officer (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

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

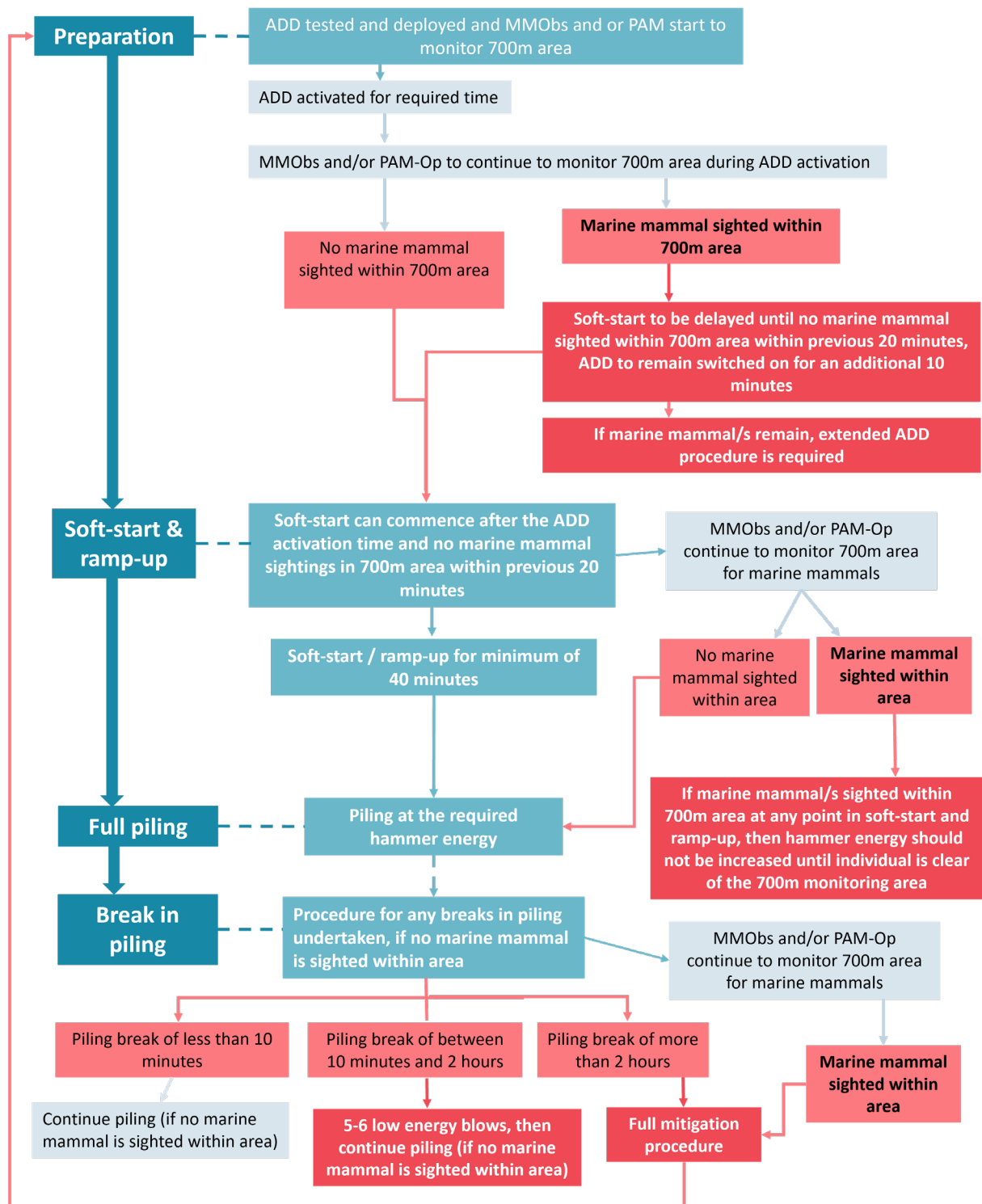


Plate 1.2 Proposed piling mitigation procedures.

1.4 Summary of mitigation for UXO clearance

110. 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.
111. 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.
112. 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.
113. This section summarises the mitigation to reduce the risk of disturbance and injury, including permanent auditory injury / a permanent shift in hearing sensitivity (PTS), to marine mammals during any UXO clearance work associated with North Falls (including the wind farm site and offshore cable corridors).
114. 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.
115. 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 disturbance and 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.
116. The mitigation in the final MMMP will be based on current industry best practice, guidance and information (using reporting such as Ocean Winds, 2024), including updated underwater noise modelling, if required. The MMMP will be updated no later than four months prior to UXO clearance activities being undertaken. The final MMMP will be based on the latest available guidance at the time of writing, currently this is JNCC (2025).

1.4.1 Potential impact ranges

117. The results of the underwater noise modelling for low-order clearance and maximum high-order clearance charge weights are presented in Table 1.3 for PTS. The potential impact ranges have been modelled based on the Southall *et al.* (2019) thresholds and criteria.

Table 1.3 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

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

119. 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.

120. 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 MA with a minimum of 1km radius:
 - The observation of the MA 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 MA will be observed for a minimum of one hour prior to UXO clearance.
 - Deployment of PAM in the MA (see Section 1.4.3.2.2), if the equipment can be safely deployed and retrieved (UXO clearance would only be performed during suitable conditions for both MMObs and PAM-Ops).
- The activation of ADD (see Section 1.4.3.3) prior to all UXO low-order clearance or high-order detonation (with 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.

121. 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.

122. Where UXO clearance is required, the following options would be considered (in line with the UXO Joint Interim Position Statement (GOV UK, 2025)):

- 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 default 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 Explosive Ordnance Disposal (EOD) specialists. If this is the case, this will be discussed with SNCBs at the earliest opportunity.
 - Three attempts of low-order clearance would be made before using high-order clearance methods.
- If a high-order UXO detonation is required (see Section 1.4.3.5.1), bubble curtains or other approved noise abatement systems would be used, 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.

123. 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

124. 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.

125. 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).

126. 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. However, in these circumstances the use of high-order will be discussed with the appropriate licensing authority and SNCBs at the earliest opportunity.

1.4.3.2 *Pre-clearance monitoring*

1.4.3.2.1 *Marine Mammal Observers*

127. The visual observations by the MMObs will commence at least 30 minutes prior to ADD activation and at one hour before the UXO detonation. These visual observations will continue throughout the duration of the ADD. If the pre-search has been completed, there were no marine mammal sightings within the MA within the last 30 minutes, and the required ADD activation time has been completed, then the UXO clearance can commence.

128. If a marine mammal is within the MA, 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 MA (or has been in the final 30 minutes), the extended ADD procedure, as outlined in paragraph 135 would be followed.

129. A precautionary approach will always be used. Therefore, if the MMObs potentially detect a marine mammal within the MA, then the UXO clearance will be delayed accordingly until the MMObs detect no further marine mammal after a minimum of 20 minutes within the MA.

130. 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*

131. The use of PAM will be used in conjunction with MMObs, if required. The use of PAM will be undertaken by trained, dedicated and experienced 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 MA. 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*

132. 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.

133. 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.
134. Based on the indicative impact ranges provided in Table 1.3, the ADD would be required to be activated for a maximum of 80 minutes prior to a high-order detonation, and up to 14 minutes for a low-order clearance. The required ADD activation period for low-order clearance and high-order detonation with bubble curtain (if required), 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.
135. A visual search will be conducted 30 minutes before ADD activation by MMObs. If a marine mammal is detected within 100m of the ADD during this search, ADD activation would be delayed until the animal has moved further away (i.e. to more than 100 m from the device) to reduce the possibility of auditory injury from the device if PAM is not on board the vessel.
136. The MA will be assessed by MMObs and / or PAM-Ops during the ADD activation period. If marine mammals are still within the MA following the ADD activation, the ADD can remain active for the duration of the delay. If the delay appears it will be extensive (i.e. the marine mammal is not moving away) the ADD will be switched off. As long as the animal does not move to within 100m of the ADD, it can be reactivated after 20 minutes. The ADD would remain active for long enough to allow the animal to leave the mitigation zone.
137. If the detonation will be delayed due to operational reasons, the ADD will be switched off and not re-activated until the appropriate time prior to the revised detonation.
138. Once the ADD activation period has been completed, and the MMOb has confirmed there are no marine mammals within the Mitigation Area, the UXO clearance will commence immediately.
139. 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

140. 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

141. 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).
142. 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, if high-order detonation is required.

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

1.4.3.5.1 Bubble curtains

144. In line with current industry practice, bubble curtains would be deployed for high-order UXO detonations 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.

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.

145. If using bubble curtains, these should not be switched on until the end of the pre-clearance search and it is confirmed there are no marine mammals within 1km of the detonation.

146. 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

147. 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.

148. 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

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

150. 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, ELO) with the titles and responsibilities being refined depending on the contractual agreement.

1.4.6 Indicative mitigation procedures for UXO clearance

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

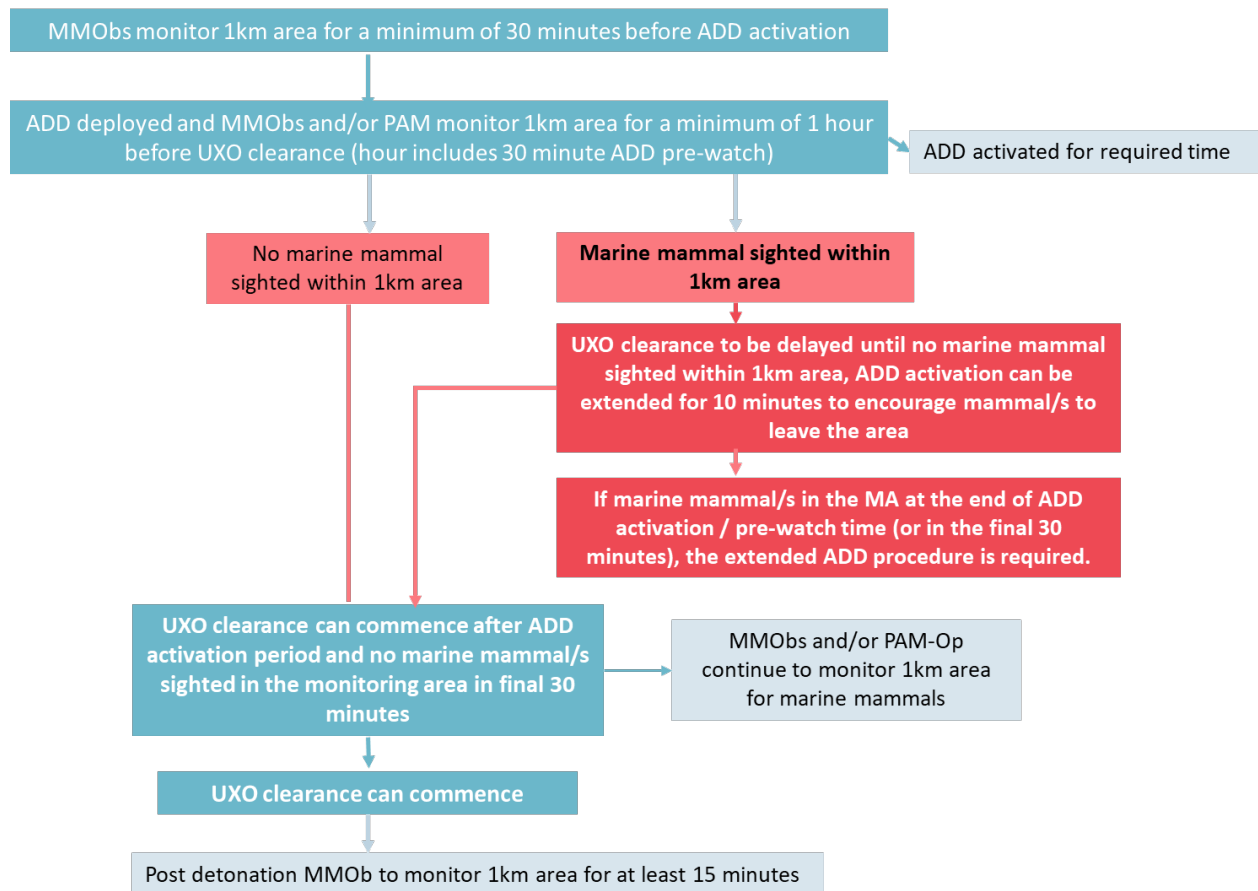


Plate 1.3 Proposed Indicative UXO clearance mitigation procedures

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Appendix A. Consultation

152. Table 1.4 provides details of consultation comments received regarding the Draft MMMP and how they have been addressed in this Draft MMMP.
153. Comments and Relevant Representations received during the Examination Process are presented in Table 1.5 outlining how they have been addressed in this Draft MMMP.

Table 1.4 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.

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
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.
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 <i>et al.</i> , 2015; Nabe-Neilson <i>et al.</i> , 2018, Brandt <i>et al.</i> , 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 MA.
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	The mitigation proposed for piling will be carried out prior to each pile, and therefore mitigation should be

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
		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.	based on the potential for effect from each individual pile, rather than the total piles to be installed within 24 hours.
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	Procedures have been amended based on Natural England comments to ensure the MA will continue to be monitored during breaks in piling.

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
		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.	
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.
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: <ul style="list-style-type: none"> • 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 this 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: <ul style="list-style-type: none"> • 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. 	Proposed UXO campaign commitments have been added to Section 1.4.2.

Consultee	Date / Document	Comment	Response / where addressed in the MMMP
		<p>Further discussions on locations and feasibility will take place on a case-by-case basis.</p> <ul style="list-style-type: none"> • 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 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.

Table 1.5 Examination Comments and Relevant Representations

Consultee	Reference	Comment	Response / where addressed in the MMMP
Natural England	P18	<p>Natural England strongly advises the Applicant to commit to using noise abatement as mitigation should driven or part-driven piles be used during construction.</p> <p>The Applicant should commit to noise abatement in the Draft Marine Mammal Mitigation Plan (MMMP) and SIP.</p>	<p>The finalisation of the SIP for the SNS SAC (in accordance with the Outline SIP [REP5-014]) and MMMP (in accordance with the draft MMMP [REP6-029]) for piling will consider the latest policy on mitigation, such as NAS at the time. It is recognised that upon further assessment of the final design information, any requirement for the implementation of NAS will be decided in consultation with the licencing authority. The Applicant is planning appropriately for the potential requirement for NAS but maintains the position that the effects will be suitably mitigated through further design refinement and embedded mitigation. The Applicant has already committed to only pile at one monopile location in any one day during the winter season, unless NAS is utilised. The Applicant has also included the mitigation option of no piling during the winter season, as detailed in the Outline SIP for the SNS SAC [REP5-014]. The Applicant notes that potential mitigation options, including NAS, are listed within the Outline SIP for the SNS SAC [REP5-014] which would be finalised post-consent in line with the final design of the Project. Additional mitigation such as NAS has been added into the Draft MMMP (Revision 1) in Section 1.3.2.8.</p>
Natural England	E4	<p>We note that the Applicant has not committed to using NAS at this stage. Natural England strongly advises the Applicant to commit to using noise abatement as mitigation should driven or part-driven piles be used during construction. Further detail regarding our advice on NAS can be found in the detailed comment below.</p> <p>The Applicant should commit to noise abatement in the Draft Marine Mammal Mitigation Plan (MMMP) and Site Integrity Plan. The effect of noise abatement systems in reducing noise impacts should be included in the assessment.</p>	<p>See response to P18 above. However, if it is determined post-consent that NAS is required, further assessment on the effects of NAS in reducing noise impacts will be included in the final MMMP and SIP.</p>
Natural England	E20	<p>We note that in the mitigation hierarchy, avoidance, and relocation of Unexploded Ordnance (UXO) should be above implementing any other mitigation measures to reduce the impacts of the noise.</p> <p>We suggest the Applicant should update the mitigation hierarchy for UXO detonations.</p>	<p>The Applicant notes Natural England's comment, paragraph 121 details how the mitigation hierarchy follows the following order: avoidance, relocation, other mitigation options.</p>
Natural England	E23	<p>Natural England notes that the Applicant established a Monitoring Area with a minimum 700m radius, and that this area will be monitored both visually and acoustically. However, there are</p>	<p>Alternative monitoring strategies will be considered in the final MMMP post-consent. MMO and PAM techniques are developing and changing, and technologies are already available including night vision binoculars and</p>

Consultee	Reference	Comment	Response / where addressed in the MMMP
		<p>limitations of both methods for detecting harbour porpoises i.e. Passive Acoustic Monitoring (PAM) can detect their vocalisation only within 300m while visual detections are limited by the environmental conditions. Thus, we advise that the Applicant considers ways to improve detectability of harbour porpoises in order to guarantee their detections within the chosen range i.e. minimum 700m. One option is to position the Marine Mammal Mitigation Team onboard a small vessel circling the piling barge at the distance of 350m thus covering the entire 700m monitoring area effectively. Natural England is happy to discuss any other options at a later stage so they can be incorporated within the Final MMMP.</p> <p>We advise further consideration of options for effective monitoring of harbour porpoise within the Monitoring Array of minimum 700m and an updated MMMP be submitted prior to the end of examination.</p>	<p>cameras that are already regularly used for research and mitigation purposes, and alternative visual strategies could be considered.</p> <p>All options will be considered, and this will be developed in consultation with relevant stakeholders, including Natural England, post-consent.</p>
Natural England	E24	<p>Natural England advises that, for clarity and completeness, a separate section on the procedures in the case of marine mammal detections should be included in the MMMP for all possible scenarios. Currently, this information is included under the section '1.3.2.1.1 Marine Mammal Observers'</p> <p>We advise that the Applicant includes a separate section within the MMMP on the procedures that should be followed when marine mammals are detected within the Monitoring Area.</p>	The Applicant has noted Natural England's comment, a separate section summarising procedures for marine mammal detections has been added in Section 1.3.2.5.
Natural England	E25	<p>We note that, for clarity and completeness, it should be clearly stated that "for any breaks in piling of less than 10 minutes, piling may continue as required (i.e. as if there was no break)" as long as no marine mammals have been detected within the Monitoring Area during this time.</p> <p>We advise that the Applicant should add the mention of no marine mammal detections during the breaks in piling within this section.</p>	The Applicant has taken note of Natural England's comment, this has been added into the first bullet point under Section 1.3.2.4.
Natural England	E26	Natural England notes that the draft MMMP provides a summary of potential mitigation measures and is not intended to identify specific mitigation measures that will be implemented during pile-driving operations.	The finalisation of the MMMP for piling will consider the latest policy on NAS at the time. The Applicant notes that potential mitigation options, including NAS, are listed within the Outline SIP for the SNS SAC [REP5-014] which would be finalised post-consent in line with the final design of the Project and the MMMP. It is recognised that upon assessment of more developed

Consultee	Reference	Comment	Response / where addressed in the MMMP
		<p>However, Natural England strongly advises that the Applicant commits to using NAS as mitigation, should driven or part-driven piles be used during construction. NAS are proven to reduce the level of noise generated by piling and its propagation through the marine environment. As the noise levels are reduced at or close to the source, the range and area over which noise-related impacts occur will be reduced significantly.</p> <p>We are aware that Defra will be publishing a marine noise policy paper in October 2024 which will include the expectation from the Marine Management Organisation (MMO) that all OWF pile driving activity in English waters should demonstrate that they have utilised best endeavours to deliver noise reductions through the use of primary and/or secondary noise mitigation methods in the first instance from January 2025.</p> <p>We expect that the majority of piling from 2025 onwards will not be able to go ahead without NAS in place, for the following reasons:</p> <p>The overall level of noise in the SNS SAC is increasing due to increasing levels of offshore wind construction and other noisy marine activities taking place. Therefore, it will be increasingly difficult to determine no Adverse Effect on Integrity (AEol) from cumulative noise disturbance. Projects that do not use NAS risk contributing to cumulative noise disturbance that could exceed the daily and seasonal thresholds for significant disturbance leading to AEol, and therefore may not be able to construct as planned.</p> <p>The large-scale piling campaigns for offshore wind projects risk causing injury and disturbance offences to marine mammals of European Protected Species (EPS), therefore developers typically apply for a wildlife licence to exempt them from an offence under the regulations. A licence can only be granted where the regulator is satisfied that the required legislative tests are met, such as that there is no other satisfactory alternative. We expect it to be increasingly difficult for projects to demonstrate that noise abatement is not a satisfactory alternative. Projects that do not use noise abatement therefore risk not meeting the legislative test needed in order to be granted a wildlife licence.</p>	<p>design information, any need for the implementation of NAS will be decided in consultation with the licencing authority. The Applicant is planning appropriately for the potential requirement for NAS but maintains the position that the effects may be suitably mitigated through further design refinement and other embedded mitigation. The Applicant has already committed to only pile at one monopile location in any one day during the winter season, unless NAS is utilised. The Applicant has also included the mitigation option of no piling during the winter season, as detailed in the Outline SIP for the SNS SAC [REP5-014].</p>

Consultee	Reference	Comment	Response / where addressed in the MMMP
		<p>We expect noise abatement to be committed to in the draft MMMP and Site Integrity Plan submitted at the DCO Application stage.</p> <p>The effect of noise abatement systems in reducing noise impacts should be included in the assessment."</p>	
Natural England	E27	<p>Natural England notes that there is a lack of commitment to some of the mitigation measures listed for the UXO clearance. For instance, in paragraph 102 the developer does not commit to the use of PAM, and states PAM will be conducted if equipment can be safely deployed and retrieved.</p> <p>We would like to emphasize that the UXO clearance should be performed during suitable conditions for both MMObs and PAM operators.</p> <p>In paragraph 104 it is stated that bubble curtains might be used for high ordnance UXO detonation if the environmental conditions are suitable. This is not in line with the MMO advise stating: "If high order clearance is required, noise abatement systems must be utilised ". Thus, the Applicant must commit to using NAS (i.e. bubble curtains) for high order UXO detonations within the MMMP.</p> <p>We advise that the Applicant should refer to the 'JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities' and commit to using PAM as a standard mitigation tool as well as commit to using NAS if high order UXO detonation are required.</p>	<p>For UXO clearance the Applicant has committed to the use of PAM in instances when there are not favourable conditions with good visibility (sea state 3 or less). In line with Natural England's comment, paragraph 120 in Section 1.4.2 has been amended to make clear the Applicant's commitments that 'UXO clearance would be performed during suitable conditions for both MMObs and PAM-Ops'.</p> <p>In line with Natural England's comment, paragraph 122 in Section 1.4.2 has been amended to make clear that if high-order clearance is required then NAS must be used.</p>
Natural England	E32	<p>Natural England is not content with the Applicant's response that PAM is considered as a potential mitigation measure for UXO clearance. The acoustic monitoring should be conducted alongside the visual monitoring during the UXO clearance. This needs to be clearly reflected in the MMMP.</p> <p>We advise that the MMMP should correctly refer to PAM as a standard mitigation tool, not potential mitigation measure.</p> <p>Refer to the "JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities (2023)".</p>	<p>The Draft MMMP [REP6-029] contains details for how PAM will be used if required, as set out in Section 1.4.3.2.2. However, it is noted the use of PAM is unlikely to be required for UXO clearance as all clearances will take place in daylight and in favourable conditions with good visibility (sea state 3 or less). This is in line with the guidance in Section 2.2 of the "JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities (2023)".</p>

Consultee	Reference	Comment	Response / where addressed in the MMMP
Natural England	E35	<p>The Applicant predicts that both the 20% spatial daily threshold and the 10% seasonal threshold could be exceeded in almost all scenarios. However, it is suggested that this scenario is unlikely thanks to other OWF SIPs, concluding that the adverse effect on the integrity of the SNS SAC will be avoided with appropriate SIPs.</p> <p>Since these SIPs have not yet been developed, it is not sufficient to conclude that adverse effects on the integrity of the SNS SAC will be avoided. At this stage, Natural England cannot agree that the integrity of the SNS SAC will be preserved especially as there was no commitment on using the NAS.</p> <p>The Applicant should commit to the use of noise abatement systems and incorporate this into the draft MMMP and SIP and incorporate this into the assessment.</p>	<p>The finalisation of the SIP for the SNS SAC (in accordance with the Outline SIP [REP5-014]) and MMMP (in accordance with the draft MMMP [REP6-029]) for piling will consider the latest policy on mitigation, such as NAS at the time. It is recognised that upon further assessment of the final design information, any requirement for the implementation of NAS will be decided in consultation with the licencing authority. The Applicant is planning appropriately for the potential requirement for NAS but maintains the position that the effects will be suitably mitigated through further design refinement and embedded mitigation. The Applicant has already committed to only pile at one monopile location in any one day during the winter season, unless NAS is utilised. The Applicant has also included the mitigation option of no piling during the winter season, as detailed in the Outline SIP for the SNS SAC [REP5-014]. The Applicant notes that potential mitigation options, including NAS, are listed within the Outline SIP for the SNS SAC [REP5-014] which would be finalised post-consent in line with the final design of the Project. Additional mitigation such as NAS has been added into the Draft MMMP (Revision 1) in Section 1.3.2.8.</p>
Essex Wildlife Trust	EWT-05	<p>Marine mammals A key mitigation for marine mammals that should be included in the condition wording of the marine licence is that piling activity must cease in the event the monitoring highlights the noise impact is in excess of the predicted impacts. The production and implementation of a Marine Mammal Mitigation Protocol (MMMP) will minimise the impacts of piling and unexploded ordnance clearance (if required). The Applicant should commit to specific mitigation measures, particularly Noise Abatement Systems (NAS), in the MMMP. This should sit alongside a Working in Proximity to Wildlife Plan to reduce the risk of disturbance from ships, boats and other vessels and the risk of them colliding with marine mammals. GCN An EPSL from NE will be required for temporary works affecting terrestrial habitat used by GCN along the route.</p>	<p>The finalisation of the SIP and MMMP for piling will consider the latest policy on NAS at the time. The Applicant notes that potential mitigation options, including NAS, are proposed within the Outline SIP [REP5-014] which would be finalised as a SIP post-consent in line with the final design of the Project. As secured by condition to the proposed deemed marine licences in the draft DCO [REP7-007] in the event that piling is required. It is recognised that upon assessment of more developed design information, any need for the implementation of NAS will be decided in consultation with the licencing authority. The Applicant is planning appropriately for the potential requirement for NAS but maintains the position that the effects may be suitably mitigated through further design refinement and embedded mitigation. The Applicant has already committed to only pile at one monopile location in any one day during the winter season, unless NAS is utilised. The Applicant is also considering the option of no piling during the winter season (October – March inclusive), as detailed in the Outline SIP at section 1.7.2 [REP5-014].</p>
Marine Management Organisation (MMO)	MMO-111	<p>Outline Marine Mammal Mitigation Protocol – Document 7.7 – APP-242, 4.12.1 The MMO welcomes that the Applicant will be considering all suitable mitigation options including the use of Noise Abatement when developing the final MMMP (as stated in Table 1-2). However, the MMO requests that a specific section</p>	<p>The finalisation of the MMMP for piling will consider the latest policy on NAS at the time. However, the Applicant notes the MMO's comment and has added in a section for potential additional mitigation in Section 1.3.2.8.</p>

Consultee	Reference	Comment	Response / where addressed in the MMMP
		regarding noise abatement is added to the MMMP. At this stage the MMO considers there is clear justification and evidence that noise abatement measures will be required for the project, to reduce the risk of potential impact on marine receptors.	
MMO	MMO-112	The MMO welcomes that 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.	Noted.
MMO	MMO-113	The MMO notes that 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. The MMO welcomes that further discussions on this matter will take place before the finalisation of the MMMP.	Noted.
MMO	MMO-179	Please see specific comments on the Draft Marine Mammal Mitigation Protocol (MMMP) below. This outline MMMP details how the Applicant would mitigate the risk of auditory injury to marine mammals. Both piling and UXO clearance have the potential to produce underwater noise capable of causing auditory injury to marine mammals. It is 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. A summary of the proposed measures to mitigate potential impacts from UXO clearance have been provided within the Draft MMMP for information purposes only. The MMO largely defers to Natural England and other relevant SNCBs for comments on the outline Site Integrity Plan (SIP) for the Southern North Sea (SNS) Special Area of Conservation (SAC).	Noted.
MMO	MMO-180	Consideration of the cumulative sound exposure predictions in the MMMP:	The Applicant notes the MMO's comment and has amended the Draft MMMP so that the sequential piling impact results are presented, and

Consultee	Reference	Comment	Response / where addressed in the MMMP
		The MMO previously advised 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 is because the recommended guidance (NOAA (NMFS, 2018) / Southall et al. (2019)) applies to a period of 24 hours for the cumulative sound exposure (SELcum). Thus, it follows that the worst case is the maximum amount of noise that could occur in 24 hours, not just for a single pile. The Applicant has responded with the following: "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".	mitigation measures are based on these. This has been amended in Section 1.3.
MMO	MMO-181	The MMO does not agree that as mitigation will be carried prior to each pile, mitigation should be based on the potential for effect from each individual pile, rather than the total piles to be installed within 24 hours. Even if mitigation is required prior to piling at each location (which is, nevertheless, standard practice), this does not negate the fact that an animal may still be exposed (to underwater noise) more than once from multiple piles. The Developer should put forward an appropriate justification to explain why the cumulative sound exposure of two piles is not required in their MMMP. In the absence of a sufficient argument, the MMO strongly recommends that mitigation is required prior to piling of foundations at each pile location, and the mitigation requirements should be based on the predicted PTS ranges for the cumulative exposure for three monopiles and six pin piles installed sequentially (or whatever the finalised worst-case number of monopiles/pin piles installed in 24-hours will be).	The Applicant notes the MMO's comment and has amended the Draft MMMP so that the sequential piling impact results are presented, and mitigation measures are based on these. This has been amended in Section 1.3.
MMO	MMO-182	The MMO previously advised that the JNCC (2010) guidance recommends that if there is a pause in piling operations for a period of greater than 10 minutes, then the pre-piling search and soft-start procedure should be repeated before piling recommences. If a watch has been kept during the piling operation, the Marine Mammal Observer or Passive Acoustic Monitoring (PAM) operative should be able to confirm the presence or absence of marine mammals, and it may be possible to commence the soft-start immediately. However, if there has been no watch, the complete pre-piling search and soft-start	Continuous monitoring will be ensured throughout piling, including any break in piling, to ensure the MA is free from marine mammals before piling recommences. This has been made clear in Section 1.3.2.4. However, we consider the requirement for another full soft-start period to be disproportionate, instead of the 5-6 hammer blows at low energy (<400kJ) which will allow any marine mammals that may have moved nearby during the break time to move away again without providing any excessive noise.

Consultee	Reference	Comment	Response / where addressed in the MMMP
		procedure should be undertaken. The guidance recommends that the soft-start duration should be a period of no less than 20 minutes. Any requested variation from a 20-minute soft-start should be agreed with the relevant agency and regulator. The MMO recommended that the guidance is adhered to, and the full soft start is implemented (not 5 to 6 blows at the starting hammer energy as is proposed in the MMMP).	
MMO	MMO-183	The Applicant has responded stating that “Procedures have been amended based on Natural England comments to ensure the MA (Monitoring Area) will continue to be monitored during breaks in piling”. Provided that the MA is being continually watched/monitored during the full break in piling (of more than 10 minutes but less than two hours), and the monitoring operatives can confirm that marine mammals are not present, then the MMO has no major objections to the altered soft-start procedure, provided Natural England and JNCC are content with the proposals. The Draft MMMP confirms that the full mitigation procedure is required for any breaks in piling of more than two hours.	Noted.
MMO	MMO-184	As advised in March 2024, references to bubble curtains are made throughout the Draft MMMP. Paragraph 104, for example, notes the ‘potential use of bubble curtains if high-order UXO detonation is required, taking into account the environmental conditions within which they could be effective’. Paragraph 117 further states that the required Acoustic Deterrent Device (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.	The Applicant notes this comment from the MMO this has been amended to ensure it is clear that if high-order clearance is required then NAS must be used in Paragraph 122.
MMO	MMO-185	In fact, paragraph 119 acknowledges that 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.	As above.
MMO	MMO-186	It is the understanding of the MMO that bubble curtains will be required for all high-order detonations, and this should be clear in	As above in response to MMO-184.

Consultee	Reference	Comment	Response / where addressed in the MMMP
		the final MMMP. The MMO suggests that the Applicant consults with the specific UXO contractor to determine the appropriate parameters for safely deploying bubble curtains. If environmental conditions are not conducive to the use of a bubble curtain, then the MMO recommends postponing any high-order detonations until conditions are suitable.	
MMO	MMO-195	The purpose of the noise monitoring during construction is to determine the actual underwater noise levels on site for comparison with the modelled levels presented in the ES. The MMO acknowledges that the measurements taken during installation will be constrained by various factors such as the piling plan and site limitations and a direct (like-for-like) comparison with a modelled scenario is unlikely to be possible. Nevertheless, even if the piling locations and choice of transects would not be matched precisely, both modelling and monitoring should provide enough information to deduce some envelope of received level curves in each case. Thus, some sort of comparison/s in the form of 'level vs range' plots (for comparable hammer strike energies), with the associated envelopes of variability, should be possible and would be expected. Therefore, the MMO recommends that such a plot is provided.	The Applicant has noted this comment from the MMO, therefore, these plots have been provided in Appendix B as part of the revised Draft MMMP (Revision 1).
MMO	MMO-204	Paragraph 181: "A MMMP for piling (Section 12.8) in accordance with the Draft MMMP (Document Reference: 7.7) would reduce the risk of PTS from a single strike of both monopiles and jacket pin piles, at the maximum hammer energy, and from the cumulative exposure of one monopile and one jacket pin pile. Mitigations will be undertaken for each pile, and therefore should be designed to ensure they cover for the potential impact of the installation either one monopile or one jacket pin pile, as required (as well as for any simultaneous piling events)". As noted above under Question 11 (point 28), even if mitigation is required prior to piling at each location, this does not negate the fact that an animal may still be exposed (to underwater noise) more than once from multiple piles. The Developer should put forward an appropriate justification to explain why the cumulative sound exposure of two piles is not required in their MMMP. In the absence of a sufficient argument, the MMO strongly recommends	The Applicant notes the MMO's comment and has amended the Draft MMMP so that the sequential piling impact results are presented, and mitigation measures are based on these. This has been amended in Section 1.3.

Consultee	Reference	Comment	Response / where addressed in the MMMP
		that mitigation is required prior to piling of foundations at each pile location, and the mitigation requirements should be based on the predicted PTS ranges for the cumulative exposure for three monopiles and six pin piles installed sequentially (or the worst-case number of monopiles/pin piles installed in 24-hours).	
MMO	Deadline 1 Submission, Further Comments	<p>The MMO would highlight that the Underwater noise policy papers have been published, by DEFRA, JNCC, NE and Cefas. These set out the direction of travel into reducing the noise at source for piling and sets out further detail on how UXO mitigation.</p> <ul style="list-style-type: none"> • Reducing noise policy • UXO position statement • NE/JNCC/Cefas joint position on Noise Abatement <p>The MMO has included links above but will enter these into the examination at Deadline 2 (if another interested party has not done this at Deadline 1). The MMO would ask the Applicant how the publication of these documents changes their Application, what updates will be made and at which deadline. This will assist in managing resources to review the most up to date information.</p>	The Applicant has noted these new policy and guidance papers that have been published, as set out at section 1.1.1., and have considered these for Revision 1 of the Draft MMMP.
MMO	MMO REP4-079	<p>The MMO acknowledges the Applicant's review on the published policy papers and welcome proposed mitigation options, including Noise Abatement Systems (NAS) within the Outline Site Integrity Plan (SIP) [APP-243]. However, the MMO would also expect the SIP and MMMP to be updated to commit to the use of noise reduction measures based on the policy papers and include reference to these papers within the document. The MMO would highlight that it is unlikely that a wildlife licence will be issued without noise reduction measures going forward, but we note that they may not be required depending on the design plan.</p> <p>In addition to this the MMO understands NE is requesting further commitment within the DML. The MMO notes that a condition has been included on a without prejudice basis in multiple recent Examinations (Morgan and Morecambe Generation Offshore Wind Farms). The MMO would welcome being part of the discussions for North Falls.</p> <p>The MMO welcomes the consideration by the Applicant of the updates to the Unexploded Ordnance (UXO) position statement</p>	<p>The Applicant notes the MMO's comment and has provided further detail on noise reduction measures within Section 1.3.2.8 for Rev. 2 of the Draft MMMP submitted at Deadline 5.</p> <p>The Applicant has discussed this matter with the MMO on 15th May 2025 and added wording similar to Morgan offshore wind farm (see comment below) in Section 1.3.2.8.</p>

Consultee	Reference	Comment	Response / where addressed in the MMMP
		and the updates to the Draft Marine Mammal Mitigation Protocol (MMMP) to incorporate the latest guidance for UXO clearance. Further comments on the updated version of the draft MMMP [7.7 Rev 1] is provided below:	
MMO	MMO REP4-079	<p>The MMO notes Paragraph 99 highlights that the details will be discussed with suppliers post consent once the final design is made. The MMO recommends the discussions with suppliers begins now and the commitment to securing noise reduction is reflected within the MMMP. For example, Morgan Generation Offshore Wind Farm added to their underwater sound management strategy (UWSMS) (noting a slightly different approach):</p> <p><i>'If it is deemed necessary to apply NAS for piled foundations either as a result of forthcoming policy on underwater sound, or it is identified (during discussions with the MMO on the final UWSMS plan following the final scheme design freeze post consent) as the most appropriate mitigation to manage underwater sound from piling, then the Morgan Generation Assets will be in a position (from a programme execution perspective) to implement such measures.'</i></p> <p>As multiple projects will be constructing at the same time and procurement and finance is not enough to ensure that best endeavours have been shown when applying for a wildlife licence, this commitment would be welcomed now.</p> <p>Comments on the response by the Applicant to MMMP consultation comments raised by NE</p> <p>The MMO has reviewed the updated Draft Marine Mammal Mitigation Protocol [REP3 014] and notes the Applicant's response to NE comments in Appendix A table 1.5.</p> <p>The MMO welcomes the amendments to text in sections 1.3.2.1.2 stating both acoustic and visual monitoring will be undertaken during daylight hours as requested by NE.</p> <p>The MMO welcomes the justification by the Applicant as to why two hours break has been chosen as a timeframe for a full restart of the procedures. The MMO defers to NE for further comments.</p> <p>The MMO welcomes that Plate 1.2 has been amended to indicate monitoring by Marine Mammal Observers (MMObs) and/or</p>	<p>The Applicant notes the MMO's comment and has provided further detail on noise reduction measures within Section 1.3.2.8 for Revision 2 of the Draft MMMP.</p> <p>The Applicant notes the MMO's comment regarding the procedures for a break in piling between 10 minutes and 2 hours. However, the Applicant maintains its position that 5-6 hammer blows at low energy (<400kJ) is appropriate as it will allow any marine mammals that may have moved into the vicinity during the break time to move away again without providing any excessive noise. This approach has been tried and tested throughout the Dogger Bank A piling campaign and ongoing DBB piling campaigns to protect marine mammals. A wildlife licence for Dogger Bank A was granted (L/2022/00254/2) following these protocols in the final MMMP (Dogger Bank Offshore Wind Farm, 2022).</p>

Consultee	Reference	Comment	Response / where addressed in the MMMP
		<p>Passive Acoustic Monitoring (PAM) operators must be continued throughout breaks in piling.</p> <p>The MMO welcomes the update to text in section 1.4.2 upon the request of NE to state that two MMObs must be continued throughout breaks in piling.</p> <p>Comments on the response by the Applicant to MMMP consultation comments raised by MMO</p> <p>The MMO notes the comment by the Applicant that the mitigation proposed for piling will be carried out prior to each pile, and therefore mitigation should be based on the effect from each individual pile, rather than the total piles installed within 24 hours. The MMO notes this and has no further comments at this time.</p> <p>The MMO welcomes the amendments to the pin-pile ramp up procedures and the reduction in ranges.</p> <p>The MMO welcomes the text referring to the “two licence” approach has been added into Section 1.1.</p> <p>The MMO notes the proposed UXO campaign commitments have been added to section 1.4.2. The MMO welcomes that the techniques and options are presented as current examples, and the mitigation options will be reviewed and updated based on the latest information and guidance in the final MMMP alongside the marine licence application.</p> <p>Comments on the responses by the Applicant to the Examination comments and Relevant Representations in relation to MMMP (Table 1.6)</p> <p>The MMO welcomes that the addition of section 1.3.2.8 for potential additional mitigation.</p> <p>The MMO notes the amendments to Section 1.3 of the Draft MMMP so that the sequential piling impact results are presented and mitigation measures are based on these.</p> <p>The MMO welcomes the clarification in Section 1.3.2.4 that continuous monitoring will be ensured throughout piling, including ay break in piling, to ensure the monitoring area is free from marine mammals before piling recommences.</p> <p>The MMO notes that the Applicant considers the requirement for another full soft start period to be disproportionate, instead of the</p>	

Consultee	Reference	Comment	Response / where addressed in the MMMP
		<p>5-6 hammer blows at low energy (<400kJ) which the Applicant considers will allow any marine mammals that may have moved nearby during the break time to move away again without providing any excessive noise. The MMO maintains their position that the guidance is adhered to and the full soft start is implemented and this should be reflected within the MMMP. The MMO is open to further discussion on this requirement post consent once the final design is confirmed however at this time the guidance should be adhered to.</p> <p>The MMO welcomes the clarification in Paragraph 108 to ensure that if high-order clearance is required then NAS must be used.</p> <p>The MMO recommended in their comment MMO-195 that the level vs range plots (for comparable hammer strike energies), with the associated envelopes of variability are provided. The MMO welcomes that these plots have been provided in Appendix B as part of the revised Draft MMMP and is currently reviewing these will our scientific advisors and will confirm this matter is closed at Deadline 5.</p>	
Natural England REP7-088	Table 1 _1	We are content with the amendments of the Plate 1.2 as per our advice.	Noted, no further action required.
Natural England REP7-088	Table 1 _2	<p>Natural England notes that the Applicant has not accepted our advice on the use of Passive Acoustic Monitoring (PAM) for Unexploded Ordnance (UXO) clearance. The Marine Mammal Mitigation Protocol (MMMP) [REP6-030] still refers to this as 'unlikely to be required'. We also note the Applicant's response in E27 of Table 1.5 Examination Comments and Relevant Representations: "For UXO clearance the Applicant has committed to the use of PAM in instances when there are not favourable conditions with good visibility (sea state 3 or less)."</p> <p>Our advice remains that PAM is a required monitoring tool for UXO clearance especially given that the proposed development is within a designated SAC for harbour porpoise. Therefore, we do not consider this issue to be resolved.</p>	The Draft MMMP [REP6-029] contains details for how PAM will be utilised, as set out in Section 1.4.3.2.2. As per Natural England's request the text has been amended to ensure PAM, if required, will be used in conjunction with the MMObs for the UXO clearance mitigation procedures.
Natural England REP7-088	Table 1 _3	We also note the Applicant's response in E23 of the Table 1.5 Examination Comments and Relevant Representations [REP6-030]: "Alternative monitoring strategies will be considered in the	The Draft MMMP has been updated (Document 7.7) and submitted at Deadline 8 to ensure this has been added to the main body of text in the Draft MMMP, Section 1.3.2.1.2.

Consultee	Reference	Comment	Response / where addressed in the MMMP
		<p>final MMMP post-consent. MMO and PAM techniques are developing and changing, and technologies are already available including night vision binoculars and cameras that are already regularly used for research and mitigation purposes, and alternative visual strategies could be considered. All options will be considered, and this will be developed in consultation with relevant stakeholders, including Natural England, post-consent."</p> <p>We advise that it is important that this statement is included in the main body text of the Draft MMMP, not just in the Appendix as a response to our comment, to ensure that the Monitoring Area (MA) of 700m will be adequately monitored to guarantee the detection of the key species.</p>	

Appendix B. Plots for Comparable Hammer Strike Energies

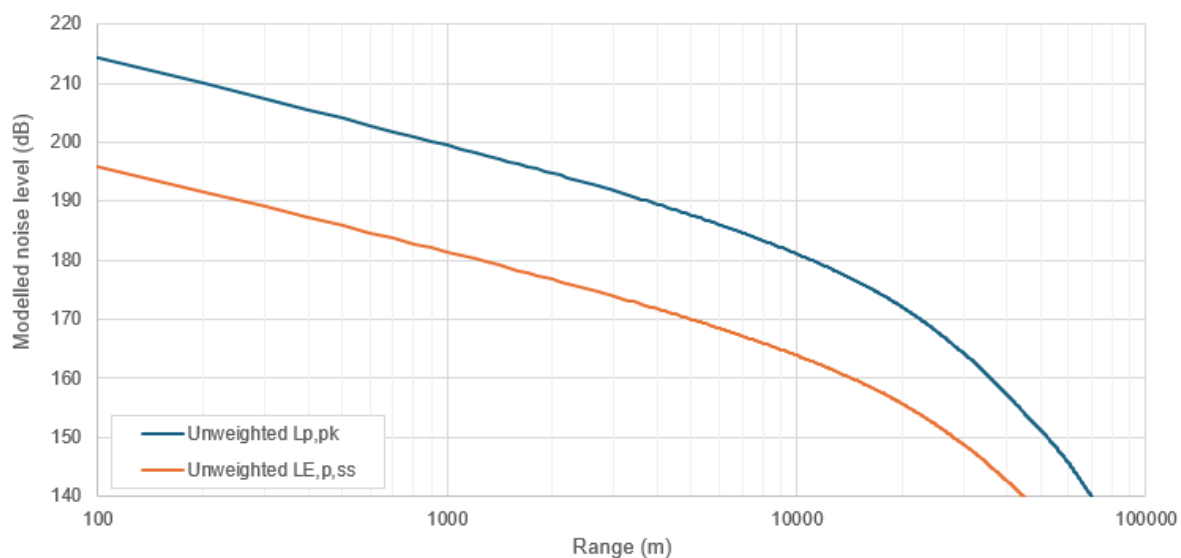


Figure B 1. Monopile worst-case (max energy).

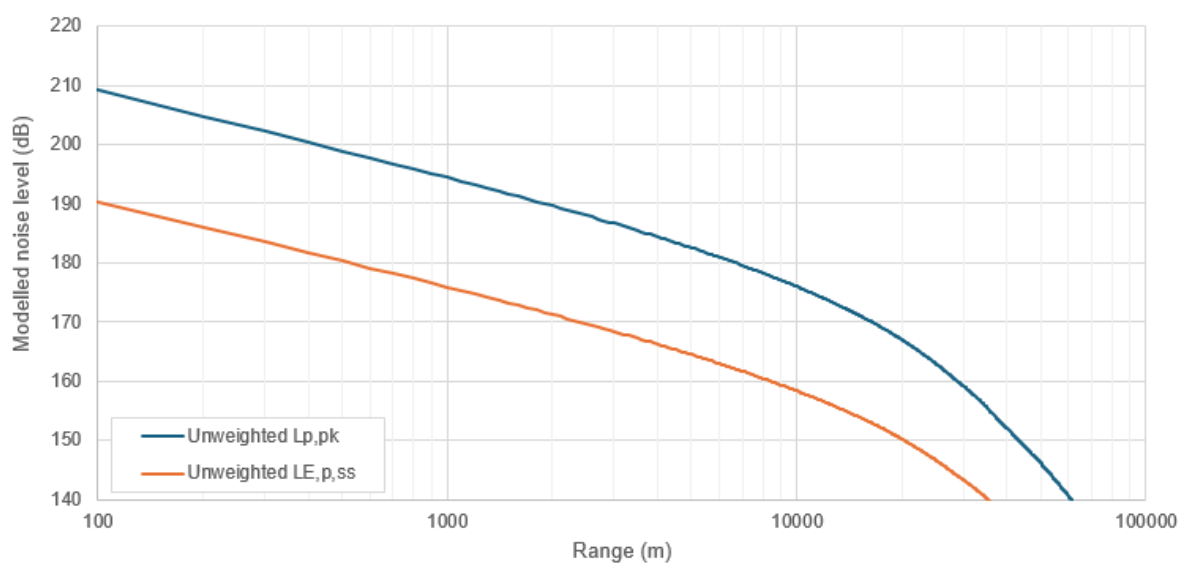


Figure B 2. Monopile worst-case (1st strike).

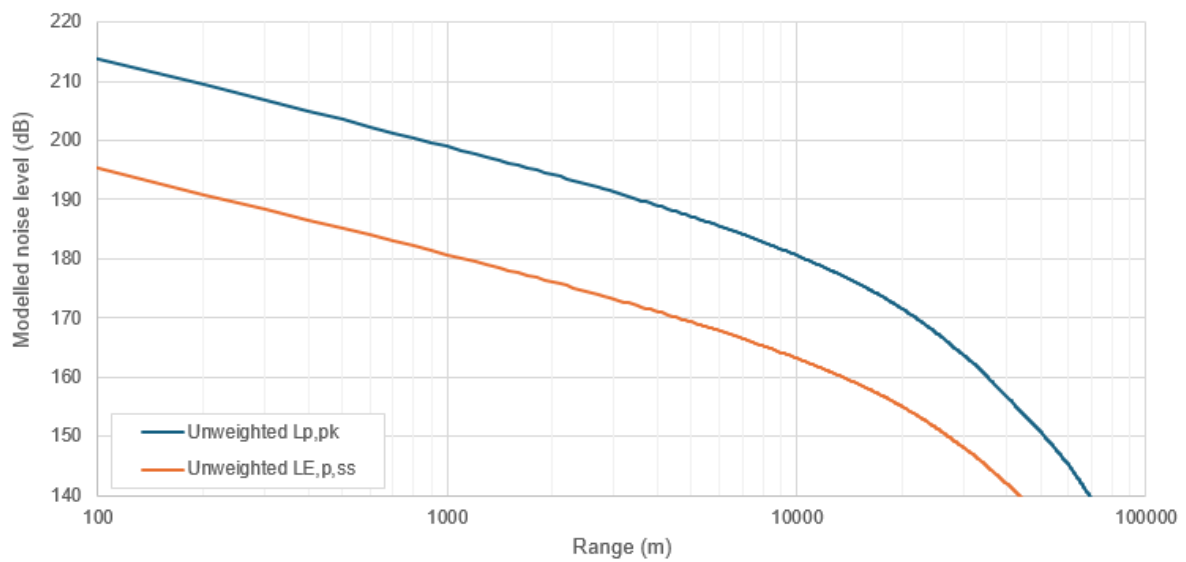


Figure B 3. Pin pile worst-case (max energy).

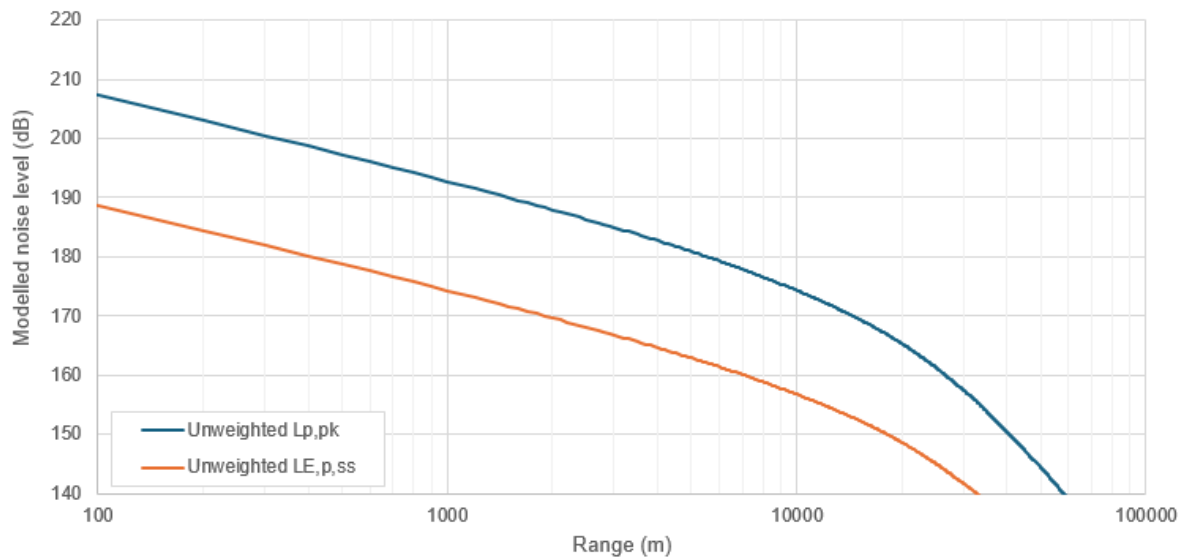


Figure B 4. Pin pile worst-case (1st strike)



NORTH FALLS

Offshore Wind Farm



HARNESSING THE POWER OF NORTH SEA WIND

North Falls Offshore Wind Farm Limited

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