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MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Annex 3.2 to the Applicant's response to Relevant Representations from Marine Management Organisation (RR-020): Underwater Sound

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Prepared by:

RPS

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Morgan Offshore Wind Limited

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Glossary

Term	Meaning
Applicant	Morgan Offshore Wind Limited.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP).
Morgan Array Area	The area within which the wind turbines, foundations, inter-array cables, interconnector cables, scour protection, cable protection and offshore substation platforms (OSPs) forming part of the Morgan Offshore Wind Project: Generation Assets will be located.
Morgan Offshore Wind Project: Generation Assets	This is the name given to the Morgan Generation Assets project as a whole (includes all infrastructure and activities associated with the project construction, operations and maintenance, and decommissioning).
The Planning Inspectorate	The agency responsible for operating the planning process for applications for development consent under the Planning Act 2008.

Acronyms

Acronym	Description
iPCoD	Interim Population Consequences of Disturbance Model
MMOb	Marine Mammal Observers
MMO	Marine Management Organisation
PAM	Passive Acoustic Monitoring
PTS	Permanent Threshold Shift
SEL	Sound Exposure Level
TTS	Temporary Threshold Shift

1 APPLICANT'S RESPONSE TO RELEVANT REPRESENTATIONS FROM MARINE MANAGEMENT ORGANISATION: : UNDERWATER SOUND

1.1 Introduction

1.1.1.1 This document has been prepared in response to points RR-020.80 to RR-020.84, of the Marine Management Organisation's (MMO) relevant representation, which states:

"4.9.5 The MMO agrees with the conclusions from paragraph 1.7.4.12, in relation to concurrent piling, in that minimum separation between two piling sources will likely result in higher noise levels around these piling locations, while maximising the source separation will reduce the overlap of the impacted areas around these two locations. However, the relevant measure of the potential impacts is the total impacted area around both piling locations, and the interplay of these two antagonistic effects is complex. This makes it difficult to establish a priori which source separation distance maximises this total impacted area. More comments are provided in 4.9.6 – 4.9.8.

4.9.6 The MMO considers that as relevant noise levels are relatively low and consequently the impacted areas are large, the area overlap can be the dominant factor. Therefore, maximum separation often results in the largest total impacted area. In the case of the injury effects, it is less clear by how much the effect range will increase when having the two sources in close proximity, and whether the corresponding injury area is greater than the sum of the individual injury areas when assuming a large source separation.

4.9.7 The MMO compared the SELcum results for marine mammals and the concurrent pin pile installation at 3,000 kJ (Table 1.41) against corresponding results for the single pin pile installation (Table 1.35). The MMO observes that the area for the concurrent piles scenario is slightly less than twice the area for a single pile scenario. This suggests a scenario with maximum separation between sources may result in a larger permanent threshold shift (PTS) total area. The MMO is therefore of the opinion that the worst case could potentially be a one of the 'intermediate' separation of sources when there could be a significant summation of the noise levels from the two sources but without a large overlap of their effected areas.

4.9.8 The point made in 4.9.7 is evidenced to a greater extent in the case of SELcum Temporary Threshold Shift (TTS) impacts. The low frequency cetaceans (LF) predicted impact range for the concurrent piling scenario (Table 1.41) is only slightly larger than the corresponding range for a single pile (Table 1.35) (40.1km versus 37.7km, or about 5% increase) which means that the total TTS impact area from two piles at maximum separation will likely exceed the TTS area of the concurrent scenario that was assumed to be the worst case.

4.9.9 The MMO cautions against the assumption that the limited selection of concurrent scenarios (two scenarios representing minimum and maximum piling location separation) considered within the Underwater Sound Technical Report (Volume 3, annex 3.1) would capture the worst-case scenario in a defined manner. Additionally, the MMO considers that if only two scenarios are considered, then it is recommended that a full investigation of all potential impacts is conducted and then the worst case is decided and reported accordingly."

1.2 Response

1.2.1.1 The Applicant notes and welcomes that the MMO agrees with the Applicant's conclusions in relation to concurrent piling, in that minimum separation between two piling sources will likely result in higher noise levels around these piling locations, while maximising the source separation will reduce the overlap of the impacted areas around these two locations. The maximum design scenario was developed on a species-by-species basis to determine which two concurrent locations could lead to the greatest potential effect. In the first instance, modelling locations were selected as those in proximity to important areas (i.e. Special Areas of Conservation, seal-haul outs) or in proximity to areas that supported high densities of marine mammals. From the locations modelled and the areas of effect were taken forward for analyses to determine the total number of animals affected and the scenario which led to the largest number of animals disturbed was subsequently presented in the marine mammal assessment (Chapter 4: Marine mammals (AS-010)). In this way, the Applicant is confident that the worst-case scenario has been investigated and presented.

1.2.1.2 The minimum and maximum separation distances set out in Table 4.17 of Volume 2, Chapter 4: Marine mammals (AS-010) are considered to bound the potential range of impacts. The assessment for concurrent piling was undertaken using the case that would result in the highest injury range. This is because the injury range is considered to be the most relevant parameter used to inform the mitigation required to reduce the risk of injury to negligible. The modelled injury range when combined with species specific swim speeds, determines the length of time required to ensure all individuals have exited the identified mitigation zone. This enables the tailoring of the pre-piling mitigation to the level of risk. Consequently, the scenario that resulted in the highest injury range would also define the most onerous mitigation requirements, and for this reason is considered to be the worst-case scenario. It is important to note that regardless of whether single piling or concurrent piling is undertaken, mitigation measures identified in the Outline MMMP (APP-072)) will be applied to all piling scenarios, as agreed post-consent in the final MMMP (as secured under Schedule 3 and 4, Condition 20(1)(h) within the Draft DCO (Draft Development Consent Order AS-003).

1.2.1.3 Standard mitigation measures include the pre-piling marine mammal searches (marine mammal observers (MMOb) and passive acoustic monitoring (PAM)) together with the soft start/ramp up embedded mitigation. Where required, tertiary mitigation can be used in the form of active deterrence (acoustic deterrence devices) which further deters individuals from the identified mitigation zone. The assessment set out in Volume 2, Chapter 4: Marine mammals (AS-010) of the Application for concurrent piling considers the residual risk to marine mammals following application of mitigation measures.

1.2.1.4 The injury range is not necessarily directly related to the area over which injury may occur for concurrent piling operations. Because the exposure calculations make the assumption that an animal swims directly away from the nearest pile (or perpendicularly away from both piles if in between them) this means that theoretical case in which the injury range is the highest is where both piles are concurrently piled immediately next to each other. Therefore, the minimum separation case represents the maximum PTS injury range case.

1.2.1.5 Figure 1.1 shows four cases (labelled A to D) with different separation distances. The shaded areas represent the extent of the area in which injury could occur, whereas the

red arrowed lines represent the maximum radius over which injury could occur. The cases shown are as follows:

- Case A shows a separation distance so large that the two zones in which PTS could occur do not overlap or significantly influence one another. Because the separation distance between the two piles is highest in this scenario (compared to scenarios B, C and D) and there is no area of overlap between the individual sound fields within which PTS may occur, this means that the overall sound levels are lower than those where an area of overlap occurs. This scenario represents a larger area at the lower sound levels but a smaller area encompassing higher sound levels. Case A results in the smallest injury radius compared to cases B to D.
- Case B shows a separation distance such that the two zones in which PTS could occur start to influence each other causing them to overlap and extending the area further than would have been experienced. The dotted white line shows the extent that the zone of PTS would have been, had the two areas not interacted to increase the zone over which injury could occur (i.e. the same size as the zones in Case A).
- Case C shows a closer separation distance where the two zones in which injury occur overlap significantly. Case C results in the largest injury radius (except for hypothetical Case D which is not practicable) and was therefore the scenario modelled in the assessment.
- Case D shows the theoretical case where the two piles are concurrently installed immediately next to each other. This case has the highest injury range of all the scenarios presented, although it is not a practical or likely scenario since it would require two rigs in the same location. Since the two piles are closest together for case D, this means that the highest sound levels are encountered only for this case (as opposed to cases A to C). Case D results in the largest injury range but was not included in the noise modelling assessment since it would not be possible to install two piles concurrently at the same location.

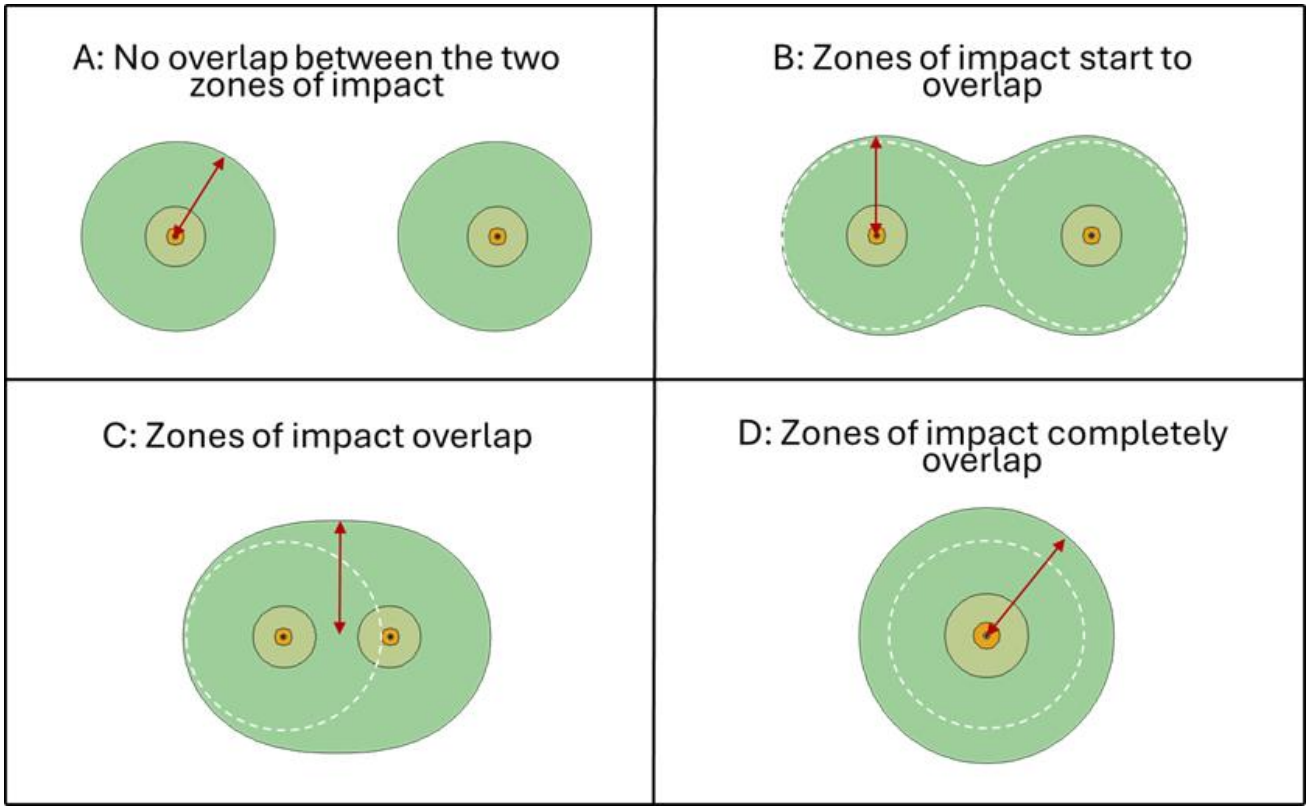

Figure 1.1: Illustrative figure showing how the shape and size of zones within which injury could occur depend on the separation distance between concurrent piles

1.2.1.6 The above illustrative examples show that determining the worst-case scenario in terms of area exceeding a threshold value for concurrent piling depends on not just the separation distance between the piles, but also depends on the threshold itself. Indeed, all four of the hypothetical cases (A to D) could be considered worse case depending on various factors. The “worst-case" scenario in terms of exceedance of a threshold will therefore be different for each effect (e.g. PTS or TTS) and different for each hearing group (because each hearing group has a different set of thresholds and hearing weightings). In addition, the calculation is made significantly more complex in the cumulative SEL calculation since this calculation includes contributions from higher sound levels when closer to the piles (at the start of piling) and lower sound levels when the animal has swum away from the piles. Comprehensively pinpointing every worst-case scenario in terms of area encompassed (as opposed to maximum radius of effect) is therefore considered to be impractical.

1.2.1.7 Conversely, the piling scenario which results in the highest injury range can be readily identified and is consistent across all scenarios assessed. As stated in paragraph 1.2.1.2, the modelled PTS ranges were used to determine the residual risk of PTS to animals once standard mitigation measures have been applied (again, based on species-specific swim speeds). The number of animals predicted to experience PTS is calculated based on the associated residual area of impact, and species-specific densities, which is carried forward to population modelling (Interim Population Consequences of Disturbance Model (iPCoD) (alongside disturbance) to understand the implications at a population level. As outlined in the Draft Development Consent Order (AS-003) no piling activities or detonation of UXO will take place until the MMO has approved the Final Underwater Sound Management Strategy.

1.2.1.8 Volume 2, Chapter 4: Marine mammals (AS-010) of the Application identified that the only species for which the risk of PTS could not be mitigated with the application of primary and tertiary mitigation (namely, MMObs, PAM and Acoustic Deterrent Devices

(30 minutes application)) was minke whale (as a low frequency cetacean). Paragraph 4.9.2.43 of Volume 2, Chapter 4: Marine mammals (AS-010) of the Application identified that there was a residual risk of injury to less than one minke whale. This was identified based on the concurrent piling scenario which presented the maximum range of PTS impact, rather than the concurrent piling scenario which resulted in the greatest area of impact. As above (paragraph 1.2.1.7), this approach is taken in order to determine mitigation requirements. This range is then used to calculate the associated area of impact, in combination with species-specific density estimates (0.00173 animals per km^2 for minke whale[1]).

1.2.1.9 The Applicant acknowledges that the actual area of residual impact is influenced by the separation distance between two concurrent piles, as well as the PTS range. Figure 1.1 demonstrates that if the zones of impact do not overlap, there is essentially a doubling of area when this is considered alongside the PTS range for a single piling activity. However, the Applicant highlights that if the residual area calculation was based on twice the area for a single pile scenario, as set out in Volume 2, Chapter 4: Marine mammals (AS-010) of the Development Consent Order Application), rather than the greatest identified range of impact as modelled for the concurrent piling the residual number of minke whale with the potential to be affected by PTS, would still be less than one: the calculation of the residual number of minke whale likely to be impacted from concurrent piling (as presented in Volume 2, Chapter 4: Marine mammals (AS-010)), was based on a residual range of 0.310 km (see Table 4.26 of Volume 2, Chapter 4: Marine mammals (AS-010)) and a density estimate of 0.00173 animals per km^2 resulting in less than one minke whale. If the residual number of minke whale were based on twice the residual area for the single pile scenario (residual range = 1.585 km) this would also result in less than one animal predicted to be impacted, again. As such, had alternative scenarios (see Figure 1.1) also been modelled, the maximum residual number of animals would remain less than one. Therefore if this approach had been applied in Volume 2, Chapter 4: Marine mammals (AS-010) of the Application the outcome of the assessment would not differ from that presented. Subsequently, given no change in the number of animals predicted to be impacted, the outcome of the iPCoD modelling would not differ from that presented, which demonstrated that there would be no long-term effect on the minke whale population (paragraph 4.9.2.46 of Volume 2, Chapter 4: Marine mammals (AS-010) of the Development Consent Order Application).

1.2.1.10 As stated in paragraph 4.9.2.34 of Volume 2, Chapter 4: Marine mammals (AS-010) of the Application, for all species except minke whale, use of an ADD for 30 minutes prior to commencement of piling of pin piles reduces the likelihood of PTS occurring as sound levels are predicted not to be greater than the relevant threshold values, during single, concurrent and consecutive piling for all species. As such, the discussion presented above is not relevant for harbour porpoise, bottlenose dolphin, short-beaked common dolphin, Risso's dolphin, grey seal or harbour seal.

1.2.1.11 As stated in paragraph 4.9.1.5 of Volume 2, Chapter 4: Marine mammals (AS-010), TTS is not considered a useful predictor of the potential effects of underwater sound on marine mammals where ranges exceed more than approximately 10 km and therefore, TTS was not included in the assessment of significance for injury for piling, as agreed through the Evidence Plan Process for marine mammals.

[1] The Applicant clarifies that, in line with the standard approach, this residual area of impact is calculated based on applying a simple πr^2 (pi x radius squared) calculation to the aforementioned residual PTS range (in the absence of an alternative agreed approach).

1.2.1.12 In conclusion the Applicant considers that the approach taken in the assessment has captured the worst-case scenario. The assessment for concurrent piling focused on the scenario with the highest injury range, as this represents the worst-case scenario for determining the necessary mitigation measures. The injury range is crucial because it helps establish the time needed for all individuals to leave the mitigation zone, based on their species-specific swim speeds. This allows for mitigation efforts to be tailored to the level of risk. Therefore, the scenario with the highest injury range requires the most stringent mitigation, making it the worst-case scenario.