Liverpool Bay CCS Ltd

HYNET CARBON DIOXIDE TRANSPORTATION AND STORAGE PROJECT - OFFSHORE

Technical Note: Marine Biodiversity – Marine Mammals and Marine Turtles MBTN03

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Glossary

Term	Meaning
Cumulative effect assessment	Assessment of the likely effects arising from the offshore components of the HyNet CO_2 Transportation and Storage System ('Proposed Development') alongside the likely effects of other development activities in the vicinity of the Proposed Development.
Effect	The consequence of an impact
Environmental Impact Assessment	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Impact Assessment (EIA) Report.
Impact	A change that is caused by an action
Magnitude	Size, extent, and duration of an impact.
Maximum Design Scenario	The maximum design parameters of each Proposed Development asset (both on and offshore) considered to be a worst case for any given assessment but within the range of the Project Description Envelope.
Mitigation Measure	Measure which would avoid, reduce, or remediate an impact
Project	The HyNet Carbon Dioxide Transportation and Storage Project.
Proposed Development	The offshore components of the Project which are subject of this Environmental Statement, as described in Chapter 3: Proposed Development Description.
Residual Impact	Residual impacts are the final impacts that occur after the proposed mitigation measures have been put into place, as planned.
The Applicant	This is Liverpool Bay CCS Ltd.

Acronyms and Initialisations

Acronym / Initialisation	Description
ADD	Acoustic Deterrent Device
BP	British Petroleum
CBRA	Cable Burial Risk Assessment
CEA	Cumulative Effects Assessment
CMS	Construction Methods Statement
CSIP	Cable Specification and Installation Plan
CTV	Crew Transfer Vessel
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EnBW	Energie Baden-Württemberg
ES	Environmental Statement
HF	High Frequency
IEF	Important Ecological Feature
INNS	Invasive Non-Native Species
IWC	International Whaling Commission
JNCC	Joint Nature Conservation Committee
LF	Low Frequency
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multi Beam Echosounder
MDS	Maximum Design Scenario
MMO	Marine Management Organisation
MMOb	Marine Mammal Observer
MMMP	Marine Mammal Mitigation Protocol
MMMU	Marine Mammal Management Unit
MPCP	Marine Pollution Contingency Plan
MWDW	Manx Whale and Dolphin Watch
MWT	Manx Wildlife Trust
NGO	Non-Government Organisation
NRW	Natural Resources Wales
NW	Northwest
OSPAR	Oslo Paris Convention
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PCW	Phocid Carnivores in Water
PTS	Permanent Threshold Shift
RIAA	Report to Inform Appropriate Assessment
RMS	root mean squared
SBP	Sub Bottom Profiler
SCANS	Small Cetaceans in the European Atlantic and North Sea
SCOS	Special Committee on Seals
SEL_{cum}	Cumulative Sound Exposure Level
SEL_{ss}	Single strike Sound Exposure Level

Acronym / Initialisation	Description
SNCB	Statutory Nature Conservation Body
SNH	Scottish Natural Heritage
SPL_{pk}	Peak Sound Pressure Level
SPL_{rms}	Sound Pressure Level (rms)
SW	Southwest
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shift
UXO	Unexploded Ordnance
VHF	Very High Frequency
VSP	Vertical Seismic Profiler

Units

Acronym	Description
%	Percent
A	Ampere
dB	Decibel
kJ	Kilo Joule
km	Kilometre
km^2	Kilometres squared
kV	Kilo Volt
knot	Nautical miles per minute
m	Metre (distance)
m/s	Metres per second (speed)
mm	Millimetre
nm	Nautical mile
µPa	Micro Pascal (10^{-6})
µT	Micro Tesla

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1 MARINE BIODIVERSITY: MARINE MAMMALS AND MARINE TURTLES

1.1 Introduction

This Technical Note provides further information, detail, and assessment to the information presented in Volume 2, Chapter 7 of the Environmental Statement (ES) (Marine Biodiversity) and should be read alongside it. This Technical Note focusses solely on the Marine Mammals and Marine Turtles element of Volume 2, Chapter 7: Marine Biodiversity chapter of the ES. Additional Technical Notes have been produced for Benthic Subtidal and Intertidal Ecology, Fish and Shellfish Ecology, and the Report to Inform Appropriate Assessment (RIAA).

1.2 Consultation

Relevant post-application consultation was received on the 13th May 2024 from Natural England and on the 14th May 2024 from Natural Resources Wales (NRW). This has been summarised in Table 1.1.

Table 1.1: Relevant Post-Application Consultation for Marine Mammals and Marine Turtles

Consultee	Consultation	Where and How Addressed
Natural England	Consideration should be given to the inclusion of Non-Government Organisation (NGO)/citizen observer data in the region. This would be particularly relevant for the more coastal areas, as these can provide local sightings information.	See section 1.3.1, NGO and Citizen Observer Data within the Region – additional NGO and citizen observer data within the region has been presented.
Natural England	Natural England advises inclusion of the Marine Mammal Atlas (Evans & Waggitt, 2023) and SCANS-IV data (Gilles *et al.,* 2023). Marine mammal densities should take account of the more recent data in the Marine Mammal Atlas (Evans and Waggitt, 2023). Update the densities in Table 7.17 [of the Environmental Statement (ES)], where relevant, using the newest reference (Evans and Waggitt, 2023).	See section 1.3.12, Updated Marine Mammal Densities - updated cetacean densities have been presented, which includes data from Evans and Waggitt, 2023 and Gilles *et al.,* 2023.
NRW	NRW (A) acknowledge the inclusion of the Marine Mammal Atlas (Evans and Waggitt, 2023) and Small Cetaceans in the European Atlantic and North Sea (SCANS) IV data in the list of desktop literature. However, we consider that the proposal to use a harbour porpoise *Phocoena phocoena,* density of 0.086 animals per km^2 to be both considerably lower and less robust than the more up to date densities supplied from the latest edition of the Marine Mammal Atlas (Evans and Waggitt, 2023), which are based on 30 years of sightings data as opposed to snapshot surveys. In line with NRW (A) recommendation for previous projects, either the most precautionary or the most scientifically robust values should be taken forward to the assessment. For harbour porpoise we recommend the use of densities taken from the Marine Mammal Atlas (Evans and Waggitt, 2023) given their greater robustness, and subsequent results revised. For bottlenose dolphin *Tursiops truncatus*, it is unclear whether dual densities will be used. This should be clarified, and biologically relevant justification provided. The Welsh Marine Mammal atlas (Evans & Waggitt, 2023) and SCANS IV have not been included in this table [Desktop datasets, Table 7.14, Volume 2, Chapter 7: Marine Biodiversity of the ES], although they were included in Volume 3, Appendix I. NRW (A) advise that the applicant should make the necessary edits	See section 1.3.12, Updated Marine Mammal Densities - updated cetacean densities have been presented, which includes data from Evans and Waggitt, 2023 and Gilles *et al.,* 2023. Dual densities have been presented where relevant, but the final assessment of significance is driven by the upper density estimate. As these data sources (Evans and Waggitt, 2023; Gilles *et al.,* 2023) are included in Volume 3, Appendix I Marine Biodiversity Technical Report to support baseline characterisation, and there is no material effect on the impact assessment (Volume 2, Chapter 7: Marine Biodiversity of the ES), no change is proposed.
Natural England and NRW	Natural England advise that bubble curtains are included in the list of possible mitigation measures and considered in the Marine Mammal Mitigation Protocol (MMMP). Other mitigation measures such as piling methods and timing of piling should also be considered. If Unexploded Ordnance (UXO) clearance needs to be done through high order methods,	See section 1.3.2 - Updated Mitigation Measures – updates to the embedded mitigation/tertiary mitigation measures have been presented, which includes measures related to piling and UXO clearance activities.

Consultee	Consultation	Where and How Addressed
	then a bubble curtain must be used. Include bubble curtains in the list of possible tertiary mitigation measures as well as other piling methods and timing of piling.	
Natural England and NRW	Natural England and NRW do not support the use of soft start charges/ donor charges for UXO clearance (considering the substantial additional impulsive noise they introduce into the environment (Robinson *et al.,* 2022). Natural England advise that the use of scare charges is removed from the planned mitigation.	Natural England's position is acknowledged. The application of soft start charges (scare charges) will be discussed and agreed with consultees post-consent once more information on the size and type of UXOs are known. A more detailed assessment of mitigation will be undertaken post-consent as further information becomes available, to inform the Final MMMP, which will be developed in line with latest guidance.
Natural England and NRW	Natural England and NRW both highlight the UXO clearance joint interim position statement (UK Government *et al.,* 2022) and advise that in accordance with this position statement, low order clearance of UXO should be prioritised and any wording should be reflected in the applicant's documents, to strengthen the commitment to use a "low order first" approach.	The Maximum Design Scenario (MDS) for the impact of "Injury and disturbance from underwater noise generated from UXO detonation" within Volume 2, Chapter 7: Marine Biodiversity of the ES states the intention for low order clearance of all UXO but highlights the potential for unintended consequences associated with low order clearance resulting in the need for high order detonation. The commitment to use a "low order first" approach is clearly stated, and therefore no change is proposed.
NRW	We recommend that a likely range of UXO sizes are presented, and clearance methods, each with their specific injury range. The ADD duration should then be calculated based on the time it would take an animal to flee that injury range, using standard speeds. Therefore, the ADD duration in each case will be proportionate to the size of the UXO and method of clearance. This should take into account the use of a bubble curtain.	The MDS for the impact of "Injury and disturbance from underwater noise generated from UXO detonation" within Volume 2, Chapter 7: Marine Biodiversity assumes clearance of a maximum UXO size of 907 kg by either low order or high order techniques. However, it is also assumed that clearance of 130 kg UXOs is considered more likely, as presented in Volume 2, Chapter 7: Marine Biodiversity. Modelled ranges for both the maximum and most likely UXO sizes are presented, and associated assessments have been undertaken. A more detailed assessment of mitigation will be undertaken post-consent as further information becomes available, to inform the Final MMMP, which will be developed in line with latest guidance. This will include more detailed information on any requirement for (and specifications of) the use of Acoustic Deterrent Devices (ADDs). As such, no change is proposed.
NRW	The magnitude of PTS resulting from a high order detonation (UXO clearance) has been concluded as negligible for all Important Ecological Features (IEFs) except for harbour porpoise. We believe this score is too low and advise a more precautionary approach is taken for this impact pathway by revising magnitude scores for UXO injury. This should also be applied to the cumulative assessment stage. The magnitude of disturbance resulting from high order detonation (UXO clearance) has been concluded as negligible for all IEFs. We believe this score is too low and advise a more precautionary approach is taken for this impact pathway by revising magnitude scores for UXO disturbance. We	See section 1.3.9, Permanent Threshold Shift (PTS) and Behavioural Disturbance resulting from a High Order Detonation (UXO Clearance) – an update to the assessments has been presented. See section 1.3.12, Updated Marine Mammal Densities - updated cetacean densities have been presented, which includes data from Evans and Waggitt, 2023 and Gilles *et al.,* 2023. Dual densities have been presented where relevant, but the final assessment of significance is driven by the upper density estimate. Given that the harbour porpoise densities presented in Volume 2, Chapter 7: Marine Biodiversity of the ES already represent the most conservative estimate of density, and therefore the most conservative estimate

Consultee	Consultation	Where and How Addressed
	advise that this should also be applied to the cumulative assessment stage. NRW (A) do not agree with the approach taken to determine harbour porpoise baseline densities and recommend that the number of animals disturbed should be revised.	of disturbance, no change to the number of animals disturbed has been proposed.
Natural England	The ADD duration for the UXO clearance should be revised; 30 minutes is not considered sufficient, given the maximum injury range is ~16 km. We recommend that a likely range of UXO sizes are presented, and clearance methods, each with their specific injury range. The ADD duration should then be calculated based on the time it would take an animal to flee that injury range, using standard speeds (3.25 m/s for minke whale *Balaenoptera acutorostrata,* 1.5 m/s for other species).	The MDS for the impact of "Injury and disturbance from underwater noise generated from UXO detonation" within Volume 2, Chapter 7: Marine Biodiversity assumes clearance of a maximum UXO size of 907 kg by either low order or high order techniques. However, it is also assumed that clearance of 130 kg UXOs is considered more likely, as presented in Volume 2, Chapter 7: Marine Biodiversity. Modelled ranges for both the maximum and most likely UXO sizes are presented, and associated assessments have been undertaken. Natural England's position is noted. A more detailed assessment of mitigation will be undertaken post-consent as further information becomes available, to inform the Final MMMP, which will be developed in line with latest guidance. This will include more detailed information on any requirement for (and specifications of) the use of Acoustic Deterrent Devices (ADDs). As such, no change is proposed.
NRW	NRW (A) advise that the specified ideal size of deterrent zone of "~16 km" would be excessively large given recent evidence which indicates that use of ADDs employed as mitigation against auditory injury from piling can evoke very strong reactions in harbour porpoise up to several km away (Elmegaard et al 2023). We therefore recommend against the use of ADD source levels that are considerably higher than necessary.	NRW's position is noted. A more detailed assessment of mitigation will be undertaken post-consent as further information becomes available, to inform the Final MMMP, which will be developed in line with latest guidance. This will include more detailed information on any requirement for (and specifications of) the use of Acoustic Deterrent Devices (ADDs). As such, no change is proposed.
Natural England	Natural England do not agree that 30 minutes of ADD usage should be included in the underwater noise modelling to predict impact ranges for the assessment. The 30 minutes ADD inclusion obscures the true worst-case scenario that the assessment must be based on. The predicted impact ranges for Permanent Threshold Shift (PTS) without ADDs should be used to determine the appropriate duration of ADD, with the purpose to deter marine mammals from the full extent of the PTS zone (accounting for species-specific fleeing speeds), as well as informing the requirement for other suitable mitigation measures. Final ADD duration will be determined post consent, and therefore Natural England do not agree to including 30 minutes ADD duration at this stage. This should also be applied to the cumulative assessment stage.	Underwater noise modelling has presented impact ranges both with and without 30 minutes of ADD. The use of ADDs is incorporated into the underwater noise modelling and assessment, in line with the implementation of current guidance on marine mammal mitigation measures for piling (Joint Nature Conservation Committee (JNCC), 2010a)). The application of 30 minutes ADD are considered to be embedded/designed-in mitigation and are therefore considered part of the design basis for assessment. Given that ADDs are considered a designed-in measure, noise modelling without the inclusion of ADDs would not be considered proportionate, and would give rise to impact ranges beyond those which could be reasonably predicted to occur. As such, no change is proposed.
Natural England	As per our comment above, Natural England do not agree that the impact ranges predicted with the use of 30 minutes ADDs should be taken forward	

Consultee	Consultation	Where and How Addressed
	to the assessment. The predicted PTS range without ADD should be the basis for the assessment. Thus, this needs to be revised accordingly.	
Natural England	Natural England do not agree that assigned magnitude of impact of low is appropriate for PTS, as it is irreversible injury. From Table 7.27 [of the ES], a more appropriate score would be medium. This should also be applied to the cumulative assessment stage.	See section 1.3.6, Updated Evidence for Conclusions of Magnitude of Impact for Injury, Disturbance, and Displacement from Underwater Noise Generated during Piling - updated evidence and justification of magnitude of impacts have been included. This will apply to both the Proposed Development alone and cumulatively with other plans and projects.
Natural England	Natural England agree with the assigned sensitivity score for all receptors for auditory injury and behavioural disturbance. However, the significance of the effect sections needs to be revised (where relevant) upon the consideration of impact ranges without 30 minutes of ADD as the basis for the magnitude scores. Please see the comment above.	Underwater noise modelling has presented modelling both with and without ADDs. The use of ADDs is incorporated into the assessment as standard, in line with the implementation of current guidance on marine mammal mitigation measures for piling (JNCC, 2010a). Based on this, ADDs are considered embedded/designed-in mitigation as part of the MMMP, and are therefore considered part of the design basis for assessment. Modelling without the inclusion of ADDs would not be considered proportionate, given that ADDs are considered a designed-in measure, and would give rise to impact ranges beyond those which could be reasonably predicted to occur. As such, no change is proposed..
Natural England	The magnitude of Temporary Threshold Shift (TTS) resulting from a high order detonation (UXO clearance) has been concluded as negligible for all IEFs. Natural England views this score as too low. Therefore, we advise a more precautionary approach is taken for this impact pathway	See section 1.3.7, Temporary Threshold Shift (TTS) Resulting from a High Order Detonation (UXO clearance) for both the Proposed Development Alone and Cumulatively with other Plans and Projects - an update to the magnitude of impact has been presented.
NRW	West Hoyle sandbank is a major haul out site for grey seal *Halichoerus grypus.* We advise the need for full assessment of the impact of routing the cable through or around West Hoyle sandbank on the major grey seal haul out site.	**Errata** There has been an inconsistency in the naming of the West Hoyle Spit within the ES. There are references to "West Hoyle Bank", which the Applicant appreciates is a different coastal feature located close to Hilbre Island on the east side of the Dee Estuary. This is an editorial error, and all references in the ES to "West Hoyle Bank" should refer to West Hoyle Spit, which is the coastal feature to the north of the Welsh Channel. The Applicant can therefore confirm that there will be no project activities on or in the vicinity of the West Hoyle Bank. There is therefore no proposal to remove the West Hoyle Bank, with the subsequent impacts on coastal protection and the grey seal haul out area. The Project worst-case proposal was to excavate a temporary trench across the West Hoyle Spit to facilitate burial of our proposed electrical cable. **Project methodology update**

Consultee	Consultation	Where and How Addressed
		Please see previous response above confirming that the cables will not be installed across the West Hoyle Spit and will follow the preferred option to the east. This means that the 'worst-case' assessed in the ES will not occur and the West Hoyle Spit will be undisturbed. As a result, the worst-case environmental effects will be avoided and are not predicted to occur. **<u>Technical response</u>** Notwithstanding the update to the preferred cable installation option, and the errata regarding the inconsistent naming of the West Hoyle Spit, a full assessment of the impact of the routing of the cable around haul-out sites at West Hoyle Bank, using available data, is provided in **section 1.3.13.**
NRW	NRW (A) recommend that additional contextual information is required. In Welsh waters the appropriate Marine Mammal Management Unit (MMMU) for grey seals is the Oslo Paris Convention (OSPAR) Region III Area. This should be included in the text when discussing management units for seal species.	See section 1.3.8, Updated MU for Grey Seal, which includes OSPAR Region III for grey seals. Please note that the OSPAR Region III population estimate was applied throughout the assessment in Volume 2, Chapter 7: Marine Biodiversity when calculating the proportion of grey seals predicted to be impacted.
NRW	NRW (A) advise that TTS thresholds should not be considered/used as disturbance thresholds for piling – NRW(A) recommend only using TTS thresholds as a proxy for assessing disturbance from UXO clearance.	See section 1.3.10, Summary of Piling in the MMMP – TTS thresholds were not applied to the assessment of behavioural disturbance for piling; disturbance was based on a dose response approach only. However, there were two occasions in the MMMP with typing errors, which implied that this was the case. As such, wording has been updated to ensure clarity on this.
	Given that final ADD duration will be determined post consent with Statutory Nature Conservation Bodies (SNCBs) and the regulator, we would not agree to basing conclusions on magnitude of effect on 30 minutes ADD duration at this stage. The assessment should be based on the underwater noise modelling without ADDs. Any assessments, that are based on the predicted ranges with 30 minutes of ADDs should be revised accordingly. NRW (A) note that due to the potential reliance on ADDs in the assessment to reduce the magnitude of PTS from piling and UXO, there is a risk that the impact pathway is instead being shifted to displacement and significant disturbance of animals (Elmegaard *et al.,* 2023).	Underwater noise modelling has presented modelling both with and without ADDs. The use of ADDs is incorporated into the assessment as standard, , in line with the implementation of current guidance on marine mammal mitigation measures for piling (JNCC, 2010a). Based on this, ADDs are considered embedded/designed-in mitigation as part of the MMMP, and are therefore considered part of the design basis for assessment. Modelling without the inclusion of ADDs would not be considered proportionate, given that ADDs are considered a designed-in measure, and would give rise to impact ranges beyond those which could be reasonably predicted to occur. As such, no change is proposed.
	We would recommend extending the mitigation zone for piling to 1 km as the predicted maximum injury zones are greater than 500 m. Where the impact radius is smaller than 1 km, we advise that an ADD is not used. This is because a 1 km zone should be effectively monitorable through visual search, therefore there is not a need to introduce additional noise to	See section 1.3.11, Updated Mitigation Zone for Piling – an update to the mitigation zone is presented. With regards to advice on ADDs, NRW's position is noted. A more detailed assessment of mitigation will be undertaken post-consent as further information

Consultee	Consultation	Where and How Addressed
	displace animals. The applicant is also encouraged to commit to single piling as the worst-case scenario.	becomes available, to inform the Final MMMP, which will be developed in line with latest guidance. With regards to advice on approach to piling, NRW's position is noted. As the project design and construction methods are undergoing finalisation, the Applicant requires flexibility at this stage to consider single and concurrent piling. Both of which are assessed under the current MDS. The Final MMMP will align with final design and construction methods, and will incorporate the advice provided where possible.
NRW	NRW (A) note that no information has been provided with respect to the expected timeframes for recovery from an effect and recommend that this information is provided [section 7.10.2 Sensitivity of receptors, table 7.30, page 86 of the ES].	NRW's position is noted , however, Table 7.30 [of the ES] follows the standard approach for determining sensitivity. Where possible, timeframes for recovery have been included in the assessment as additional information, however this is not always possible for all impacts. Therefore, no change to the assessment is proposed.
NRW	NRW(A) advise that the applicant clarify that the cut-off of 10 km is an assumption that has been made for the purpose of the application, as current scientific consensus is that while there is a decrease in impulsiveness as sounds travel further away from the source, there is still insufficient evidence to establish a range of distances beyond which these sounds are no longer impulsive.	See section 1.3.5, 10 km cut-off for Impulsive Sound – clarification on assumptions associated with the aforementioned 10 km cut-off for impulsive sound has been presented.
NRW	While NRW(A) may be able to agree with an overall impact magnitude of low and may tentatively agree that it may be unrealistic to assess injury and disturbance from geophysical and seismic site investigation use by "presenting a sum of the impact ranges of all vessels", no alternative method has been proposed as an alternative to gauge the impact. The applicant should assess this impact pathway adequately. Given the intended annual routine nature of said surveys (as per table 7.23 of the ES), the assessment should also be potentially revised to account for the operation and maintenance stages.	See section 1.3.14, Injury, Disturbance, and Displacement from Vessel Activity and other Noise Producing Activities - further text has been provided on quantifying the impact of Injury, Disturbance, and Displacement from Vessel Activity and other Noise Producing Activities
NRW	[For the impact of Injury, Disturbance, and Displacement from Vessel Activity and other Noise Producing Activities]. While NRW (A) may be able to agree with an overall magnitude of low for the Proposed Development alone during the construction phase given the number of trips in comparison with the background levels, there is currently insufficient justification for this conclusion particularly given that the number of animals have not been quantified and only static impact ranges provided. The assessment could be significantly strengthened by showing (ideally using available evidence) how vessel slowdowns outlined in the mitigation plan may reduce disturbance for animals.	See section 1.3.3, Vessel Slowdowns - additional information and evidence has been presented on the effectiveness of vessel slowdowns for reducing disturbance to marine mammals and marine turtles.

Consultee	Consultation	Where and How Addressed
NRW	NRW(A) could agree with an overall assessment of minor adverse [for vessel collision], however we disagree with a sensitivity of medium for both marine mammals and turtles. Sensitivity should not consider avoidance behaviour since this should measure the result of a collision occurring, thus NRW (A) recommend that this should be high. Avoidance behaviour may however be expected to play a role in magnitude (since it reduces the probability of collision and hence the number of animals affected).	See section 1.3.4, Vessel Collision: Updated Sensitivities and Significance of Effect – an update to the assessment for Sensitivity of the Receptor and Significance of the Effect, for both the Proposed Development alone assessment and cumulatively with other plans and projects.
NRW	NRW (A) disagree with the adopted screening distances (based on impact radii) of: • 20 km for vessel noise • 13 km for geophysical and seismic surveys, and • Liverpool Bay only for injury due to collision with marine vessels NRW (A) advise that the applicant strongly justify this approach or adopt either the (1) full marine mammal study area or (2) MMMUS as screening distances.	NRW's position is noted. Justifications for screening distances are as follows: • 20 km for vessel noise: it is expected that other plans and projects will contribute to increased vessel traffic and hence to the amount of noise produced in the environment during all phases of development. However, a proportionate approach to the assessment was taken - given the large scale of the marine mammal and marine turtle Cumulative Effects Assessment (CEA) study area (the entire Irish Sea, down to the southwestern tips of England and Ireland), only projects within the maximum modelled disturbance range for the Proposed Development have been included in the CEA. As the maximum disturbance range of vessel activity and other noise producing activities was modelled at 20 km for the Proposed Development alone, projects within 20 km from the Eni Development Area were screened into the CEA.. • 13 km for geophysical and seismic surveys: this screening distance was based on the maximum impact range modelled for the Proposed Development (13 km). This distance (13 km) is the range modelled for mild behavioural disturbance (for all hearing groups) from a Vertical Seismic Profiler (VSP). The maximum modelled range for strong disturbance was modelled at 800 m (again, for VSP). Modelled ranges for mild disturbance and strong disturbance for other sources were considerably smaller - Multi Beam Echosounder (MBES) (1.1 km and 0.49 km, respectively) and Sub Bottom Profiler (SBP) (1.18 km and 0.43 km, respectively). Therefore, a screening distance of 13 km is considered an appropriate, precautionary screening range for the CEA for this impact. • Liverpool Bay for vessel collision: it is expected that other plans and projects will contribute to increased vessel collision risk during all phases of development. However, a proportionate approach to the assessment was taken - given the large scale of the marine mammal and marine turtle CEA study area in comparison to the Eni Development Area (where vessels associated with the Proposed Development will be operating), only projects within Liverpool Bay

Consultee	Consultation	Where and How Addressed
		have been included for the CEA. Vessel use associated with projects at the extremities of the marine mammal and marine turtle CEA study area, (e.g. those along the coast of Ireland or south west England) is not considered to contribute to increased cumulative vessel activity. As such, no change is proposed.
	NRW (A) note the statements that: "*it would not be realistic to present a sum of all vessels anticipated within the Proposed Development and Awel y Môr. Introduction of vessels during construction and operations and maintenance phases of the projects will not be a novel impact for marine mammals and marine turtles in the vicinity, and animals, therefore, are anticipated to demonstrate some degree of habituation to this impact."* and "*The cumulative impact is predicted to be of local spatial extent, short-term duration (due to the <1 year overlap between construction phase), intermittent (in terms of vessel movements and activities) and both the impact itself (increased underwater noise) and effect of behavioural disturbance are reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low*." While NRW(A) may be able to tentatively agree that it may be unrealistic to assess injury and disturbance from geophysical and seismic site investigation use by "*presenting a sum of the impact ranges of all vessels*", no alternative method has been proposed as an alternative to quantify the impact. The applicant should assess this impact pathway adequately and given the extent of the cumulative increase in the number of vessel trips within the relevant management units over the lifetime of the Proposed Development either justify a cumulative magnitude of low or update this assessment.	See section 1.3.15, Cumulative Injury, Disturbance, and Displacement from Vessel Activity and other Noise Producing Activities – an update to his assessment has been presented.
	NRW (A) disagree with the statement that animals are anticipated to demonstrate some degree of habituation to this impact. Current evidence suggests otherwise, given the various studies showing reactions to boat noise with no evidence of habituation occurring.	See section 1.3.16, Further Evidence for Tolerance to Vessel Presence – additional information on this topic has been presented.

1.3 Consultation Responses

1.3.1 NGO and Citizen Observer Data within the Region

The baseline characterisation presented within Volume 2, Chapter 7: Marine Biodiversity and the Marine Biodiversity Technical Report (Volume 3, Appendix I) is considered to incorporate sufficient information to provide a robust characterisation of the baseline environment to inform the assessment of impacts and is considered proportionate to the impacts associated with the proposed Eni Development Area.

If required, the Applicant can provide a technical note summarising NGO/citizen observer data, however it is anticipated that adding this data would not result in any material change to the established baseline characterisation, nor to the assessment of significant effects. Table 1.2 presents a summary of additional highlighted NGO and citizen observer data sources.

Table 1.2 Extended Summary of NGO and Citizen Observer Data Sources

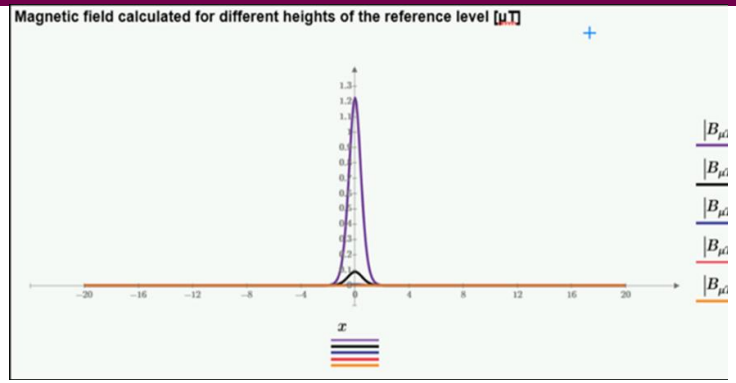
Title	Source	Year	Author
Manx Whale and Dolphin Watch (MWDW) surveys: Opportunistic and effort-based sighting data	MWDW	2006 – 2022	Data from MWDW Manley (2021, 2020, 2019); Clark *et al*. (2019, 2017); Felce and Adams (2016); Felce, (2015); Adams (2017)
Manx Wildlife Trust (MWT) surveys: • Seal pup surveys on Calf of Man • Opportunistic land sightings • Seal haul-out survey data • Calf of Man Seal Survey Reports 2017 to 2021	MWT	2017 – 2021 2016 – 2022 2017 2017 – 2021	MWT
Walney Nature Reserve survey data	Cumbria Wildlife Trust	1981 – 2023	Data from Cumbria Wildlife Trust

1.3.2 Updated Mitigation Measures

Table 1.3 shows an updated table for the embedded mitigation measures adopted as part of the development. Wording that is additional to that included in Table 7.32 of Volume 2, Chapter 7: Marine Biodiversity, is set out in red.

Table 1.3: Embedded Mitigation Measures Adopted As Part Of The Proposed Development

Embedded Mitigation	Justification	How these Measures will be Secured
Primary Mitigation: Measures Embedded into the Design of the Proposed Development		
Development of, and adherence to, a Cable Specification and Installation Plan (CSIP) which will include cable burial where possible (in accordance with the specific policies set out in the North West Inshore and North West Offshore Marine Plan (Marine Management Organisation (MMO), 2021)) and cable protection, as necessary.	The CSIP will set out appropriate cable burial depth in accordance with industry good practice, minimising the risk of cable exposure. The CSIP will also ensure that cable crossings are appropriately designed to mitigate environmental effects, these crossings will be agreed with relevant parties in advance of CSIP submission. The CSIP will include a detailed Cable Burial Risk Assessment (CBRA) to enable informed judgements regarding burial depth to maximise the chance of cables remaining buried whilst limiting the amount of sediment disturbance to that which is necessary. Measures will seek to reduce the amount of Electromagnetic Fields (EMF) which benthic and fish and shellfish receptors are exposed to during the operations and maintenance phase by increasing the distance between the seabed surface and the surface of the cables. Furthermore, the Applicant is familiar with the scientific references provided by Natural England, along with some others, as set-out below (Bochert and Zettler (2006), Wilhelmsson *et al.* (2010)). It was the understanding of the latest scientific research and our knowledge of EMF sources that provided the evidence to scope out EMF from the EIA. Principally, there has to be a source that generates an EMF of a magnitude that is capable of affecting marine life. Our cable will not generate such a source. The figure below is from one of our vendors for a cable similar to ours (33 kV, three core x 630 mm^2 cable with a current rating of 750 A (although ours will be an even lower amperage)), with grounded metallic sheath, and buried at 1 m below surface (our cable will be buried 2-3 m below). As they are DC cables, there will be no detectible electric fields external to the metallic sheath. However, the cable will generate static magnetic fields, which will not be screened by the metallic sheath. Curves in the graph represent the anticipated magnetic field at 0 m (purple), and 0.5 m (black) distance from the seabed. Values are in micro Tesla. At the seabed the magnetic field will be ~0.1 uT, and at 0.5 m above ~1.2 uT.	Proposed to be secured as a condition of the marine license(s).

Embedded Mitigation	Justification	How these Measures will be Secured
	 These are extremely low values and are much lower than any of those cited from the published literature on the matter where effects may occur on marine life. EMF generated by the cables is likely to be ~0.1 µT calculated at the seabed for a cable buried at 1m deep, which is below the levels which have been observed to have impacts upon marine life, including fish and marine invertebrates. In addition, the cables will be buried 2-3 m below the surface through the subtidal and intertidal zones, which will mean that the EMF at the surface will be even less than the ~0.1 µT shown in the graph.	
Implementation of potential piling methods, timing of piling, piling initiation, soft-start, and ramp-up measures within the MMMP. An initiation stage and soft starts will be used during the installation of pin piles. This involves the implementation of an initial low hammer energy with a low number of strikes, followed by lower hammer energies at a higher strike rate 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 fish, marine mammal, and marine turtle species in the immediate vicinity of piling activities, allowing individuals to move away from the area before noise levels reach a level at which injury may occur.	

Embedded Mitigation	Justification	How these Measures will be Secured
Inclusion of low order techniques as a UXO clearance option noting, however, that it is not possible to fully commit to this measure at this stage. Low order techniques are not always possible and are dependent upon the individual situations surrounding each UXO. Given that high order detonation may be required, the MMMP will also include far-field mitigation measures such as bubble curtains as a measure of mitigation to reduce the risk of injury from high order UXO clearance, where necessary.	Low order techniques generate less underwater noise than high order techniques and therefore present a lower risk to sound-sensitive receptors such as fish, marine mammals, and marine turtles during UXO clearance.	
Development of and adherence to an Environmental Management Plan (EMP) that will be prepared and implemented during the construction, operational and maintenance and decommissioning phases of the Proposed Development. The EMP will include appendices detailing actions to minimise Invasive Non-Native Species (INNS) (the INNS Management Plan), and a Marine Pollution Contingency Plan (MPCP) will be developed which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact details.	Measures will be adopted to ensure that the potential for release of pollutants from construction, operational and maintenance and decommissioning plant is 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 tanks containing hazardous substances, and storage of these substances in impenetrable bunds. All vessels will be required to comply with the standards set out in the International Convention for the Prevention of Pollution from Ships (MARPOL).	
Tertiary Mitigation: Measures Required to meet Legislative Requirements, or Adopted Standard Industry Practice		
Development of and adherence to a MMMP, based on a draft MMMP submitted alongside the ES. The MMMP will present appropriate mitigation for activities that could potentially lead to injurious effects on marine mammals including: piling, UXO clearance and some types of geophysical activities. The MMMP will be developed on the basis of the most recent published statutory guidance and in consultation with key stakeholders.	**Piling:** for the purpose of developing the MMMP, a mitigation zone of 500 m will be applied, following the JNCC (2010a) guidance. The Draft MMMP will set out the measures to apply in advance of and during piling activity including the use of piling methods, timing of piling, Marine Mammal Observers (MMObs), Passive Acoustic Monitoring (PAM), and ADD, thereby following the latest JNCC guidance (JNCC, 2010a). **UXO Clearance:** Measures including visual and acoustic monitoring (MMObs and PAM), the use of an ADD, and soft start charges, will be applied to deter animals from the mitigation zone as defined by sound modelling for the largest possible UXO following the latest JNCC (2010b) guidance. In the case of high order UXO clearance the MMMP will also include far-field measures such as bubble curtains as a measure of mitigation to reduce the risk of injury from high order UXO clearance, where necessary. **Geophysical and Seismic Surveys:** Mitigation for injury during high resolution geophysical and seismic site-investigation surveys	Proposed to be secured through a condition in the marine licence(s).

Embedded Mitigation	Justification	How these Measures will be Secured
	using a sub-surface sensor from a conventional vessel will involve the use of MMObs and PAM to ensure that the risk of injury over the defined mitigation zone is reduced in line with JNCC (2017) guidance (500 m). Soft start is not possible for SBP equipment but will be applied for other high-resolution surveys where possible. It should be noted that some multi-beam surveys in shallow waters (<200 m) are not subject to the requirements of mitigation.	
Development of, and adherence to, a Construction Methods Statement (CMS).	This measure will confirm the actual methodology that will be employed to construct the Proposed Development, provide details on aspects of the methodology not known at the application stage and confirm that the methodology falls within the parameters assessment in the ES.	
Actions to minimise INNS, including a biosecurity plan to limit spread and introduction of INNS.	These measures will aim to manage and reduce the risk of potential introduction and spread of INNS so far as reasonably practicable to best protect the biological integrity of the local natural environment and communities.	
Development of, and adherence to, an EMP, which will be issued to all vessel operators, requiring them to: • not deliberately approach marine mammals, marine turtles, and basking sharks; • keep vessel speed to a minimum; and • avoid abrupt changes in course or speed should marine mammals approach the vessel to bow-ride.	To minimise the potential for collision risk, or potential injury to, marine mammals and megafauna this code of conduct outlines in the EMP will be adhered to at all times.	An EMP will be issued to all vessel operators associated with the Proposed Development. Proposed to be secured through a condition in the marine licence(s).
Development of, and adherence to, a Decommissioning Plan.	The aim of this plan is to adhere to the relevant UK and international legislation and guidance in place at the time, with decommissioning industry practice applied to reduce the amount of long-term disturbance to the environment so far as reasonably practicable.	Proposed to be secured as a condition of the marine license(s).

1.3.3 Vessel Slowdowns

As a mitigation measure, it is proposed to keep vessel speed to a minimum. Joy *et al.* (2019) conducted a voluntary commercial vessel slowdown trial through 16 nm of shipping lanes which overlapped with critical habitat of at-risk southern resident killer whales *Orcinus orca*. Disturbance metrics were simplified to a "lost foraging time" measure and demonstrated (when compared to baseline sound levels in the region) the slowdown trial achieved 22% reduction in 'potential lost foraging time' for killer whales (with 40% reductions when 100% of vessels were under the 11 knot speed limit). With the exception of Crew Transfer Vessels (CTVs), most vessels involved in all phases of development are likely to be travelling considerably slower than 11 knots. Further, all vessels will be required to adhere to the EMP, which will require them to travel at safe speeds at all times, reduce speed if appropriate when a marine mammal is in the vicinity, and not abruptly change direction or course (see the embedded mitigation measures outlined in Table 1.3). Findlay *et al.* (2023), showed that a vessel slowdown could also reduce the overall exposure time during which an animal could be affected by vessel noise. If a vessel traveling at a speed of 20 knots slows down by 50% (10 knots) it could reduce the time during which a marine mammal is exposed to vessel noise above ambient noise (assumed to be 90 decibel (dB) re 1 µPa SPL (root mean squared (rms)) by 76% for all frequencies at the closest approach distance of 300 m. If a ship even slowed down 30% from 20 knots to 14 knots, it is predicted that its source level drops by 10 dB (Findlay *et al*., 2023).

With the proposed mitigation measure the impact is predicted to be of local spatial extent, medium-term duration, intermittent and reversible (i.e. increased underwater noise only occurs during the vessel presence and activities). Similarly, the effect of behavioural disturbance is reversible as receptors are expected to recover within days, even hours. It is predicted that the impact will affect the receptor directly. Therefore, the magnitude of impact is considered to be **low.**

1.3.4 Vessel Collision: Updated Sensitivities and Significance of Effect

1.3.4.1 Magnitude of the Impact

The magnitude of the impact has not changed from that presented in Volume 2, Chapter 7: Marine Biodiversity: the magnitude of the impact is considered to be **low** for all IEFs.

1.3.4.2 Sensitivity of the Receptor

1.3.4.2.1 Marine Mammal IEFs

Overall, for both the Proposed Development alone assessment of significant effects and the CEA, all marine mammal IEFs are deemed to have some tolerance (largely due to avoidance behaviour), medium recoverability and international value. The sensitivity of the receptor is therefore, considered to be **high**.

1.3.4.2.2 Marine Turtle IEFs

Overall, marine turtle IEFs are deemed to have low tolerance, medium recoverability, and international value. The sensitivity of the receptor is therefore, considered to be **high.**

1.3.4.3 Significance of Effect

1.3.4.3.1 Marine Mammal and Marine Turtle IEFs

Overall, the magnitude of impact is deemed to be low, and the sensitivity of the receptor is considered to be high. There would be no change to the international value of these species. As per the matrix used to assess the significance of effect (Table 7.31 in Volume 2, Chapter 7: Marine Biodiversity), this results in a 'minor or major' significance of effect. Whilst the effects of this potential impact are irreversible, with mitigation in place, this impact is not expected to occur. Therefore, for both the Proposed Development alone assessment of

significant effects and the CEA, the effect will be of **minor adverse** significance, which is **not significant** in Environmental Impact Assessment (EIA) terms.

1.3.5 10 km cut-off for Impulsive Sound

The assumptions and limitations of underwater noise modelling (e.g. equal energy rule, reduced sound levels near the surface, conservative swim speeds, and use of impulsive sound thresholds at large ranges) are considered to lead to an overestimation of ranges. Notably, Hastie *et al.* (2019) reported that during piling operations, there were range dependent changes in signal characteristics with received sound losing its impulsive characteristics at ranges of several kilometres, especially beyond 10 km. As such under this assumption, TTS is not considered to be a useful predictor of the effects of underwater sound on marine mammals and turtles where ranges exceed more than 10 km. Therefore, where this is the case (i.e. piling and UXO clearance), for the purposes of this assessment, TTS is not included in the final assessment of significance for injury. Ranges for TTS were modelled for completeness for all noise-related impacts and are presented in Volume 2, Chapter 7 and in Volume 3, Appendix J: Underwater Noise.

1.3.6 Updated Evidence for Conclusions of Magnitude of Impact for Injury (PTS)from Underwater Noise Generated during Piling

1.3.6.1 Harbour Porpoise

The impact (elevated underwater sound during piling) is predicted to be of local spatial extent with respect to the ranges over which PTS could occur, medium term duration, intermittent and, although the impact itself is reversible (i.e. the elevation in underwater sound only occurs during piling), the effect of PTS is permanent. It is predicted that the impact will affect the receptor directly. Without mitigation, PTS could affect a very small number of harbour porpoise (less than one animal) which could lead to measurable changes at an individual level, but is unlikely to affect the wider population. With primary and tertiary mitigation applied, injury is assumed to be entirely mitigated; the PTS threshold for Very High Frequency (VHF) cetacean species is not exceeded with the activation of an ADD for 30 minutes. As such the Applicant is confident that the assessment presented in Volume 2, Chapter 7: Marine Biodiversity is appropriate: the magnitude is therefore considered to be **low.**

1.3.6.2 Minke Whale

The impact (elevated underwater sound during piling) is predicted to be of local spatial extent with respect to the ranges over which PTS could occur, medium term duration, intermittent and, although the impact itself is reversible (i.e. the elevation in underwater sound only occurs during piling), the effect of PTS is permanent. It is predicted that the impact will affect the receptor directly. Without mitigation, PTS could affect a very small number of minke whale (less than one animal) which could lead to measurable changes at an individual level, but this is unlikely to affect the wider population. With primary and tertiary mitigation applied, injury is assumed to be entirely mitigated; the PTS threshold for Low Frequency (LF) cetacean species is not exceeded with the activation of an ADD for 30 minutes. As such the Applicant is confident that the assessment presented in Volume 2, Chapter 7: Marine Biodiversity is appropriate: the magnitude is therefore considered to be **low.**

1.3.6.3 All other IEFs

The magnitude of the impact for all other IEFs has not changed from that which was presented in Volume 2, Chapter 7: Marine Biodiversity: the magnitude of the impact is considered to be **negligible.**

1.3.7 Temporary Threshold Shift (TTS) Resulting from a High Order Detonation (UXO clearance) for both the Proposed Development Alone and Cumulatively with other Plans and Projects

1.3.7.1 Updated Magnitude of Impact

Adopting a precautionary approach, and with the embedded mitigation adopted, the assessment considered the magnitude of a high order detonation. The magnitude of TTS resulting from a high order detonation is predicted to be of regional spatial extent, short-term duration, and intermittent throughout the construction phase. Both the impact itself (i.e. the increased underwater noise during a detonation event) and effect of TTS are reversible. It is predicted that the impact will affect the receptor directly. Taking a precautionary approach, for both the Proposed Development alone assessment of significant effects and the CEA, the magnitude is therefore considered to be low for all IEFs. This includes marine turtles, as although they were not included in the underwater noise modelling for this impact, the magnitude of effect can be extrapolated from that of the marine mammal IEFs (as per the reasoning provided for 'Auditory Injury (PTS)' in Volume 2, Chapter 7: Marine Biodiversity).

1.3.7.2 Sensitivity of the Receptor

The sensitivity of the receptor has not changed from that presented in Volume 2, Chapter 7: Marine Biodiversity: the sensitivity of the receptor is considered to be **low** for all IEFs.

1.3.7.3 Updated Significance of Effect

For all IEFs, for both the Proposed Development alone assessment of significant effects and the CEA, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be low. As per the matrix used to assess the significance of effect (Table 7.31 in Volume 2, Chapter 7: Marine Biodiversity), this results in a 'negligible or minor' significance of effect. Given that the effects of this impact are reversible and are not predicted to affect a significant percentage of the relevant Management Unit (MU) populations, only a very minor loss or detrimental alteration to these species at a population level is possible. Taking a precautionary approach, it has been concluded that the effect, for both the Proposed Development alone assessment of significant effects and the CEA will be of **minor adverse** significance, which is **not significant** in EIA terms.

1.3.8 Updated MU for Grey Seal

The most recent abundance estimates for the relevant grey seal MUs are presented in Table 1.4. Further detail on the ecology, abundance, and densities of grey seal is provided in Volume 3, Appendix I: Marine Biodiversity Technical Report. The OSPAR Region III population estimate was applied throughout the assessment in Volume 2, Chapter 7: Marine Biodiversity when calculating the proportion of grey seals predicted to be impacted by activities for the Proposed Development alone assessment of significant impacts and the CEA.

Table 1.4: Population Estimates for Relevant Grey Seal MUs

Species	Management Unit (MU)	Population Estimate in MU
Grey seal	Wales	3,766[1]
	Northwest England	1,046[1]
	Northern Ireland	2,113[1]
	Southwest Scotland	2,163[1]
	Isle of Man estimate	400[2]
	East of Ireland Southeast of Ireland	1,749[3] 2,326[3]
	OSPAR Region III	60,780[4]

Species	Management Unit (MU)	Population Estimate in MU

[1] Population estimate in MU based upon SCOS (2020) using scalars from Russel *et al.* (2016)
[2] Population Estimate based on Howe (2018)
[3] Population estimates based upon counts from Duck and Morris (2019), using scalars from Russell *et al.* (2016)
[4] OSPAR Region III Estimate

1.3.9 Permanent Threshold Shift (TTS) resulting from a High Order Detonation (UXO Clearance)

1.3.9.1 Auditory Injury (PTS)

Magnitude of Impact

Adopting a precautionary approach, and assuming application of mitigation, the assessment considered the magnitude for a high order detonation. The magnitude of impact is predicted to be of local to regional spatial extent (depending on species), very short-term duration (for each UXO detonation), and intermittent throughout the construction phase. Although the impact itself is reversible (i.e. the elevation in underwater noise only occurs during the UXO detonation activity), the effect of PTS on sensitive receptors is permanent. It is predicted that the impact will affect the receptor directly. With tertiary mitigation applied (i.e. MMMP), it is anticipated that for most species, individuals would be deterred from the ZoI and therefore the risk of PTS would be reduced. Adopting a precautionary approach, for all marine mammal IEFs (except harbour porpoise) for both the Proposed Development alone assessment of significant effects and the CEA, the magnitude of impact is therefore considered to be **low**.

The magnitude of impact for harbour porpoise has not changed from how it was presented in Volume 2, Chapter 7: Marine Biodiversity: the magnitude of impact is considered to be **low**.

Injury ranges to marine turtles due to UXO clearance activities were not presented in the underwater noise modelling assessment (Volume 3, Appendix J: Underwater Noise). As per the criteria by Popper *et al.* (2014), insufficient data exist to determine a quantitative guideline value for PTS as a result of UXO clearance activities. Instead, the available criteria provide relative terms as “high”, “moderate” or “low” at three distances from the source: “near” (i.e. in the tens of metres), “intermediate” (i.e. in the hundreds of metres) or “far” (i.e. in the thousands of metres). As such, no assessment of the impact of UXO clearance on the marine turtles IEF could be conducted. However, marine turtle populations within the regional marine mammal and marine turtle study area are likely to be lower than those of the marine mammal IEFs, and this study area does not represent important habitat for reproduction or nesting. Although marine turtles are not as sensitive to underwater noise as marine mammals, a precautionary approach has been taken, and a **low** magnitude of impact can be extrapolated from that presented for all marine mammal IEFs (except harbour porpoise) for both the Proposed Development alone assessment of significant effects and the CEA.

Sensitivity of the Receptor

The sensitivity of the receptors for both the Proposed Development alone assessment of significant effects and the CEA has not changed from that which was presented in Volume 2, Chapter 7: Marine Biodiversity: the sensitivity of the receptor is considered to be **high** for all IEFs.

Updated Significance of Effect

For all IEFs, for both the Proposed Development alone assessment of significant effects and the CEA, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. As per the matrix used to assess the significance of effect (Table 7.31 in Volume 2, Chapter 7: Marine Biodiversity), this results in a ‘minor or major’ significance of effect. Whilst the effects of this potential impact are irreversible, only a small number of animals are predicted to be affected, which is expected to represent

only a very minor loss or detrimental alteration to these species at a population level. As such, it has been concluded that the effect, for all marine mammal IEFs (except harbour porpoise) for both the Proposed Development alone assessment of significant effects and the CEA will be of **minor adverse** significance, which is **not significant** in EIA terms.

The significance of the effect for harbour porpoise, for both the Proposed Development alone assessment of significant effects and the CEA, has not changed from how it was presented in Volume 2, Chapter 7: Marine Biodiversity: minor adverse significance, which is not significant in EIA terms.

1.3.9.2 Behavioural Disturbance (TTS as a Proxy)

Magnitude of impact

Adopting a precautionary approach, and with the embedded mitigation adopted, the assessment considered the magnitude of a high order detonation. The magnitude of behavioural disturbance (TTS as a proxy) resulting from a high order detonation is predicted to be of regional spatial extent, very short-term duration, and intermittent throughout the construction phase. Both the impact itself (i.e. the increased underwater noise during a detonation event) and effect of behavioural disturbance (TTS as a proxy) are reversible. It is predicted that the impact will affect the receptor directly. Taking a precautionary approach, the magnitude is therefore considered to be **low** for all IEFs. This includes marine turtles, as although they were not assessed in the underwater noise modelling for this impact, the magnitude of effect can be extrapolated from that of the marine mammal IEFs (as per the reasoning provided above for 'Auditory Injury (PTS)').

Sensitivity of the Receptor

The sensitivity of the receptors for both the Proposed Development alone assessment of significant effects and the CEA has not changed from how it was presented in Volume 2, Chapter 7: Marine Biodiversity: the sensitivity of the receptor is considered to be **low** for all IEFs.

Significance of Effect

For all IEFs, for both the Proposed Development alone assessment of significant effects and the CEA, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be low. As per the matrix used to assess the significance of effect (Table 7.31 in Volume 2, Chapter 7: Marine Biodiversity), this results in a 'negligible or minor' significance of effect. Therefore, taking a precautionary approach, for both the Proposed Development alone assessment of significant effects and the CEA will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusions of significance to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.10 Summary of Piling in the MMMP

An update to the summary of piling for marine mammals and marine turtles has been presented below. Updated sentences (key to clarification that TTS was not presented as a threshold for behavioural disturbance) are set out in red.

Piling during the construction phase of the Proposed Development has the potential to result in elevated levels of underwater noise that are detectable by marine mammals and megafauna above background levels, and which could result in injurious or behavioural effects on the IEFs. A detailed underwater noise modelling assessment has been carried out to investigate the potential for injurious a on marine mammal and turtle IEFs as a result of impulsive sounds from piling (Volume 3, Appendix J: Underwater Noise). The results of this modelling were drawn upon to inform the impact assessment presented in Volume 2, Chapter 7: Marine Biodiversity.

Injury from PTS and TTS were investigated with respect to two metrics over the entire piling sequence from hammer initiation to maximum hammer energy (3,000 kJ) based on up to one pile being installed within a 24 hour period. 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. The SEL_{cum} metric can lead to overestimates in effect ranges which means that subsea noise modelling results in a precautionary assessment due to the conservative assumptions adopted, namely:

- maximum hammer energy (3,000 kJ) would be reached at all locations;
- underwater noise would remain impulsive at all distances, and not transition to a non impulsive character;
- the soft start procedure does not include short pauses in piling which would reduce the noise exposure that fleeing animals experience;
- animals would swim away from the noise source at the onset of activity at a constant rate and in a straight line; and
- time spent at the surface, where sound levels are reduced, was not considered.

Injury ranges from underwater noise modelling for impact piling are summarised in Table 1.5 and Table 1.6. For all species except LF cetaceans, injury (PTS) ranges based on the SPL_{pk} metric were greater (Table 1.5), with the greatest distance being 490 m for VHF cetaceans (e.g. harbour porpoise), compared with 20 m for SEL_{cum}. For LF cetaceans (which includes minke whale), injury ranges based on the SEL_{cum} metric were greater, at distances up to 1,000 m (compared with 180 m for SPL_{pk}). However, this assumes that an ADD would not be deployed, and the use of an ADD would be expected to deter marine mammals and marine turtles to distances sufficient to avoid injury. TTS ranges were also greater for SEL_{cum} across species, with the exception of High Frequency (HF) cetaceans (such as bottlenose dolphin). For these species TTS may be experienced out to 69 m at maximum hammer energy (SPL_{pk}) compared to the SEL_{cum} threshold of 170 dB re 1 μPa^2s not being exceeded.

Table 1.5: Auditory Injury Ranges Based On The SEL_{cum} Metric For Marine Mammals Due To Impact Piling Of The Platform Jackets, With And Without The Use Of An ADD (N/E = Threshold Not Exceeded)

Hearing Group	Threshold (Weighted SEL)	Range (m)	
		Without ADD	With 30 mins ADD
LF	PTS – 183 dB re 1 μPa^2s	1,000	N/E
	TTS – 168 dB re 1 μPa^2s	35,300	31,400
HF	PTS – 185 dB re 1 μPa^2s	N/E	N/E
	TTS – 170 dB re 1 μPa^2s	N/E	N/E
VHF	PTS – 155 dB re 1 μPa^2s	20	N/E
	TTS – 140 dB re 1 μPa^2s	8,660	5,960
Phocid Carnivores in Water (PCW) (i.e. grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina*)	PTS – 185 dB re 1 μPa^2s	N/E	N/E
	TTS – 170 dB re 1 μPa^2s	3,710	585
Marine turtles	Mortality – 210 dB re 1 μPa^2s	N/E	N/E

Table 1.6: Summary Of Peak Pressure (SPL_{pk}) Injury Ranges For Marine Mammals And Marine Turtles Due To The Phase Of Impact Piling At Maximum Hammer Energy, And At The First Hammer Strike

Hearing Group	Threshold (Unweighted Peak)	Range (m)	
		Max Hammer Energy	First Hammer Strike
LF	PTS – 219 dB re 1 µPa (pk)	180	45
	TTS – 213 dB re 1 µPa (pk)	184	77
HF	PTS – 230 dB re 1 µPa (pk)	41	17
	TTS – 224 dB re 1 µPa (pk)	69	29
VHF	PTS – 202 dB re 1 µPa (pk)	490	204
	TTS – 196 dB re 1 µPa (pk)	836	349
PCW	PTS – 218 dB re 1 µPa (pk)	118	49
	TTS – 212 dB re 1 µPa (pk)	201	84
Marine turtles	Mortality – 207 dB re 1 µPa (pk)	314	131

There is a possibility that multiple pin piles will need to be installed in a single 24 hour period, in which case the potential SEL_{cum} injury ranges may be greater than those for single piles, due to the longer period of piling. The results for the consecutive piling are shown in Table 1.7. The PTS threshold was not exceeded for any marine mammal hearing group after 30 minutes of ADD activation. The highest TTS threshold after 30 minutes of ADD activation was 42,800 m for the LF hearing group (minke whale). For marine turtles, the SEL_{cum} threshold for mortality due to consecutive piling was the same for the single pile scenario described above and was not exceeded.

Table 1.7: Marine Mammal And Marine Turtle Injury Ranges For Consecutive Pin Pile Installation Based On The SEL_{cum} Metric (N/E = Threshold Not Exceeded)

Hearing Group	Threshold (Weighted SEL)	Range (m)	
		Without ADD	With 30 min ADD
LF	PTS – 183 dB re 1 μPa^2s	1,905	N/E
	TTS – 168 dB re 1 μPa^2s	46,900	42,800
HF	PTS – 185 dB re 1 μPa^2s	N/E	N/E
	TTS – 170 dB re 1 μPa^2s	N/E	N/E
VHF	PTS – 155 dB re 1 μPa^2s	22	N/E
	TTS – 140 dB re 1 μPa^2s	11,700	8,960
PCW	PTS – 185 dB re 1 μPa^2s	N/E	N/E
	TTS – 170 dB re 1 μPa^2s	6,280	3,050
Marine turtles	Mortality – 210 dB re 1 μPa^2s	N/E	N/E

Overall, underwater noise modelling indicated that the embedded mitigation measure of 30 minutes of ADD activation would result in no PTS injury thresholds being exceeded.

1.3.11 Updated Mitigation Zone for Piling

Following JNCC guidelines, the mitigation zone for pre start monitoring has been determined as having a minimum radius of 500 m from the source geophysical surveys (JNCC, 2017) and 1 km for UXO clearance (JNCC, 2010b). For piling, a 1 km mitigation zone will also be applied as the predicted maximum injury zones are greater than 500 m (noting that this is not in line with standard JNCC guideline (JNCC, 2010s)). The extent to which the PAM will be able to acoustically record marine mammals will depend on the equipment used and the species present. For example, typically PAM can detect harbour porpoise over a maximum range of up to approximately 300 m, but this may extend to more than a kilometre for LF cetaceans (e.g. minke whale).

1.3.12 Updated Marine Mammal Densities

At the time of writing Volume 2, Chapter 7: Marine Biodiversity, the SCANS-IV (Gilles *et al*., 2023) and the Welsh Marine Mammal Atlas (Evans and Waggitt, 2023) were not available. In early 2024, the cetacean densities applied were updated to include those from SCANS-IV. For a precautionary approach, the highest densities were used. While grey seal and harbour seal were not included in Evans and Waggitt (2023), densities for the cetacean species were available. Maximum densities have been calculated over the Proposed Development marine mammal and marine turtle study area and are presented in Table 1.8 alongside the densities used in the ES originally. As the maximum densities for all cetaceans used in the ES are higher than that of Evans and Waggitt (2023), no updates to use the latter have been undertaken, as the densities used in the ES are more precautionary.

Table 1.8: Summary of Marine Mammal Densities used in the ES and those from the Welsh Marine Mammal Atlas (Evans and Waggitt, 2023) recommended by NRW

Species	Density used in the ES (animals per km$^{2)}$	Density from Evans and Waggitt (2023) (animals per km^2)	Management Unit (MU)[7]	Population Estimate in MU
Harbour porpoise	0.086[1] to 0.515[2]	0.194[9]	Celtic and Irish Sea	62,517
Bottlenose dolphin	0.0104[2] to 0.035[3]	0.001[9]	Irish Sea	293
Common dolphin	0.027[4]	0.0002[9]	Celtic and Greater North Seas	102,656
Risso's dolphin	0.0313[5]	0.00008[9]	Celtic and Greater North Seas	12,262
Minke whale	0.009[2]	0.0007[9]	Celtic and Greater North Seas	20,118
Grey seal	0.467 to 4.06[6]	-	Wales	3,766
			NW England	1,046
			Northern Ireland	2,113
			SW Scotland	2,163
			Isle of Man estimate	400
			East of Ireland Southeast of Ireland	1,749[8] 2,326[8]
			OSPAR Region III	60,780
Harbour seal	0.0049 to 0.593[6]	-	Wales	14
			NW England	7
			Northern Ireland	1,406
			Isle of Man	No estimate available

[1] SCANS-III (Hammond *et al*., 2021) Block F.

Species	Density used in the ES (animals per km^2)	Density from Evans and Waggitt (2023) (animals per km^2)	Management Unit (MU)[7]	Population Estimate in MU

[2] SCANS-IV (Gilles at al., 2023) Block CS-E.

[3] High-density coastal area density in outer Cardigan Bay from Lohrengel *et al*. (2018).

[4] SCANS-IV for adjacent Block CS-D as none observed for Block CS-E.

[5] SCANS-II (Hammond *et al*., 2013) Block O, as no values for SCANS-III for this species.

[6] Carter *et al.* (2022) – average and maximum densities calculated to per km^2 using absolute mean values for cells overlapping with the Proposed Development marine mammal and marine turtle study area.

[7] All population estimates include the Isle of Man unless population estimate is given separately.

[8] Population estimates based upon counts from Duck and Morris (2019), using scalars from Lonergan *et al.* (2013) for harbour seal and Russell *et al.* (2016) for grey seal.

[9] Evan and Waggitt (2023) Modelled Distributions and Abundance of Cetaceans and Seabirds of Wales and Surrounding Waters – Applied to the proposed development marine mammal and marine turtle study area.

1.3.13 West Hoyle Bank Grey Seal Haul-out Site Assessment

1.3.13.1 Impact at grey seal haul-out sites due to disturbance and injury due to vessel noise or other (non-piling) noise activities

1.3.13.1.1 Magnitude of Impact

Increased activity around West Hoyle Bank haul-out site, including an increase in vessel and human activity, has the potential to disturb grey seals, particularly during sensitive periods, such as the breeding season and moult period. The grey seal moult period is between December and April, and pupping occurs mainly between early November and mid-December.

The West Hoyle Bank haul-out site is located close to Hilbre Island on the east side of the Dee Estuary, approximately 5.5 km to the east of the export cable corridor of the Proposed Development, therefore there is potential for some disturbance from construction activities. Please see errata note in Table 1.1 that explains the different location of the West Hoyle Bank, and West Hoyle Spit.

There are two main grey seal haul-outs in the NW England MU: one in the Dee Estuary on the Welsh-English border (Hilbre Island), and one in South Walney. The August count at Walney Island was 248 in 2019 and 300 adults in 2020. It has been a pupping site since 2015 and numbers are currently still low (2-10 pups produced per year), however data suggest grey seal abundance is steadily increasing (Special Committee on Seals (SCOS), 2020). Data are not available for the Dee Estuary haul-out (SCOS, 2020). In North Wales, grey seals mainly haul-out around the coast of Anglesey (including the Skerries), near Llandudno (Angel Bay) and the Dee Estuary (Hilbre North and West Hoyle Bank). There were 236 unique individuals identified at the Dee Estuary haul-out by the Irish and Celtic Sea Database for Grey Seal (EIRPHOT) Photo-ID data showed connectivity between the Dee Estuary and the Skerries, with some connectivity with Cardigan Bay and Skomer (Langley *et al.,* 2018).

Carter *et al.,* (2022) present at-sea distribution of grey seal around the UK and Ireland. The paper demonstrates areas of high at-sea usage for grey seals around Liverpool Bay, the east coast of Ireland, and to the Northwest of the Isle of Man. Distribution and predicted number of grey seal in the Proposed Development marine mammal and marine turtle study area are illustrated in Figure 1.1, which shows areas of high grey seal at-sea density in the inshore areas of Liverpool Bay, with a peak of more than 100 animals per 25 km^2 around East Hoyle Spit and moderate densities (>5 to 10 animals per 25 km^2) further out from Liverpool Bay and to the Southwest of the Isle of Man (Carter *et al.,* 2022). These at-sea distribution maps improve on those in Carter *et al.,* (2020) and have increased potential for ecological insights at regional and population wide scales. Carter

et al., (2020) identified finer scale seasonal movements, with seals transitioning between sites within the Irish Sea, but not leaving Wales.

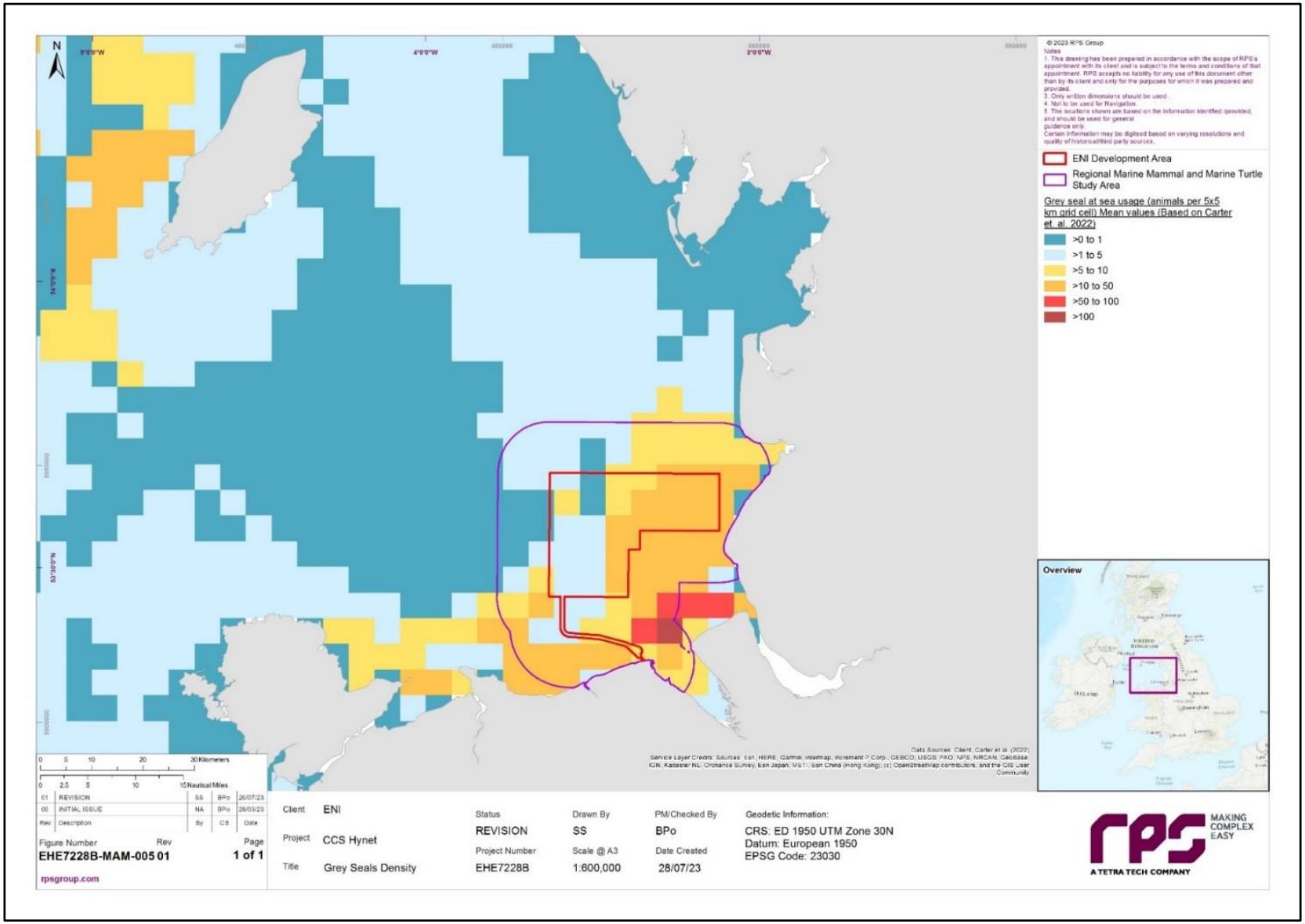


Figure 1.1: Grey Seal Usage at Sea In The Vicinity Of The Eni Development Area (Carter *et al,* 2022)

Based on the data available, and the absence of localised movement data for the Dee Estuary, it is difficult to conclude the level of connectivity between the Eni Development Area and the haul-out sites located in the Dee Estuary. However, the information available does show connectivity between the Dee Estuary and the Skerries, and some connectivity with Cardigan Bay and Skomer (Langley *et al.,* 2018) and areas of high at-sea usage for grey seals around Liverpool Bay, the East coast of Ireland, and to the Northwest of the Isle of Man (Figure 1.1).

Grey seals typically live between 20 to 30 years with gestation lasting between 10 to 11 months (SCOS, 2015; SCOS, 2018), thus the duration of vessel presence (albeit intermittent) could potentially overlap with up to two breeding cycles. Considering the above, the duration of the effect in the context of the life cycle of grey seal is classified as medium term.

Barrier effects

The potential for barrier effects (i.e. the ability to move between key areas such as haul-out sites and foraging areas offshore) was considered for both concurrent and single piling scenarios. The level at which a measurable response is predicted to occur in seal species is at a maximum received sound level of 145 dB re 1 μPa^2s SEL_{ss} (= 155 dB re 1 µPa SPL_{rms}) (Whyte *et al.,* 2020). Animals exposed to lower sound levels are likely to experience mild disruptions of normal behaviours but prolonged or sustained behavioural effects, including displacement, are unlikely to occur (Southall *et al*., 2021).

With respect to the above, it was considered that grey seals from the West Hoyle haul-out site could experience very mild disturbance but that this would be unlikely to lead to barrier effects, (i.e. preventing animals from using the foraging grounds in waters along the coast) as animals are unlikely to be excluded from the coastal areas. Figure 7.11 of in Volume 2, Chapter 7: Marine Biodiversity shows that sound levels overlapping with the haul-out site are likely to be within the range of 125 to 135 dB re 1 μPa^2s SEL_{ss}, with the closest 145 dB re 1 μPa^2s SEL_{ss}contour lying several kilometres away. Furthermore, grey seal has a large foraging range (up 448 km reported in Carter *et al.,* 2022) and could therefore move to alternative foraging grounds during vessel activity. In addition, there may be an energetic cost associated with longer foraging trips and alternative habitat may be sub-optimal in terms of abundance of key prey species.

The impact is predicted to be of local spatial extent, medium-term duration, intermittent and reversible (i.e. the elevation in underwater sound only occurs during the activities). Similarly, the effect of behavioural disturbance is reversible as receptors are expected to recover within hours/days. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **low**.

1.3.13.1.2 Sensitivity of the Receptor

Grey seals may become disturbed from haul-out sites due to the presence of vessels, which, if occurring in the breeding season, can result in the abandonment of pups. Due to this, grey seals are considered to be sensitive to vessel disturbance at haul-out sites, particularly if that occurs within the breeding season.

The response of grey seals to disturbance at haul-out sites can range from increased alertness to moving into the water (Wilson, 2014). The potential impact on pupping groups can include temporary or permanent pup separation, disruption of suckling, energetic costs and energetic deficit to pups, physiological stress and sometimes an enforced move to a distant or suboptimal habitat. Potential impacts on moulting groups can include energy loss and stress, while impacts on other haul-out groups can cause loss of resting and digestion time and stress (Wilson, 2014). The potential impacts will be determined by the response of the seals, the duration and proximity of the disturbance to the seals.

Studies on grey seals found that, mothers respond by moving into the water more due to boat speed than as a result of the distance, although movement into the water was generally observed to occur at distances of between 20 and 70 m, with no detectable disturbance at 150 m (Wilson, 2014; Strong and Morris, 2010). However, both grey and harbour seals have also been reported to move into the water when vessels are at a distance of approximately 200 to 300 m (Wilson, 2014).

Further studies on the effects of vessel disturbance on harbour seals when they are hauled out, suggest that even with repeated disturbance events that are severe enough to cause individuals to flee into the water, the likelihood of harbour seals moving to a different haul-out site would not increase. Furthermore, this appeared to have little effect on their movements and foraging behaviour (Paterson *et al.,* 2019). A study of the reactions of harbour seal from cruise ships found that, if a cruise ship was less than 100 m from a harbour seal haul-out site, individuals were 25 times more likely to flee into the water than if the cruise ship was at a distance of 500 m from the haul-out site (Jansen *et al.,* 2010). At distances of less than 100 m, 89% of individuals would flee into the water, at 300 m this would fall to 44% of individuals, and at 500 m, only 6% of individuals would flee into the water (Jansen *et al.,* 2010). Beyond 600 m, there was no discernible effect on the behaviour of harbour seal. Therefore, it is considered that, for grey seal, vessels travelling within 300 m of a haul-out site, a grey seal may flee into water, but significant disturbance would be expected at a distance of less than 150 m.

The sensitivity of grey seal to disturbance from seal haul-out sites is therefore **low**, and as a very precautionary approach, it is proposed that sensitivity during the breeding season and annual moult could be slightly higher and has therefore been considered as **medium** in this assessment.

1.3.13.1.3 Significance of Effect

Overall, for grey seal at the West Hoyle Bank, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be low to medium. The significance of effect will therefore be **minor** adverse, which is **not significant** in EIA terms.

1.3.14 Injury, Disturbance, and Displacement from Vessel Activity and other Noise Producing Activities

The impact of vessel use during the construction, operation and maintenance, and decommissioning phases of the Proposed Development have the potential to cause injury, behavioural disturbance, and associated displacement of marine mammals. Noise producing activities (e.g., seabed preparation, drilling, and rock placement over the cables) could additionally result in disturbances to marine mammals within the development area.

The impacts from elevated underwater noise due to vessel use and other activities is based on a vessel and/or activity basis, considering the maximum injury/disturbance range as assessed in Volume 3, Appendix J: Underwater Noise). However, several activities could be potentially occurring at the same time and therefore ranges of effects may extend from several vessels/locations where the activity is carried out and potentially overlap.

1.3.14.1 Construction Phase

1.3.14.1.1 Magnitude of Impact

Auditory Injury

All Species

During the construction phase of the Proposed Development, the increased levels of vessel activity will contribute to total underwater noise levels. The MDS for construction activities is up to a total of 236 construction vessels round trips. These include heavy lift vessels, tug/anchor handlers, survey vessels, cable lay and installation vessels, and support vessels. While this will result in an increase in vessel presence, movement will be limited to within the Eni Development Area and are likely to follow existing shipping routes while travelling to and from ports. These routes have been long established during existing Eni operations within Liverpool Bay The MDS also accounts for other noise producing activities in the construction phase, such cable laying, cable trenching/cutting, and the use of jack-up rigs.

Whilst this will lead to an uplift in vessel activity, the movements will be limited to within the Eni Development Area and are likely to follow existing shipping routes to/from the ports. Currently, approximately 54 vessels per day in total pass through the Eni Study Area. Vessel traffic activity shows a seasonal trend that peaks over spring and summer months (March to August) and decreases in the autumn and winter months (September to February). The difference in vessels counts can be attributed largely to recreational activity in the summer months, while passenger and wind farm vessels were also more frequent over the summer. Most vessels crossing the Eni Study Area are commercial cargo and tanker vessels. Commercial traffic is largely concentrated at the Queen's Channel, which serves as the main access route to the ports within the River Mersey including Liverpool and the Manchester Ship Canal, the Liverpool Bay Traffic Separation Scheme (TSS) which channels the traffic to the North and South of the proposed location of the Douglas platform, as well as the various wind farms in the area and their associated vessel routes. Main vessel routes used by cargo vessels, tankers and passenger vessels heading to Ireland also form high density routes towards the Northwest of the study area. It was noted during consultation that the Port of Liverpool carries out frequent maintenance dredging the Queen's Channel, further contributing to this high-density area. Any vessel movements are likely to follow existing shipping routes to and from the ports.

The main drivers influencing the magnitude of the impact are vessel type, speed and ambient sound levels (Wilson *et al.,* 2007). Baseline levels of vessel traffic in the Eastern Irish Sea are already high, largely due to ferry routes. For example, in 2019, there were 1,912 commercial ferry crossings between Liverpool or Heysham and the Isle of Man, 1,696 crossings between Liverpool and Belfast, 1,087 between Heysham and Warrenpoint (Northern Ireland), and 604 crossings between Heysham and Dublin (Energie Baden-Württemberg (EnBW) and British Petroleum (BP), 2023). Vessels and construction activities will be temporary and transitory, as opposed to permanent and fixed. In this respect, vessel and construction activity noise is unlikely to differ significantly to that of vessel traffic already present in the area.

Other sound-generating activities will include burial of up to 126.04 km of subsea power cables via trenching and ploughing.

A detailed underwater noise modelling assessment has been carried out to investigate the potential for injurious effects due to increase underwater noise (non-impulsive sound), using the latest criteria (see Volume 3, Appendix J: Underwater Noise). A conservative assumption has been made that all individuals will respond to increased vessel noise. The exposure metrics for different species and flee speeds were employed. In reality, the distance over which effects may occur will, however, vary according to the species, the ambient sound levels, hearing ability, and behavioural response differences.

The underwater noise modelling results indicate that the threshold for PTS was not exceeded for any species for all vessels and activities. The threshold for TTS was also not exceeded for all species except harbour porpoise (in the VHF hearing group) (Table 1.9). Therefore, there is a negligible risk of PTS occurring to marine mammals as a result of elevated underwater sound due to vessel use, and cable laying, trenching, and jack-up rig activities. These activities were not modelled for marine turtles. However, given that thresholds were not exceeded for all marine mammal hearing groups (except TTS for VHF), the same result has been extrapolated for marine turtles.

Table 1.9: Estimated PTS And TTS Ranges (m) From Different Vessel Types And Activities For The Marine Mammal Hearing Groups (N/E = Threshold Not Exceeded)

Noise Source	Range (m)							
	LF		HF		VHF		PCW	
	PTS	TTS	PTS	TTS	PTS	TTS	PTS	TTS
Vessels								
Anchor handling vessel	N/E	N/E	N/E	N/E	N/E	700	N/E	N/E
Main installation vessel, construction vessel	N/E	N/E	N/E	N/E	N/E	1,440	N/E	N/E
Survey vessel, crew transfer vessels, and support vessels	N/E	N/E	N/E	N/E	N/E	6,740	N/E	N/E
Miscellaneous small vessel (e.g. tugs, vessels carrying Remotely Operated Vehicles (ROVs), dive boats, guard vessels)	N/E	N/E	N/E	N/E	N/E	700	N/E	N/E
Activities								
Cable trenching/cutting	N/E	N/E	N/E	N/E	N/E	5,000	N/E	N/E
Cable laying	N/E	N/E	N/E	N/E	N/E	1,440	N/E	N/E
Jack-up rig	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E

Overall, for all IEFs, the likelihood of auditory injury is extremely low, and the maximum duration of the construction phase is up to two years. Therefore, this impact is predicted to be of limited spatial extent, medium term duration, intermittent and, although the impact itself is reversible (i.e. the elevation in underwater noise only occurs during the activities), the effect of PTS is permanent. It is predicted that the impact will affect the receptor directly. Since the PTS threshold was not predicted to be exceeded for any activities or hearing groups, the magnitude of impact is considered to be **negligible** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

All Species

Behavioural disturbance is only likely to occur if vessel sound and activities exceed the background ambient noise levels. As discussed above for auditory injury, vessel traffic within the Eni Development Area is already high, indicating high background ambient noise levels.

As above for auditory injury, a detailed underwater noise modelling assessment has been carried out to investigate the potential for behavioural disturbance due to increase underwater noise (non-impulsive sound), using the latest criteria (see Volume 3, Appendix J: Underwater Noise. A conservative assumption has been made that all individuals will respond to increased vessel noise. The exposure metrics for different species and flee speeds were employed. In reality, the distance over which effects may occur will, however, vary according to the species, the ambient sound levels, hearing ability, and behavioural response differences. It should be borne in mind that there is a considerable degree of uncertainty and variability in the onset of disturbance and therefore any disturbance ranges should be treated as potentially over precautionary.

Based on the results of the underwater noise modelling, the estimated behavioural disturbance ranges for all hearing groups are presented in Table 1.10. The greatest behavioural disturbance range was from survey vessels, crew transfer vessels, and support vessels, with an estimated range of 20 km. Disturbance ranges for other vessels and activities varied from 6.3 to 16 km, with the threshold of disturbance not exceeded for jack-up rig activities.

Table 1.10: Estimated Behavioural Disturbance Ranges (km) From Different Vessel Types And Activities For All Marine Mammal Hearing Groups (N/E = Threshold Not Exceeded)

Noise Source	Disturbance Range (km)
Vessels	
Anchor handling vessel	6.3
Main installation vessel, construction vessel	7.5
Survey vessel, crew transfer vessels, and support vessels	20
Miscellaneous small vessel (e.g. tugs, dive boats, guard vessels)	6.3
Activities	
Cable trenching/cutting	16
Cable laying	7.5
Jack-up rig	N/E

With impulsive sound sources, there is an understanding of the difference between strong and mild disturbance, whereas for non-impulsive (continuous) sound sources, there is only a single available threshold (120 dB re 1 µPa (rms)) (NMFS, 2005). This threshold has been classed as the distance beyond which no animals would be disturbed. Given that ranges for disturbance for vessels are presented up to the 120 dB re 1 µPa (rms) threshold, and there is no distinction between mild and strong disturbance, it can be assumed that not all animals found within those ranges presented within Table 1.10 would be disturbed. There is also likely to be a proportional response (i.e. not all animals will be disturbed to the same extent), although there is no dose-response curve available to apply in the context of non-impulsive sound sources. Individual life history and context will also influence the likelihood of an individual to exhibit an aversive response to noise. These impacts will not be continuous over the construction phase, instead carried out over a shorter number of days within the period. Therefore, given the limited quantitative information available, as described above, any simplified calculation would likely lead to an unrealistic overestimation of the number of animals likely to be disturbed. As such, this value has not been quantified.

The impact is predicted to be of local spatial extent, medium-term duration, intermittent and reversible (i.e. increased underwater noise only occurs during the vessel presence and activities). Similarly, the effect of behavioural disturbance is reversible as receptors are expected to recover within days, even hours. It is predicted that the impact will affect the receptor directly. Therefore, the magnitude of impact is considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.14.1.2 Sensitivity of Receptor

Increased vessel movements during the construction phase of the Proposed Development have the potential to result in a range of effects on marine mammals and marine turtles including injury due to elevated underwater noise, avoidance behaviour or displacement, and masking of vocalisations or changes in vocalisation rate.

Auditory Injury

All Species

The sensitivity of all marine mammal and marine turtle IEFs to auditory injury from underwater noise has been described in Volume 2, Chapter 7: Marine Biodiversity and is not repeated here in full detail. Overall, all marine mammal and marine turtle IEFs are deemed to have limited tolerance to PTS, high vulnerability, low recoverability, and international value. The sensitivity of these receptors to auditory injury is therefore considered to be **high** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Since TTS is reversible, all marine mammal and marine turtle IEFs are assessed as having high tolerance, medium vulnerability, high recoverability, and international value. The sensitivity of these receptors to TTS is therefore considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

The sensitivity of all marine mammal and marine turtle IEFs to auditory injury from underwater noise has been described in Volume 2, Chapter 7: Marine Biodiversity and is not repeated here in full detail.

Marine Mammal IEFs

Vessel movements involved in the construction phase, however, are unlikely to result in barrier effects to migration for these receptors as disturbance ranges will likely constitute a small area in the context of the wider available habitat in the Irish Sea. Overall, the marine mammal IEFs are deemed to have some tolerance to behavioural disturbance, medium vulnerability, high recoverability and international value. The sensitivity of these receptors to behavioural disturbance is therefore considered to be **medium** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Marine Turtle IEFs

Given existing baseline levels of traffic within Liverpool Bay, vessels involved in the construction phase are unlikely to increase the risk of disturbance and therefore it is expected that marine turtles could tolerate the effects of disturbance without any impact on reproduction and survival rates and would return to previous activities once the impact had ceased. Overall, marine turtles are deemed to be of low vulnerability, high tolerance, high recoverability and international value. The sensitivity of these receptors to behavioural disturbance is therefore considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.14.1.3 Significance of Effect

Auditory Injury

All Species

Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be high. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

Marine Mammal IEFs

Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms.

Marine Turtle IEF

Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be low. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.14.2 Operation and Maintenance Phase

1.3.14.2.1 Magnitude of Impact

The size and sound outputs from vessels during the operation and maintenance phase will be similar to those used in the construction phase and therefore will result in a similar spatial MDS.

Auditory Injury

Vessel traffic associated with operation and maintenance activities will result in up to 750 return trips by vessels to and from the Eni Development Area over the 25-year lifetime of the Proposed Development. Over a 25-year period this equates to just 2.5 vessel return trips per month. Vessel presence within the Eni Development Area at any one time will be lower during the operation and maintenance than in the construction phase, but will be of a longer duration, over the whole 25-year lifetime of the Proposed Development.

An overview of potential impacts from elevated underwater noise due to vessel use and other activities are described above for the construction phase and have not been reiterated here. The impact is predicted to be of limited spatial extent, long term duration, intermittent, and although the impact itself is reversible (i.e. the elevation in underwater noise only occurs during the activities), the effect of PTS (if it were to occur) is permanent. It is predicted that the impact will affect the receptor directly. Since the PTS threshold was not predicted to be exceeded for any activities or species, the magnitude of impact is considered to be **negligible** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

Vessel activities within the operation and maintenance phase include cable maintenance. An overview of potential impacts from elevated underwater noise due to vessel use and other activities are described above for the construction phase and have not been reiterated here. The impact is predicted to be of local spatial extent, long-term duration, intermittent and reversible (i.e. the elevation in underwater noise only occurs during the activities). Similarly, the effects of behavioural disturbance are reversible as receptors are expected to recover within hours/days. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.14.2.2 Sensitivity of Receptor

Auditory Injury

All Species

The sensitivity of all marine mammal and marine turtle IEFs to auditory injury from underwater noise has been described previously for piling in Volume 2, Chapter 7: Marine Biodiversity and is not repeated here. The sensitivity of marine mammal and marine turtle IEFs during the operations and maintenance phase is not expected to differ from the construction phase. Overall, all marine mammal and marine turtle IEFs are deemed to have limited tolerance to auditory injury, high vulnerability, low recoverability, and international value. The sensitivity of these receptors to auditory injury is therefore considered to be **high** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Since TTS is reversible, all marine mammal and marine turtle IEFs are assessed as having high tolerance, medium vulnerability, high recoverability, and international value. The sensitivity of these receptors to TTS is

therefore considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

Marine Mammal IEFs

The sensitivity of marine mammals during the operations and maintenance phase is not expected to differ from the construction phase. The sensitivity of marine mammals to behavioural disturbance as a result of this impact is as described above for the construction phase. All marine mammals are deemed to have some tolerance to behavioural disturbance, medium vulnerability, high recoverability, and international value. The sensitivity of these receptors to behavioural disturbance is therefore considered to be **medium** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Marine Turtle IEFs

The sensitivity of marine turtles during the operations and maintenance phase is not expected to differ from the construction phase. The sensitivity of marine turtles to behavioural disturbance as a result of this impact is as described above for the construction phase. All marine turtles are deemed to be of low vulnerability, high tolerance, high recoverability, and international value. The sensitivity of these receptors to behavioural disturbance is therefore considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.14.2.3 Significance of Effect

Auditory Injury

All Species

Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be high. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

Marine Mammal IEFs

Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Marine Turtle IEF

Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be low. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.14.3 Decommissioning Phase

1.3.14.3.1 Magnitude of Impact

Auditory Injury

Vessel traffic associated with decommissioning activities will result in up to 128 return trips by vessels to and from the Eni Development Area. Vessel presence within the Eni Development Area during the decommissioning will be equal to or lower than that of the construction phase at any one time.

An overview of potential impacts from elevated underwater noise due to vessel use and other activities are described above for the construction phase and have not been reiterated here. The impact is predicted to be of limited spatial extent, long term duration, intermittent, and although the impact itself is reversible (i.e. the elevation in underwater noise only occurs during the activities), the effect of PTS (if it were to occur) is permanent. It is predicted that the impact will affect the receptor directly. Since the PTS threshold was not predicted to be exceeded for any activities or species, the magnitude of impact is considered to be **negligible** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

Vessel activities within the decommissioning phase include cable and foundation removal. An overview of potential impacts from elevated underwater noise due to vessel use and other activities are described above for the construction phase and have not been reiterated here. The impact is predicted to be of local spatial extent, long-term duration, intermittent and reversible (i.e. the elevation in underwater noise only occurs during the activities). Similarly, the effects of behavioural disturbance are reversible as receptors are expected to recover within hours/days. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.14.3.2 Sensitivity of Receptor

Auditory Injury

All Species

The sensitivity of all marine mammal and marine turtle IEFs to auditory injury from underwater noise has been described previously for piling in Volume 2, Chapter 7: Marine Biodiversity and is not repeated here. The sensitivity of marine mammal and marine turtle IEFs during the decommissioning phase is not expected to differ from the construction phase. Overall, all marine mammal and marine turtle IEFs are deemed to have limited tolerance to auditory injury, high vulnerability, low recoverability, and international value. The sensitivity of these receptors to auditory injury is therefore considered to be **high** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Since TTS is reversible, all marine mammal and marine turtle IEFs are assessed as having high tolerance, medium vulnerability, high recoverability, and international value. The sensitivity of these receptors to TTS is therefore considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

Marine Mammal IEFs

The sensitivity of marine mammals during the decommissioning phase is not expected to differ from the construction phase. The sensitivity of marine mammals to behavioural disturbance as a result of this impact is as described above for the construction phase. All marine mammals are deemed to have some tolerance to behavioural disturbance, medium vulnerability, high recoverability, and international value. The sensitivity of these receptors to behavioural disturbance is therefore considered to be **medium** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Marine Turtle IEFs

The sensitivity of marine turtles during the decommissioning phase is not expected to differ from the construction phase. The sensitivity of marine turtles to behavioural disturbance as a result of this impact is as described above for the construction phase. All marine turtles are deemed to be of low vulnerability, high tolerance, high recoverability, and international value. The sensitivity of these receptors to behavioural

disturbance is therefore considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.14.3.3 Significance of Effect

Auditory Injury

All Species

Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be high. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Behavioural Disturbance

Marine Mammal IEFs

Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

Marine Turtle IEF

Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be low. Therefore, the effect will be of **minor adverse** significance, which is **not significant** in EIA terms (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity).

1.3.15 Cumulative Injury, Disturbance, and Displacement from Vessel Activity and other Noise Producing Activities

1.3.15.1 Operation and Maintenance and Decommissioning Phases

1.3.15.1.1 Magnitude of Impact

All Species

There is potential for cumulative impacts with one Tier 1 project in both the operation and maintenance and decommissioning phases of the Proposed Development: Awel y Môr Offshore Wind Farm (OWF). It should be noted that the operation and maintenance phase of Awel y Môr OWF is expected to be between 2030 and 2055, therefore it will still be in operation after cessation of the decommissioning phase of the Proposed Development. The MDS for Awel y Môr OWF includes up to 1,232 vessel return trips annually over the 25-year operation and maintenance phase (30,800 total) (RWE Renewables UK, 2021). Only two jack-up vessels and two service operation vessels would be on site at any one time (RWE Renewables UK, 2022). In addition, the MDS for the Proposed Development assumes that there will be up to 750 and 128 vessel round trips over the operation and maintenance and decommissioning phases, respectively.

As in the construction phase, there may be a noticeable increase in vessel activity from the baseline. Although, it should be noted that the assessments are based on the MDSs and the number of vessels present at respective projects at any given time is likely to be lower. In addition, vessel movements will be confined to their respective construction areas and will follow existing shipping routes to and from ports. Therefore, it would not be realistic to present a sum of all vessels anticipated within the Proposed Development and Awel y Môr OWF. Introduction of vessels during operations and maintenance and decommissioning phases of the projects will not be a novel impact for marine mammals and marine turtles in the vicinity, and animals, therefore, are anticipated to demonstrate some degree of tolerance to this impact.

As for the construction phase, vessel movements at the Mostyn Energy Park Extension are not expected to cause injury, disturbance or displacement of marine mammals. The cumulative number of vessels at any given time is expected to be lower for the operations and maintenance phase compared to the construction phase. Therefore, the magnitude of the impact and associated effect (disturbance) as a result of elevated underwater sound due to vessel use and other activities, for all marine mammal receptors, is expected to be less than that assessed for the construction phase. However, considering that the duration of the impact will be longer a precautionary approach has been taken in assessing the magnitude.

The cumulative impact is predicted to be of local spatial extent, long-term duration (temporally over the operation and maintenance and decommissioning phase, but not in terms of individual vessel movements/activities), intermittent (in terms of vessel movements/activities) and both the impact itself (increased underwater noise) and effect of behavioural disturbance are reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low** (no change to conclusion to that which was presented in Volume 2, Chapter 7: Marine Biodiversity)).

1.3.16 Further Evidence for Tolerance to Vessel Presence

The word ‘habituation’ has been updated to ‘tolerance’ as a more appropriate word for this given circumstance. Despite there being multiple studies that show no evidence of increasing tolerance to vessel presence/noise (Wisniewska *et al*., 2018; Pirotta *et al* 2015; Dyndo *et al.,* 2015; Oakley *et al.,* 2017; Marley *et al.,* 2017) there are also studies that show tolerance to boat noise, as detailed in the following paragraphs.

Hastie *et al*. (2021) demonstrated how foraging context is important when interpreting avoidance behaviour in grey seals and should be considered when predicting the effects of anthropogenic activities. Avoidance rates appeared to depend on the perceived risk (e.g. silence, pile driving sound, operational sound from tidal turbines) versus the quality of the prey patch Hastie *et al*. (2021). Therefore, it must be highlighted that sound exposure in different prey patch qualities may result in markedly different avoidance behaviour and should be considered when predicting impacts in EIAs. Given the existing levels of vessel activity in the Eni Development Area, it is expected that marine mammals and turtles could tolerate the effects of disturbance without any impact on reproduction and survival rates and would return to previous activities once the impact had ceased.

There is indication of tolerance to boat traffic (and anthropogenic sounds and activities in general) and so a slight increase from the existing levels of traffic in the vicinity of the Eni Development Area may not necessarily result in high levels of disturbance (Vella *et al*., 2001). Whilst it cannot be assumed that tolerance to a stressor is evidence of absence of detrimental consequences for targeted animals (e.g. physiological responses are not easily detectable in free-ranging wild animals), there is evidence of animals (from multiple species) remaining in areas of high vessel traffic. For example, high co-occurrence between grey seal/harbour seal and shipping traffic within 50 km of the coastline near to haul-out sites were shown in a national scale assessment of seals and shipping in the UK (Jones *et al*., 2017). Thompson *et al*. (2011) (Scottish Natural Heritage (SNH) commissioned report) undertook a modelling study which predicted that increased vessel movements associated with offshore wind development in the Moray Firth would not have an adverse effect on the local population of bottlenose dolphin (although, like Benhemma-Le Gall *et al*. (2021), it did note that foraging may be disrupted by disturbance from vessels).

Owen *et al*. (2024) studied the long-term presence of harbour porpoises during the rerouting of the major shipping lane, through the Kattegat into the Baltic Sea. Despite changes observed in vessel traffic and sound levels, no significant changes were found in monthly presence or foraging behaviour. Presence and foraging behaviour remained the same in areas of increased underwater sound and increased vessel traffic and there was no increase in presence in areas where the vessel traffic/sound levels had decreased, suggesting that the harbour porpoises had not moved to quieter areas. The study suggested harbour porpoise have preferred habitat that they continued to use, even when faced with sudden changes in vessel traffic and noise levels. Owen *et al*. (2024) demonstrated no detected change in monthly presence of foraging behaviour as a result of the shift in shipping lane location.

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