REPORT

Boston Alternative Energy Facility

Addendum to Environmental Statement Chapter 17 and Appendix 17.1 - Marine Mammals (Clean)

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Acronyms

CI	Confidence Interval
dB	Decibel
DCO	Development Consent Order
DML	Deemed Marine Licence
DP	Dynamic Positioning
EIA	Environmental Impact Assessment
ES	Environmental Statement
HRA	Habitats Regulations Assessment
JNCC	Joint Nature and Conservation Committee
km	Kilometre
km^2	Squared kilometre
LWT	Lincolnshire Wildlife Trust
m	Metre
MMMP	Marine Mammal Mitigation Protocol
MU	Management Unit
NMP	Navigation Management Plan
NRW	Natural Resources Wales
PDV	phocine distemper virus
PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SCOS	Special Committee on Seals
SMRU	Sea Mammal Research Unit
SNCBs	Statutory Nature Conservation Bodies
SEL_{cum}	Sound Exposure Level (cumulative)
SPL_{peak}	Sound Pressure Level (peak)
TTS	Temporary Threshold Shift

1 Executive Summary

1.1.1 This Marine Mammal Addendum Report is provided to further support the application for the Boston Alternative Energy Facility. This report is an addendum to the information provided within the submitted Environmental Statement (ES) for marine mammals (specifically in relation to harbour seal *Phoca vitulina*), in Chapter 17 Marine and Coastal Ecology (document reference 6.2.17, APP-055) and Appendix 17.1 Habitats Regulations Assessment (document reference 6.4.18, APP-111).

1.1.2 Since the submission of the application, further baseline information for harbour seal, has been made publicly available on the population decline of harbour seal in the south-east of England and The Wash (with recent counts in Special Committee on Seals (SCOS), 2020). There has also been further information on habitat-based predictions of at-sea distribution for harbour seal (Carter *et al*., 2020). As such, the relevant assessments within both the ES and the Information for the Habitats Regulations Assessment (HRA), have been updated to reflect the changes in the harbour seal counts and reference populations within this marine mammal addendum report.

1.1.3 For impacts relating to underwater noise from piling and dredging activities during construction, the updates result in only small changes to the percentage of the harbour seal population that could be impacted (from between 0.000005% and 0.01% as set out in previous assessments to between 0.000006% and 0.015% in these updated assessments). These small changes are not significantly different from previous assessments and result in no change to the overall magnitude levels of the assessments. Therefore, there is no change to the impact significance of the previous assessments.

1.1.4 For the impact of disturbance to harbour seal from vessel noise, the updated assessments results in a small increase in potential harbour seal population impacts. As a result, the magnitude level changes from ‘negligible’ to ‘low’, and the change in the overall impact significance is from ‘negligible’ to ‘negligible to minor’. However, this is not a significant impact and does not change the overall conclusions of the previous assessments. In addition, these assessments do not take into account the best practice measures that will be in place to reduce the potential for disturbance to harbour seal, so are based on in initial assessment rather than residual levels. With the best practice measures in place the risk of impact is reduced to negligible levels.

1.1.5 There has been no change to the information on harbour seal haul-out sites, and therefore no change to the assessments relating to harbour seal haul-out sites.

1.1.6 For the potential impact of any increase in collision risk to harbour seal with vessels, despite there being a significant decline in the population levels from the 2018 to 2019 counts, there are only small changes in the percentage of the harbour seal population that could be impacted (from between 0.03% and 0.05% in previous assessments to between 0.05% and 0.07% in these updated assessments). These changes are not significantly different from the previous assessments, and result in no change to the overall magnitude levels of the previous assessments. Therefore, there is no change to the impact significance previously assessed.

1.1.7 In addition, further information has been included within this report to assess any potential risk to harbour seal (adults or pups) as a result of interactions with vessels within the anchorage area. Concerns have been raised that there could be risks to harbour seal (notably pups) from (i) interactions with propellers and (ii) from entanglement in anchor chains. However, it is highly unlikely that vessels would remain stationary through the use of dynamic positioning (DP), within the anchorage area, due to the high levels of fuel that would required to remain stationary using this method. In the rare instance that DP was used, the information available (based on a desk-based review of the risk) and resultant assessment indicates that it would be unlikely for any seal (either adult or pup) to be at increased risk of collision with DP propellers. Similarly, the further information (based on a desk-based review of the risk) and assessment for the potential of harbour seal entanglement in anchor chains, also indicates that there would be no risk to harbour seals. No information is available to support any view that harbour seal pups are more at risk to vessels within the anchorage area, than adults are, and therefore the assessments provided are relevant to both adult harbour seal, as well as pups.

1.1.8 The outline mitigation measures, as provided in paragraph 17.8.127 of Chapter 17 of the ES, have been used to inform the Outline Marine Mammal Mitigation Protocol (MMMP) (document reference 9.12). These mitigation and management measures will be in place to reduce the potential impact to marine mammals, (e.g. harbour seal), they include:

- Mitigation for piling:
    - Pre-piling watch for marine mammals, when piling activities are undertaken within three hours of high water, following the standard JNCC ‘Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise’ (JNCC

Protocol)[1] (JNCC, 2010) for minimising the risk of injury to marine mammals from piling noise; and

- Soft-start and ramp-up procedures, for piling activities undertaken within three hours of high water.

- Best practice measures for all vessels:
  - Subject to the pilotage requirements for navigational safety and efficiency (vessel management), and the application of the principle of 'safe speed' (application of COLREGS), vessel speeds of 'as low a speed as reasonably practicable' are to be encouraged within The Haven and The Wash. Noting that since the potential for fatal collisions with marine mammals is significantly reduced at vessel speeds of less than 10 knots, vessel speeds should be aimed to be below that speed.Safety permitting, vessels will maintain the same course (if possible) and speed to give, if required, any seal time to avoid the vessel.
  - Monitoring Option 1: Observers on board each vessel, monitoring for marine mammals as the vessel makes it way though The Wash and up The Haven.
  - Monitoring Option 2: Adaptive monitoring programme Observers on board each vessel, monitoring to record for marine mammal presence and behaviour s in response to vessels within The Haven and The Wash.

These measures will form part of the Navigation Management Plan (NMP) secured by Requirement 14 of the draft DCO.

[1] https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf

2 Purpose of this Report

2.1.1 This 'Marine Mammal Addendum Report' is provided with regard to the Boston Alternative Energy Facility (the Facility). This report is on behalf of Alternative Use Boston Projects Limited (the Applicant), to support the application for a Development Consent Order (DCO) (the DCO application) that has been made to the Planning Inspectorate under Section 37 of the Planning Act 2008 (the Act).

2.1.2 The purpose of this report is to provide additional information and assessment in response to relevant representations received by the Applicant following DCO submission. The additional information and assessment relate to the additional baseline information on harbour seal *Phoca vitulina* that has become available since submission of the DCO application.

2.1.3 The updates included within this report relate to marine mammal topics within both Chapter 17 Marine Ecology [2] and Appendix 17.1 Habitats Regulations Assessment (HRA)[3] of the Environmental Statement (ES), submitted as part of the DCO Application for the Facility.

2.2 Consultation Comments Requiring Further Assessment Work

2.2.1 **Table 2-1** includes the relevant representations that requested additional information with regard to the harbour seal population. **Table 2-1** also provides an indication as to where the information has been provided within this report.

Table 2-1 Relevant Representations and further comments made that require additional assessment work

Organisation	Comment	Section of this Addendum providing the additional information
Lincolnshire Wildlife Trust (LWT) – relevant representation (RR-011)	Impact to harbour seals is not adequately assessed: Population decline - recent evidence suggests a decline in population of harbour seals along the east coast. This should be investigated using up to date information, assessed and reported in the HRA. If a population is in decline, even small impacts could have significant effect on the designated feature.	Information on the recent harbour seal population decline has been provided in **Section 3.3**. The assessments undertaken within both the ES and HRA have been updated within

[2] 6.2.17 Environmental Statement - Chapter 17 - Marine and Coastal Ecology [document reference 6.2.17, APP-055]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010095/EN010095-000440-6.2.17.%20Chapter%2017%20Marine%20and%20Coastal%20Ecology.pdf

[3] 6.4.18 Environmental Statement - Appendix 17.1 - Habitats Regulations Assessment [document reference 6.4.18, APP-111]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010095/EN010095-000490-6.4.18.%20Appendix%2017.1%20Habitats%20Regulations%20Assessment.pdf

Organisation	Comment	Section of this Addendum providing the additional information
		Sections 4 and **5**, respectively.
Natural England – relevant representation (RR-021)	Natural England advises that recent monitoring of the Wash Harbour seals population has demonstrated that the numbers in the Wash has significantly declined along with the national population. Therefore, further impacts to this species should be avoided. Further information on this will become available over the examination of this project. Reference to Russel *et al.* (2017) is now incorrect and we advise that a 5-10% further decline in the population would be an adverse effect on integrity. (Environmental Statement Chapter 17 Marine and Coastal Ecology (document reference 6.2.17, APP-055) Paragraph 17.6.86)	Information on the recent harbour seal population decline has been provided in **Section 3.3**. The assessments undertaken within both the ES and HRA have been updated within **Sections 4** and **5**, respectively.
Natural England – relevant representation (RR-021)	Natural England notes that the applicant proposes to have an observer on the vessel to mitigate for potential collisions. However, Natural England advises that due to the elevation of the vessel and need for not only 360 degree views but also directly adjacent to the vessel this is unlikely to provide the required mitigation for potential collisions. (Environmental Statement Chapter 17 Marine and Coastal Ecology (document reference 6.2.17, APP-055) Paragraphs 17.8.127, 17.8.228)	Information on the efficacy of the proposed mitigation measures has been included within the accompanying Outline Marine Mammal Mitigation Protocol (MMMP) (document reference 9.12).
Natural England – relevant representation (RR-021)	Natural England notes that there is mention of the anchor areas but no assessment of their use when waiting for available tidal window to enter the Haven. It is our understanding that depending on the vessel and timeframes the vessel will either maintain its position using multiple anchors or dynamic positioning. Both of these options potentially increase the potential for Harbour Seals to be injured and/or killed through entanglement with anchor chains or being dragged into unguarded propellers. This is especially the case for pups are more inquisitive and therefore have shown to interact with stationary vessels. (Environmental Statement Chapter 17 Marine and Coastal Ecology (document reference 6.2.17, APP-055) Paragraphs 17.8.144, 17.6.222)	The vessels using the anchorage areas will use the same methods as currently used in this area. Use of anchor is more likely if the vessels would be present for a longer period of time and is beneficial from a pollution and Green House Gas perspective, especially if within designated anchorage areas. Harbour seal, due to their small size, are not considered to be at high risk of entanglement in anchor chains. An assessment of the potential risk from vessels in the anchorage area has also been included within **Section 4.5**

Organisation	Comment	Section of this Addendum providing the additional information
		and **Section 5.5** of this addendum report.
Natural England – further comment made in September 2021	Natural England believes that based on the response the ES is providing contradictory assessments and therefore further clarity is required. Natural England advises that the proposed mitigation is unlikely to reduce the impacts to acceptable levels. In particular we remain concerned about Vessels waiting in anchorage areas for appropriate tidal windows to enter the Haven and the potential for seal pups in the near vicinity becoming entangled in propellers during this time. Consideration should therefore be given for there to be a requirement for guarded propeller ducts for all vessels associated with the project.	See above response.
Natural England – further comment made in September 2021	It was NE's understanding during the call on the 19th August that the 4 knots speed may not be appropriate for the large vessels. In addition, there is no evidence presented to demonstrate why 4 knots would be acceptable in reduce potential collision risk. Therefore, this remains an outstanding concern.	Information on the efficacy of the proposed mitigation measures has been included within the accompanying Outline MMMP. The vessel speed limit has been updated to A 'safe speed' as required by the Port of Boston and COLREGS. Noting that since the potential for fatal collisions with marine mammals is significantly reduced at vessel speeds of less than 10 knots, vessel speeds should be aimed to be below that speed. Further information is provided within the accompanying Outline MMMP.

3 Updates to Harbour Seal Baseline Information

3.1.1 As outlined above, since the submission of the DCO Application, further information on the harbour seal population within The Wash has become available that indicates a population decline (SCOS, 2020). In order to ensure that the proposed project would not have a significant impact to the harbour seal population, in light of this decline, further information and assessment has been provided.

3.1.2 **Table 3-1** provides a comparison of the baseline information used within the ES and HRA, and the more recently available information that the following updates to the assessments have been based on.

Table 3-1 Updates to harbour seal baseline information

Baseline Information	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
Harbour seal haul-out sites			
The Wash haul-out site harbour seal population	3,747 adults / 1,498 pups[4]	2,415[5] adults	Reduction in harbour seal population within The Wash = potential for implications to magnitude levels within all assessments and overall significance.
Blakeney Point haul-out site harbour seal population	399[6]	329[5]	Reduction in harbour seal population = potential for implications to magnitude levels within all assessments and overall significance.
Friskney South haul-out site harbour seal population	38 adults / 16 pups[6]	No update available[7]	None
Rodger haul-out site harbour seal population	7 adults / 0 pups[4]	No update available[7]	None
Ants haul-out site harbour seal population	1 adult / 1 pup[4]	No update available[7]	None
Kenzies Creek haul-out site harbour seal population	143 adults / 94 pups[4]	No update available[7]	None
Designated Sites			
The Wash and North Norfolk Coast Special Area of Conservation (SAC) harbour seal population	4,146 (based on 3,747 in The Wash proper[4], and 399 at Blankney Point[6])	2,744 (based on 2,415 in The Wash proper and 329 at Blakeney Point)	Reduction in harbour seal population within The Wash and North Norfolk Coast SAC = potential for implications to magnitude levels within all assessments and overall significance.
Overall populations (reference population)			
South-east England	4,965[5]	3,752[5]	Reduction in harbour seal population within the south-east England MU = potential for

[4] Based on the August 2018 harbour seal count (as reported in Thompson, 2019)
[5] Based on the August 2019 harbour seal count (as reported in Special Committee on Seals (SCOS), 2020)
[6] Based on the August 2017 harbour seal count (as reported in SCOS, 2018)
[7] No seal survey was undertaken in 2020 due to the Covid-19 restrictions on travel (SCOS, 2020)

Baseline Information	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
Management Unit (MU) population			implications to magnitude levels within all assessments and overall significance.
Harbour seal densities			
Harbour seal density	3.189 /km^2 (in anchorage and shipping channel)[8] 0.80 /km^2 (in The Haven)[8]	See **Section 3.2** for more information.	None
Harbour seal population decline			
South-east England MU population trend	The harbour seal population has remained stable from 2012, with a decrease in numbers from 2016 to 2017, providing an early indication that the population is nearing capacity[9]	See **Section 3.3** for more information.	Reduction in harbour seal population = potential for implications to magnitude levels within all assessments and overall significance.

3.2 Harbour Seal Density Estimates

3.2.1 Density estimates have been used alongside the population estimates (as shown in **Table 3-1** above) to inform the following assessments. Within the ES, the at-sea density estimates reported by Russell *et al.*, 2017 were used. However, an updated report has been published since that time (in Carter *et al.*, 2020).

3.2.2 Carter *et al.* (2020) provides habitat-based predictions of at-sea distribution for harbour seal around the British Isles. The habitat preference approach predicted distribution maps provide estimates per species, on a 5 km x 5 km grid, of relative at-sea density for seals hauling-out in the British Isles. It is important to note that Carter *et al.* (2020) provides *relative* density (i.e. percentage of the total at-sea population in each grid at any one time), whereas previous usage maps (Russell *et al.*, 2017) have presented *absolute* density (i.e. number of animals within each grid at any one time). The densities for the assessments within for both the ES and HRA, as submitted for the DCO, will therefore continue to be used within the assessments in this addendum report, as they represent the best available information for absolute harbour seal densities. These densities are provided in

[8] Taken from Russell *et al.* (2017).
[9] SCOS (2018)

Table 3-1 and described below.

3.2.3 While the Carter *et al.* (2020) report will not be used to inform the updated assessments, a summary of that report has been provided below, for information purposes only.

3.2.4 The mean predicted distribution estimates for harbour seal in the Boston project area (including the facility, The Haven, the shipping corridor and anchorage area, indicate the relative density is very high, 0.067% per 25km^2 (95% Confidence Interval (CI) = 0.036-0.112% per 25km^2) (**Plate 3-1**, Carter *et al.,* 2020). Throughout the area within The Wash, the harbour seal density is high to considerably high (up to 0.209% of the population per 25 km^2), and much lower (less than 0.001% of the population per 25km^2) within The Haven. The anchorage area is within a grid square with a considerably high proportion of the population, more than 0.1% of the population per 25km^2 (0.147% (95% CI = 0.078-0.234% per 25km^2)).

3.2.5 The at-sea usage maps produced by Russell *et al.* (2017) also indicate that harbour seal usage is high in and around the shipping channel for the Facility and anchorage area, with a harbour seal density of 3.189 per km^2 within the shipping channel and anchorage location (Russel *et al.,* 2017). This is similar to the harbour seal density within the whole of The Wash, with an estimated density of 3.2 per km^2, based on the data provided by Russel *et al.* (2017). The harbour seal density is lower within The Haven itself, with an estimated density of 0.80/km^2.

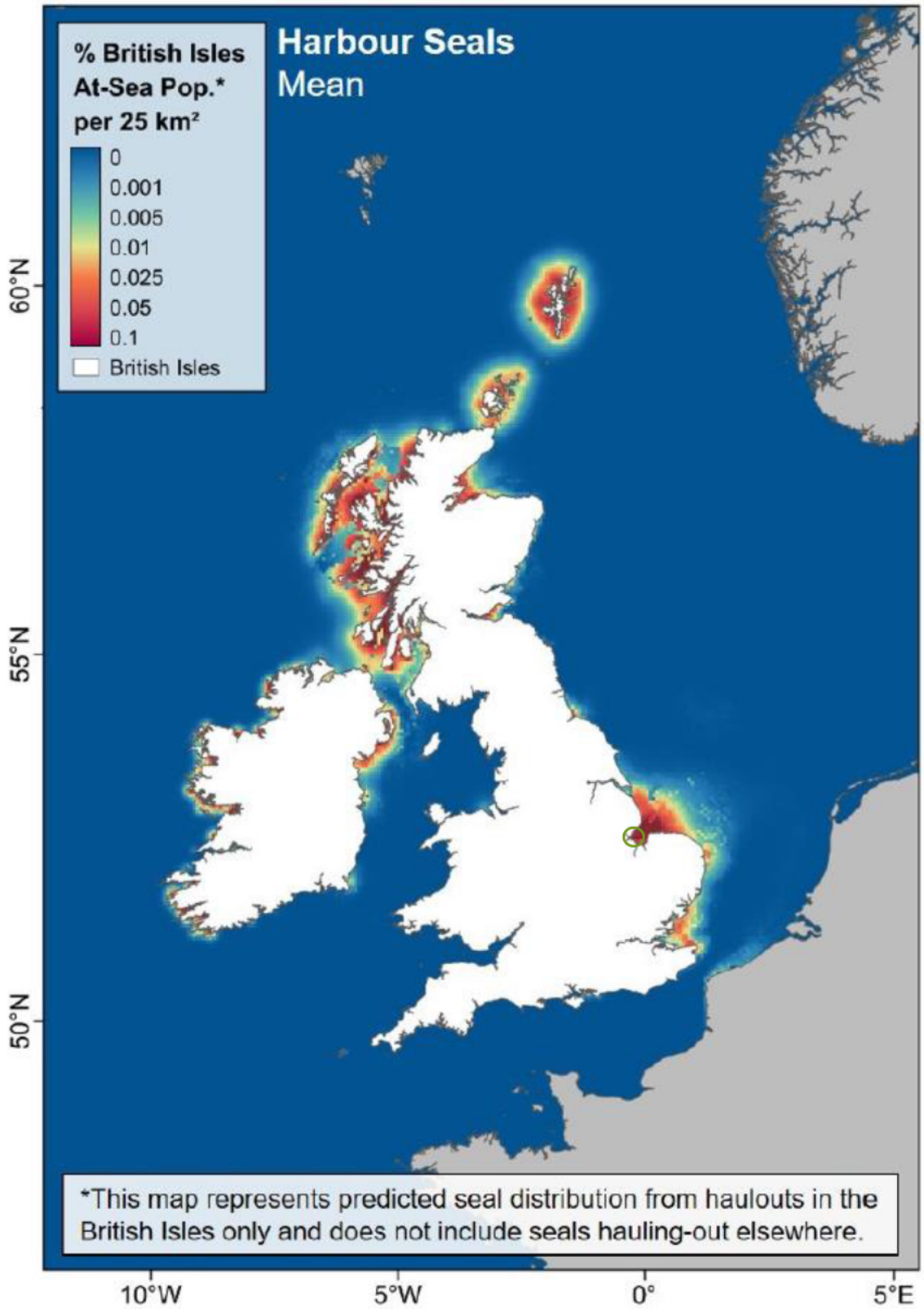

Plate 3-1 Predicted mean harbour seal relative densities (taken from Carter *et al.*, 2020) [approx. location of the Facility, shipping channel and anchorage area shown by the green circle]

3.3 Harbour Seal Population Trends

3.3.1 Between 1988 and 1992, the phocine distemper virus (PDV) caused a decrease in the harbour seal population on the south-east coast of England (from 3,035 in 1988, to 1,671 in 1992 in The Wash proper) (SCOS, 2020). Following that time, the population began to increase to the early 2000s (to 3,194 in 2001), before a short-term drop in 2006, where the population again began to increase from 2006 to 2012, approximately doubling in The Wash (from 1,695 in 2006 to 3,372 in 2012) and increasing by 50% around the south-east England coast (SCOS, 2020).

3.3.2 The increase in harbour seal gradually slowed from 2012 and has been stable, with a peak in 2018 of 3,747 (Thompson, 2019), until the most recent count was undertaken in 2019. The 2019 count indicated a significant decrease in the harbour seal population, with a reduction of 2,415 harbour seal, an approximate 25% decrease in comparison to the 2018 count (SCOS, 2020). **Plate 3-2** shows the population trend of harbour seal within The Wash and North Norfolk Coast SAC from 1967 to 2019, which shows this increase and decrease over time.

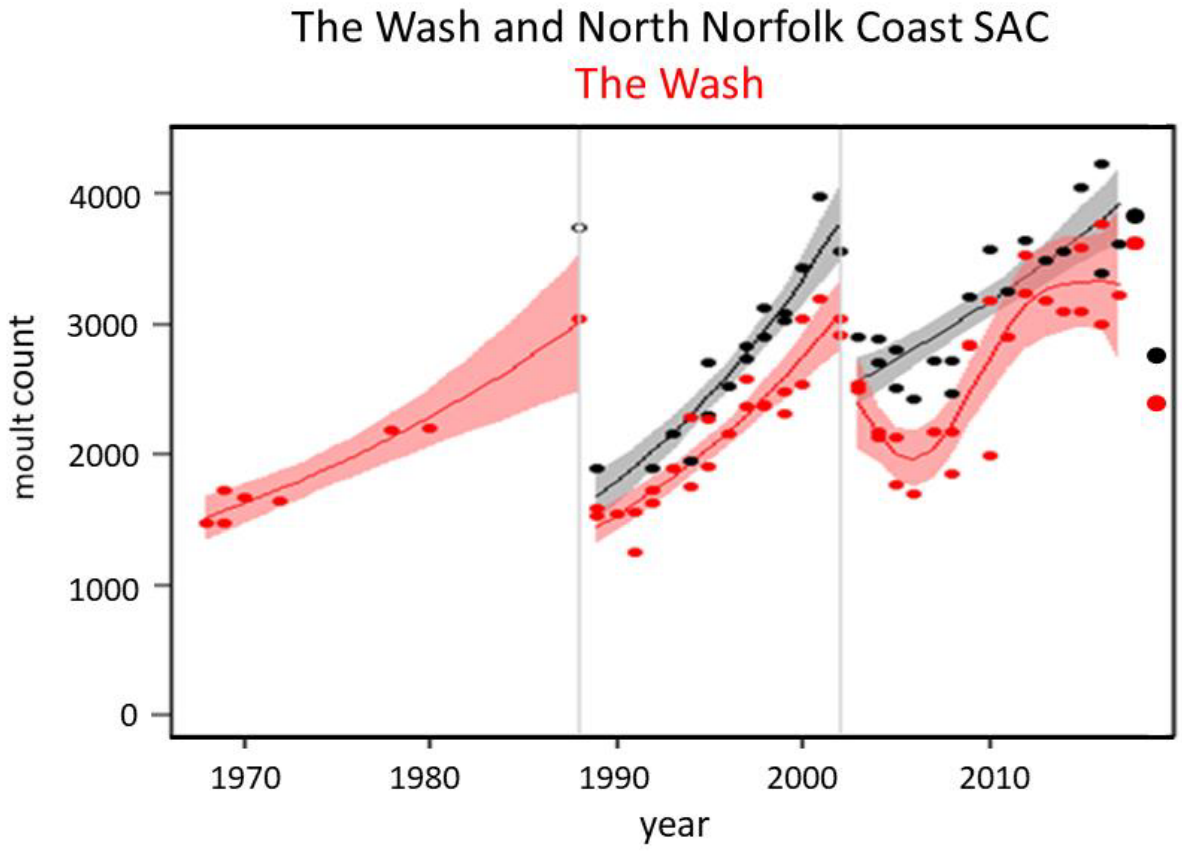

Plate 3-2 Population trend of harbour seal within The Wash and North Norfolk Coast SAC (counts within The Wash proper are shown in red, and total counts for the SAC are shown in black; 95% CI are shown in shaded areas) (taken from SCOS, 2020)

3.3.3 The combined harbour seal count in 2019 for all of south-east England provides a total of 3,081 seals, 27.6% lower than the mean count for the same area from 2012 to 2018 (SCOS, 2020). No outside influences were noted as the cause of this drop in harbour seal numbers (e.g. adverse weather conditions, or disturbances). This decrease in harbour seal numbers in the area follows a period where the growth rates of the population had reached zero in the preceding six year period, indicating that previous years had reached carrying capacity (SCOS, 2020). This decrease in the 2019 count suggests that the population has begun to decline, and surveys undertaken in following years will be needed to confirm the overall status of this population (SCOS, 2020). A reduction in harbour seal population was noted throughout the haul-out sites in the south-east of England, including the Essex and Kent sites (with a 2019 count of 672 compared to an average of 742 for the 2016 to 2018 counts), and Donna Nook (with a reduction from 369 recorded in the 2016 count, to 128 in the 2019 count) (SCOS, 2020). A preliminary review of the 2020 survey data indicates a similar estimate to the 2019 survey results (SCOS, 2020).

3.3.4 As noted above, by SCOS (2020), it is not currently known what the harbour seal reduction in population could be attributed to. However, it is not just seen within The Wash, but the wider south-east of England. For historic harbour seal declines (for example, in Scotland), competition for prey with grey seal *Halichoerus grypus* has been noted as a potential cause, particularly where a reduction in sandeel, a key prey species for both harbour and grey seal, has been reported in areas of high use by both species (e.g. Wilson & Hammond, 2019; Planque *et al*., 2021). Planque *et al.* (2021) stated that in any area where both grey and harbour seal coexist, an increase in the population of seals, and / or a decrease in prey availability, could cause or amplify competition between seal species, and impact on the harbour seal population.

3.3.5 The cause of the decline in harbour seal populations in Scotland is also not known, however, research is ongoing for a number of potential explanations, including competition with grey seal, predation by grey seal, predation by killer whales *Orcinus orca*, juvenile dispersal and exposure to toxins (from harmful algae) (SCOS, 2020). Disturbance as a cause of the harbour seal decline (in Scotland) is considered unlikely, as sites near high levels of anthropogenic use (e.g. renewable energy facilities) have not shown negative impacts at the population level (SCOS, 2020). Likewise, the potential for entanglement has been noted as an unlikely cause for the decline (SCOS, 2020).

4 Updates to Environmental Impact Assessment for Harbour Seal

4.1 Assessment of Potential Underwater Noise Impacts on Harbour Seal due to Piling and Dredging Activities during Construction

4.1.1 Chapter 17 of the ES, paragraphs 17.8.109 to 17.8.118, assess the potential impacts of piling and dredging activities on harbour seal from the underwater noise associated with each activity. This section provides an update of these previous assessments based on the updated baseline information.

4.1.2 **Table 4-1** updates Table 17-20 in Chapter 17 of the ES and provides an impact assessment based on the baseline information for the updated reference population of 3,752 harbour seal and updated count within The Wash of 2,415 harbour seal (as described in **Table 3-1**). All other information used to inform these assessments remain the same, including the Russell *et al*. (2017) density estimate. See **Section 3.2** for more information on why these densities are used rather than the Carter *et al.* (2020) seals at-sea density maps.

Table 4-1 Updates to maximum number of harbour seal (and % of reference population) that could be at risk of permanent or temporary auditory injury (Permanent Threshold Shirt (PTS) or Temporary Threshold Shift (TTS)) from a single piling strike or cumulative exposure during piling (updates to Table 17-20 of Chapter 17 of the ES) [as noted above, all density estimates remain as used within the ES at DCO submission – see Section 3.2 for more information]

Potential impact	Criteria and threshold	Assessment in ES			Updated Assessment		
		Impact range (and area)	Maximum number of individuals (% of reference population)	Magnitude	Impact range (and area)	Maximum number of individuals (% of reference population)	Magnitude
Permanent Threshold Shift (PTS) from single strike at maximum hammer energy during piling	218 dB re 1 µPa SPL^{10}_{peak} unweighted impulsive criteria (Southall *et al.*, 2019)	0m (0km^2)	0 harbour seal	No potential for impact	0m (0km^2)	0 harbour seal	No potential for impact
PTS from cumulative exposure during piling	185 dB re 1 µPa^{2}s SEL^{11}_{cum} weighted impulsive criteria (Southall *et al.*, 2019)	90m (<0.01km^2)	0.008 harbour seal (based on the harbour seal density of 0.80/km^2). 0.0002% of the previous SE England MU population of 4,965.	Permanent effect with negligible magnitude (less than 0.001% of the reference population anticipated to be exposed to effect).	90m (<0.01km^2)	0.008 harbour seal (based on the harbour seal density of 0.80/km^2). 0.0002% of the updated SE England MU population of 3,752. 0.0003% of the most recent count of 2,415 adult seals in The Wash.	Permanent effect with negligible magnitude (less than 0.001% of the reference population anticipated to be exposed to effect).

[10] SPL = Sound Pressure Level
[11] SEL = Sound Exposure Level

Potential impact	Criteria and threshold	Assessment in ES			Updated Assessment		
		Impact range (and area)	Maximum number of individuals (% of reference population)	Magnitude	Impact range (and area)	Maximum number of individuals (% of reference population)	Magnitude
			0.0002% of the previous Wash count of 3,747.				
Temporary Threshold Shift (TTS) from single strike of maximum hammer energy during piling	212 dB re 1 µPa SPL_{peak} unweighted impulsive criteria (Southall *et al.*, 2019)	<10m (0.0003km^2)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000005% of the previous SE England MU population of 4,965. 0.000005% of the previous Wash count of 3,747.	Temporary effect with negligible magnitude (less than 1% of the reference population anticipated to be exposed to effect).	<10m (0.0003km^2)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000006% of the updated SE England MU population of 3,752. 0.00001% of the most recent count of 2,415 adult seals in The Wash.	Temporary effect with negligible magnitude (less than 1% of the reference population anticipated to be exposed to effect).
TTS from cumulative exposure during piling	170 dB re 1 µPa^{2}s SEL_{cum} weighted impulsive criteria (Southall *et al.*, 2019)	690m (0.46km^2)	0.37 harbour seal (based on the harbour seal density of 0.80/km^2). 0.007% of the previous SE England MU population of 4,965. 0.01% of the previous Wash count of 3,747.	Temporary effect with negligible magnitude (less than 1% of the reference population anticipated to be exposed to effect).	690m (0.46km^2)	0.37 harbour seal (based on the harbour seal density of 0.80/km^2). 0.01% of the updated SE England MU population of 3,752. 0.015% of the most recent count of 2,415 adult seals in The Wash.	Temporary effect with negligible magnitude (less than 1% of the reference population anticipated to be exposed to effect).

Potential impact	Criteria and threshold	Assessment in ES			Updated Assessment		
		Impact range (and area)	Maximum number of individuals (% of reference population)	Magnitude	Impact range (and area)	Maximum number of individuals (% of reference population)	Magnitude
PTS from dredging activities (cumulative impact over 24 hour exposure)	201 dB re 1 μPa^2s SEL_{cum} weighted non-impulsive criteria (Southall *et al.*, 2019)	<10m (0.0003km^2)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000005% of the previous SE England MU population of 4,965. 0.000005% of the previous Wash count of 3,747.	Permanent effect with negligible magnitude (less than 0.001% of the reference population anticipated to be exposed to effect).	<10 m (0.0003km^2)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000006% of the updated SE England MU population of 3,752. 0.00001% of the most recent count of 2,415 adult seals in The Wash.	Permanent effect with negligible magnitude (less than 0.001% of the reference population anticipated to be exposed to effect).
TTS from dredging activities (cumulative impact over 24 hour exposure)	181 dB re 1 μPa^2s SEL_{cum} weighted non-impulsive criteria (Southall *et al.*, 2019)	<10m (0.0003km^2)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000005% of the previous SE England MU population of 4,965. 0.000005% of the previous Wash count of 3,747.	Temporary effect with negligible magnitude (less than 1% of the reference population anticipated to be exposed to effect).	<10m (0.0003km^2)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000006% of the updated SE England MU population of 3,752. 0.00001% of the most recent count of 2,415 adult seals in The Wash.	Temporary effect with negligible magnitude (less than 1% of the reference population anticipated to be exposed to effect).

* based on the area of a circle

4.1.3 **Table 4-1** indicates that although there are small changes in the percentage of the harbour seal population that could be impacted, based on the updated baseline information, the results are not significantly different from the previous assessments and there is no change to the overall magnitude levels. Therefore, there is no change to the impact significance levels, and the assessment of **minor adverse** remains.

4.1.4 The outline mitigation measures, as provided in paragraph 17.8.127 of Chapter 17 of the ES, have been used to inform the Outline MMMP, the mitigations of which are below. These would further reduce the potential underwater noise impacts due to piling:

- Pre-piling watch for marine mammals, when piling activities are undertaken during high water, following the Joint Nature and Conservation Committee (JNCC) protocol for minimising the risk of injury to marine mammals from piling noise[12].
- Soft-start and ramp-up procedures, for piling activities undertaken during high water.

4.1.5 These measures are set out in the Outline MMMP, which is secured by a condition of the Deemed Marine Licence (DML) included at Schedule 9 to the latest version of the draft DCO (document reference 2.1(1)) submitted at Deadline 1 and will form part of the piling method statement submitted for approval under condition 13 of the draft DML.:

4.2 Assessment for Potential Underwater Noise Impacts on Harbour Seal due to an Increase in Vessel Presence during Construction and Operation

4.2.1 Chapter 17 of the ES, paragraphs 17.8.119 to 17.8.129 and 17.8.216 to 17.8.220 assess the potential impacts of underwater noise on harbour seal due to an increase in vessel presence during construction and operation, respectively. This section provides an update of these previous assessments based on the updated baseline information.

4.2.2 As within Chapter 17 of the ES, paragraphs 17.8.126 and 17.8.128, the number of harbour seals that could be disturbed by underwater noise from vessels has been assessed based on the total proposed scheme area, including the shipping corridor from The Wash to the project location, and the vessel anchorage area; a

[12] https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf

total area of 10.46km^2 (shown as the shipping channel on Figure 17.6[13] of the ES). This is very precautionary, because it is highly unlikely that underwater noise from vessels could result in disturbance to the entire area at any one time. Any disturbance is likely to be limited to the immediate vicinity around the actual vessel (for example, less than 10m) at any one time. Any disturbance of harbour seals due to vessel noise would be temporary and localised.

4.2.3 Based on a very precautionary total area of 10.46km^2, vessel noise could potentially affect up to 33.4 harbour seal, which represents 0.89% of updated SE England MU population of 3,752 harbour seal, or 1.38% of the most recent count of 2,415 adult seals in The Wash, based on the harbour seal density within the shipping corridor and anchorage area of 3.189 harbour seals per km^2 (as calculated from Russell *et al.,* 2017). This equates to a negligible magnitude of impact[14] for the overall SE England population, and low for the population within The Wash. Taking into account the low sensitivity of harbour seal from disturbance, and the magnitude of negligible to low from the presence and movements of vessels, the overall effect significance is **negligible to minor adverse**.

4.2.4 While the magnitude of impact has increased from negligible to low when assessed against the updated population of harbour seal within The Wash, the change in magnitude, and overall significance levels (from negligible as assessed in Chapter 17 of the ES to negligible to minor adverse as assessed against the updated baseline information) does not constitute a significant impact.

4.2.5 The outline mitigation measures, as provided in paragraph 17.8.127 of Chapter 17 of the ES, have been used to inform the Outline MMMP, the mitigations of which are below. These would further reduce the potential underwater noise impacts due to an increase in vessel presence:

- Best practice measures will be put in place in order to minimise the disturbance that is caused to marine mammals from the vessel traffic. This includes:
    - Monitoring Option 1: Observers on board each vessel, monitoring for marine mammals as the vessel makes it way though The Wash and up The Haven.
    - Monitoring Option 2: Adaptive monitoring programme Observers on board each vessel, monitoring to record for marine mammal

[13] 6.3.25 Environmental Statement - Chapter 17 - Figures 17.1 - 17.10 [APP-091]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010095/EN010095-000476-6.3.25.%20Chapter%2017%20Figures%2017.1%20-%2017.10.pdf

[14] *See table 17-18 in the ES for definitions of magnitude levels*

presence and behaviour s in response to vessels within The Haven and The Wash.

- Safety, weather and tidal conditions permitting, vessel speeds of 10 knots will be aimed for subject to the pilotage requirements for navigational safety and efficiency (including the application of 'safe speed') for all vessels travelling within The Haven and The Wash, will reduce the potential for fatal collisions with marine mammals, including harbour seal.
- If marine mammals are observed in the area, there is a requirement that vessels should maintain the same course (if possible, given the narrow shipping lanes) and speed to give the seal time to avoid the vessel.

4.2.6 These measures are set out in the Outline MMMP, which is secured by condition 17 of the DML included at Schedule 9 to the latest version of the draft DCO (document reference 2.1(1)) submitted at Deadline 1 and will form part of the Navigation Management Plan (NMP) secured by condition 14 of the draft DML.

4.3 Assessment for Potential Disturbance to Harbour Seal at Haul-Out Sites due to an Increase in Vessel Presence during Construction and Operation

4.3.1 Chapter 17 of the ES, paragraphs 17.8.130 to 17.8.140 and 17.8.221 to 17.8.223 assess the potential impacts of disturbance at harbour seal haul-out sites due to an increase in vessel presence during construction and operation respectively. As noted in **Table 3-1**, there has been no update to the number of harbour seal present at each of the individual haul-out sites within The Wash. There is therefore no update to the assessment of disturbance at harbour seal haul-out sites.

4.3.2 As stated in paragraph 17.8.134 of the ES, beyond a distance of 600m, vessels did not cause any disturbance impact to harbour seals hauled-out (Jansen *et al*., 2010). While there are a number of harbour seal haul-out sites within The Wash, the closest to any area of the shipping corridor or anchorage area is at a distance of 840m. Therefore, as stated within the ES, there is unlikely to be any impact of disturbance at harbour seal haul-out sites at that distance.

4.4 Assessment for Potential Increase in Vessel Collision Risk for Harbour Seal due to an Increase in Vessels during Construction and Operation

4.4.1 Chapter 17 of the ES, paragraphs 17.8.141 to 17.8.147 and 17.8.224 to 17.8.228 assess the potential for an increase in collision risk for harbour seal due to the

increased number of vessels present in the area during construction and operation. This section provides an update of these previous assessments based on the updated baseline information.

4.4.2 As stated in paragraph 17.8.142 of the ES, the existing levels of shipping traffic around the facility shipping corridor is high, and harbour seals would be habituated to the presence of vessels, and be able to detect and avoid vessels. Although marine mammals are able to detect and avoid vessels, vessel strikes are known to occur, possibly due to distraction whilst foraging and socially interacting, or due to the marine mammals' inquisitive nature (Wilson *et al.,* 2007). Therefore, increased vessel movements can pose an increased risk of vessel collision to harbour seals, although they are considered to have a low sensitivity to the increased risk of collision.

4.4.3 As within Chapter 17 of the ES, paragraphs 17.8.145 to 17.8.146, although the risk of collision related to the operation of the Facility is likely to be low given the low speed of the vessels and restricted area in The Wash, as a precautionary scenario, the number of harbour seals that could be at increased collision risk with vessels during the operation of the Facility has been assessed based on a very worst-case of 5% of the number of individuals that could be present in the shipping channel and anchorage location.

4.4.4 In total, the area that has been defined as having the potential for an increase in collision risk for harbour seal is 10.46km^2, with an estimated density of 3.189 harbour seals per km^2 within this area (as calculated from the Russell *et al.,* 2017 data).

4.4.5 A total of 1.7 harbour seals (0.05% of the updated SE England MU population of 3,752 harbour seal or 0.07% of the most recent count of 2,415 adult seals in The Wash (SCOS, 2020)) could be at potential increased risk of collision, based on a 5% at collision risk. The magnitude of this permanent impact is therefore medium (as previously assessed within Chapter 17 of the ES). This results in an impact significance of **minor adverse**. While there are small changes in the percentage of the harbour population that could be impacted, they are not significantly different form the previous assessment, and result in no change to the overall magnitude level. Therefore, there would no change to the impact significance level, and the assessment of **minor adverse** remains.

4.4.6 The outline mitigation measures, as provided in paragraph 17.8.127 of Chapter 17 of the ES, have been used to inform the Outline MMMP, the mitigations of which are below. These would further reduce the potential for increased risk of collision, due to an increase in vessel presence:

- Best practice measures will be put in place in order to reduce collision risk of marine mammals with vessels. This includes:
    - Monitoring Option 1: Observers on board each vessel, monitoring for marine mammals as the vessel makes it way though The Wash and up The Haven.
    - Monitoring Option 2: Adaptive monitoring programme Observers on board each vessel, monitoring to record for marine mammal presence and behaviour s in response to vessels within The Haven and The Wash.
    - Safety, weather and tidal conditions permitting, vessel speeds of 10 knots will be aimed for subject to the pilotage requirements for navigational safety and efficiency (including the application of 'safe speed') for all vessels travelling within The Haven and The Wash, will reduce the potential for fatal collisions with marine mammals, including harbour seal.
    - If marine mammals are observed in the area, there is a requirement that vessels should maintain the same course (if possible, given the narrow shipping lanes) and speed to give the seal time to avoid the vessel.

4.4.7 These measures are set out in the Outline MMMP, which is secured by condition 17 of the DML included at Schedule 9 to the latest version of the draft DCO (document reference 2.1(1)) submitted at Deadline 1 and will form part of the NMP secured by condition 14 of the draft DMML.

4.5 Risk of Injury and / or Fatality to Harbour Seal within the Vessel Anchorage Area

4.5.1 As vessels are unable to transit through The Haven at low water, there is the requirement for vessels to remain stationary within the anchorage area, while awaiting opportunity to transit through The Haven. While in the anchorage area, there has been concern raised for the potential of injury and / or fatality to harbour seals, particularly for pups, within The Wash, through collision with unguarded propellors, or entanglement in anchor chains. The following sections review the potential for these risks to occur through construction and operation.

Risk of Injury / Fatality of Harbour Seal with Unguarded Propellors and / or Dynamic Positioning

4.5.2 While vessels remain stationary, there is the potential for the use of Dynamic Positioning (DP) to maintain the vessel's position. It is considered unlikely that

any vessel would use this method for maintaining their position for an extended period of time, as it would require significant levels of fuel. Vessels would have to remain within the anchorage areas for a period of up to six hours, while awaiting a suitable tidal window, and therefore the use of dynamic positioning for this period of time would be highly unlikely. For this reason, it is considered much more likely that any vessels within the anchorage area would remain in a stationary position through the use of anchors. However, the following sections outline the risk to harbour seal in the case that any vessel did use DP (and ducted propellors) for any length of time within the anchorage area.

4.5.3 Ducted propellers operate with non-rotating nozzles which are encircled by a duct or passageway. Their use is prevalent in the shipping industry and has been since 1931. A report by the Sea Mammal Research Unit (SMRU) (Thompson *et al.,* 2010) cited that Kort nozzle ducted propellers are frequently utilised in high load vessels such as tugboats and fishing trawlers, as the loads increase the propulsive efficiency. Ducted propellers can also be found in a number of other vessels including offshore supply vessels, submarines and survey vessels.

4.5.4 The SMRU report also refers to DP when considering potential mechanisms for injury to seals. DP is a computer-controlled system to automatically maintain a vessel's position and heading using its propellers and thrusters. Position reference sensors, combined with wind sensors, motion sensors and gyro compasses, provide information to the computer pertaining to the vessel's position and the magnitude and direction of environmental forces affecting its position. This information allows the computer to calculate the steering angle and thruster output required to maintain the vessels position.

4.5.5 DP therefore does not necessarily refer to a specific thruster type, but is more a method of automatically controlling position. Many vessels not equipped with DP equipment will manually maintain station using operator control of the thrusters (ducted propellers) to enable a stable position.

4.5.6 From 2008, there was an increasing concern over the number of seal carcasses washed up at various locations on the UK coastline, all displaying the same fatal ‘corkscrew’ injury. Given the features of the injuries it was considered that they could be as a result of ducted propellers.

4.5.7 At the time, the majority of seals identified with ‘corkscrew’ injuries were female harbour seals (Thompson *et al.,* 2010). Although no empirical evidence exists, one suggested mechanism for a number of these deaths was that female harbour seals were attracted to the vessels by the noise ducted propellers produce. Although there was no evidence for this, a proposed hypothesis was that such

vessels may be producing sounds that mimic breeding males (Thompson *et al.,* 2010).

4.5.8 Another suggestion, again related to noise, was that juvenile grey seals were attracted by sounds with a pulsating rhythm (such as those produced by propellers), mimicking conspecific calls (Thompson *et al.,* 2010).

4.5.9 However in 2015, grey seal were identified as the most likely cause of 'corkscrew' injuries on seals (Brownlow *et al.,* 2016). During a study of grey seals at the Isle of May, an adult was observed and recorded fatally injuring five weaned grey seal pups, and a further nine deceased pups were found with similar injuries. Necropsies were performed on 11 on these pups, and they found that the wounds inflicted were indistinguishable from these previously thought to have been victims of propeller interactions (Brownlow *et al.,* 2016).

4.5.10 Between 1985 and 2015, a total of 149 seals were reported with unexplained trauma lesions in Scotland, and 48 of these were necropsied. Following the findings from the Isle of May pups (as described above), the necropsy findings were re-examined. The injuries previously attributed to interactions with propellers were all consistent with the injuries seen in the pups, which were fatally injured by an adult grey seal at the Isle of May (Brownlow *et al.,* 2016). Indicating that seals previously thought to have died as a result of propeller interaction, were in fact a result of grey seal predation and / or attack (Brownlow *et al.,* 2016).

4.5.11 It is possible that grey seal predation is therefore responsible for many of the 'corkscrew' injuries reported in the UK, as well as in Europe and Canada (where 'corkscrew' injuries were also reported) as grey seals are known to be present in all locations where these injuries have been reported (Brownlow *et al.,* 2016).

4.5.12 Conversely, if it is considered that corkscrew injuries are the result of propeller interaction, it would be expected that these injuries would be found in locations with high vessel presence, and high numbers of harbour seal. However, this is not the case, and in areas of high shipping, 'corkscrew' injuries have not been reported, where grey seal are not known to be present (Brownlow *et al.,* 2016). This lends further evidence to support that 'corkscrew' injuries are more likely to be caused by grey seal, not by vessel propellers.

4.5.13 There is also an apparent seasonality of the reported 'corkscrew' injuries, with seal breeding and pupping periods coinciding with the reported seasonality. Grey seal pups with 'corkscrew' injuries have been reported significantly more in the winter months, and harbour seals within the spring and summer, aligning with their respective pupping periods (Brownlow *et al.,* 2016).

4.5.14 Therefore, while historically it was considered likely that some reported injuries ('corkscrew injuries') to seals were the result of collision with ducted propellers, more recent findings and research has found that these 'corkscrew' injuries were related to predation by grey seal. Therefore, interim advice provided by the Statutory Nature Conservation Bodies (SNCBs), including Scottish Natural Heritage (now NatureScot), Natural England, Natural Resources Wales (NRW), and JNCC (Scottish Natural Heritage *et al.,* 2015) states that:

"Based on the latest information it is considered very likely that the use of vessels with ducted propellers may not pose any increased risk to seals over and above normal shipping activities and therefore mitigation measures and monitoring may not be necessary in this regard, although all possible care should be taken in the vicinity of major seal breeding and haul-out sites to avoid collisions".

4.5.15 In 2016, SMRU conducted a study to determine the likelihood of harbour seal injury occurring due to co-presence with large vessels within the Moray Firth (Onoufriou *et al.*, 2016). This study used telemetry data of harbour seal within the Moray Firth, alongside vessel AIS data, to both allow a comparison of harbour presence and movements against vessel movements, and to compare the densities of harbour seals and vessels, in order to identify areas of high spatial overlap. A total of 37 tags were deployed on harbour seal at two sites in Ardersier and the Dornoch Firth, from 2014 to 2015. The tagging data was used to create usage maps on a 0.5km by 0.5km grid. Observations of seals did not identify any pattern of avoidance response, with individuals not appearing to react to vessel presence, and not moving towards or away (Onoufriou *et al.*, 2016).

4.5.16 Vessel AIS data was collated for the same period as the tagging study for seals, and an estimated mean shipping usage map was developed. Vessels within the area included tugs, cargo vessels, fishing vessels, dredgers, pilot and sailing vessels, dive boats, military vessels, and passenger ferries. The analysis included for vessels that were stationary and using DP. This was then combined with the harbour seal usage map to create a map showing the total number of minutes of seals and vessels being in the same grid cell (of 0.5km by 0.5km) per year (Onoufriou *et al.*, 2016). It was determined that a seal and vessel co-occurrence occurred where a seal and vessel were within the same grid square in the same five-minute interval. For the Moray Firth area, vessel and seal co-occurrence was high (defined as over 2,500 co-occurrence minutes per year) in very localised areas (total of four grid squares only). Comparing these maps to locations of 'corkscrew' injury, there appeared to be no relationship between areas in high co-occurrence and incidences of this injury (Onoufriou *et al.*, 2016).

4.5.17 Individual seal and ship movements were also analysed, to determine the

reactions of harbour seal to vessel presence. On 78 occasions, harbour seal were located within 100m of a moving vessel, the majority of which (n=77) were within one of the four high co-occurrence areas (Onoufriou *et al.*, 2016). On none of these occasions were harbour seal identified to swim towards the vessel, rather either the vessel transited past a seal, or the seal and vessel transited past each other. Seal to vessel proximity was never less than 100m for more than 15 minutes (Onoufriou *et al.*, 2016). One seal was identified to swim directly towards a vessel at anchor, and remain within 80m of the vessel for four hours. The tagging data for this individual continued to transmit for a further 73 days, indicating that the close proximity of the seal to the vessel did not compromise the animal in any way. Overall, the lack of observed interaction of seals with vessels suggest that harbour seal are not commonly attracted to shipping activity (Onoufriou *et al.*, 2016).

4.5.18 While this study states that the results are not conclusive, it also states the number and location of 'corkscrew' injuries in harbour seal are not proportional to the areas of high seal and ship overlaps (Onoufriou *et al.*, 2016). This supports the conclusions of Jones *et al*. (2015), which stated that areas of high 'corkscrew' incidences did not generally coincide with intense seal and shipping co-occurrence. Earlier studies presumed that seals would only interact with a vessels' propellers if they were actively approaching slowly moving vessels, however, there are no recorded instances of this behaviour in either adults or pups, suggesting that seals are unlikely to be interacting with propellers (Onoufriou *et al.*, 2014).

4.5.19 Within The Wash itself, there is an existing vessel anchorage area for the Port of King's Lynn. At this anchorage area, an average of two vessels arrive and two vessel depart per day, between 28th August and 24th September 2021[15]. Harbour seals would therefore be expected to be used to the presence of stationary vessels within The Wash.

4.5.20 Taking into account that the use of DP to remain in a stationary position within the anchorage area is expected to be rare (with the anchoring via anchor chains considered the predominant method), that harbour seal are rarely attracted to vessels (Onoufriou *et al.*, 2016), and that the 'corkscrew' injuries have been established to be a result of grey seal predation rather than the use of DP or ducted propellers, it is considered highly unlikely that any interaction would occur between a harbour seal (either adult or pup) and a vessel using the anchorage area.

[15] *based on data available on marinetraffic.com on 27th September 2021.*
https://www.marinetraffic.com/en/ais/details/ports/23218/United_Kingdom_port:KINGS_LYNN_ANCH

4.5.21 Based on the information available, the sensitivity of harbour seal is considered be low (taking into account the rarity of seal-ship close interactions). The magnitude is considered to be negligible, as very few (or no) seals are considered to be at risk. As a result, the potential impact of significance is **minor adverse** (not significant) for harbour seal as a result of interactions with propellers, either during construction or operation.

4.5.22 It is therefore considered that the SNCBs guidance (Scottish Natural Heritage *et al.,* 2015), as outlined above, is still appropriate. However, an additional mitigation measure will be added (see the Outline MMMP for more information) to reduce the potential for harbour seal to be impacted by vessels within the anchorage area. This additional measure is for the MMOb, who would already be on-board each vessel, to check for any seal presence in close proximity to the vessel, prior to engines restarting after being stationary in the anchorage area.

Risk of Injury / Fatality of Harbour Seal with Anchor Chains

4.5.23 As outlined above, it is considered that the majority of vessels utilising the anchorage area would remain stationary through the use of anchoring. This has raised concern that there could be the potential to increase the risk of entanglement of seals in the anchor chains.

4.5.24 It remains unclear why a marine animal becomes entangled, but is could be as a result of: (i) failure to detect the rope or chain, (ii) the individual not perceiving the rope or chain as a danger, or (iii) the animal deliberately making contact.

4.5.25 It was also considered that ropes and chains become more difficult to see at night, particularly in high turbidity or in deep water. However, seals are able to detect wakes downstream of ropes, moorings or cables through their whiskers (Hanke *et al.,* 2013).

4.5.26 There are several factors that can determine the likelihood of a marine mammal becoming entangled, including body size, flexibility of the mammal, their ability to detect the rope or chain, and feeding behaviours (Benjamins *et al.,* 2014). Seals are considered to be the least likely to be at risk, due to their small size, manoeuvrability in small spaces, and their foraging behaviours (Benjamins *et al.,* 2014).

4.5.27 There are also factors within the rope or chain itself that impacts the likelihood of entanglement, with ropes or chains with high tension being the least likely (as there is no movement within the chain to allow entanglement to occur), the ability for the ropes or chain to bend and form ‘loops’, and the strength of the rope or chain (Benjamins *et al.,* 2014).

4.5.28 While there are reports of large whale species becoming entangled in vessel anchor chains (although rarely), very little is known on the potential risk to seal species, although anchor chains have the lowest relative risk of entanglement to seal species, and entanglements of smaller marine mammals are considered to be unlikely (in comparison to larger species) (Benjamins *et al.,* 2014). There are no reported instances of seals becoming entangled in vessel anchor chains.

4.5.29 As noted above, a study on harbour seal movement around vessels in the Moray Firth found that harbour seal only interact with vessels very rarely (only one through the study) and no detrimental effect was observed on that individual (Onoufriou *et al.*, 2016). In addition, there is an existing anchorage area within The Wash for King's Lynn port, that is regularly used. Harbour seals within The Wash would therefore be used to stationary vessels being present in the area.

4.5.30 As there is no evidence to suggest that seals (either adults or pups) are at risk of entanglement in vessel anchor chains, and there are no reported instances of such events occurring. It is therefore, considered that there is **no potential increased risk to harbour seals** from entanglement in anchor chains, for vessels using the anchorage area, either during construction or operation.

4.6 Summary of Updates to Harbour Seal Impact Assessments

4.6.1 **Table 4-2** summarises the impact assessments for harbour seal, using the updated baseline information for the most recent population counts. The significant reduction in the harbour seal population has the potential to alter the assessments made in the ES, as, while the actual number of seals impacts has not changed, it could alter the proportion of harbour seal within the overall population, and therefore lead to increased population level impacts.

4.6.2 Despite the significant decline in the harbour seal population in the south-east of England, the only change to impact significance level is for disturbance from vessels, with a change from negligible (as assessed in the ES) to negligible (for the SE England MU population) and minor adverse (for the population in The Wash), with a small proportion of the overall harbour seal population being impacted. All other impact assessments remain as assessed in Chapter 17 of the ES.

4.6.3 It should also be noted here that these impact assessments do not take into account the mitigation measures that will be put in place, which would effectively reduce the potential impact to harbour seal to negligible levels.

Table 4-2 Summary of the Updated Impact Assessments for Harbour Seal

Impact	Magnitude	Sensitivity	Update significance	Significance reported in Chapter 17 of the ES	Mitigation
Impacts during construction phase					
Risk of permanent auditory injury (PTS) in harbour seal during piling or dredging	Negligible	High	Minor adverse	Minor adverse = no change	Mitigation for piling at high water following JNCC protocols, as outlined in Paragraphs 17.8.117 and 17.8.118 of Chapter 17 of the ES. Now set out in the Outline MMMP.
Potential for temporary auditory injury (TTS) or fleeing response in harbour seal during piling or dredging	Negligible	Medium	Minor adverse	Minor adverse = no change	
Disturbance from vessels	Negligible to low	Low	Negligible to minor adverse	Negligible	Best practice measures as outlined in Paragraph 17.8.127 of Chapter 17 of the ES. Now set out in the Outline MMMP.
Increased risk of collisions for marine mammals (impact zone includes the Wash as a transit area)	Medium	Low	Minor adverse	Minor adverse = no change	
Disturbance at harbour seal haul-out sites	Negligible	High	Minor adverse	Minor adverse = no change	Not required
Risk of Injury and / or Fatality within the Vessel Anchorage Area	No impact to negligible	No impact to negligible	No impact to minor adverse	No impact to minor adverse = no change	Not required
Impacts during operation phase					
Disturbance from vessels – harbour seal	Negligible	Low	Negligible	Negligible = no change	Best practice measures as outlined in Paragraph 17.8.127 of Chapter 17 of the ES. Now set out in the Outline MMMP.
Increased risk of collisions for marine mammals (impact zone includes the Wash as a transit area)	Medium	Low	Minor adverse	Minor adverse = no change	
Disturbance at harbour seal haul-out sites	Negligible	High	Minor adverse	Minor adverse = no change	Not required

Impact	Magnitude	Sensitivity	Update significance	Significance reported in Chapter 17 of the ES	Mitigation
Risk of Injury and / or Fatality within the Vessel Anchorage Area	No impact to negligible	No impact to negligible	No impact to minor adverse	No impact to minor adverse = no change	Not required

5 Updates to Habitats Regulations Assessment

5.1 Assessment for Underwater noise effects on Harbour Seal from piling and dredging activities at the Facility during construction

5.1.1 Appendix 17.1 of the ES, paragraphs A17.6.96 to A17.6.106 provide the information for assessments of potential effects of underwater noise during piling and dredging activities on harbour seal from The Wash and North Norfolk Coast SAC. This section provides an update of these previous assessments based on the updated baseline information.

5.1.2 **Table 5-1** updates Table A17-11 in Appendix 17.1 of the ES and provides an updated assessment of potential effect based on the updated baseline information (the updated reference population of 3,752 harbour seal, and recent count of 2,744 harbour seal within The Wash and North Norfolk Coast SAC, as described in **Table 3-1**). All other information used to inform these assessments remain the same.

Table 5-1 Updates to maximum number of harbour seal (and % of reference population) that could be at risk of permanent and temporary auditory injury (PTS and TTS) from a single piling strike or cumulative exposure (updates to Table 17-11 of Appendix 17.1 of the ES)

Potential effect	Criteria and threshold	Assessment for HRA		Updated Assessment	
		Impact range (and area)	Maximum number of individuals (% of reference population)	Impact range (and area)	Maximum number of individuals (% of reference population)
PTS from single strike of maximum hammer energy during piling.	218 dB re 1 µPa SPL_{peak} unweighted impulsive criteria (Southall *et al.*, 2019)	0m (0km^2)	0 harbour seal	0m (0km^2)	0 harbour seal
PTS from cumulative exposure during piling	185 dB re 1 µPa^{2}s SEL_{cum} weighted impulsive criteria (Southall *et al.*, 2019)	90m (<0.01km^2)	0.008 harbour seal (based on the harbour seal density of 0.80/km^2). 0.0002% of the previous SE England MU population of 4,965. 0.0002% of the previous count of 4,146 in The Wash and North Norfolk Coast SAC.	90m (<0.01km^2)	0.008 harbour seal (based on the harbour seal density of 0.80 /km^2). 0.0002% of the updated SE England MU population of 3,752. 0.0003% of the most recent count of 2,744 in The Wash and North Norfolk Coast SAC.
TTS from single strike of maximum hammer energy during piling	212 dB re 1 µPa SPL_{peak} unweighted impulsive criteria (Southall *et al.*, 2019)	<10m (0.0003km^2)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000004% of the previous SE England MU population of 4,965. 0.000005% of the previous count of 4,146 in The Wash and North Norfolk Coast SAC.	<10m (0.0003km^2)*	0.0002 harbour seal (based on the harbour seal density of 0.80 /km^2). 0.000006% of the SE England MU population of 3,752. 0.000009% of the most recent count of 2,744 in The Wash and North Norfolk Coast SAC.
TTS from cumulative	170 dB re 1 µPa^{2}s SEL_{cum} weighted	690m (0.46km^2)	0.37 harbour seal (based on the harbour seal density of 0.80/km^2).	690m (0.46km^2)	0.37 harbour seal (based on the harbour seal density of 0.80/km^2).

Potential effect	Criteria and threshold	Assessment for HRA		Updated Assessment	
		Impact range (and area)	Maximum number of individuals (% of reference population)	Impact range (and area)	Maximum number of individuals (% of reference population)
exposure during piling	impulsive criteria (Southall *et al.*, 2019)		0.007% of the previous SE England MU population of 4,965. 0.009% of the previous count of 4,146 in The Wash and North Norfolk Coast SAC.		0.01% of the SE England MU population of 3,752. 0.013% of the most recent count of 2,744 in The Wash and North Norfolk Coast SAC.
PTS from dredging activities (cumulative effect over 24 hour exposure)	201 dB re 1 μPa^2s SEL_{cum} weighted non-impulsive criteria (Southall *et al.*, 2019)	<10m ($0.0003km^2$)*	0.0002 harbour seal (based on the harbour seal density of 0.80 /km^2). 0.000004% of the previous SE England MU population of 4,965. 0.000005%[16] of the previous count of 4,146 in The Wash and North Norfolk Coast SAC.	<10m ($0.0003km^2$)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000006% of the updated SE England MU population of 3,752. 0.000009% of the most recent count of 2,744 in The Wash and North Norfolk Coast SAC.
TTS from dredging activities (cumulative effect over 24 hour exposure)	181 dB re 1 μPa^2s SEL_{cum} weighted non-impulsive criteria (Southall *et al.*, 2019)	<10m ($0.0003km^2$)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000004% of the previous SE England MU population of 4,965. 0.000005%[16] of the previous count of 4,146 in The Wash and North Norfolk Coast SAC.	<10m ($0.0003km^2$)*	0.0002 harbour seal (based on the harbour seal density of 0.80/km^2). 0.000006% of the SE England MU population of 3,752. 0.000009% of the most recent count of 2,744 in The Wash and North Norfolk Coast SAC.

* based on the area of a circle

[16] Note this was reported incorrectly in the HRA as 0.002%. All calculations have been re-checked and are correct.

5.1.3 **Table 5-1** indicates a very small number of harbour seal could be affected by underwater noise during piling and dredging. Although there are small changes in the percentage of the SAC population that could be affected, compared to the previous assessments, there is no overall change to the outcomes of the assessments. Taking into account the small percentage of The Wash and North Norfolk Coast SAC harbour seal population that could be affected as a result of piling and dredging activities, there would be no adverse effect on the integrity of The Wash and North Norfolk Coast SAC in relation to the conservation objectives for harbour seal.

5.1.4 The outline mitigation measures, as provided in paragraph A17.6.105 of Appendix 17.1 of the ES, have been used to inform the Outline MMMP, the mitigations of which are below. These would further reduce the potential underwater noise effects due to piling activities:

- Pre-piling watch for marine mammals, when piling activities are undertaken during high water, following the JNCC protocol for minimising the risk of injury to marine mammals from piling noise[12].
- Soft-start and ramp-up procedures, for piling activities undertaken during high water.

5.1.5 These measures are set out in the Outline MMMP, which is secured by a condition of the DML included at Schedule 9 to the latest version of the draft DCO (document reference 2.1(1)) submitted at Deadline 1 and will form part of the piling method statement submitted for approval under condition 13 of the draft DML.

5.2 Assessment for Underwater Noise Effects on Harbour Seal due to an Increase in Vessel Presence during Construction and Operation

5.2.1 Appendix 17.1 of the ES, paragraphs A17.6.107 to A17.6.116 and paragraphs A17.6.133 to A17.6.136 provide the information for an assessment of the potential effect of underwater noise due to an increase in vessel presence during construction and operation respectively. This section provides an update of these previous assessments based on the updated baseline information.

5.2.2 As stated within Appendix 17.1 of the ES, paragraph A17.6.114, as a worst-case scenario, the number of harbour seals that could be disturbed by underwater noise from vessels has been assessed based on the total proposed scheme area, including the shipping corridor from The Wash to the Application Site, and the vessel anchorage area; a total area of 10.46km^2 (shown as the shipping channel on Figure 17.1 of the ES). This is very precautionary, because it is highly unlikely that underwater noise from vessels could result in disturbance to the entire area

at any one time. Any disturbance is likely to be limited to the immediate vicinity around the actual vessel (for example, less than 10m).

5.2.3 Any disturbance of harbour seals due to vessel noise during construction would be temporary, but could affect up to 33.4 harbour seals (1.2% of The Wash and North Norfolk Coast SAC population (SCOS, 2020)) based on the harbour seal density within the shipping corridor and anchorage area of 3.189 harbour seals per km^2 (as calculate from Russell *et al.,* 2017).

5.2.4 The assessment indicates that just over 1% of The Wash and North Norfolk Coast SAC population of harbour seals could be temporarily disturbed as a result of vessel noise. However, this is likely to be an overestimation as harbour seals are unlikely to be disturbed from the entire area, and the best practice measures (i.e. the vessel speed limits), as noted below, would further reduce the potential for disturbance. Therefore, there would be no significant disturbance and no adverse effect on the integrity of The Wash and North Norfolk Coast SAC in relation to the conservation objectives for harbour seal, and there is no change to the overall assessment of effect as provided within Appendix 17.1 of the ES.

5.2.5 The outline mitigation measures, as provided in paragraph A17.6.115 of Appendix 17.1 of the ES, have been used to inform the Outline MMMP, the mitigations of which are below. These would further reduce the potential underwater noise effects due to an increase in vessel presence:

- Best practice measures will be put in place in order to minimise the disturbance that is caused to marine mammals from the vessel traffic will include:
    - Observers on board each vessel, monitoring for marine mammals as the vessel makes its way through The Wash and up The Haven.
    - Safety, weather and tidal conditions permitting, vessel speeds of 10 knots will be aimed for subject to the pilotage requirements for navigational safety and efficiency (including the application of ‘safe speed’) for all vessels travelling within The Haven and The Wash, will reduce the potential for fatal collisions with marine mammals, including harbour seal.
    - If marine mammals are observed in the area, there is a requirement that vessels should maintain the same course (if possible, given the narrow shipping lanes) and speed to give the seal time to avoid the vessel.

5.2.6 These measures are set out in the Outline MMMP, which is secured by condition 17 of the DML included at Schedule 9 to the latest version of the draft DCO (document reference 2.1(1)) submitted at Deadline 1 and will form part of the

Navigation Management Plan (NMP) secured by condition 14 of the draft DML.

5.3 Assessment for Potential Disturbance to Harbour Seal at Haul-Out Sites due to an Increase in Vessel Presence during Construction and Operation

5.3.1 Appendix 17.1 of the ES, paragraphs A17.6.117 to A17.6.126 and A17.6.137 to A17.6.139 provide the information for the assessment of potential effects due to disturbance at harbour seal haul-out sites due to an increase in vessel presence during construction and operation respectively. As noted in **Table 3-1**, there has been no update to the number of harbour seal present at each of the individual haul-out sites within The Wash. There is therefore no update to the assessment of disturbance at harbour seal haul-out sites.

5.3.2 As stated in paragraph 17.8.134 of the ES, beyond a distance of 600m, vessels did not cause any disturbance impact to harbour seals haul-out (Jansen *et al*., 2010). While there are a number of harbour seal hula-out sites within The Wash, the closest to any area of the shipping corridor or anchorage area is at a distance of 840m. Therefore, as stated within the ES, there is unlikely to be any impact of disturbance at harbour seal haul-out sites at that distance.

5.4 Assessment for an Increase in Vessel Collision Risk to Harbour Seal due to an Increase in Vessels during Construction and Operation

5.4.1 Appendix 17.1 of the ES, paragraphs A17.6.127 to A17.6.132 and A17.6.140 to A17.6.141 provide the information for the assessment of potential effects on harbour seal due to an increase in collision risk due to the proposed increase in the number of vessels present in the area during construction and operation respectively. This section provides an update of these previous assessments based on the updated baseline information.

5.4.2 As stated within Appendix 17.1 of the ES, paragraph A17.6.133, although the risk of collision related to the construction of the Facility is likely to be low given the low speed of the vessels and restricted area in The Wash, as a precautionary scenario, the number of harbour seals that could be at increased collision risk with vessels has been assessed on a very worst-case of 5% of the number of individuals that could be present in the shipping channel and anchorage location.

5.4.3 In total, the area that has been defined as having the potential for an increase in collision risk for harbour seal is 10.46km^2, with an estimated density of 3.189 harbour seals per km^2 within this area (as calculated from the Russell *et al.,* 2017 data).

5.4.4 A total of 1.7 harbour seals (0.045% of the SE England MU, or 0.06% of The Wash and North Norfolk Coast SAC population (SCOS, 2020)) could be at increased risk of collision at any one time. Taking into consideration the small relative increase in the number of vessels in the area, their speed of travel, which will significantly reduce the potential for fatal collision) and restricted area of the shipping channel and anchorage site, the likelihood that harbour seals would be able to detect and avoid any vessels in order to avoid collision and the small number of seals that could be at risk; it is concluded that there would be no adverse effect on the integrity of The Wash and North Norfolk Coast SAC in relation to the conservation objectives for harbour seal.

5.4.5 The outline mitigation measures, as provided in paragraph A17.6.115 of Appendix 17.1 of the ES, have been used to inform the Outline MMMP, the mitigations of which are below. These would further reduce the increase in collision risk due to an increase in vessel presence:

- Observers on board each vessel, monitoring for marine mammals as the vessel makes its way through The Wash and up The Haven.
    - Safety, weather and tidal conditions permitting, vessel speedsof 10 knots will be aimed for subject to the pilotage requirements for navigational safety and efficiency (including the application of ‘safe speed’) for all vessels travelling within The Haven and The Wash, will reduce the potential for fatal collisions with marine mammals, including harbour seal.
    - If marine mammals are observed in the area, there is a requirement that vessels should maintain the same course (if possible, given the narrow shipping lanes) and speed to give the seal time to avoid the vessel.

5.4.6 These measures are set out in the Outline MMMP, which is secured by condition 17 of the DML included at Schedule 9 to the latest version of the draft DCO (document reference 2.1(1)) submitted at Deadline 1 and will form part of the Navigation Management Plan (NMP) secured by condition 14 of the draft DML.

5.5 Risk of Injury and / or Fatality to Harbour Seal within the Vessel Anchorage Area

5.5.1 As noted above, as vessels are unable to transit through The Haven at low water, there is the requirement for vessels to remain stationary within the anchorage area, while awaiting opportunity to transit through The Haven. While in the anchorage area, there has been concern raised for the potential of injury and / or fatality to harbour seals within The Wash. The following sections (and **Section 4.5**

above) review the potential for these risks to occur through construction and operation.

5.5.2 While vessels remain stationary, there is the potential for the use of DP to maintain the vessel's position; however, it is considered unlikely that any vessel would use this method for maintaining their position for an extended period of time, as it would require significant levels of fuel. For this reason, it is considered much more likely that any vessels within the anchorage area would remain in a stationary position through the use of anchors. However, the following sections outline the risk to harbour seal in the case that any vessel did use DP (and ducted propellors) for any length of time within the anchorage area. Further information on the risk of harbour seal interacting with the propellers is included in **Section 4.5** above.

5.5.3 Taking into account that the use of DP to remain in a stationary position within the anchorage area is expected to be rare, that harbour seal are attracted to vessels very rarely (Onoufriou *et al.*, 2016), and that the corkscrew injuries are more likely to be a result of grey seal predation than the use of DP or ducted propellers, it is considered highly unlikely that any interaction would occur between a harbour seal and a vessel using the anchorage area.

5.5.4 With regard to the potential for harbour seal to become entangled within vessel anchor chains, as noted above, a study on harbour seal movement around vessels in the Moray Firth found that harbour seal only interact with vessels very rarely (only one through the study) and no detrimental effect was observed on that individual (Onoufriou *et al.*, 2016). In addition, there is an existing anchorage area within The Wash for King's Lynn port, that is regularly used. Harbour seals within The Wash would therefore be used to stationary vessels being present in the area. Furthermore, there is no evidence to suggest that seals are at risk of entanglement in vessel anchor chains, and there are no reported instances of such events occurring. See **Section 4.5** for more information on the risk of entanglement in vessel anchor chains.

5.5.5 Therefore, it is considered unlikely for any such interaction to occur, and therefore **no potential for adverse effect to harbour seals within The Wash and North Norfolk Coast SAC due to the presence of stationary vessels within the anchorage area, either during construction or operation**.

5.6 Summary of Updates to Marine Mammal Habitats Regulations Assessment

5.6.1 **Table 5-2**Table *4-2* summarises the assessments of effect for harbour seal, using

the updated population counts. All other assessments remain the same, with no potential for adverse effect on The Wash and North Norfolk Coast SAC in relation to the Conservation Objectives for harbour seal.

5.6.2 It should also be noted here that these assessments of potential effect do not take into account the mitigation measures that will be put in place, which would effectively reduce the potential effects on harbour seal from the SAC.

Table 5-2 Summary of the Updated Assessments of Effect for Harbour Seal within The Wash and North Norfolk Coast SAC

Impact	Updated assessment of Effect	Assessment of effect reported in Appendix 17.1 of the ES	Mitigation
Potential Effects during Construction			
Risk of any permanent auditory injury (PTS) in harbour seal during piling or dredging	No potential for adverse effect	No potential for adverse effect on site integrity	Mitigation for piling at high water following JNCC protocols[17], as stated in Paragraphs A17.6.105 of Appendix 17.1 of the ES. Now set out in the Outline MMMP.
Potential for temporary auditory injury (TTS) or fleeing response in harbour seal during piling or dredging	No potential for adverse effect	No potential for adverse effect on site integrity	
Disturbance from vessels	No potential for adverse effect	No potential for adverse effect on site integrity	Best practice measures as stated in Paragraph A17.6.115 and A17.6.135 of Appendix 17.1 of the ES. Now set out in the Outline MMMP.
Increased risk of collisions for marine mammals (impact zone includes the Wash as a transit area)	No potential for adverse effect	No potential for adverse effect on site integrity	
Disturbance at harbour seal haul-out sites	No potential for adverse effect	No potential for adverse effect on site integrity	None required
Risk of Injury and / or Fatality within the Vessel Anchorage Area	No potential for adverse effect	No potential for adverse effect on site integrity	None required
Potential Effects during Operation			

[17] https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf

Impact	Updated assessment of Effect	Assessment of effect reported in Appendix 17.1 of the ES	Mitigation
Disturbance from vessels – harbour seal	No potential for adverse effect	No potential for adverse effect on site integrity	Best practice measures as stated in Paragraph A17.6.115 and A17.6.135 of Appendix 17.1 of the ES. Now set out in the Outline MMMP.
Increased risk of collisions for marine mammals (impact zone includes the Wash as a transit area)	No potential for adverse effect	No potential for adverse effect on site integrity	
Disturbance at harbour seal haul-out sites	No potential for adverse effect	No potential for adverse effect on site integrity	None required
Risk of Injury and / or Fatality within the Vessel Anchorage Area	No potential for adverse effect	No potential for adverse effect on site integrity	None required

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