Liverpool Bay CCS Ltd

HYNET CARBON DIOXIDE TRANSPORTATION AND STORAGE PROJECT - OFFSHORE

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Glossary

Term	Meaning
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 the Eni Development Area assets (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.

Acronyms and Initialisations

Acronym / Initialisation	Description
ADD	Acoustic Deterrent Device
AEoI	Adverse Effects on the Integrity
CSIP	Cable Specification and Installation Plan
EDR	Effective Deterrence Range
EMF	Electromagnetic Field
EMP	Environmental Management Plan
ES	Environmental Statement
HRA	Habitats Regulations Assessment
IEF	Important Ecological Feature
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
MarESA	Marine Evidence Based Sensitivity Assessment
MBES	Multi Beam Echosounder
MDS	Maximum Design Scenario
MMMP	Marine Mammal Mitigation Protocol
MU	Management Unit
NRW	Natural Resources Wales
OPEP	Oil Pollution Emergency Plan
OSPAR	Oslo Paris Convention
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PTS	Permanent Threshold Shift
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SBP	Sub Bottom Profiler
SCANS	Small Cetaceans in the European Atlantic and North Sea
SNCB	Statutory Nature Conservation Body
SOPEP	Shipboard Oil Pollution Emergency Plan
SPL_{pk}	Peak Sound Pressure Level
SSC	Suspended Sediment Concentration
TTS	Temporary Threshold Shift
UXO	Unexploded Ordnance
VHF	Very High Frequency
VSP	Vertical Seismic Profiler

Units

Acronym	Description
%	Percent
A	Ampere
dB	Decibel
kg	Kilogram
kg/s	Kilograms per second
km	Kilometres
km^2	Kilometres squared
kV	Kilovolt
m	Metres
m^2	Metres squared
m^3/m/year	Metres cubed per metre per year
sqmm	Square millimetre
µPa	Micro Pascal (10^{-6})
uT	Micro Tesla

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1 REPORT TO INFORM APPROPRIATE ASSESSMENT (RIAA)

1.1 Introduction

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

1.2 Consultation

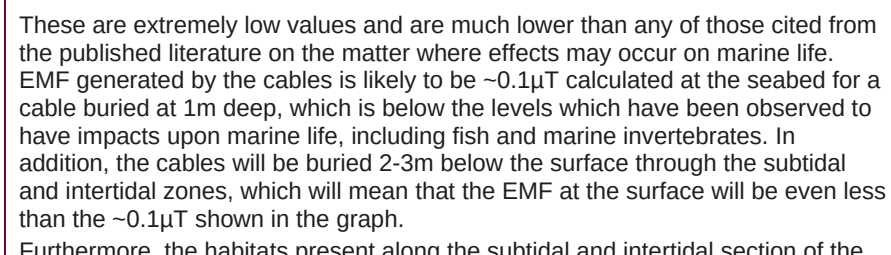
Post-application consultation was received on the 13th of May 2024 from Natural England and on the 14th of May 2024 from Natural Resources Wales (NRW). This has been summarised in Table 1.1.

Table 1.1: Relevant Post-Application Consultation for the RIAA

Consultee	Consultation	Where and How Addressed
Annex I Habitats		
NRW	Conservation objectives for the Dee Estuary Special Area of Conservation (SAC) should be taken from the regulation 33 advice package, as these are the agreed conservation objectives for cross border sites.	Further information is presented in section 1.3.1.
NRW	We advise this table [Table 1.4 of the RIAA] is revised to include only the Maximum Design Scenario (MDS) for those impacts that have the potential to impact the Dee Estuary SAC and its designated features. For example, the MDS in this table currently includes potential impacts from temporary subtidal habitat loss and/or disturbance to West Hoyle Bank (which falls outside the Dee Estuary SAC) and for the whole of the cable corridor when only the intertidal section of the cable corridor interacts with the SAC. This comment is also relevant to the assessments carried out in this RIAA, some of which discuss the potential impacts from the total footprint of the proposed works, but do not clarify how much of that is relevant to the Dee Estuary SAC only.	**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** On a point of clarification, the Marine Licence application, and Environmental Statement (ES) project description (see Offshore ES Chapter 3) presented two cable route options to negotiate the West Hoyle Spit between the Point of Ayr and the New Douglas platform. The worst-case scenario, assessed within the ES, followed in parallel alignment with the existing natural gas pipeline crossing West Hoyle Spit whilst the preferred option, presented in the ES, runs to the east and does not cross West Hoyle Spit. It was never proposed or intended to remove the entire West Hoyle Spit. For the worst-case scenario, to take the cable directly across the West Hoyle Spit, would have required dredging a channel (most likely with a barge operated backhoe dredger). This channel would be circa 7 m in depth; with approximately 3 m to take the Bank down to LAT, then approximately 3 m depth for cable burial. The excavated material would be side cast along the length of the trench, and then backfilled after cable installation. Since publication of the ES and submitting the Marine Licence application, the Applicant has been in negotiations with contractors for the supply and installation of

Consultee	Consultation	Where and How Addressed
		the offshore electrical cables. The outcome of these negotiations is that the cables will not be installed across the West Hoyle Spit and will follow the preferred option to the east. Additionally, only one cable will now be installed between Point of Ayr and the New Douglas platform, instead of the two originally proposed. This also means that there will be a simultaneous lay and burial of the electrical cable requiring only one passage of the cable lay vessel between Point of Ayr and the New Douglas platform, instead of the four that would have been needed. 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. **Technical response** Where possible, separate values for the intertidal zone have been discussed in the MDS and in the assessment text within the RIAA, however there are instances where it was not possible to specify the MDS for the intertidal habitats within the Dee Estuary SAC only. For example, the following text from the RIAA illustrates this: "*The MDS also includes up to 34,500 m^2 of temporary habitat loss due to the footprints of jack up vessels for maintenance activities over the 25-year lifetime. However, both values are for the entire Eni Development Area, as operation and maintenance requirements within the intertidal zone along the cable connection are not available. Therefore, these values of 37,500 m^2 and 34,500 m^2 are considerable overestimations of the temporary habitat loss and/or disturbance along the cable connection*." Further, temporary habitat loss and disturbance to West Hoyle Spit was considered relevant to the Dee Estuary SAC and therefore included within the RIAA. This is because any morphological change to the West Hoyle Spit could impede these feature's ability to act as a natural breakwater for waves propagating towards the Dee Estuary SAC. However, as concluded in the RIAA: "*The temporary change to the morphology of West Hoyle Bank [Spit] will have minimal impact on the feature's ability to act as a natural breakwater for waves propagating towards the Dee Estuary/Aber Dyfrdwy SAC. Given the location and orientation of the channel, cutting through the middle of the bank from its southern face to its northern face, there will be no change to the waves breaking on the west of the sand bank.*"
NRW	NRW (A) advise potential impacts from: • Increased risk of introduction and/or spread of Invasive Non-Native Species (INNS) • Accidental Pollution should be screened into the in-combination assessment.	Due to limited connectivity routes or "stepping-stones" available to introduce and/or spread INNS and overlap with other in-combination plans and projects within or in proximity to the Dee Estuary SAC, along with embedded measures such as an Environmental Management Plan (EMP) (including an INNS Management Plan) and industry standard documents such as an Emergency Response Plan (ERP), Oil Pollution Emergency Plan (OPEP) and Shipboard Oil Pollution Emergency Plan

Consultee	Consultation	Where and How Addressed
		(SOPEP), which other projects will also have, it is considered there are no additional in-combination risks posed to Annex I habitats in the Dee Estuary SAC by the Eni Development Area.
NRW	Insufficient information has been presented here to support the conclusion that the impacts [of Temporary habitat loss/disturbance] to the Annex I Mudflat and sandflats feature will be temporary, and that the habitat will recover within the short-medium term. Please note this information was presented in the Environmental Statement (ES).	Further information and assessment are presented in **section 1.3.2**.
NRW	The suspended sediment plume generated from dredging a channel at West Hoyle Bank will extent into the Dee Estuary SAC, as shown in Volume 2, Chapter 6: Physical Processes. We advise potential impacts to Annex I features of the Dee Estuary SAC within the identified zone of influence should be appropriately assessed in the RIAA. This is particularly relevant to the Annex I Estuaries feature which supports cockle beds which are sensitive to smothering.	Further information and assessment are presented in **section 1.3.3**.
Annex II Diadromous Fish		
NRW	Table 1.2 [of the RIAA] has omitted Cardigan Bay from the sites taken forward to the appropriate assessment stage. The site is, however, included in figure 1.6 [of the RIAA], and section 1.4 [of the RIAA] as a site to be taken forward for further assessment.	Cardigan Bay SAC was screened into the RIAA for bottlenose dolphin within **Table 1.2**. In error, this was not included in Table 1.2 of the RIAA for Annex II diadromous fish, however, is included in the assessment presented in **section 1.7** of this document for the sea and river lamprey features. Further, grey seal was not included in Table 1.2 of the RIAA in error, however, is included in the assessment for Marine Mammal features presented in **section 1.8** of the RIAA. An update to Table 1.2 of the RIAA in relation to Cardigan Bay SAC is presented in **section 1.4.1** of this Technical Note for completeness.
NRW	Table 1.18 [of the RIAA] contains information regarding mitigation measures around Electromagnetic Field (EMF) impacts, however, EMF is not mentioned as a potential impact in the text above. It is noted that the reasons for scoping out EMF are listed in Volume 2, Chapter 7 of the ES, however that reasoning would be useful to include within the RIAA. The Marine Mammal Mitigation Plan (MMMP) is listed under the fish receptor section as a relevant mitigation. NRW (A) advise that measures to mitigate against impacts to marine mammals	EMF impacts, which are relevant only to the operation and maintenance phase, have been scoped out of further assessment within the RIAA as there is limited scope for impacts from EMFs on Annex II diadromous fish ecology. This is because although low-frequency EMFs will be present along subsea cables used to transmit electricity and fish receptors may be receptive to EMF; a recent study has demonstrated increased cable burial depth reduces the intensity of EMF for receptive species due to increasing the distance between the source and receptor (Hutchison *et al.*, 2021). Further, EMFs are expected to be elevated within a range of metres of the cable, returning to baseline levels at close range, thereby reducing the potential footprint of impact to the immediate vicinity of the cable

Consultee	Consultation	Where and How Addressed
	are not appropriate, due to the lack of evidence on their effectiveness for fish receptors. With regards to mitigation measures, NRW (A) acknowledge that 'ramping up' and 'soft start' are standard industry techniques used to reduce the impact of piling on animal receptors, however we are unaware of any evidence that these measures are appropriate/ successful in mitigating the impulsive noise impact for fish receptors.	itself. The cables within the development area will be buried to a target burial depth of 2 to 3m and/or protected, as per the Cable Specification and Installation Plan (CSIP). Therefore, there are no likely significant effects due to EMF on Annex II diadromous fish species. 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 sqmm cable with a current rating of 750 A (although ours will be an even lower amperage)), with grounded metallic sheath, and buried at 1m below surface (our cable will be buried 2-3m 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 0m (purple), and 0.5 m (black) distance from the seabed. Values are in micro Tesla (uT). At the seabed the magnetic field will be ~0.1 uT, and at 0.5 m above ~1.2 uT.  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 ~0.1µT 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 2-3m below the surface through the subtidal and intertidal zones, which will mean that the EMF at the surface will be even less than the ~0.1µT shown in the graph. Furthermore, the habitats present along the subtidal and intertidal section of the cable route are not optimal for species such as the crawfish/spiny lobster, which has a habitat preference of rocky exposed coasts with depths of 5-400m. In addition to this, the desk study and field surveys did not identify any other benthic invertebrates that are sensitive to EMF. Therefore, given the EMF source is so low (~0.02-0.04% the value in studies), the potential effects are likely to be negligible. There are limited findings on the electro sensitivity of benthic organisms and on the associated impact of EMFs on the surrounding benthic invertebrates. The

Consultee	Consultation	Where and How Addressed
		Applicant has reviewed the findings of the four research papers shared by Natural England, and can conclude the following: **Scott *et al.* (2021)** found that EMF strengths of up to 250 µT were found to have limited physiological and behavioural impacts on edible crab. Their study found that it was not until there was exposure to 500 µT and 1000 µT where effects were observed. The power cable for the Proposed Development will generate <0.1 µT at the seabed, which equates to just 0.04% of the EMF in the study. **Taormina *et al.* (2020)** showed that juvenile lobsters did not exhibit any change of behaviour when submitted to an artificial magnetic field gradient (maximum intensity of 200 µT) compared to non-exposed lobsters in the ambient magnetic field. Additionally, no influence was noted on either the lobsters' ability to find shelter or modified their exploratory behaviour after one week of exposure to anthropogenic magnetic fields (225 ± 5 µT) which remained similar to those observed in control individuals. The study concluded that static and time-varying anthropogenic magnetic fields, at these intensities, do not significantly impact the behaviour of juvenile European lobsters in daylight conditions. The power cable for the Proposed Development will generate <0.1 µT at the seabed, which equates to just 0.04% of the EMF in the study. **Chapman *et al.* (2023):** this study simulated an EMF of 500 µT, as modelled for an export cable over a rocky shore, where the industry standard cable burial would not be possible. It found no significant differences in either behavioural or physiological responses in edible sea urchins, periwinkles, common starfish, and velvet crabs. The power cable for the Proposed Development will generate <0.1 µT at the seabed, which equates to just 0.02% of the EMF in the study. **Jakubowska *et al.* (2019)** this study simulated EMF at 1,000 µT, and no avoidance or attraction behaviour to EMF was shown. The power cable for the Proposed Development will generate <0.1 µT at the seabed, which equates to just 0.01% of the EMF in the study. The shared studies present similar findings to those used in our Offshore ES. Bochert and Zettler (2006) studied the effects of EMF on the survival and physiology of various crustaceans, marine worms, and echinoderms in the context of cables associated with OWFs in the Baltic Sea. The authors demonstrated no significant effects for any species after three months of exposure. Furthermore, Wilhelmsson *et al.* (2010) demonstrated that there were no differences between benthic community assemblages observed in visual surveys of OWF subsea cables and their peripheral areas. Finally, the presence of diverse and seemingly healthy benthic communities on existing offshore infrastructure indicates that EMF is unlikely to cause a long-term significant effect upon benthic receptors (Linley *et al*., 2007; Walker *et al*., 2009).

Consultee	Consultation	Where and How Addressed
		Embedded mitigation for this impact includes cable burial and/or protection when not available (such as at cable crossings). The target cable burial depth of 2 to 3 m is sufficient to eliminate the potential for impacts from EMF on benthic invertebrates. Based on this, and the findings of the literature provided above, the evidence supports scoping this impact out of the RIAA and the assessment on benthic subtidal and intertidal ecology. **Marine Mammal Mitigation Plan (MMMP)** Whilst the MMMP and measures within are not designed to specifically mitigate for fish receptors, some fish species may benefit from the measures proposed, therefore it is considered appropriate to include this within the mitigation measures presented for Annex II diadromous fish. Mitigation within the MMMP, such as soft starts, will be undertaken regardless of the benefit to fish, and will reduce the level of first exposure to sound, allowing those species which may be reactive to move away from the source.
NRW	Table 1.19 [of the RIAA] only covers low order and low yield Unexploded Ordnance (UXO) activities. NRW (A) advise the full range of UXO should be included here (as detailed in appendix J), or it should focus on the worst-case scenario: high order, high yield.	High order UXO clearance impact ranges for fish are discussed within the RIAA in the UXO section above Table 1.19, and the assessments presented within section 1.7 are based upon the maximum impact ranges for UXO clearance associated with high order techniques. An updated table to replace Table 1.19 of the RIAA is presented in **section 1.4.2** of this Technical Note. No updates to the assessment presented within the RIAA is required, as this information is already fully integrated into the MDS.
NRW	In Table 1.25 [of the RIAA], underwater noise impacts are listed as only relevant during construction; however, the text mentions geophysical and seismic surveys may occur during the operation and maintenance phases of the development. The table should be updated to capture this information, and risks to species assessed for all relevant phases of development.	Further information is presented in **section 1.4.3**.
Annex II Marine Mammals		
Natural England	Natural England do not agree that 30min Acoustic Deterrent Device (ADD) usage should be included in the underwater noise modelling to predict impact ranges for the assessment. The 30min 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.	The use of ADDs is incorporated into the underwater noise modelling and assessment as standard, in line with the implementation of current guidance on marine mammal mitigation measures for piling (JNCC, 2010). 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. No change is proposed.

Consultee	Consultation	Where and How Addressed
	Final ADD duration will be determined post consent, and therefore Natural England do not agree to including 30 minutes ADD duration at this stage.	
Natural England	Natural England do not support the use of soft start charges for UXO clearance and advise that the use of scare charges is removed from the planned mitigation.	The use of scare charges will be a post consent decision dependent on the type and location of the UXO. The final decisions on UXO clearance will also be discussed post consent with Natural England, and NRW, and the agreed approach included within the final version of the MMMP.
NRW	NRW (A) recommend that densities should be updated where relevant, and justification provided for the density selected. We 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 per km^2 to be considerably lower than the more up to date densities supplied from the latest edition of the Marine Mammal Atlas (Evans and Waggitt, 2023). In line with what NRW has recommended 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.	The Marine Mammal Atlas densities are provided and compared with those used in the RIAA in **section 1.5.1**. No changes to the assessment are considered required due to the values used within the RIAA being more precautionary than those within Evans and Waggitt (2023).
NRW	As per comments provided on Volume 1, chapters 1 to 5: Introductory Chapters and Volume 2, Chapter 7 Marine Biodiversity, West Hoyle sandbank is a major haul out site for grey seal *Halichoerus grypus*. NRW (A) advise that the impact of routing the cable through or around West Hoyle sandbank on the major grey seal haut out site is fully assessed.	**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** 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.

Consultee	Consultation	Where and How Addressed
		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 1.5.2**.
NRW	Given that final ADD duration will be determined post consent with SNCBs and the regulator, NRW (A) 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, including in-combination, cumulative and RIAA, that are based on the predicted ranges with 30min ADDs should be revised accordingly. We 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). NRW (A) 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 displace animals. The applicant is also encouraged to commit to single piling as the worst-case scenario.	The use of ADDs is incorporated into the underwater noise modelling and assessment as standard, in line with the implementation of current guidance on marine mammal mitigation measures for piling (JNCC, 2010). 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. No change is proposed. The mitigation zone range will be reviewed post-consent during finalisation of the MMMP, and will include an increase of mitigation zone from 500 m to 1,000 m, noting that this range is greater than that recommended within the JNCC guidelines for piling (JNCC, 2010). The use of an ADD where the impact range is of <1 km will also be reviewed post consent when finalising the MMMP upon confirmation of the final design parameters to ensure the most appropriate mitigation techniques are applied to the activity. 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 MMMP and all relevant measures defined within this document will be finalised post-consent to ensure full representation of the final design and construction methods, and will incorporate the advice provided where possible.
NRW	NRW(A) acknowledge that to ensure that the assessment of the conservation objective 2 (“There is no significant disturbance of the species”) is comparable, the in-combination assessment will focus only on the approach recommended by (JNCC, 2020) guidance and will use impact specific Effective Deterrence Ranges (EDRs). However, 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,	The screening distances are based on the following justifications: • **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, given the large scale of the marine mammal in-combination assessment study area (the entire Irish Sea, down to the southwestern tips of England and Ireland), only projects within the maximum disturbance range modelled for the Eni Development Area have been included in the in-combination assessment. As the maximum disturbance range of vessel activity and other noise

Consultee	Consultation	Where and How Addressed
	• 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) Management Units (MUs) as screening distances.	producing activities was modelled at 20 km for the project alone, projects within 20 km from the Eni Development Area were screened into the in-combination assessment. This allowed a proportionate approach to the in-combination assessment. • **13 km for geophysical and seismic surveys:** this was based on the maximum impact range modelled for the Project alone (13 km). This was associated for mild behavioural disturbance (for all hearing groups) from a Vertical Seismic Profiler (VSP), although disturbance ranges for Multi Beam Echosounder (MBES) and Sub Bottom Profiler (SBP) were considerably lower (1.1 km and 1.18 km, respectively). Therefore, 13 km is considered an appropriate, precautionary screening range for the in-combination assessment for this impact. This allowed a proportionate approach to the in-combination assessment. • **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, given the large scale of the marine mammal in-combination assessment study area in comparison to the Eni Development Area (where vessels will be operating), only projects within Liverpool Bay have been included for in-combination assessment. This is because vessel use associated with projects at the extremities of the marine mammal in-combination assessment study area, such as those along the coast of Ireland or South West England, would not contribute to increased vessel activity in combination with that of the Eni Development Area. This allowed a proportionate approach to the in-combination assessment.
NRW	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 and vessel activity 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 in-combination increase in the number of vessel trips within the relevant MUs over the lifetime of the project either justify an in-combination magnitude of low or update this assessment.	In combination assessments for both vessel activity and other noise producing activities and underwater noise generated during geophysical and seismic surveys are presented in section 1.84 of the RIAA. Information to support this assessment is provided in **section 1.5.3** of this Technical Note.

1.3 Annex I Habitats

1.3.1 Conservation Objectives for the Dee Estuary SAC

NRW requested that the conservation objectives for the Dee Estuary SAC should be taken from the Regulation 33 Advice Package.

Section 1.5.4 of the RIAA states:

"For European sites which fall within both Welsh and English or English and Scottish territorial waters the two relevant governing Statutory Nature Conservation Bodies (SNCBs) can publish separate conservation objectives for the same European site. ...Where this is the case for European sites assessed within this HRA Stage 2 Appropriate Assessment, the most recently published conservation objectives have been used."

The Natural England Conservation Objectives used in Table 1.10 (and throughout the Section 1.6 of the RIAA were published in 2018 (Natural England, 2018), complying with this statement, as opposed to the Regulation 33 Advice Package, which was published in 2010 (Natural England and NRW, 2010).

The Natural England (2018) high level conservation objectives for the Dee Estuary SAC are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring:

- the extent and distribution of qualifying natural habitats and habitats of qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of qualifying species; and
- the distribution of qualifying species within the site.

The Annex I habitat qualifying features of the Dee Estuary SAC which were taken forward for Appropriate Assessment are:

- mudflats and sandflats not covered by seawater at low tide;
- *Salicornia* and other annuals colonizing mud and sand; and
- estuaries.

As detailed in Table 1.3 of the RIAA, the Annex I estuaries habitat feature of the SAC is currently in unfavourable condition, while the remaining two features are in favourable condition. Therefore, the conservation objective for the estuaries feature of the SAC within the Regulation 33 Advice Package is not applicable as it is to "*maintain the feature in favourable condition*" (Natural England and NRW, 2010). As this feature is in unfavourable condition, the Natural England (2018) conservation objectives are more relevant, as they are specified to "*maintain or restore".* Further, the conservation objectives within the Regulation 33 Advice Package are split out for each feature, with a range of 'conditions' undermining the conservation objective, as detailed in Table 1.2. These conditions are largely encompassed by the wording of the Natural England (2018) conservation objectives listed above. Assessment against each of these conditions would result in unnecessary repetition with little added value to the assessment.

Table 1.2: Conservation Objectives For The Relevant Annex I Habitats Encompassed Within The RIAA As Per The Regulation 33 Advice Package (Natural England and NRW, 2010)

Feature	Conservation Objective
Mudflats and sandflats not covered by seawater at low tide	The conservation objective for the "mudflats and sandflats" feature of the Dee Estuary SAC is to maintain the feature in favourable condition. The "mudflats and sandflats" feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met: i. the total extent of mudflat and sandflat communities within the site is maintained; ii. the proportions of individual mudflat and sandflat communities within the site are maintained; iii. the topography of the intertidal flats and the dynamic processes of channel migration and sinuosity across the flats are maintained; and iv. the abundance of typical species of the mudflat and sandflat feature within the site is maintained.
Salicornia and other annuals colonizing mud and sand	The conservation objective for the "Salicornia and other annuals colonising mud and sand" feature of the Dee Estuary SAC is to maintain the feature in favourable condition. The "*Salicornia* and other annuals colonising mud and sand" feature will be considered to be in favourable condition when both: • subject to natural processes, each of the following conditions (i) to (v) are met: i. the total extent of pioneer saltmarsh vegetation communities within the site is maintained; ii. the presence of pioneer saltmarsh vegetation communities as part of transitions from intertidal sediment communities to higher saltmarsh are maintained; iii. the abundance of the typical species3 of the pioneer saltmarsh vegetation communities is maintained; and iv. the abundance of the notable species of the pioneer saltmarsh vegetation communities is maintained. • and, regardless of natural processes, condition (v) is also met: v. the overall extent and abundance of common cord grass *Spartina anglica* is not increasing within the pioneer saltmarsh zone.
Estuaries	The conservation objective for the "estuaries" feature of the Dee Estuary SAC is to maintain the feature in favourable condition. The "estuaries" feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met: i. the aggregate total extent of all estuarine communities within the site is maintained; ii. the spatial distribution3 of estuarine communities within the site is maintained; iii. the extent of individual estuarine habitat features within the site is maintained; iv. the variety and relative proportions of sediment and rocky substrates within the estuary is maintained; v. the variety and extent of any notable subtidal sediment communities is maintained; vi. the variety and extent of notable intertidal hard substrata communities is maintained; and vii. the spatial and temporal patterns of salinity, suspended sediments and nutrients concentrations are maintained within limits sufficient to satisfy the requirements of statements (i) to (vi) above.

1.3.2 Annex I Mudflats and Sandflats not covered by Seawater at Low Tide

NRW requested further evidence to support the conclusion that impacts to the Annex I habitat feature 'mudflats and sandflats not covered by seawater at low tide' of the Dee Estuary SAC from trenching in West Hoyle Spit will be minor and that the habitat will recover in the short to medium term. Further detail on the recoverability of this Annex I habitat has been provided in this section to satisfy the concerns raised by NRW in Table 1.1.

Elliott *et al.* (1998) provide a detailed overview of the sensitivity characteristics of intertidal sandflats and mudflats and note that the greatest threats to biotopes in these habitats are through large-scale loss and/or removal. No large-scale loss or removal of habitat will occur due to cable trenching around West Hoyle Spit, nor for cable installation in the intertidal zone itself, due to natural and mitigated backfilling. The overview of the sensitivities of intertidal mudflats and sandflats by Elliott *et al.* (1998) is broadly consistent with the sensitivities to the defined Marine Evidence Based Sensitivity Assessment (MarESA) pressures presented as part of the assessment of temporary habitat loss and/or disturbance on the 'mudflats and sandflats not covered by seawater at low tide' Important Ecological Feature (IEF) within Volume 2, Chapter 7: Marine Biodiversity (see Table 1.3, from Volume 2, Chapter 7).

Table 1.3: Sensitivity of the Representative Biotopes Identified as part of the Mudflats and Sandflats Not Covered by Seawater at Low Tide Habitat to Temporary Habitat Loss and/or Disturbance

Representative Biotopes Identified	Sensitivity to Defined MarESA Pressure				Overall Sensitivity (based on the sensitivity matrix in Volume 2: Chapter 7)
	Habitat structure changes – removal of substratum	Abrasion / disturbance of the surface of the substratum or seabed	Penetration or disturbance of the substratum subsurface	Smothering and siltation rate changes (heavy)	
Mudflats and sandflats not covered by seawater at low tide					
Talitrids on the upper shore and strand-line (LS.Lsa.St.Tal)	Medium	Low	Low	Medium	Medium
Macoma balthica and *Arenicola marina* in littoral muddy sand (LS.Lsa.MuSa.MacAre)	Medium	Medium	High	Medium	Medium
Barren or amphipod dominated mobile sand shores (LS.Lsa.MoSa)	Medium	Not sensitive	Not sensitive	Not sensitive	Medium
Polychaete / bivalve dominated muddy sand shores (LS.Lsa.MuSa)	Medium	Low	Not assessed in the MarESA for this biotope	Low	Medium

In the Oslo Paris Convention (OSPAR) 2023 status assessment on intertidal mudflat habitats, these habitats were noted to have natural resilience and the ability to recover well from isolated physical and chemical disturbance (OSPAR Assessment Portal, 2024). In Volume 2, Chapter 7: Marine Biodiversity, the MDS for this impact represented minimal isolated physical disturbance to the West Hoyle Spit (up to 21,000 m^2) over a period of up to three weeks. This supports the prediction of the impact to be of short term duration, within intermittent operations, and of high reversibility. While it is not currently possible to provide a specific timeframe for habitat recovery, this updated cable route around the sandbank will greatly reduce the (already low) level of temporary habitat loss and/or disturbance.

The function of the Dee Estuary SAC is to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the favourable conservation status of its qualifying features (such as mudflats and sandflats not covered by seawater at low tide), by maintaining or restoring:

- Conservation objective 1 - The extent and distribution of qualifying natural habitats and habitats of qualifying species.

- Conservation objective 2 - The structure and function (including typical species) of qualifying natural habitats.
- Conservation objective 3 - The structure and function of the habitats of qualifying species.
- Conservation objective 4 - The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely (Natural England, 2018).

The Eni Development Area overlaps only with 0.21 km^2 of the Dee Estuary SAC, corresponding to 0.13% of the SAC's total area. As such, 'mudflats and sandflats not covered by the seawater at low tide' within the site would be only temporarily affected over a small spatial scale. This impact is therefore highly unlikely to adversely affect natural processes within the estuarine environment. The total extent of 'mudflats and sandflats not covered by the seawater at low tide' within the Dee Estuary SAC is 104.06 km^2, as such temporary habitat loss and disturbance could potentially impact only 0.2% of the extent of this habitat within the SAC.

Based on the information provided above, temporary habitat loss and/or disturbance associated with trenching at West Hoyle Spit during the construction phase will be temporary, of short-term duration and reversible. As such, this pressure is not expected to adversely affect the extent, distribution, structure, function, or supporting processes of the Annex I habitat 'mudflats and sandflats not covered by the seawater at low tide'. Therefore, adverse effects on this Annex I habitat which undermine the conservation objectives of the Dee Estuary SAC will not occur as a result of the Eni Development Area alone or in-combination with other plans and projects.

1.3.3 Suspended Sediment Concentration and Associated Deposition from Dredging at West Hoyle Spit

1.3.3.1 Additional Information to Inform the Assessment

Based upon the modelling detailed in Volume 3: Physical Processes Technical Report, the dredging of a channel through West Hoyle Spit was simulated. The channel was 1 km in length, with a depth of 7 m and a width of 21 m and was modelled with a rate of release of approximately 295 kg/s uniformly throughout the water column. The operation was modelled to take approximately 14 days to complete over a range of tidal conditions.

As shown in Figure 1.1 and Figure 1.2, Suspended Sediment Concentrations (SSCs) during dredging are concentrated around the dredge path and the coastline at the mouth of the Dee Estuary SAC, with maximum plume extents reaching 25 km southeast to the mouth of the River Dee. Maximum SSC values in excess of 3,000 mg/l occur along the dredging route itself, to a peak of approximately 3,200 mg/l, reflecting the shallow water depths. Concentrations are seen to be generally greater inshore where water depths are shallower. Along the western coast of the Dee Estuary SAC maximum values can fall within the range of 3,000 mg/l to 10,000 mg/l, however in most areas fall below 30 mg/l (Figure 1.1). Average SSCs within the Dee Estuary SAC are largely <3 mg/l (Figure 1.2).

SSCs on the final day of dredging (day 14) on both an ebb and a flood tide are presented in Figure 1.3 and Figure 1.4. These figures show that SSCs are largely < 0.05 mg/l throughout most of the Dee Estuary SAC, with some elevated SSCs of up to 3 – 10 mg/l in the northwest corner. This highlights the short-term nature of this impact on the Dee Estuary SAC.

The maximum and average sedimentation values presented in Figure 1.5 and Figure 1.6 show deposition of < 0.1 mm throughout the majority of the Dee Estuary SAC, and between 0.1 – 3 mm in the northwest corner. Average sedimentation values outside of the dredge path are generally limited to < 50 mm, and < 10 mm outside of the area of development area and at negligible levels into the mouth of the Dee Estuary (< 50 mm). Sedimentation one day after the cessation of dredging activity further demonstrates that deposited material is focused in close proximity to the dredge path (Figure 1.7). Sedimentation levels at the Dee Estuary cockle beds are therefore predicted to be below the MarESA pressure benchmark for common cockle of 5 cm as a result of dredging at West Hoyle Spit.

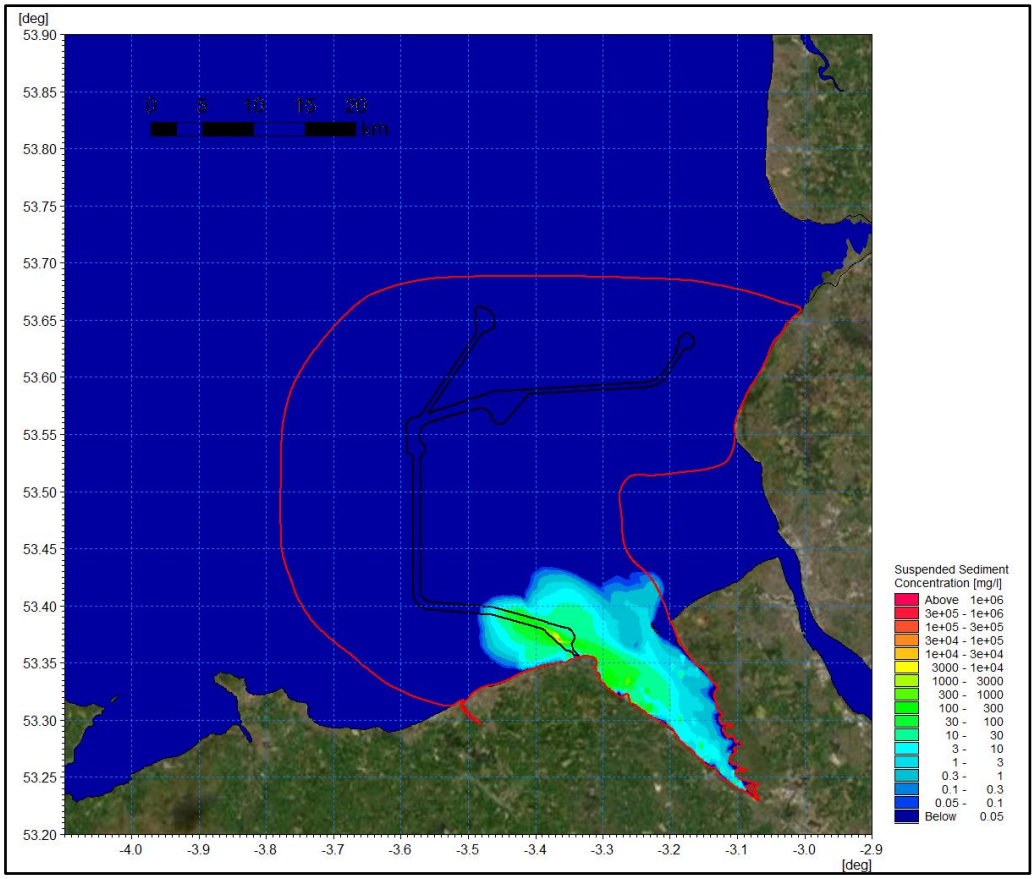


Figure 1.1: Maximum SSCs over the Dredging Phase

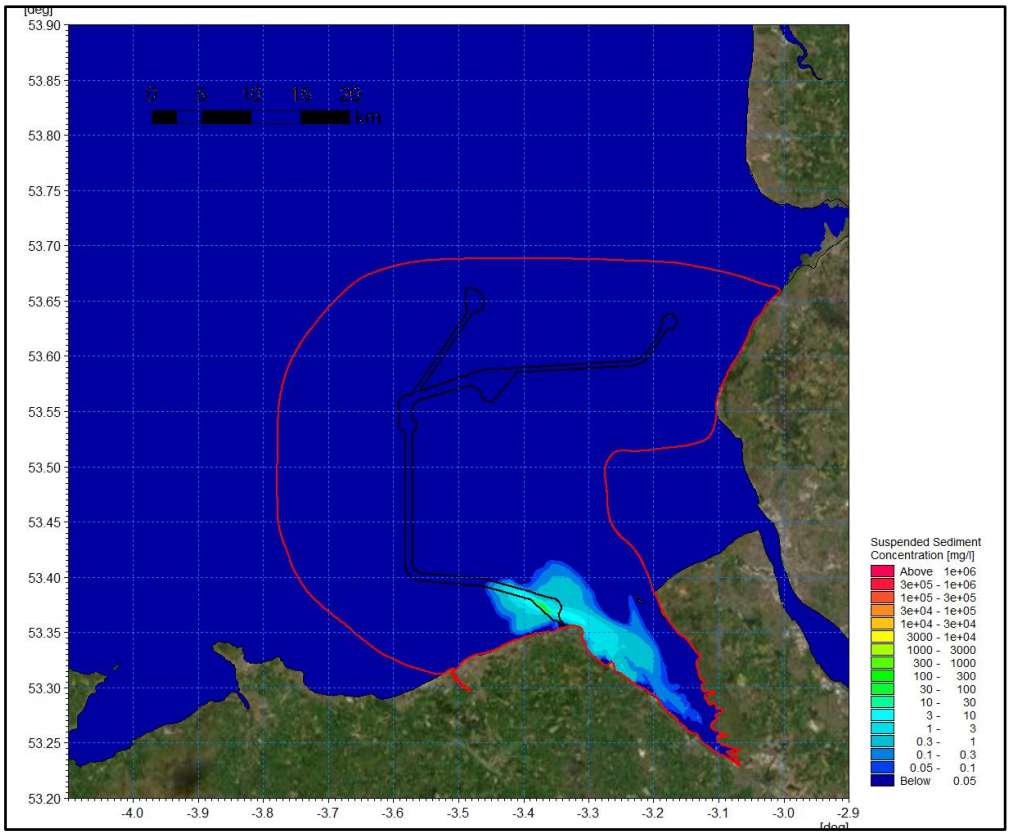


Figure 1.2: Average SSCs over the Dredging Phase

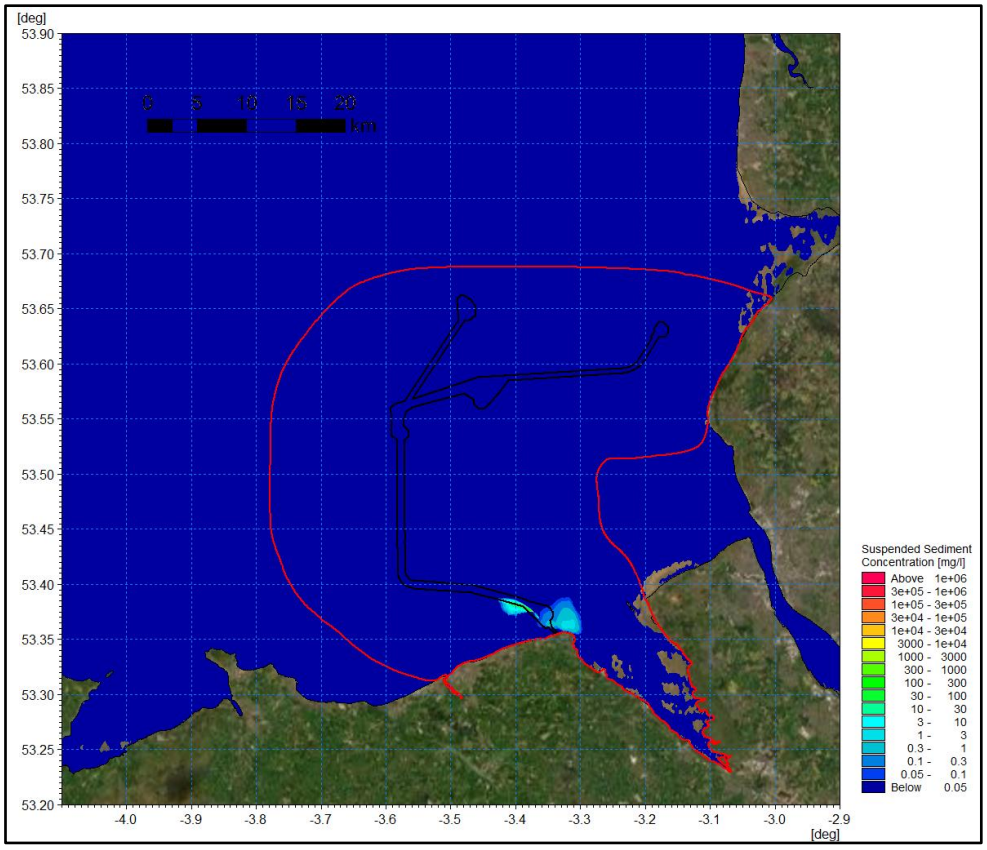


Figure 1.3: SSCs on the Final Day under an Ebb Tide

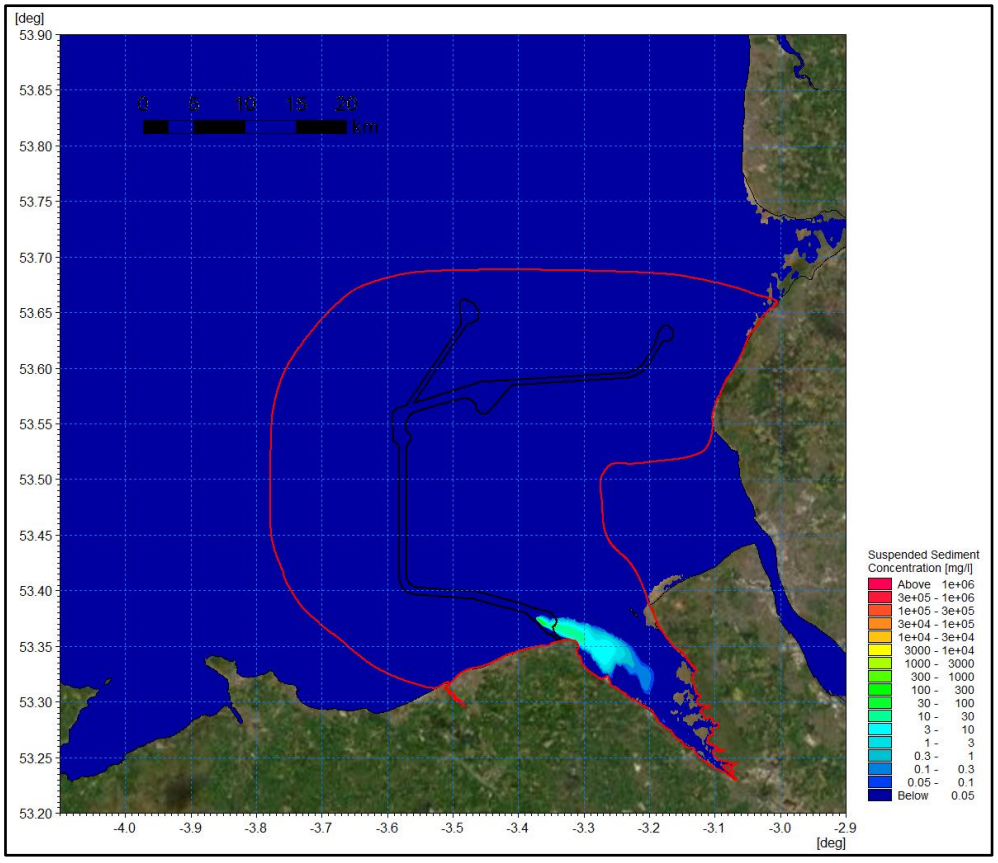


Figure 1.4: SSCs on the Final Day under a Flood Tide

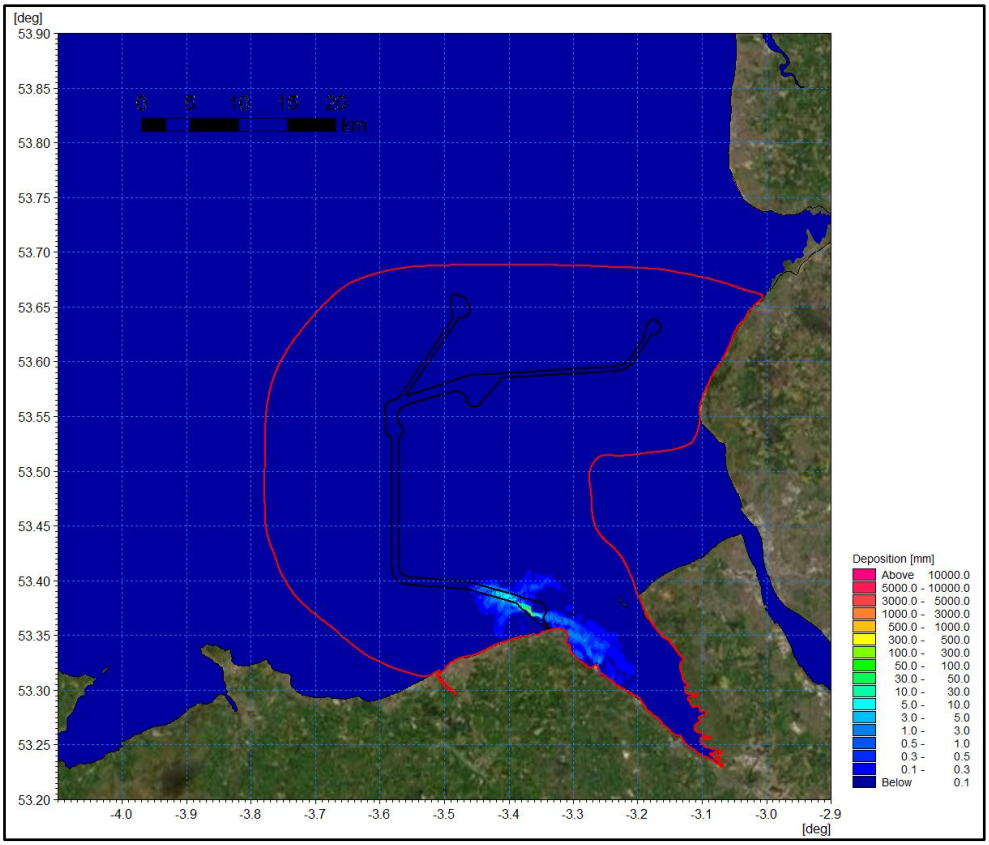


Figure 1.5: Maximum Sedimentation over the Dredging Phase

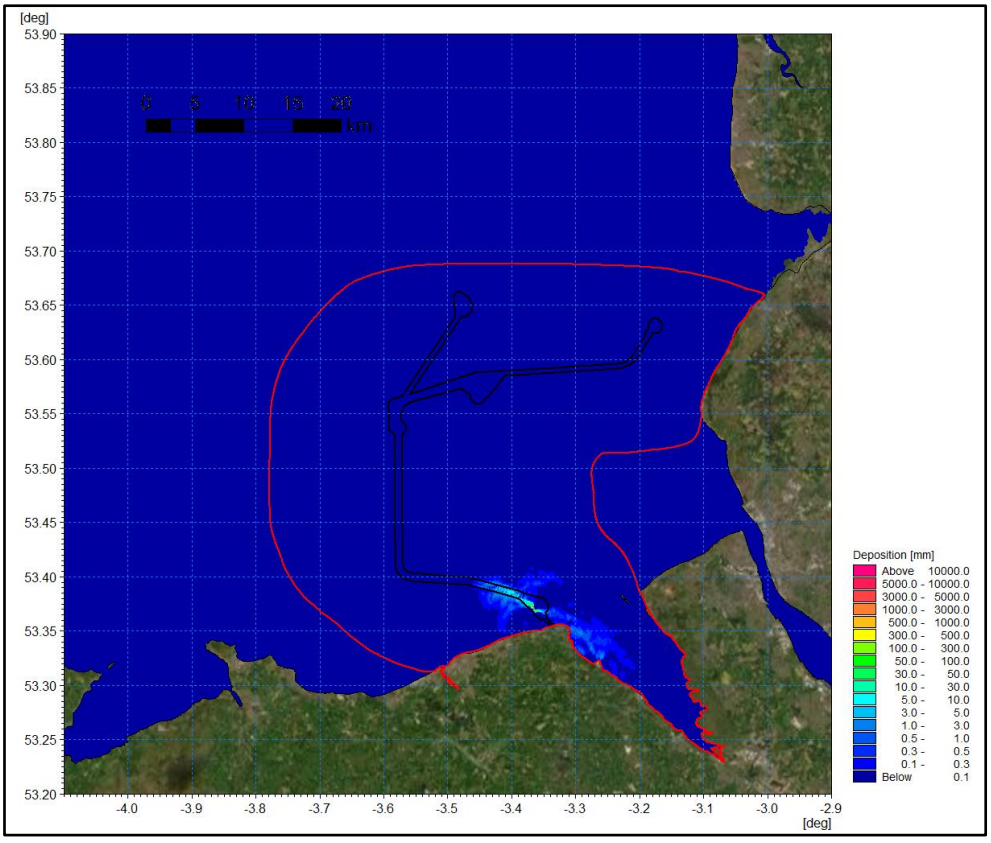


Figure 1.6: Average Sedimentation over the Dredging Phase

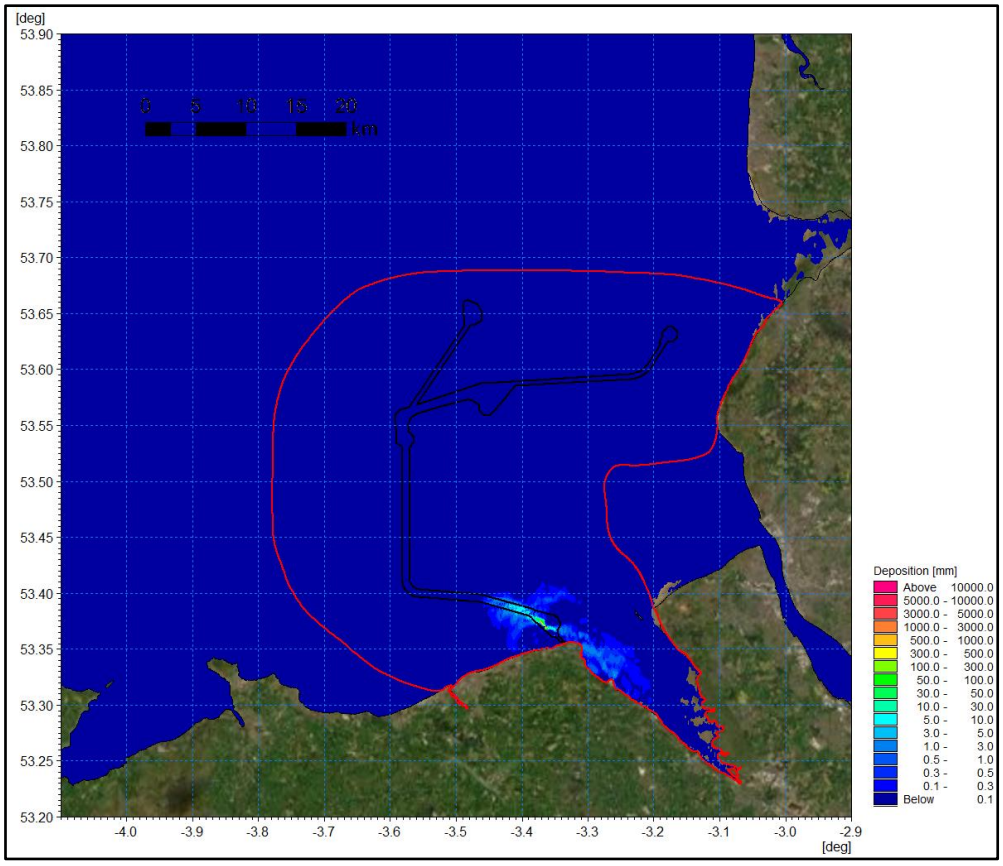


Figure 1.7: Sedimentation One Day After Cessation of Dredging

1.3.3.2 Assessment of Adverse Effects on the Integrity of the Annex I Habitats of the Dee Estuary SAC

The Annex I habitat qualifying features of the Dee Estuary SAC which were taken forward for Appropriate Assessment are:

- mudflats and sandflats not covered by seawater at low tide;
- Salicornia and other annuals colonizing mud and sand; and
- estuaries.

The tidal flow into the Dee Estuary SAC is flood dominant, which implies stronger flood tide currents and net sediment movements into it, especially in the shallow intertidal Annex I habitats, and residual currents ensure landward transport of sand and silt into the Dee Estuary Sac from Liverpool Bay (Bolaños and Souza, 2010, Halcrow Group Ltd, 2013, Moore *et al.*, 2009). In addition, the Dee Estuary SAC is a major sink for both mud and sand (Halcrow Group Ltd, 2013). Average yearly sediment transport (in m^3/m/year) is illustrated in Figure 1.8 (Halcrow Group Ltd, 2013). These data indicate that the sediment transport rates are highest within the Dee Estuary itself (and thus within the area the Annex I habitats are primarily located).

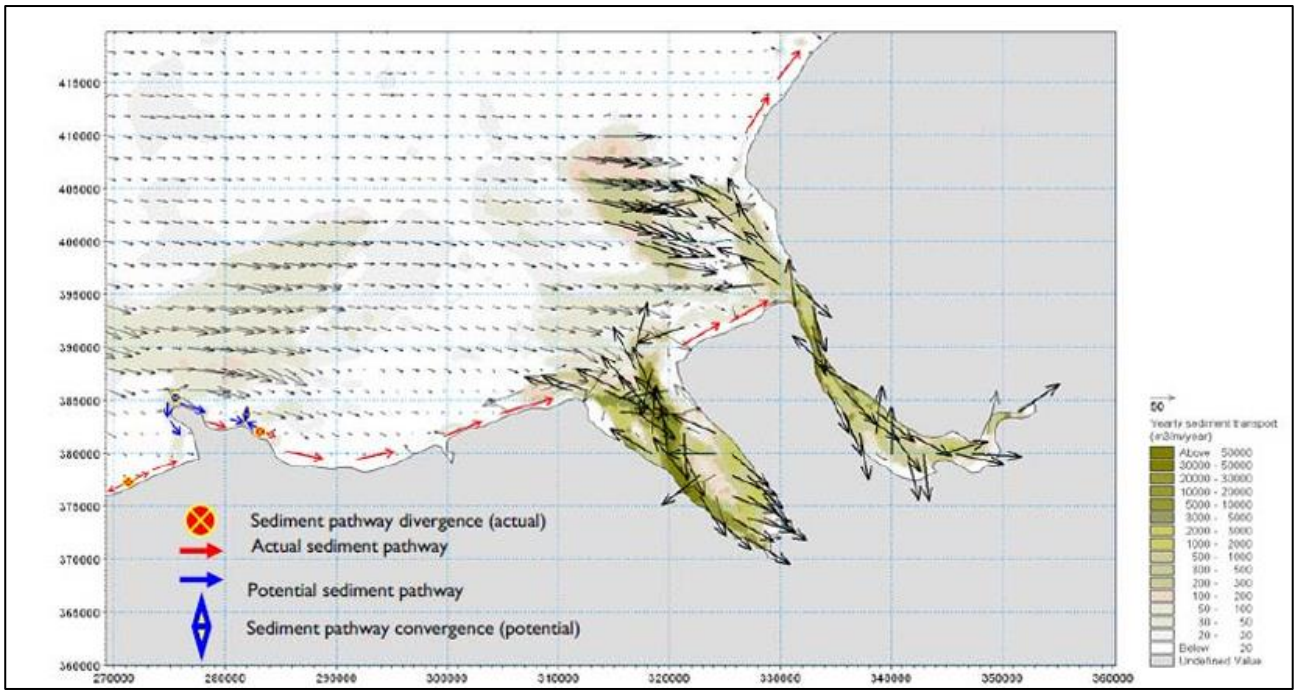


Figure 1.8: Sediment Transport within the Dee Estuary (Source: Halcrow Group Ltd (2013))

Natural England and Countryside Council for Wales (2010) reported intertidal mudflats and sandflats as vulnerable to siltation and changes to turbidity. However, given that the sediment plumes resulting from dredging activities will stay within background levels of the naturally turbid system of the Dee Estuary, it can be anticipated that this pressure will not alter the total extent of mudflat and sandflat communities nor the abundance of typical species within the site.

Salicornia and other annuals colonising mud and sand and Atlantic salt meadows are located approximately 1.78 km and 2.21 km from the Eni Development Area. These qualifying Annex I habitats are not sensitive to sediment plumes as well as associated changes in turbidity and siltation (BSH, 2012, Doody, 2008, Hough *et al.*, 1999, Natural England and Countryside Council for Wales, 2010). As such, the extent of pioneer saltmarsh and Atlantic salt meadow vegetation communities as well as the abundance of typical and notable species of both vegetation communities within the site is unlikely to be affected by dredging activities.

NRW requested further information on the Annex I estuaries feature of the Dee Estuary SAC, which supports cockle beds that could be sensitive to smothering. As per the Regulation 33 Advice, cockle beds are part of the mudflats and sandflats no covered by sea water at low tide sub-feature: 'intertidal muddy sand communities including cockle beds' (Natural England and NRW, 2010). A full assessment of this impact on the cockle beds of the Dee Estuary SAC is provided in the Fish and Shellfish Ecology Technical Note as per similar feedback from NRW on the Volume 2, Chapter 7: Marine Biodiversity.

The common cockle *Cerastoderma edule* has been assessed in the MarESA as having low sensitivity to smothering and not sensitive to increases in SSCs and turbidity (Tyler-Walters, 2007). This is because the species naturally inhabits sedimentary and turbid environments and is therefore considered to be tolerant to these impacts (Navarro and Widdows, 1997, Tyler-Walters, 2007). The common cockle also has intermediate tolerance to smothering of up to 5 cm of deposited sediment, with a high recovery rate, and thus an overall low sensitivity to smothering and siltation effects associated with increased SSCs and associated deposition (Tyler-Walters, 2007). For example, in laboratory and field conditions, individuals have been observed to burrow quickly to the surface if smothered by 2 to 5 cm of sediment (Jackson and James, 1979, Richardson *et al.*, 1993). Therefore, the cockle beds of the Annex I estuaries habitat are considered to have a high tolerance to the impact of increased SSCs and associated deposition.

As outlined within the Physical Processes modelling presented within Volume 3: Physical Processes Technical Report, dredging at West Hoyle Spit is not expected to result in sedimentation levels exceeding the MarESA pressure benchmark for common cockle of 5 cm of deposited sediment. Finally, the Dee Estuary itself is a naturally turbid system; therefore any increases in turbidity from anthropogenic actions typically fall within the natural range that the estuary communities (such as cockle beds) generally experience (Natural England and NRW, 2010).

Based on the information provided above, increased SSCs and associate deposition associated with dredging at West Hoyle Spit during the construction phase will be temporary, of short-term duration and reversible. As such, this pressure is not expected to adversely affect the extent, distribution, structure, function, or supporting processes of the Annex I habitats of the Dee Estuary SAC carried forward for Appropriate Assessment, including cockle beds within the Annex I estuary habitat. Therefore, adverse effects on the Annex I habitats which undermine the conservation objectives of the Dee Estuary SAC will not occur as a result of the Eni Development Area alone and in-combination with other plans and projects.

1.4 Annex II Diadromous Fish

1.4.1 Cardigan Bay SAC

Table 1.4 below shows an update to Table 1.2 of the RIAA, to include reference to sea and river lamprey, and grey seal features of the Cardigan Bay SAC. Bottlenose dolphin in the Cardigan Bay SAC were already included within Table 1.2 of the RIAA.

Table 1.4: A Summary of Cardigan Bay SAC For Which Potential For LSE Could Not Be Discounted At HRA Stage 1 Screening And For Which Appropriate Assessment Is Required

European Site	Distance to the Proposed Development	Relevant Qualifying Feature	Project Phase	Impact
Cardigan Bay SAC	183.99 km	Sea lamprey *Petromyzon marinus*	Construction	Underwater noise impacting fish receptors
		River lamprey *Lampetra fluviatilis*	Construction	Underwater noise impacting fish receptors
		Bottlenose dolphin *Tursiops truncatus*	Construction	Injury and disturbance from underwater noise generated from piling
				Injury and disturbance from underwater noise generated during UXO detonation
		Grey seal	Construction	Injury and disturbance from underwater noise generated from piling
				Injury and disturbance from underwater noise generated during UXO detonation

1.4.2 Unexploded Ordnance (UXO) Clearance

An updated table to replace Table 1.19 of the RIAA is provided in Table 1.5 to include Permanent Threshold Shift (PTS) ranges for both low order and high order UXO clearance.

Table 1.5: Potential Impact Ranges For UXO Clearance Activities

UXO Size	PTS range, (Peak Sound Pressure Level (SPL_{pk}) (m)
0.08kg low order donor charge	
Fish (lower range*)	44
Fish (upper range*)	27

UXO Size	PTS range, (Peak Sound Pressure Level (SPL_{pk}) (m)
0.5kg clearing shot	
Fish (lower range)	81
Fish (upper range)	49
2 x 0.75kg low yield charge	
Fish (lower range)	117
Fish (upper range)	70
4 x 0.75kg low yield charge	
Fish (lower range)	147
Fish (upper range)	88
1.2kg donor charge for high-order UXO disposal	
Fish (lower range)	108
Fish (upper range)	65
3.5kg donor blast-fragmentation charge for high-order UXO disposal	
Fish (lower range)	154
Fish (upper range)	93
Potential UXOs (high-order disposal)	
25kg UXO – high order explosion	
Fish (lower range)	297
Fish (upper range)	179
130kg UXO – high order explosion	
Fish (lower range)	514
Fish (upper range)	309
907kg UXO – high order explosion	
Fish (lower range)	985
Fish (upper range)	590

*The lower range and upper range refer to those provided within volume 3, appendix J of the ES, based upon the Popper *et al.* (2014) guidance for explosions, where thresholds are quoted as ranges. Values presented herein reflect those associated with the extremes of the ranges presented within volume 3, appendix J.

1.4.3 Underwater Noise Impacts during the Operation and Maintenance Phase

Geophysical surveys will be required throughout the project lifetime, occurring intermittently (approximately every 4-5 years) throughout the operation and maintenance phase (25 years). However, individual survey campaigns are likely to be very short term and spatially limited at any one time, reducing the magnitude of their likely impact on diadromous fish. As explained in section 1.4.2, impacts from underwater noise on Group 1 and 2 fish are likely to be minimal, due to their low sensitivity to underwater noise. Non-impulsive sources such as geophysical survey equipment are not considered a key impact to Group 1 and 2 fish; lamprey and salmonids are at a “moderate” risk of behavioural effects at the “near” (i.e. in the tens of metres) or “intermediate” (i.e. in the hundreds of metres) (Popper *et al.*, 2014), however any behavioural responses are likely to result in temporary avoidance reducing any potential for mortality, recoverable injury or Temporary Threshold Shifts (TTS) further.

As per the text in the assessment of Adverse Effects on the Integrity (AEoI) on the SAC tables in section 1.7.3 of the RIAA (e.g. Table 1.15), the implementation of embedded mitigation measures during survey activities, including soft starts, will allow some fish to move away from the areas of highest sound levels, before they reach a level that would cause an injury. Fish that are sensitive to particle motion also more likely to respond

behaviourally to high sound levels (Hawkins and Popper, 2014, Mueller-Blenkle *et al.*, 2010), and it is likely that at least some lamprey or salmonids will temporarily avoid the survey area.

Therefore, adverse effects on the qualifying Annex II diadromous fish, which undermine the conservation objectives of the SACs, will not occur due to underwater noise impacts during the operation and maintenance phase. This is because short term noise behavioural effects are unlikely to translate to population scale, range restriction or habitat alteration effects.

1.5 Annex II Marine Mammals

1.5.1 Marine Mammal Densities

At the time of writing the RIAA the SCANS-IV (Gilles *et al.*, 2023) and the Welsh Marine Mammal Atlas (Evans and Waggitt, 2023) were not available. In early 2024, the densities for harbour porpoise and bottlenose dolphin used in the RIAA were updated to include those from SCANS-IV. For a precautionary approach, the highest densities were used. While grey seal and harbour seal *Phoca vitulina* were not included in Evans and Waggitt (2023), densities for harbour porpoise and bottlenose dolphin were available. Maximum densities have been calculated over the Eni Development Area marine mammal and marine turtle study area and are presented in Table 1.6, alongside the densities used in the RIAA originally. As the maximum density for harbour porpoise used in the RIAA (0.515 animals per km^2) is higher than that of Evans and Waggitt (2023) (0.195 animals per km^2), no updates to use the latter have been undertaken, as the density used is more precautionary. Similarly, the bottlenose dolphin density of 0.035 animals per km^2 used in the RIAA is more precautionary than that from Evans and Waggitt (2023) (0.001 animals per km^2).

Table 1.6: Summary Of Annex II Marine Mammal Densities Used In The RIAA And Those From The Welsh Marine Mammal Atlas (Evans and Waggitt, 2023) Recommended By NRW

Annex II Marine Mammal Species	Density (animals per km^2) used in the RIAA	Density (animals per km^2) from Evans and Waggitt (2023)
Harbour porpoise	0.086[1] to 0.515[2]	0.194[5]
Bottlenose dolphin	0.0104[2] to 0.035[3]	0.001[5]
Grey seal	0.467 to 4.06[4]	Species not included in Evans and Waggitt (2023)
Harbour seal	0.0049 to 0.593[4]	

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

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

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

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

[5] Maximum Densities from Welsh Marine Mammal Atlas (Evans and Waggitt, 2023) overlapping with the Eni Development Area marine mammal and marine turtle study area

1.5.2 West Hoyle Bank Grey Seal Haul-out Site Assessment

1.5.2.1 Disturbance to Grey Seals

Annex II grey seals may become disturbed from haul-out sites due to the presence of vessels and other activities (such as cable laying), which, if occurring in the breeding season, can result in the abandonment of pups. Due to this, grey seals are considered sensitive to vessel disturbance at haul-out sites, particularly during 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 deficit to pups, physiological stress and sometimes an enforced move to 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 and the duration and proximity of the disturbance.

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 (Strong and Morris, 2010, Wilson, 2014). However, 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 100m 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, individuals may flee into the water as a response to vessels travelling within 300 m of a haul-out site, but significant disturbance would be expected at a distance of less than 150 m.

1.5.2.2 Grey seal Presence at West Hoyle Bank

Increased activity around West Hoyle Bank haul-out site during cable laying, 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 their 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 Project. There is potential for some disturbance from construction activities.

There are two main grey seal haul-outs in the North West 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 Sandbank). 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. They demonstrated areas of high at-sea usage for grey seals around Liverpool Bay, the east coast of Ireland, and to the north-west of the Isle of Man. Distribution and predicted number of grey seal in the Eni Development Area marine mammal and marine turtle study area are illustrated in Figure 1.9, which shows areas of high 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

south-west 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.

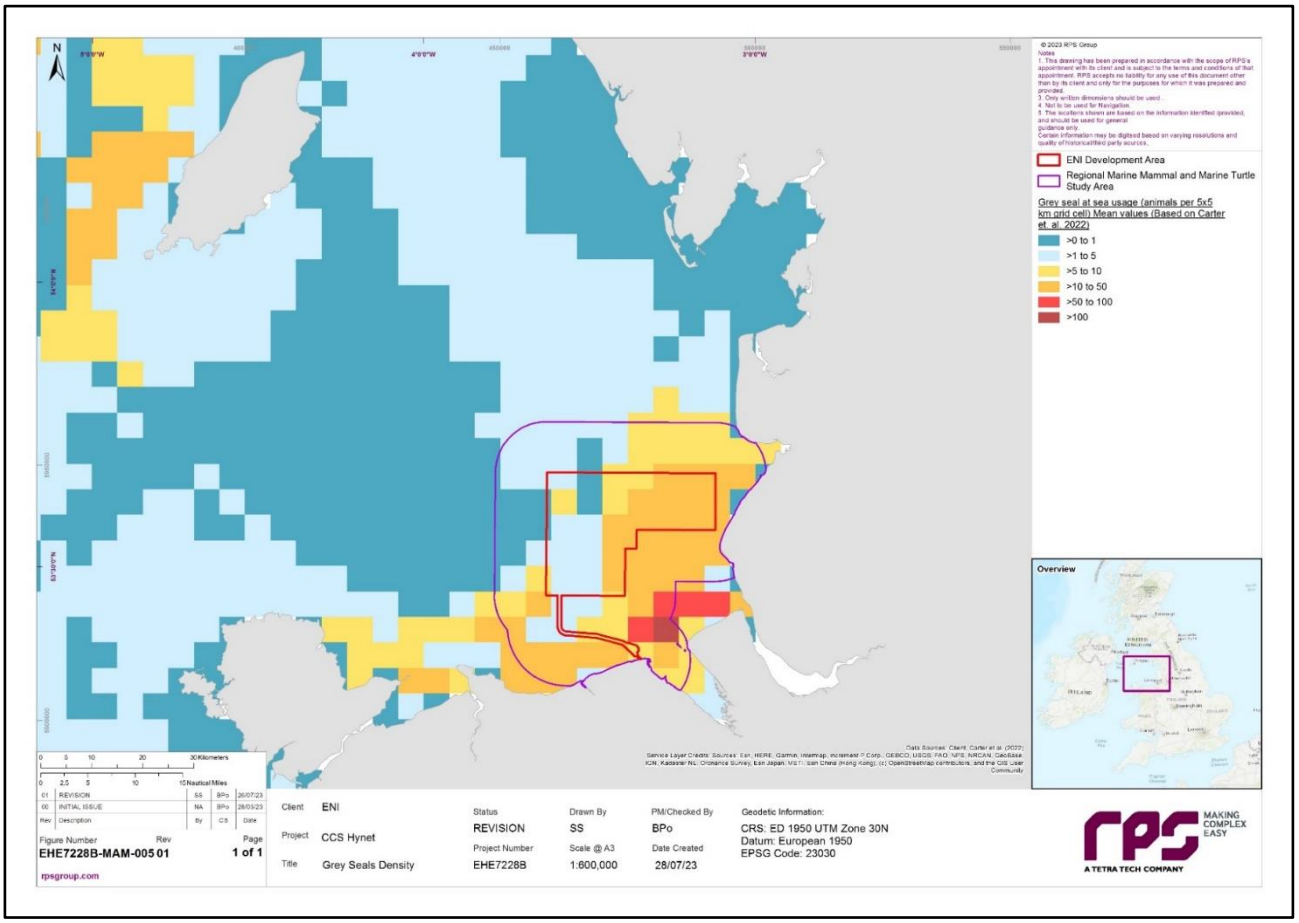


Figure 1.9: Grey Seal Usage At Sea In The Vicinity Of The Eni Development Area (Carter *et al.*, 2022)

Based on the data available, and the absence of telemetry data for the Dee Estuary, it is hard 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, with 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 north-west of the Isle of Man (Figure 1.9).

Grey seal typically live between 20 to 30 years with gestation lasting between 10 to 11 months (SCOS, 2018), thus the duration of vessel presence and cable laying (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 short term.

1.5.2.3 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 µPa2s SEL_{ss} (equal to 155 dB re 1 µPa SPLrms; (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 Bank 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. 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.

1.5.2.4 Assessment of Adverse Effects on Integrity

There are no SACs within Liverpool Bay designated for grey seal, with the closest site screened into the assessment presented within the RIAA being the Lleyn Peninsula and the Sarnau SAC, located 115.39 km away in north-west Wales. After this, the following SACs designated for grey seal as a qualifying feature have been included in the RIAA:

- Cardigan Bay/Bae Ceredigion SAC: 183.99 km;
- The Maidens SAC: 190.72 km;
- Pembrokeshire Marine/Sir Benfro Forol SAC: 233.18 km;
- Saltee Islands SAC: 239.28 km; and
- Lundy SAC: 330.73 km.

It is unlikely that the grey seal features of these SACs, particularly those over 100 km will regularly haul out at West Hoyle Bank, particularly during their breeding season, as their respective SACs will likely represent their haul-outs for breeding and pupping. Overall, based on the information provided in the preceding sections, disturbance to Annex II grey seals using the West Hoyle Bank as a haul-out, due to vessel activity at West Hoyle Spit during cable installation, will not undermine the conservation objectives of the SACs listed for this species. No adverse effect on the integrity of Annex II grey seal features of any of the aforementioned SACs is anticipated from this activity associated with the Eni Development Area alone.

Given that cable installation any associated vessels or personnel involved will be highly localised to the cable route, and short term in duration, in-combination impacts with other plans and projects in the area are not considered possible for this activity. Further, the publicly available information for the Tiers 1 to 4 plans and projects included in the in-combination assessment within the RIAA do not contain any similar cable installation activities around West Hoyle Bank.

An in-combination assessment of vessel disturbance and collision risk has already been conducted within the RIAA, and is not repeated here, as it will encompass the West Hoyle Bank by proxy, given its location within Liverpool Bay and proximity to the Eni Development Area.

1.5.3 Further Information on Vessel Movements and Activity

The impact of vessel use during the construction, operation and maintenance, and decommissioning phases of the Eni Development Area has the potential to cause injury, behavioural disturbances, and associated displacement of Annex II marine mammals. Geophysical and seismic surveys and other noise producing activities (e.g., seabed preparation, drilling, and rock placement over the cables) could additionally result in disturbances to Annex II marine mammals within the Eni Development Area. In combination assessments for both vessel activity and other noise producing activities and underwater noise generated during geophysical and seismic surveys are presented in section 1.84 of the RIAA.

The impacts from elevated underwater noise due to vessel use and these activities is based on a vessel and/or activity basis, considering the maximum injury/disturbance range as assessed in Volume 3, Underwater Noise Technical Report. However, several activities could potentially occur concurrently and therefore ranges of

effects may extend from several vessels/locations where the activity is carried out and potentially overlap. Further information to inform the assessment presented in section 1.84 of the RIAA is provided in the following sections, for the Eni Development Area in-combination with other plans and projects.

1.5.3.1 Eni Development Area Alone

1.5.3.1.1 Auditory Injury

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 Development 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 Development 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 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 of 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 (Mona Offshore Wind Ltd, 2023b). 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 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) from the Eni Development Area alone, using the latest criteria (see Volume 3: Underwater Noise Technical Report). 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 associated with the Eni Development Area alone. The threshold for TTS was also not exceeded for all species except harbour porpoise (in the Very High Frequency (VHF) hearing group).

Therefore, there is a negligible risk of PTS occurring to Annex II marine mammals as a result of elevated underwater sound due to vessel use, and cable laying, trenching, and jack-up rig activities associated with the Eni Development Area alone.

1.5.3.1.2 Behavioural Disturbance

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: Underwater Noise Technical Report). 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 greatest behavioural disturbance range was from survey vessels, crew transfer vessels, and support vessels, estimated at 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.

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 would be disturbed. 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, and cannot be accurately attributed to a single SAC's population. As such, this value has not been quantified.

1.5.3.2 Tier 1 Projects

There is potential for in-combination impacts with two Tier 1 projects: Awel y Môr Offshore Wind Farm (OWF) and Mostyn Energy Park Extension works. It should be noted that the construction phase of Awel y Môr OWF is anticipated to be between 2026 and 2030, so construction activities will only temporally overlap with those of the Eni Development Area for less than a year. Further, the Mostyn Energy Park Extension works are planned from 2023 to 2025, so minimal overlap is predicted with the Eni Development Area (whose construction phase begins in 2026).

The MDS for Awel y Môr OWF describes up to 101 construction vessels in total, of which 35 may be on site at one time (RWE Renewables UK, 2021). For the Eni Development Area, the MDS assumes a total of 236 vessel round trips over the two year construction phase. For operation and maintenance phase, Awel y Mor assumes up to 1,232 vessel return trips annually over the 25 year operation and maintenance phase (30,800 total). In addition, the MDS for the Eni Development Area assumes that there will be up to 750 and 128 vessel round trips over the operation and maintenance and decommissioning phases, respectively.

In the ES for Awel y Môr OWF, impacts associated with underwater noise due to vessel traffic and other construction activities was based on a desktop study. This study stated that using Benhemma-Le Gall *et al.* (2021), harbour porpoise and other cetaceans may be displaced up to 4 km from construction vessels. It also identified localised behavioural disturbance ranges for harbour porpoise and grey seal with avoidance reported

up to 5 km from the site during dredging activities (RWE Renewables UK, 2021). Further, the PTS ranges for the impact of non-piling construction activities (such as cable laying, suction dredging, trenching, rock placement, and vessel movements) were <100 m for all marine mammal species modelled (RWE Renewables UK, 2022). TTS ranges for these activities were also typically <200 m for all hearing groups, with the exception of 1 km for rock placement for the VHF hearing group (i.e. harbour porpoise) (RWE Renewables UK, 2022). These values are similar or lower than those modelled for the Eni Development Area alone (section 1.5.3.1.1), and thus do not represent significant additional potential for AEoI of the SACs taken forward for Appropriate Assessment.

The vessel movements at the Mostyn Energy Park Extension works are not expected to cause injury, disturbance or displacement of marine mammals, given the nature of these works (an extension of a port wall). Therefore, the in-combination number of vessels from the Tier 1 projects at any given time is expected to be lower for the operations and maintenance and decommissioning phases compared to the construction phase. Therefore, potential AEoI of the SACs brought forward to the RIAA for Annex II marine mammals in terms of increased vessel use and other activities in the latter two phases of development is expected to be less than that assessed for the construction phase.

It is a standard practice to present estimated ranges over which behavioural disturbance may occur for different vessel types in isolation. For the Eni Development Area alone, disturbance ranges of up to 20 km were predicted for survey vessels, crew transfer vessels, and support vessels. It is likely that several activities could be taking place across several offshore developments, and therefore disturbance ranges may extend from several vessels/locations where the activity is carried out.

Therefore, the Eni Development Area in-combination with the Tier 1 projects, may lead to a noticeable increase in vessel activity from the baseline. Although, it should be noted that the assessments are based on the MDSs and that 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 Eni Development Area and the Tier 1 projects or a sum of animals potentially affected. Introduction of vessels during all phases of the projects will not be a novel impact for Annex II marine mammals in the vicinity, and animals, therefore, are anticipated to demonstrate some degree of tolerance to this impact. Finally, modelled PTS, TTS and disturbance levels due to vessel use and associated activities do not represent additional potential for AEoI, especially considering that many of the SACs carried forward for Appropriate Assessment are tens to hundreds of kilometres away.

1.5.3.3 Tier 2 Projects

The construction, operation and maintenance as well as decommissioning phases of the Eni Development Area may interact in-combination with that of two Tier 2 projects: the Mona OWF and Morgan OWF Generation Assets.

The MDS for the Mona OWF assumes up to 80 vessels on site at any one time and up to 2,004 vessel round trips over the construction phase (Mona Offshore Wind Ltd, 2023a). The MDS for Morgan OWF Generation assets assumes up to 63 vessels on site at any one time, with 1,878 total round trips over the construction phase (Morgan Offshore Wind Ltd, 2023). In contrast, there will be up to 236 vessel round trips in the construction phase of the Eni Development Area. It should be noted that the construction phases for both these Tier 2 projects are anticipated to be between 2026 and 2028, therefore will only overlap with that of the Eni Development Area for <1 year (in 2026).

Both Mona OWF and Morgan OWF Generation Assets also include drilling, cable trenching and laying, and jack up rig use as other noise producing activities (Mona Offshore Wind Ltd, 2023a, Morgan Offshore Wind Ltd, 2023). Like the assessment for the Eni Development Area alone, the maximum disturbance ranges modelled for Mona OWF and Morgan OWF Generation Assets were for survey vessel movements, at 22 km and 21 km, respectively.

During operation and maintenance, both projects predict up to 21 vessels on site at any one time and up to 2,351 vessel round trips (Mona Offshore Wind Ltd, 2023a, Morgan Offshore Wind Ltd, 2023). For the Eni Development Area, there will be up to 750 vessel round trips in the operation and maintenance phase and 128 in the decommissioning phase. The Tier 2 projects are also likely to include activities such as cable repair and reburial over their operation and maintenance phases, although values for these are unknown.

For the Mona OWF and Morgan OWF Generation Assets, disturbance ranges of up to 22 km and 21 km, respectively, were predicted for survey vessel, support vessels, crew transfer vessel, scour/cable protection/seabed preparation and installation vessels activities (Mona Offshore Wind Ltd, 2023a, Morgan Offshore Wind Ltd, 2023).

As above for the Tier 1 assessment, there may be a noticeable increase in vessel activity from the baseline due to these projects. Although, it should be noted that the assessments are based on the MDSs and that 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 Eni Development Area and the Tier 2 projects or a sum of animals potentially affected. Introduction of vessels will not be a novel impact for marine mammals in the vicinity, and animals, therefore, are anticipated to demonstrate some degree of tolerance to this impact.

Therefore, the Eni Development Area in-combination with the Tier 1 projects, may lead to a noticeable increase in vessel activity from the baseline. Although, it should be noted that the assessments are based on the MDSs and that 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 Eni Development Area and the Tier 1 projects or a sum of animals potentially affected, and the approach presented herein is considered robust. Introduction of vessels during all phases of the projects will not be a novel impact for Annex II marine mammals in the vicinity, and animals, therefore, are anticipated to demonstrate some degree of tolerance to this impact. Finally, modelled PTS, TTS, and disturbance levels due to vessel use and associated activities do not represent additional potential for adverse effects on integrity, especially considering that many of the SACs carried forward for Appropriate Assessment are tens to hundreds of kilometres away.

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