BERWICK BANK WIND FARM

OFFSHORE ENVIRONMENTAL IMPACT ASSESSMENT

APPENDIX 23: OUTLINE MARINE MAMMAL MITIGATION PROTOCOL

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1. DRAFT MARINE MAMMAL MITIGATION PROTOCOL

1.1. INTRODUCTION

1. Berwick Bank Wind Farm Limited (BBWFL) is a wholly owned subsidiary of SSE Renewables Limited and will hereafter be referred to as the Applicant. The Applicant is developing the Berwick Bank Wind Farm (hereafter referred to as 'the Project').

2. The Project is an offshore wind farm in the outer Firth of Forth and Firth of Tay, sitting approximately 47.6 km offshore of the East Lothian coastline and 37.8 km from the Scottish Borders coastline at St. Abbs. The Project is comprised of both offshore and onshore infrastructure (offshore components of the Project are hereafter referred to as the 'Proposed Development') required to generate and transmit electricity from the Proposed Development array area to a Scottish Power Energy Networks (SPEN) 400kV Grid Substation located at Branxton, southwest of Torness Power station. The Proposed Development export cable corridor will make landfall in the East Lothian coast, specifically at Skateraw. The Applicant is also developing an additional export cable grid connection to Blyth, Northumberland (the Cambois connection). Applications for necessary consents (including marine licences) will be applied for separately (SSER, 2022e). The Cumulative Effects Assessment (CEA) of the Cambois connection is based on information presented in the Cambois connection Scoping Report (SSER, 2022e), submitted in October 2022.

3. The Proposed Development boundary, illustrated within Figure 1.1, covers an area of 1,178.1 km^2 (including both Proposed Development array area and Proposed Development export cable corridor) and has the capacity to generate up to 4.1 GW of renewable electricity. The Proposed Development is crucial for the Scottish Government to meet its target of installing 11 GW of offshore wind capacity by 2030 (Scottish Government, 2020).

4. This draft Marine Mammal Mitigation Plan (MMMP) presents a summary of findings as assessed in the offshore Environmental Impact Assessment (EIA) on the effects of underwater noise during piling (fixed foundations), Unexploded Ordnance (UXO) clearance, and pre-construction geophysical surveys, on marine mammals. Piling and UXO clearance have the potential for impact during the construction phase, and geophysical surveys have the potential for impact during both the construction and operation and maintenance phase. This draft MMMP is informed by the following sections of the Offshore EIA Report:

- volume 2, chapter 10: Marine Mammals;
- volume 3, appendix 10.1: Subsea Noise Technical Report; and
- volume 3, appendix 10.2: Marine Mammal Technical Report.

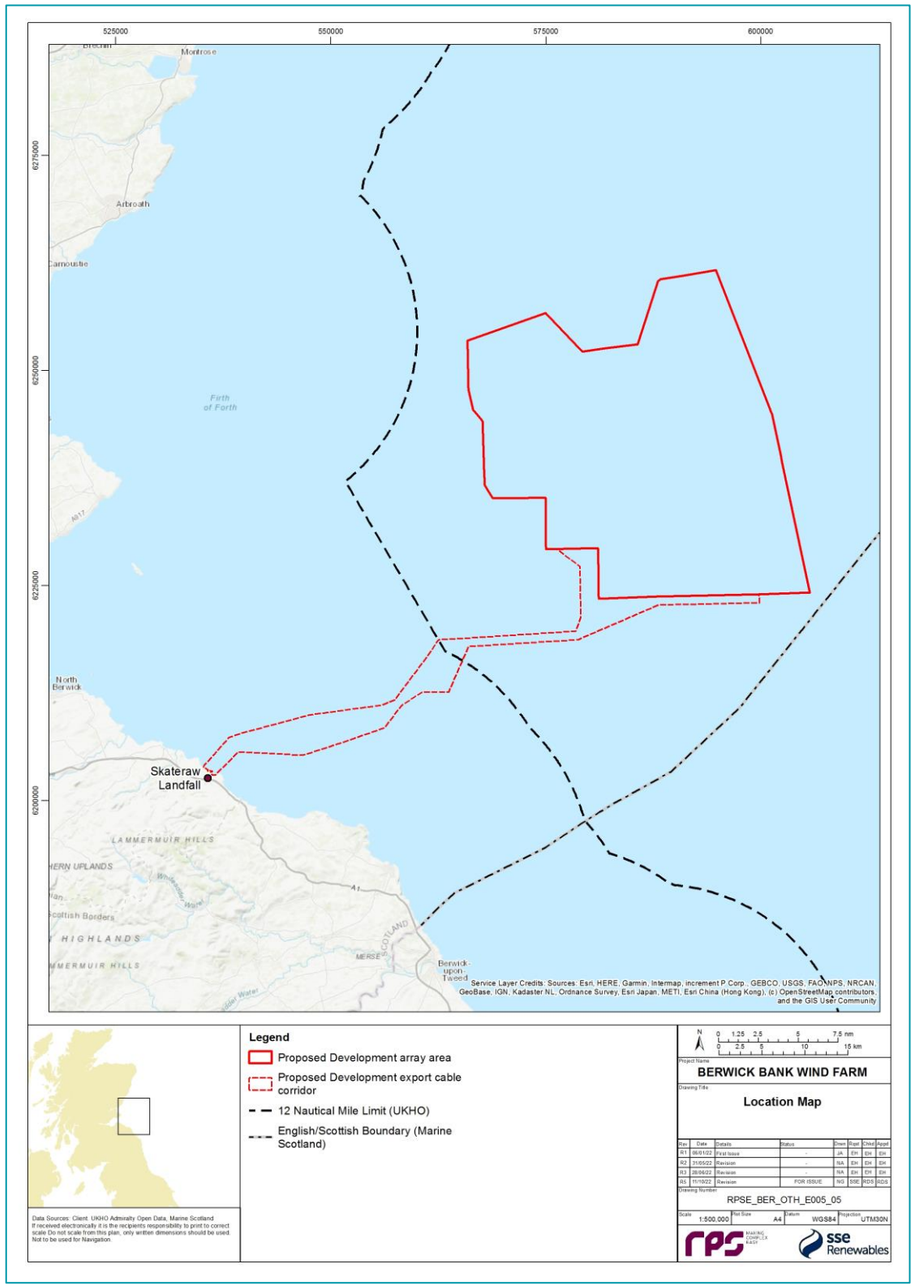

Figure 1.1: Proposed Development Array Area and Export Cable Corridor for Berwick Bank Wind Farm

1.2. PURPOSE OF THE MMMP

5. This draft MMMP has been prepared to secure designed in measures (which include primary and tertiary mitigation), and secondary mitigation strategies to seek to ensure no injury to marine mammals as a result of the following activities associated with the Proposed Development:

   - underwater noise during piling;
   - UXO clearance; and
   - site investigation surveys (geophysical).

6. Information presented in this MMMP is based on the volume 2, chapter 10, which considers the potential impacts of the Proposed Development seaward of Mean High Water Springs (MHWS) during the construction, operation and maintenance, and decommissioning phases. The maximum design scenario informing the assessment of potential impacts on marine mammals as a result of underwater noise during piling, UXO clearance, and geophysical site investigation surveys is presented in Table 1.1.

Table 1.1: Maximum Design Scenario Considered in the Assessment of Potential Impacts on Marine Mammals

Potential Impact	Phase[1] C	O	D	Maximum Design Scenario	Justification
Injury and disturbance from elevated underwater noise during piling (fixed foundations)	✓	×	×	**Construction Phase** Wind turbines: • up to 179 piled jacket foundations, with up to 4 legs per foundation and up to 2 x 5.5 m diameter piles per leg (1,432 piles); • maximum hammer energy up to 4,000 kJ, with realistic maximum hammer energy of 3,000 kJ (based on average of up to 75% maximum hammer energy); • up to 2 concurrent piling of wind turbine foundations with 2 vessels; • minimum 950 m and maximum 49.43 km distance between concurrent piling events; • up to 10 hours absolute maximum piling per pile (9 hours realistic maximum); • total duration of piling = 12,888 hours (realistic maximum) to 14,320 hours (absolute maximum); and • maximum piles installed within 24 hours (concurrent piling) = 5. Offshore Substation Platforms (OSPs)/Offshore convertor station platforms: • up to 8 jacket foundations with up to 6 legs per foundation and 4 x 3.0 m diameter piles per leg (192 piles) and up to 2 jacket foundations with up to 8 legs per foundation and 4 x 4.0 m diameter piles per leg (64 piles); • maximum hammer energy up to 4,000 kJ, with realistic maximum hammer energy of 3,000 kJ (based on average of up to 75% maximum hammer energy); • up to 8 hours absolute maximum (7 hours realistic maximum) piling per pile; • total duration of piling = 1,792 hours (realistic maximum) to 2,048 hours (absolute maximum); and • maximum piles installed within 24 hours (based on single piling) = 3. The maximum scenario for concurrent piling is maximum of 2 piling events at any one time. Number of days when piling may occur within piling phase (OSPs/Offshore convertor station platforms and wind turbines) = 372 days. Total piling phase of 52 months over a construction period of 96 months.	The largest hammer energy and the maximum spacing between concurrent piling vessels could lead to the largest area of ensonification at any one time. Minimum spacing between concurrent piling represents the highest risk of injury to animals. Note that the absolute maximum hammer energy is the maximum achieved at any one location whilst the 'realistic maximum' is taken as the average of the maximum energy likely to be achieved across all 179 locations (and is estimated as 75% of the maximum). The longest duration of piling at any location results in the greatest number of days when piling could occur. The maximum number of piles installed within 24 hours will result in the greatest impact over 24 hours. Maximum number of piles for wind turbines installed within 24 hours is based on the realistic maximum duration of piling and assuming up to 2 concurrent piling vessels for wind turbines, with an assumption that there will be a maximum of 2 piling events at any one time. Note that maximum design scenario assumes concurrent piling for wind turbine foundations as the maximum design scenario but it may occur as a combination of wind turbines and OSPs/Offshore convertor station platforms. Figures have been rounded to nearest whole number. The maximum number of days when piling occurs will result in the greatest potential impact. Total number of days when piling may occur is based on the total number of piles divided by the number of piles that can be installed within 24 hours for wind turbines and OSPs/Offshore convertor station platforms s. Duration of piling at wind turbines assumes 2 concurrent vessels. OSPs/Offshore convertor station platforms s only assume a single vessel for pile installation. In total, a maximum of 2 piling vessels will be piling at any one time.
Injury and disturbance to marine mammals from elevated underwater noise during UXO clearance	✓	×	×	**Pre-Construction phase** • clearance of 14 UXOs within the Proposed Development array area or export cable corridor; • maximum UXO size of up to 300 kg; • surveys will involve the use of up to 7 vessels on site at any one time with up to 30 vessel movements in total; • intention for low order clearance of all UXOs using low order techniques (subsonic combustion) with a single donor charge of up to 80 g net explosive quantity (NEQ) for each clearance event; • up to 500 g NEQ clearance shot for neutralisation of residual explosive material at each location; • small risk of potential for unintended consequence of low order techniques to result in high order detonation of UXO (approximately 10% of the total number of UXOs could result in high order detonation); and • up to 2 detonations within 24 hours. Clearance during daylight hours only.	Maximum number and maximum size of UXOs encountered in the project area based on UXO Hazard Assessment undertaken for Seagreen will result in the greatest potential impact. Donor charge is maximum required to initiate low order detonation. Assumption of a clearance shot of up to 500 g at all locations although noting that this may not always be required.

[1] Impacts with a potential to occur during: C = Construction, O = Operation and maintenance, D = Decommissioning

Potential Impact	Phase[1]			Maximum Design Scenario	Justification
	C	O	D		
Injury and disturbance to marine mammals from elevated underwater noise during site investigation surveys	✓	✓	×	**Pre-Construction phase** Geophysical site investigation activities include: • Multi-beam echo-sounder (MBES) (200 kHz to 400 kHz; 180-240 dB re 1 1µPa); • Sidescan Sonar (SSS) (200 kHz to 900 kHz; 190-245 dB re 1 1µPa); • Single Beam Echosounder (SBES) (200 kHz to 400 kHz; 180-240 dB re 1 1µPa); • Sub-Bottom Profiler (SBP) (0.5 kHz to 12 kHz chirp, 4 kHz pinger, 100 kHz pinger; 200-240 chirp dB re 1 1µPa, 200-235 pinger (both) dB re 1 1µPa.); and • Ultra-High Resolution Seismic (UHRS) (19.5 kHz to 33.5 kHz; 170-200 dB re 1 1µPa). Site investigation surveys will involve the use of up to two geophysical/geotechnical survey vessels and take place over a period of up to three months with up to 70 return trips. **Operation and maintenance phase** Routine geophysical surveys of wind turbine foundations, estimated to occur every six months for first two years and annually thereafter (approximately 37 surveys over the 35-year life cycle of the Proposed Development). It is assumed that approximately 10% of the inter-array cables length will require inspections each year (more if issues are found). Offshore export cables surveyed annually	Maximum range of geophysical and geotechnical activities likely to be undertaken using equipment typically employed for these types of surveys will result in the greatest potential impact.

7. In addition to designed in measures and secondary mitigation proposed to reduce the injurious impacts on marine mammals associated with piling, UXO clearance and geophysical surveying, a range of procedures will be applied to reduce other environmental impacts of the Proposed Development. For example, development and adherence to an Environmental Management Plan (volume 3, appendix 22), Marine Pollution Contingency Plan (volume 3, appendix 22, annex 22.2), Code of Construction Practice, and a Decommissioning Plan have been outlined and committed to as part of the Offshore EIA Report process.

8. This draft MMMP has been prepared in accordance with the following guidance and it is considered that compliance with these will reduce the risk of injury to marine mammals to negligible levels:

- Joint Nature Conservation Committee (JNCC; 2010a), Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise;
- JNCC (2010b), Guidelines for minimising the risk of injury to marine mammals from using explosives; and
- JNCC (2017), Guidelines for minimising the risk of injury to marine mammals from geophysical surveys.

1.3. TARGET SPECIES

9. Marine Mammals were characterised based on their abundance and densities at a regional scale (Regional marine mammal study area) and local scale (Proposed Development marine mammal study area), as detailed in volume 2, chapter 10.

10. Aerial digital surveys carried out from March 2019 to April 2021 identified that harbour porpoise (*Phocoena phocoena)* was the most commonly sighted marine mammal in the Proposed Development. Other marine mammals that were regularly sighted in the surveys include grey seal (*Halichoerus grypus*), harbour seal (*Phoca vitulina*), minke whale (*Balaenoptera acutorostrata*), white-beaked dolphin (*Lagenorhynchus albirostris*), and bottlenose dolphin (*Tursiops truncatus*). These species use sound for many aspects of their lives and are sensitive to underwater noise, which can cause permanent damage to their ear tissue. A detailed account on the effects of underwater noise on the marine mammal species presented in this MMMP can be found in section 10.11.1 in volume 2, chapter 10.

11. All of the marine mammal species which would potentially be affected by the Proposed Development are protected by international legislation and/or are important from a conservation perspective at an international or national context (see volume 2, chapter 10). Therefore, the value of marine mammal Important Ecological Features (IEF) at the Proposed Development was designated as International (Table 1.2).

Table 1.2 Marine Mammal IEFs and their Importance Within the Marine Mammal Regional Study Area

Species	Protection Legislation
Harbour porpoise	• Annex II species that is a designated feature of Southern North Sea Special Area of Conservation (SAC), Doggerbank SAC, Doggerbank Site of Community Importance (SCI) and Klaverbank SAC; • European Protected Species (EPS); • OSPAR protected species; • International Union for the Conservation of Nature (IUCN) Red List Least Concern; and • Scottish Priority Marine Feature (PMF).
Bottlenose dolphin	• Annex II species that is a designated feature of Moray Firth SAC; • EPS; • IUCN Red List Least Concern; and • Scottish PMF.
White-beaked dolphin	• EPS; • IUCN Red List Least Concern; and • Scottish PMF.
Minke whale	• EPS; • Scottish PMF; and • IUCN Red List Least Concern.
Grey seal	• Annex II species that is a designated feature of Berwickshire and Northumberland Coast SAC and Isle of May SAC; • IUCN Red List Least Concern; and • Scottish PMF.
Harbour seal	• Annex II species that is a designated feature of Firth of Tay and Eden Estuary SAC; • IUCN Red List Least Concern; and • Scottish PMF.

1.4. MEASURES ADOPTED AS A PART OF THE PROPOSED DEVELOPMENT

12. As part of the Project design process, a number of designed in measures have been proposed to reduce the potential for injury and/or mortality on marine mammals (Table 1.3). As there is commitment to implementing these measures, they are considered inherently part of the design of the Proposed Development and represent a standard industry practice for this type of development.

13. Secondary mitigation measures, such as use of Acoustic Deterrent Devices (ADDs) may be implemented and are further discussed in section 1.6, however these are not considered to be a designed in measure.

Table 1.3 Designed in Measures Adopted as Part of the Proposed Development.

Designed in Measures Adopted as Part of the Proposed Development	Justification
Implementation of piling soft start and ramp up measures. During piling operations, soft starts will be used. This will involve the implementation of lower hammer energies (i.e., approximately 15% of the maximum hammer energy) at the beginning of the piling sequence before energy input is 'ramped up' (increased) over time to required higher levels.	This measure will minimise the risk of injury to marine mammals in the immediate vicinity of piling operations, allowing individuals to flee the area before noise levels reach a level at which injury may occur. It is considered that compliance with these guidelines will, in most cases, reduce the risk of injury to marine mammals to negligible levels. Measures such as visual and acoustic monitoring will be applied.
A mitigation zone will be defined based on the maximum predicted injury range from the dual metric subsea noise modelling carried out, for any of the modelled scenarios (4,000 kJ for concurrent piling of wind turbines and 4,000 kJ for single piling OSPs/Offshore convertor station platforms) and across all marine mammal species.	The potential to mitigate for injury was considered with respect to the largest potential injury zone across all species (2,319 m based on predictions of injury for minke whale using the 4% reducing to 0.5% conversion factor). Measures such as visual and acoustic monitoring will be applied.
Detonation of UXO using low order techniques	Low order techniques will be adopted where practicable for the detonation of UXO (where detonation is required). Measures such as visual and acoustic monitoring will be applied.

Designed in Measures Adopted as Part of the Proposed Development	Justification
Adherence to JNCC (2017) guidance to mitigate risk of injury to marine mammals during geophysical survey activities	The measures outlined in the JNCC (2017) guidelines are designed to reduce the risk of injury to marine mammals during geophysical survey activities. Measures such as visual and acoustic monitoring will be applied.
Code of Conduct (volume 4, appendix 25) will be issued to all Project vessel operators, requiring them to: • not deliberately approach marine mammals; • keep vessel speed to a minimum; and • avoid abrupt changes in course or speed should marine mammals approach the vessel to bow-ride. Code of Conduct will be adhered to at all times.	To minimise the potential for collision risk, or potential injury to, marine mammals and megafauna.
Development of, and adherence to, an Environmental Management Plan (EMP), including Marine Pollution Contingency Plan (MPCP).	To ensure that the potential for release of pollutants during construction, operation and maintenance, and decommissioning phases are minimised. These will likely include designated areas for refuelling where spillages can be easily contained, storage of chemicals in secure designated areas in line with appropriate regulations and guidelines, double skinning of pipes and takes containing hazardous substances, and storage of these substances in impenetrable bunds. The MPCP will ensure that in the unlikely event that a pollution even occurs, that plans are in place to respond quickly and effectively to ensure any spillage is minimised and effects on the environment are ideally avoided or minimised. Implementation of these measures will ensure that accidental release of contaminants from vessels will be avoided or minimised, thus providing protection for marine life across all phases of the Proposed Development.
Development of, and adherence to, an appropriate Code of Construction Practice (CoCP).	Measures within the CoCP have been identified during the design of the onshore and intertidal elements of the Proposed Development as part of the EIA process. They include strategies, control measures and monitoring procedures for managing the potential environmental impacts of constructing the Proposed Development and limiting disturbance from construction activities as far as reasonably practicable.
Development of, and adherence to, a Decommissioning Plan.	The aim of this plan is to adhere to the existing UK and international legislation and guidance. Overall, this will ensure the legacy of the Proposed Development will result in the minimum amount of long-term disturbance to the environment.

1.5. SUMMARY OF THE EIA

1.5.1. PILING

14. Pile driving during the construction phase of the Proposed Development has the potential to result in injury to marine mammals through increased underwater noise levels. A detailed underwater noise modelling assessment was carried out to investigate these effects (see volume 3, appendix 10.1). Injury, in the form of a permanent threshold shift (PTS) was investigated with respect to two metrics over the entire piling sequence from hammer initiation to maximum hammer energy (4,000 kJ). Peak Sound Pressure Level (SPL_{PK}) was used to determine ranges for instantaneous injury at the highest point over the piling sequence whilst cumulative Sound Exposure Level (SEL_{CUM}) was modelled to estimate the injury range from cumulative exposure as an animal flees the area (Table 1.4). For all species, with the exception of minke whale, the largest predicted injury ranges were based on the SPL_{PK} metric. For minke whale the maximum range of effect (injury) was 2,319 m based on the SEL_{CUM} metric for concurrent piling at adjacent piling locations (1,039 m for single piling). A summary of the injury ranges and significance of the effect assessed in marine mammal impact assessment is provided in Table 1.4.

15. Therefore, across all species, the maximum range over which injury could occur was predicted to be 2,319 m, which is greater than the standard 500 m mitigation zone proposed by JNCC (2010). This was considered to be highly precautionary as the SEL_{CUM} metric can lead to overestimates in effect ranges due to the assumptions included in the model for cumulative exposure, including:

- the sound retains its impulsive character at all distances;
- animals flee from the sound at constant and conservative swim speeds;
- the same shift in hearing could occur regardless of how energy is distributed over time (equal-energy rule);
- the soft-start procedure does not allow for short pauses in piling (e.g. for realignment) when exposure would be reduced; and
- the maximum hammer would be reached and maintained.

16. The modelled ranges suggest that injury could occur well below the maximum range of 2,319 m, particularly with respect to SPL_{PK} ranges. This is typical for subsea noise modelling results for piling and for this reason, mitigation zones have previously been based on SPL_{PK} ranges only. To adopt a conservative approach, the risk of injury and subsequently the ability to mitigate for this risk was investigated with respect to the maximum possible ranges; thus adopting the dual metric approach as recommended in Southall *et al.*, (2019). A maximum mitigation zone of 2,319 m has therefore been presented here, but final agreement on the appropriate mitigation zone will be agreed with MS-LOT following consultation of with Marine Science Scotland and NatureScot post-consent.

Table 1.4 Potential Maximum Ranges of Effect of Piling on Six Marine Mammal Species as Presented in the Volume 2, Chapter 10. Injury Ranges for SEL_{CUM} are Shown for Single Piling (Lower) to Concurrent Piling (Higher).

Species	Threshold	Maximum Potential Range of Effect (m)	Magnitude of Impact	Sensitivity of Receptor	Injury Risk Reduced by Designed in Mitigation	Significance of Effect in EIA Terms
Harbour porpoise	SPL_{PK}	449	Low	High	Yes	Minor
	SEL_{CUM}	104 - 201				
Bottlenose dolphin	SPL_{PK}	43	Low	High	Yes	Minor
	SEL_{CUM}	N/E[1]				
White-beaked dolphin	SPL_{PK}	43	Low	High	Yes	Minor
	SEL_{CUM}	N/E[1]				
Minke whale	SPL_{PK}	83	Medium	High	No; secondary mitigation is required	Moderate
	SEL_{CUM}	1,030 - 2,319				
Grey seal	SPL_{PK}	118	Low	High	Yes	Minor
	SEL_{CUM}	N/E[1] - 25				
Harbour seal	SPL_{PK}	118	Low	High	Yes	Minor
	SEL_{CUM}	N/E[1] - 25				

[1] N/E = Threshold not exceeded

17. Since the potential for injury in terms of PTS were predicted to be significant (moderate) in EIA terms for minke whale (see volume 2, chapter 10), and due to the potential for injury to other marine mammals (which are all international IEFs), secondary mitigation - in addition to designed in protocols (i.e. use of marine mammal observers and passive acoustic monitoring (PAM) operators) - is proposed (JNCC, 2010a). The secondary mitigation will be applied by deploying an ADD to deter marine mammals from the area of impact prior to commencement of construction-related "noisy" activities. The JNCC (2010a) guidance for mitigating the effects of piling recommends usage of ADDs in addition to Marine mammal observers and PAM operators, particularly in low visibility or at night. This is because there are inherent uncertainties in these visual and acoustic techniques, as they can be unreliable in detecting animals in high sea state and/or in low visibility. More details about required duration of ADD is provided in paragraph 19 *et seq.*

18. There are numerous ADDs with different sound characteristics available (see review by McGarry *et al.,* 2020) and a suitable device will be selected based on the key species requiring secondary mitigation, following discussion with relevant stakeholders. It is expected that key species to consider will be minke whale and harbour porpoise, however this will be agreed with stakeholders post-application. The sound emitted by the ADD will not injure marine mammals but will be loud enough to deter them from the sound source (hence their effectiveness as a secondary mitigation measure).

19. Results from the Proposed Development subsea noise modelling (volume 3, appendix 10.1) suggest that use of an ADD for 30 minutes prior to commencement of piling would further reduce the potential to experience injury to marine mammal receptors (Table 1.5 and Table 1.6) . The maximum injury zones for species predicted using the SPL_{PK} metric for piling at a maximum hammer energy of 4,000 kJ (as presented in the volume 2, chapter 10), are illustrated in Table 1.5. In addition, consultees requested investigation of potential ranges of effect based on the maximum hammer energy for the highest conversion factor of 10%. Whilst this was deemed unrepresentative (since the conversion factor decreases as the pile becomes embedded) the ranges were modelled and presented in volume 3, Appendix 10.5 and have also been shown here for context (Table 1.5). Assuming conservative swimming speeds (agreed via consultation with key stakeholders during the Marine Mammal Road Map process), the Proposed Development marine mammal impact assessment demonstrated that use of an ADD for 30 minutes prior to commencement of piling would deter all animals beyond the maximum modelled injury zones, including those modelled using the maximum 10% conversion factor at the maximum hammer energy. This finding is in line with previous studies which reported that ADDs were able to deter marine mammal species over several kilometres (McGarry *et al.,* 2020).

Table 1.5: Summary of Peak Pressure Injury Ranges for Marine Mammals Due to Concurrent Piling (Wind Turbine and OSP/Offshore Convertor Station Platform) at 4,000 kJ Hammer Energy Based on 1% Constant Conversion Factor for all Species Except Minke Whale for which the Range is Based on 4% Conversion Factor Reducing to 0.5%. Ranges in Parentheses were Predicted using a Maximum Conversion Factor of 10% at the 4,000 kJ Hammer Energy and Added for Comparison as Requested by Consultees.

Species	Threshold (Unweighted Peak)	Potential Injury Range (m)	Swim Speed (m/s)	Swimming Distance (m)	Potential to Flee Potential Injury Range
Bottlenose dolphin White-beaked dolphin	PTS - 230 dB re 1 µPa (pk)	43 (143)	1.52 (Bailey and Thompson, 2010)	2,736	Yes
Harbour porpoise	PTS - 202 dB re 1 µPa (pk)	449 (1,519)	1.5 (Otani *et al.,* 2000)	2,700	Yes
Minke whale	PTS - 219 dB re 1 µPa (pk)	83 (359)	2.3 (Boisseau *et al.,* 2021)	4,140	Yes
Grey seal Harbour seal	PTS - 218 dB re 1 µPa (pk)	118 (243)	1.8 (Thompson, 2015)	3,240	Yes

20. Similarly, modelling using the SEL_{CUM} metric demonstrated that the use of an ADD is useful for reducing PTS injury ranges, even over the largest injury range predicted for minke whale (2,319 m). The activation of an ADD 30 minutes prior to commencement of piling effectively reduced PTS to a level not exceeding the injury thresholds for minke whale (Table 1.6). It is recognised that additional noise sources, including the use of ADDs, should be minimised and therefore, subject to final agreement on the mitigation zone post-consent, the duration of ADD activation will be agreed as part of the final MMMP.

Table 1.6: Injury Ranges for Minke Whale due to Concurrent Piling of Wind Turbine at 4,000 kJ Hammer Energy with and without 30 Minutes of ADD

Species	Threshold (Weighted SEL)	Range (m)	
		Without ADD	With ADD
Minke whale	PTS - 183 dB re 1 μPa^2s	2,319	N/E[1]

[1] N/E = Threshold not exceeded

1.5.2. UXO CLEARANCE

21. Low order clearance techniques will be applied as the intended methodology for UXO clearance, however, based on modelling and assessments presented in the Proposed Development Offshore EIA Report, approximately 10% of the total number of UXOs requiring clearance could lead to a high order detonation. This is because there is a small inherent risk with low order clearance methods that the UXO will result in a high order detonation. In addition, some UXOs may not be stable enough to warrant a low order approach and therefore would need to be cleared using high order methods for safety reasons. This will not be known until a UXO pre-construction survey is carried out.

22. High-order detonation of UXO has the potential to generate some of the highest peak sound pressures of all anthropogenic underwater noise sources (von Benda-Beckan *et al.,* 2015). Underwater noise from high order UXO detonation could result in physical and/or auditory injury, or death for marine mammals.

23. Low order techniques of UXO clearance uses a single charge of up to 80 g Net Explosive Quantity (NEQ) which is placed in close proximity to a UXO to target a specific entry point. When detonated, a shaped charge penetrates the UXO's casing to introduce a small, clinical plasma jet into the main explosive filling. The intention is to excite the explosive molecules within the main filling to generate enough pressure to burst the UXO casing, producing a deflagration of the main filling and neutralising the UXO. Recent controlled experiments showed low-order clearance using deflagration to result in a substantial reduction in acoustic output over traditional high-order methods, with SPL_{PK} and SEL_{CUM} being typically significantly lower for the low order techniques of the same size munition, and with the acoustic output being proportional to the size of the shaped charge, rather than the size of the UXO itself (Robinson *et al.,* 2020).

24. Based on a study of the nearby Seagreen Wind Farm site (Ordtek, 2017; Ordtek, 2016), it was anticipated that up to 70 UXOs are likely to be found within the Proposed Development array area and export cable corridor, however, that only 14 of these will require clearance. Furthermore, it has been assumed that the

maximum design scenario will be clearance of UXOs up to 300 kg. The maximum frequency would be up to two detonations within 24 hours. The clearance activities will be tide and weather dependant as detonations will take place during daylight hours and slack water only. The aim is to allow clearance of at least one UXO per tide, during daylight hours only.

25. For bottlenose dolphin, white-beaked dolphin, minke whale, and harbour seal, the magnitude of impact was deemed to be low and the sensitivity of receptors to be high. As the estimated number of individuals with the potential to be injured was low, the potential effect was assessed as of minor significance, which is not significant in EIA terms (Table 1.7). For harbour porpoise and grey seal however, the magnitude of impact was deemed to be medium as the estimated number of animals with the potential to be injured was higher. Additionally, the sensitivity of receptor for harbour porpoise and grey seal was deemed to be high, resulting in a potential effect of moderate significance, which is significant in EIA terms (Table 1.7). As the predicted injury zone is too extensive to be effectively mitigated by designed in measures (marine mammal observers and PAM operators) the use of secondary mitigation in the form of ADDs and soft start charges (see paragraph 1.6.3.47), has been proposed and is detailed in this draft MMMP. Maximum injury ranges are based on the dual-metric approach, as detailed in volume 2, chapter 10.

Table 1.7: Potential Effect of UXO Clearance on Six Marine Mammal Species.

Species	Maximum Injury Range (m)	Estimated Number of Animals with the Potential to be Injured	Magnitude of Impact	Sensitivity of Receptor	Risk of Injury Reduced by Designed in Mitigation	Significance of Effect in EIA terms
Harbour porpoise	10,630	293	Medium	High	No	Moderate
Bottlenose dolphin	615	<1	Low	High	Yes	Minor
White-beaked dolphin	615	<1	Low	High	Yes	Minor
Minke whale	4,175	<1	Low	High	No	Minor
Grey seal	2,085	16	Medium	High	No	Moderate
Harbour seal	2,085	<1	Low	High	No	Minor

1.5.3. GEOPHYSICAL SURVEYS

26. Site investigation surveys during the construction and operation and maintenance phases has the potential to result in direct or indirect effects on marine mammals. The potential impact ranges predicted for injury were the same for both phases. During the construction phase, site investigation geophysical surveys will take place over a period of up to three months. Geophysical surveys are expected to be short-term (weeks to a few months) and occur intermittently over the lifespan of the Proposed Development. For example, routine geophysical surveys of wind turbine foundations are estimated to occur every six months for first two years and annually thereafter (approximately 37 surveys over the 35 year life cycle of the Proposed Development). It is assumed that approximately 10% of the inter- array cables length will require inspections each year (more if issues are found). Offshore export cables will be surveyed annually.

27. A detailed underwater noise modelling assessment was carried out to investigate the potential for auditory injury on marine mammals due to geophysical surveys (see volume 3, appendix 10.1). Several sonar-based surveys will potentially be used for the geophysical surveying; these include:

- Multibeam Echosounder (MBES);
- Single Beam Echosounder (SBES);
- Sidescan Sonar (SSS); and
- Sub-Bottom Profiler (SBP).

28. The equipment used can typically operate at a range of frequencies, depending on the distance to the seabed and the required resolution. Sonar based sources are considered continuous (non-impulsive) as they typically compromise a single frequency instead of a broadband signal with high kurtosis, high peak pressures, and rapid rise times. Unlike the sonar-based surveys, the Ultra High Resolution Seismic (UHRS) survey is likely to use a sparker, which produces an impulsive, broadband source signal.

29. The noise modelling showed that the ranges within which there is potential for marine mammals to experience PTS as a result of geophysical surveys are relatively low (Table 1.8). For harbour porpoise PTS could occur out to 360 m as a result of the SBP survey.

Table 1.8 Potential PTS Impact Ranges for Marine Mammals During the Geophysical Site Investigation Surveys

Threshold	PTS Impact Range (m)				
	Harbour Porpoise	Bottlenose Dolphin	White-beaked Dolphin	Minke Whale	Seal species
MBES					
180-240 dB re 1 µPa re 1 m (rms)	70	65	65	20	40
SSS					
190-245 dB re 1 µPa re 1 m (rms)	100	65	65	65	65
SBES					
180-400 dB re 1 µPa re 1 m (rms)	65	65	65	60	65
SBP					
200-240 dB re 1 µPa re 1 m (rms)	360	65	65	65	65
UHRS					
170-200 dB re 1 µPa re 1 m (rms)	15	N/E[1]	N/E[1]	N/E[1]	N/E[1]

[1] N/E = Threshold not exceeded

30. Due to low impact ranges for all species (Table 1.8), there is potential for less than one animal to experience PTS (and none when the threshold is not exceeded) as a result of geophysical surveys. Standard designed in measures to reduce the risk of injury will be implemented following JNCC guidance (see section 1.4., JNCC, 2017). With these measures in place, the risk is deemed to be negligible. It should also be noted that as sonar-based systems have strong directivity, there is only potential for injury when the marine mammal is directly underneath the source.

1.6. MITIGATION METHODS AND PROCEDURES

31. The mitigation measures presented in subsections below include designed in measures and, secondary mitigation in order to reduce the risk of injury to marine mammals as described in the volume 2, chapter 10.

1.6.2. PILING

32. As per the JNCC (2010a) guidance, a 30-minute pre-piling search will be undertaken using marine mammal observers and a PAM operator to monitor the specified 2,319 m mitigation zone in order to minimise the likelihood of marine mammals being present within this range. In addition to visual and acoustic monitoring, an ADD will be deployed in close proximity to the pile to be installed at the start of the pre-piling search. The ADD will be activated for a minimum period of 30 minutes to allow animals sufficient time to disperse while also minimising the additional noise produced by the device and therefore emitted into the marine environment. Visual and acoustic monitoring will continue throughout the ADD deployment to seek to ensure marine mammals leave the potential impact zone prior to the start of piling.

33. Piling commencement during periods of low visibility or darkness, where visual monitoring is not possible, will involve the PAM of the mitigation zone over the duration of the pre-piling search, which will be conducted for a minimum of 30 minutes.

34. After the 30-minute pre-piling search and ADD activation period has elapsed, the piling initiation, soft start and ramp up designed in measures will commence with hammer initiation at the lowest hammer energy and strike rate (as specified in volume 3, appendix 10.1 of the Offshore EIA Report). The ADD will be turned off immediately after the piling activity has commenced.

35. The piling soft start and ramp up designed in measures comprise of the three following activity stages:

- initiation (10 minutes);
- soft start (20 minutes); and
- ramp up (60 minutes).

36. The initiation stage is a slow start to allow for alignment and to allow marine mammals to leave the area and involves a hammer energy of 600 kJ.

37. The soft start stage is a period of low hammer energy and involves a hammer energy of 600 kJ.

38. The ramp up stage is a ramp up in hammer energy following the soft start and involves an initial hammer energy of 600 kJ which builds up to 3,000 kJ over the 60-minute period.

39. These above activities were included in subsea noise modelling (with the inclusion of an ADD for 30 minutes prior to commencement of any piling activity) in volume 3, appendix 10.1. The ADD itself was assumed to not contribute towards any injury to marine mammals.

40. If marine mammals are detected within the mitigation zone during the pre-piling search, piling will not commence until at least 20 minutes after the last visual or acoustic detection of the animal. The marine mammal observers and PAM operative will track any marine mammals detected and ensure that they have left the mitigation zone before piling commences. If a marine mammal is detected in the mitigation zone during the soft-start procedures, the piling operation should cease, whenever possible, or at least not be increased further until the marine mammal clears the mitigation zone and is not detected again for 20 minutes.

41. If for any reason there is a break in piling activity for over ten minutes, then the pre-piling search and ADD activation should be repeated before piling recommences.

42. If during piling at full power a marine mammal is detected in the mitigation zone, there will be no requirement to cease piling, as the JNCC guidance (2010a) concludes that the animal is deemed to have entered the mitigation zone voluntarily. It may also not be possible to stop piling at full power due to engineering restrictions.

43. The designed in and secondary mitigation measures detailed in this draft MMMP reduce the risk of auditory injury to a safe threshold, whereby marine mammals are not at risk of auditory injury, in terms of PTS. With mitigation in place, the potential effect of piling (auditory injury) on marine mammals is considered to be of minor significance, which is not significant in EIA terms.

1.6.3. UXO CLEARANCE

44. The primary technique implemented to reduce the risk associated with UXO clearance will be avoiding the need for the use of explosives, either by leaving the confirmed UXO *in situ* and constructing around it or by relocating it to a safe place and leaving *in situ* in the new location. However, where this is not possible, it is assumed that up to 14 UXO may require clearance. The controlled explosions of the UXOs will be undertaken by specialist contractors using the minimum size of explosive possible in order to safely dispose of the UXOs. The detonations will take place during daylight hours only and in good visibility.

45. A pre-detonation search will be carried out. This will involve marine mammal observers and PAM over a minimum 1 km mitigation zone (standard set by JNCC guidance; JNCC, 2010b) and out as far as possible over the predicted injury range. This will be undertaken for a specified duration based on the JNCC (2010b) guidance (see paragraph 47 *et seq.*). Since injury could occur beyond the 1 km standard mitigation zone (up to a maximum range of ~10.6 km (paragraph 25), an ADD will also be deployed and activated to deter animals from the potential injury zone. The ADD selected will be suitable for the target species (see McGarry *et al.*, 2020) and will be placed in the water in close proximity to the UXO. ADD activation will commence at the start of the search period for a specified period (Table 1.9). If marine mammals are observed or acoustically detected within the potential injury range, noting the limitations of visually or acoustically detecting marine mammals at large ranges, they will be tracked until they move out of range. Detonation will not occur until the animal has not been detected again for 20 minutes.

46. A range of UXO munitions sizes have been considered for the purpose of determining effective secondary mitigation measures, up to a maximum scenario of a UXO size of 300 kg. This approach follows a similar strategy as per the Seagreen EPS Risk Assessment and MMMP (Seagreen Wind Energy Ltd, 2021). The assumption is that marine mammals swim away from the ADD in a straight line at speeds agreed in consultation with NatureScot and Marine Scotland Science for the Proposed Development (see volume 3, appendix 10.3). These swim speeds are summarised in Table 1.5. The duration of the activation of the ADD prior to UXO detonation will determine whether animals can move out of the potential injury zone. The potential range of displacement based on these swimming speeds for varying UXO sizes is summarised in Table 1.9.

Table 1.9 Recommended ADD Duration for High Order UXO Clearance and Sizes and Associated Displacement Distance

		Displacement Distance (m)				
UXO size (kg)	**Minimum ADD Duration Prior to Detonation (Minutes)**	**Harbour Porpoise**	**Bottlenose Dolphin**	**White-beaked Dolphin**	**Minke Whale**	**Grey and Harbour Seals**
Up to 3	22	1,980	2,006	2,006	3,036	2,376
Up to 6.5	30	2,700	2,736	2,736	4,140	3,240
Up to 15	40	3,600	3,648	3,648	5,520	4,320

Displacement Distance (m)						
UXO size (kg)	**Minimum ADD Duration Prior to Detonation (Minutes)**	**Harbour Porpoise**	**Bottlenose Dolphin**	**White-beaked Dolphin**	**Minke Whale**	**Grey and Harbour Seals**
Up to 50	60	5,400	5,472	5,472	8,280	6,480
Up to 300	60 minutes plus soft start charges for 20 minutes	7,200	7,296	7,296	11,040	8.640
Maximum PTS range (m)		**10,630**	**615**	**615**	**4,175**	**2,085**

47. The length of the pre-detonation search will depend on the size of UXO to be cleared (Table 1.9). For all species, except harbour porpoise and minke whale, duration of ADD for 22 minutes would be sufficient to deter marine mammals from the potential injury zone. For minke whale, an ADD duration of 40 minutes will be required. To mitigate risk of injury to harbour porpoise for a UXO between 50-300 kg, the pre-detonation search will be 60 minutes and include secondary mitigation in the form of soft-start detonations, as per the JNCC (2010b) guidance. For UXO sizes between 50kg and 300kg, following the 60-minute search, the ADD will be switched off and the soft start will be undertaken using a sequence of small explosive charges detonated every five minutes over a total of 20 minutes (50 g at 20 min prior to main detonation, 100 g at 15 min, 150 g at 10 min, 200 g at 5 min), allowing time for marine mammals to move away from the mitigation zone prior to the detonation of the UXO. Based on the findings presented in the Offshore EIA Report, it is expected that 80 minutes of deterrence activities, with a combination of ADD followed by the soft start procedures, will displace harbour porpoise to a range of up to 7,200 m. This is considered sufficient to deter most animals, however, there may be a residual effect for harbour porpoise for the largest UXO size, as the maximum predicted injurious impact range for this species as 10,630 m. As described in more detail in volume 2, chapter 10, given that following secondary mitigation (ADD and scare charges) only a small proportion of harbour porpoise population could be potentially injured (PTS), the effect was predicted to be of minor adverse significance, which is not significant in EIA terms. The use of ADD and soft-start procedure as mitigation technique will be further discussed and refined post-submission as a part of EPS risk assessment (see paragraph 49). The MMMP will be updated accordingly and submitted for approval by MS-LOT.

48. Following detonation, the marine mammal observers and PAM operator will undertake a post-detonation search of the mitigation zone for at least 15 minutes after the final detonation. The purpose of this search is to look for evidence of injury to marine life, including fish kills. Any other unusual observation will also be noted.

49. Prior to the commencement of UXO clearance works, a more detailed update to this MMMP will be produced as a part of the EPS licence supporting information. Additionally, tailored secondary mitigation measures will be further developed based on further information on UXO number, sizes and depth of burial. The final secondary mitigation will be agreed with statutory stakeholders as a part of a UXO specific MMMP.

1.6.4. GEOPHYSICAL SURVEYS

50. Standard JNCC (2017) guidance will be adhered to in order to mitigate any injurious effects to marine mammals. This will involve the use of marine mammal observers and PAM within a standard 500 m mitigation zone, as well as soft-starts where the power is built up gradually from a low-energy. The duration of the soft-start will be survey-specific. As the maximum predicted ranges for PTS are lower than 500 m across all species and geophysical survey techniques (Table 1.8), the standard 500 m mitigation zone will be sufficient to mitigate against injury (in terms of PTS) for all species.

51. As the geophysical surveys will be conducted in shallower waters (<200 m) marine mammal observers and PAM will be used for a pre-shooting search of at least 30 minutes prior to commencement of geophysical surveys. The pre-shooting search is a period of visual and acoustic monitoring of the 500 m mitigation zone for the presence of marine mammals.

52. If geophysical survey activities are conducted during periods of low visibility or darkness, where visual monitoring is not possible, only the PAM operator will monitor the mitigation zone for a pre-shooting search of at least 30 minutes.

53. The JNCC (2017) guidance will be adhered to if marine mammals are detected within the mitigation zone. Firstly, if marine mammals are detected in the mitigation zone during the 30-minute pre-shooting search, the soft-start to geophysical activities must be delayed until the passage of the marine mammal(s), or transit of the vessel, results in the animals being outside of the mitigation zone. There will be a minimum 20-minute delay from the time of last detection and the commencement of the soft-start to allow marine mammals to move out of the mitigation zone. Secondly, if seal(s) are congregating around a fixed platform within the survey area, the soft start should commence at least 500 m from the platform. If marine mammals are detected within the mitigation zone whilst the airguns are firing (whether during the soft start or when at full power), there is no requirement to stop firing.

54. Overall, the implementation of designed in and secondary mitigation measures detailed above ensure the potential risk of injury from geophysical surveys is minimised.

55. If multi-beam surveys (such as MBES) are conducted in shallow waters (<200 m), the secondary mitigation (in form of pre-shooting search and soft-starts) will not be required (based on the JNCC guidance; JNCC, 2017).

1.7. ROLES AND RESPONSIBILITES

56. As per the JNCC guidance (2010a, 2010b, 2017), persons involved in implementing, and ensuring compliance with this MMMP include:

- the Applicant's Environmental Manager;
- independent Environmental Clerk of Work (ECoW)
- marine mammal observers;
- PAM Operator;
- ADD Operator; and
- piling, Explosive Ordinance Disposal (EOD) or geophysical survey supervisor.

57. They will be equipped with the appropriate means of communication between each other in order to ensure that the correct mitigation protocols are undertaken and to allow timely communication if a marine mammal is detected.

1.7.2. THE APPLICANT'S ENVIRONMENTAL MANAGER

58. The Applicant's Manager is responsible for ensuring all compliance documents, such as the MMMP, are included in construction contract documents. They will report marine mammal monitoring and activities related to piling, UXO clearance, and geophysical surveying.

1.7.3. INDEPENDENT ENVIRONMENTAL CLERK OF WORK

59. The independent ECoW will be responsible for completing inductions and toolbox talks to onsite construction teams (including piling and UXO detonation) on requirements of the MMMP and monitoring that all piling and UXO detonation activities are being completed in accordance with the MMMP, other related consent management plans and all relevant regulations and legislation. The independent ECoW is also responsible for stopping operations e.g. piling in the event of a non-compliance with the MMMP and/or consent conditions and reporting all non-compliances to MS-LOT.

1.7.4. MARINE MAMMAL OBSERVERS

60. There will be two dedicated marine mammal observers responsible for monitoring the mitigation zones and conducting searches prior to piling, UXO detonation and/or soft start procedures, and geophysical surveys. They will report to the ECoW and will be responsible for conducting the 15-minute post-detonation search as part of the UXO clearance protocol. They will be appropriately trained: have completed the JNCC registered marine mammal observer course and have sufficient field experience (at least one year of marine mammal observers experience on offshore projects).

61. They will be positioned on a suitable platform on a vessel that allows full 360o coverage of the mitigation zone and an observer eye height of at least 5 m. They will be equipped with appropriate visual aids (such as reticule binoculars) and will be capable of determining the extent of the various mitigation zones depending on the survey. They will be responsible for recording any marine mammal observations using Marine Mammal Reporting Forms provided by JNCC.

1.7.5. PAM OPERATOR

62. There will be one dedicated PAM Operator who will be responsible for acoustically tracking vocalising marine mammals using a hydrophone, via the computer software PAMGuard. They will report to the ECoW and will also be responsible for deploying and maintaining the hydrophone and any spares. They will be appropriately trained and have sufficient field experience (at least one year of PAM experience on offshore projects).

63. They will operate from the same vessel as the marine mammal observers and will collaborate with the marine mammal observers to compile all the data on mitigation activities and observations. They will also be responsible for using PAMGuard to confirm that the ADD is functioning correctly and communicating with the ADD operator if it is not.

1.7.6. ADD OPERATOR

64. There will be one ADD Operator responsible for deploying, maintaining, and operating the ADDs and any spares, with the requirements outlined in this MMMP. They will report to the ECoW and will be required to communicate clearly with marine mammal observers, PAM Operator and, in the case of UXO disposal, the EOD Supervisor, to confirm commencement and cessation of ADD usage. They will also be required to communicate with the PAM Operator to check that ADDs are functioning correctly.

65. The ADD Operator will also be responsible for providing final report(s) on ADD usage during the UXO clearance excursions.

1.7.7. EOD SUPERVISOR

66. An EOD Supervisor will be required during UXO clearance activities to ensure that the requirements of the MMMP are met. They will report to the ECoW and will be responsible for decisions involving initiating, delaying or pausing detonation and ensuring that no UXO detonation occurs without their explicit consent. They must ensure clear lines of communication between the ECoW, marine mammal observers, PAM Operator, ADD Operator and EOD contractors.

1.8. REPORTING

67. The ECoW will be responsible for monitoring piling, UXO clearance and geophysical surveys and implementation of the MMMP and will keep a detailed record of operations, mitigation procedures and any marine mammal sightings. These records will be prepared and submitted in compliance with consent and/or license conditions to MS-LOT and will include completing and submitting Marine Mammal Recording Forms provided by the JNCC (annex A).

1.8.2. PILING

68. Reporting will include a record of the following:

- date and location of piling operations;
- a record of all occasions when piling occurred, including details of the duration of the pre-piling search and soft-start procedures, and any occasions when piling activity was stopped or delayed due to the presence of marine mammals;
- presence, location, and activity of vessels during piling procedures;
- the mitigation procedures followed for each piling event, including details of marine mammal observer activities, PAM operation, ADD duration and size and timing of soft-start charges where required;
- details of PAM equipment and ADDs used and any relevant observations on their efficacy;
- all marine mammal sightings and mitigation taken and completed JNCC marine mammal recording forms;
- detailed descriptions of any technical problems encountered and what, if any, actions were taken;
- any problems encountered and instances of non-compliances with the JNCC guidelines (2010a), MMMP, and variations from agreed procedures; and
- protocols followed and put forward any recommendations based on the project and any marine mammal sightings/behaviour encountered during the piling operations which could benefit future projects.

1.8.3. UXO CLEARANCE

69. Reporting will include a record of the following:

- identification of all confirmed UXO, including estimated size, type, location and depth;
- approach taken for each UXO, including dates, times, disposal method attempted (based on size and type, and number of donor charge(s) used);
- details of any UXOs relocated or if any UXOs larger than 300 kg are identified;
- presence, location, and activity of vessels during UXO clearance;
- outcome of each UXO clearance, including evidence of high-order detonation, clearing charges required, and method of debris and residue recovery;
- the mitigation procedures followed for each UXO clearance, including details of marine mammals observers activities, PAM operation, ADD duration and size and timing of soft-start charges where required;
- details of PAM equipment and ADDs used and any relevant observations on their efficacy;
- all marine mammal sightings and mitigation taken and completed JNCC marine mammal recording forms;
- detailed descriptions of any technical problems encountered and what, if any, actions were taken;
- any problems encountered and instances of non-compliance with the JNCC guidelines (2010b), MMMP, and variations from agreed procedures; and

- protocols followed and put forward any recommendations based on the project and any marine mammal sightings/behaviour encountered during the UXO operations which could benefit future projects.

1.8.4. GEOPHYSICAL SURVEYING

70. Reporting will include a record of the following:

- approach taken for each geophysical survey, including dates, times, survey type, equipment used, and coordinates and transects of surveys;
- presence, location, and activity of vessels during geophysical surveying;
- a summary of the marine mammal observers and PAM activities, including specifics of the conducted surveys and any relevant observations on the efficacy of PAM equipment;
- all marine mammal sightings and mitigation taken and completed JNCC marine mammal recording forms;
- detailed descriptions of any technical problems encountered and what, if any, actions were taken;
- any problems encountered and instances of non-compliances with the JNCC guidelines (2017), MMMP, and variations from agreed procedures; and
- protocols followed and put forward any recommendations based on the project and any marine mammal sightings/behaviour encountered during the geophysical surveying operations which could benefit future projects.

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ANNEX A: MARINE MAMMAL RECORDING FORMS

Marine Mammal Recording Forms - General Guidance

Please read the Guide to Using Marine Mammal Recording Forms prior to use - this is available to download from this link: https://data.jncc.gov.uk/data/e2a46de5-43d4-43f0-b296-c62134397ce4/Marine-mammal-recordingforms-guide-rev05.pdf

The Marine Mammal Recording Forms were designed under a project funded by the International Association of Oil and Gas Producers (OGP) Joint Industry Programme (JIP) on Sound and Marine Life. The forms are aimed primarily at seismic surveys, but could also be used for other operations. They are intended for use globally wherever regulators accept their use therefore contain information relevant to several jurisdictions – not all fields will require to be filled in for all jurisdictions (e.g. *Time of reduced output* and *Length of power-down and/or shut-down* are not required for UK waters).

To facilitate importation of these forms into a database, please observe the following:

- Do not change the validation settings
- Do not leave blank lines between records
- Do not add extra columns
- Do not change columns
- Do not delete columns
- Do not change the order of columns
- Do not use formulae
- Do not use N/A where data are not available, just leave the cell blank
- Do not submit as a pdf

Please note that new entries should be made on the Effort form each time source activity or weather conditions change, and at least once an hour as a minimum.

General hints:

Date should be entered as dd/mm/yyyy or dd/mm/yy

Times should be entered in UTC, using the format hh:mm

To copy a record between rows (e.g. for regulatory reference number) use Ctrl + D or click on the lower right corner and drag (selecting Copy Cells in the Auto Fill Options).

To facilitate analysis, if a field is not applicable or data is not available, leave the cell blank (do not use N/A or any equivalent entry).

To facilitate analysis, do not start a new line at midnight on the Operations form, but do start a new line at midnight (00:00 UTC) on the Effort form

PAM records:

Where there are both marine mammal observers and PAM operators on a vessel, they should take care not to duplicate data. For example, there should be only one Cover Page and one set of Operations data. Marine mammal observers and PAM operators should each record their own Effort data and Sightings/acoustic detections - these can be included in the same Excel workbook, or separate workbooks if this is easier (although both should ideally be submitted within one report for the survey). Records of animals detected both visually and acoustically should not be duplicated on the Sighting form.

Detailed guidance:

For some fields, input messages containing guidance on what to enter pop up as a yellow box when you click on a cell in that field. For more detailed information please consult the *Guide to Using Marine Mammal Recording Forms* that can be downloaded at the link above.

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