Hornsea Project Four

F2.11: Outline Southern North Sea Special Area of Conservation Site Integrity Plan

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Version B

Revision Summary

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Revision Change Log

Rev	*Page*	*Section*	*Description*
01	NA	NA	Submitted at Application
02	12-13	Table 2	Added text around submission and review timescales.
02	12-13	Table 2	Added text around commitment to noise mitigation.
02	16	2.1.2.1	Updated commitment Co85 wording.

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Glossary

Term	Definition
Commitment	A term used interchangeably with mitigation and enhancement measures. The purpose of Commitments is to reduce and/or eliminate Likely Significant Effects (LSEs), in EIA terms. Primary (Design) or Tertiary (Inherent) are both embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, Preliminary Environmental Information Report (PEIR) or ES). Secondary commitments are incorporated to reduce LSE to environmentally acceptable levels following initial assessment i.e. so that residual effects are acceptable.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Habitats Regulations Assessment (HRA)	A process which helps determine likely significant effects and (where appropriate) assesses adverse effects on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI).
High Voltage Alternating Current (HVAC)	High voltage alternating current is the bulk transmission of electricity by alternating current , whereby the flow of electric charge periodically reverses direction.
Hornsea Project Four Offshore Wind Farm	The term covers all elements of the project (i.e. both the offshore and onshore). Hornsea Four infrastructure will include offshore generating stations (wind turbines), electrical export cables to landfall, and connection to the electricity transmission network. Hereafter referred to as Hornsea Four.
Orsted Hornsea Project Four Ltd.	The Applicant for the proposed Hornsea Project Four Offshore Wind Farm Development Consent Order (DCO).

Acronyms

Acronym	Definition
AfL	Agreement for Lease
AA	Appropriate Assessment
AEoI	Adverse Effect on Integrity
CfD	Contract for Difference
CPEMMP	Construction Project Environmental Management and Monitoring Plan
DCO	Development Consent Order
DML	Deemed Marine Licence
EDR	Effective Deterrent Radius
EIA	Environmental Impact Assessment
EPS	European Protected Species
ES	Environmental Statement
FCS	Favourable Conservation Status
FID	Final Investment Decision

Acronym	Definition
GBS	Gravity Base Structure
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
LSE	Likely Significant Effect
MCA	Maritime and Coastguard Agency
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MMMP	Marine Mammal Mitigation Protocol
OSS	Offshore Substation
PEIR	Preliminary Environmental Information Report
PTS	Permanent Threshold Shift
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SIP	Site Integrity Plan
SNCB	Statutory Nature Conservation Body
SNS	Southern North Sea
TWT	The Wildlife Trusts
UXO	Unexploded Ordnance
VMP	Vessel Management Plan
WDC	Whale and Dolphin Conservation
WTG	Wind Turbine Generator

Units

Unit	Definition
kJ	Kilojoules
km	Kilometres
min	Minutes

1 Introduction

1.1 Overview

1.1.1.1 Orsted Hornsea Project Four Ltd (hereafter the 'Applicant') is proposing to develop the Hornsea Project Four Offshore Wind Farm (hereafter 'Hornsea Four'). Hornsea Four will be located approximately 69 km off the coast of the East Riding of Yorkshire in the southern North Sea and will be the fourth project to be developed in the former Hornsea Zone (see **Volume A1, Chapter 1: Introduction** for further details). Hornsea Four will include both offshore and onshore infrastructure including an offshore generating station (wind farm), export cables to landfall, and a connection to the electricity network (**see Volume A1, Chapter 4: Project Description**). The Order Limits combine the search areas for all onshore and offshore infrastructure.

1.1.1.2 The Hornsea Four Agreement for Lease (AfL) area was 846 km^2 at the Scoping phase of project development. In the spirit of keeping with Hornsea Four's approach to Proportionate Environmental Impact Assessment (EIA), the project has due consideration to the size and location (within the existing AfL area) of the final project that is being taken forward to Development Consent Order (DCO) application. This consideration is captured internally as the "Developable Area Process", which includes Physical, Biological and Human constraints in refining the developable area, balancing consenting and commercial considerations with technical feasibility for construction.

1.1.1.3 The combination of Hornsea Four's Proportionality in EIA and Developable Area process has resulted in a marked reduction in the array area taken forward at the point of DCO application. Hornsea Four adopted a major site reduction from the array area presented at Scoping (846 km^2) to the Preliminary Environmental Information Report (PEIR) boundary (600 km^2), with a further reduction adopted for the Environmental Statement (ES) and DCO application (468 km^2) due to the results of the PEIR, technical considerations and stakeholder feedback. The evolution of the Hornsea Four Order Limits is detailed in **Volume A1, Chapter 3: Site Selection and Consideration of Alternatives** and **Volume A4, Annex 3.2: Selection and Refinement of the Offshore Infrastructure**.

1.1.1.4 The Report to Inform Appropriate Assessment (RIAA) (**B2.2: Report to Inform Appropriate Assessment**) identified the need to address uncertainty with regard to potential in-combination impacts from multiple projects, which may or may not have a construction timetable which overlaps with Hornsea Four. Specifically, the uncertainty relates to harbour porpoise (*Phocoena phocoena*) and the Southern North Sea Special Area of Conservation (SNS SAC) and the risk of an exceedance of the Statutory Nature Conservation Body (SNCB) defined underwater noise disturbance thresholds (Joint Nature Conservation Committee (JNCC) 2019) from Hornsea Four in-combination with other plans and projects. The uncertainty predominantly relates to the construction schedule for other plans and projects that could give rise to an in-combination effect.

1.1.1.5 Therefore, in the event that driven or part-driven pile foundations are to be used, a Site Integrity Plan (SIP), in line with the Guidance for Assessment Significance of Noise Disturbance Against Conservation Objectives of Harbour Porpoise SACs (JNCC, Natural England & DAERA 2020), has been secured as a condition in the draft DCO and the draft Deemed Marine Licences (DMLs) (**C1.1: Draft DCO Including Draft DML**), with an Outline Southern North Sea Special Area of Conservation SIP (hereafter 'Outline SNS SAC SIP') submitted as part of the DCO Application. GoBe Consultants were commissioned to draft

the Outline SNS SAC SIP in relation to the SNS SAC, designated solely for harbour porpoise. The SNS SAC is illustrated in relation to Hornsea Four in **Figure 1**.

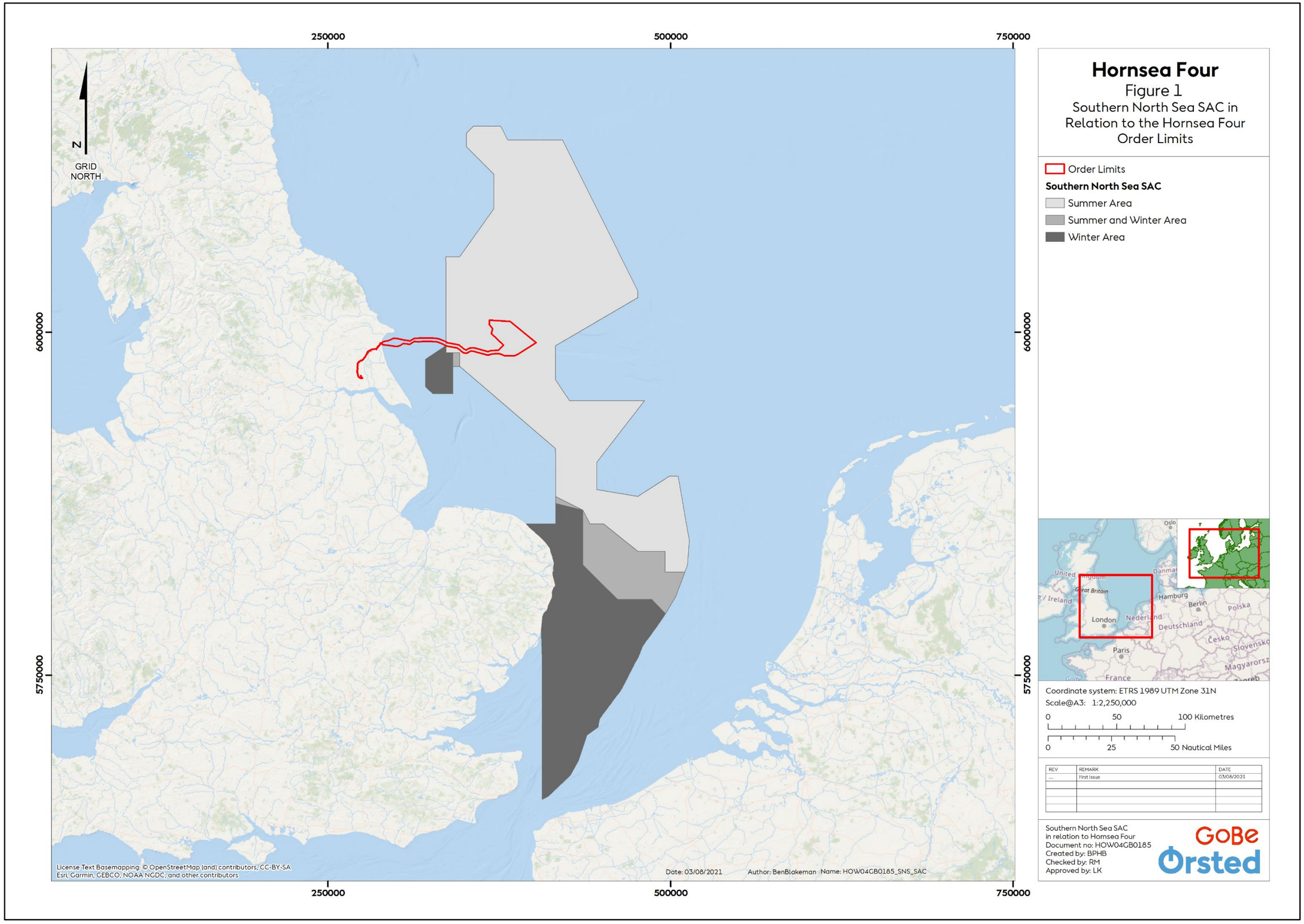

Figure 1: Southern North Sea SAC in Relation to the Hornsea Four Order Limits.

1.2 Purpose of the Outline SNS SAC SIP

1.2.1.1 The purpose of this Outline SNS SAC SIP is to set out the approach being taken by Hornsea Four to provide certainty in the conclusions of the Appropriate Assessment (AA), specifically that the conclusions of no Adverse Effect on Integrity (AEoI) as identified in **B2.2: Report to Inform Appropriate Assessment**, remain valid. The requirement for certainty relates to the conclusion of no AEoI as a result of underwater noise disturbance of harbour porpoise within the SNS SAC in-combination with other plans and projects (**B2.2: Report to Inform Appropriate Assessment**). Specifically, the potential for uncertainty arises as a result of the published construction schedules of a number of projects, which are typically considerably longer than actually required, resulting in uncertainty around which plans and projects to include within the in-combination assessment and which will actually be relevant at the time of the construction of Hornsea Four.

1.2.1.2 This Outline SNS SAC SIP sets out the proposed approach to addressing this uncertainty by identifying a series of potential mitigation measures which could be implemented (if required) when drafting the final SNS SAC SIP prior to commencement of the relevant licensed activities, in order to ensure that an AEoI will be avoided with respect to significant disturbance to harbour porpoise in relation to the conservation objectives of the SNS SAC. The SNS SAC SIP therefore ultimately ensures that the conclusion that there will be no AEoI on the SNS SAC remains valid.

1.2.1.3 A number of mitigation measures are available and these are described in **Section 4** below, with a commentary on the relative efficacy of each measure provided. Which of these mitigation measure(s) is ultimately chosen (if indeed any are required) to ensure the conclusion of no AEoI is maintained, will be determined through the drafting of the final SNS SAC SIP prior to the construction of Hornsea Four and will be a function of the final construction methodology and schedule of individual plans and projects (including Hornsea Four).

1.2.1.4 The Outline SNS SAC SIP is therefore limited in scope to a single issue – that of potential for in-combination disturbance of harbour porpoise within the SNS SAC resulting from underwater noise, during construction only. The AA provides certainty in all other instances that no AEoI will result, with the SNS SAC SIP required solely to provide necessary certainty around this single issue (as provided for within **B2.2: Report to Inform Appropriate Assessment**). Although specific to the potential for underwater noise arising from piling works to result in the disturbance of harbour porpoise within the SNS SAC, it is noted that mitigation of underwater noise may have wider benefits for other noise sensitive species as well.

1.2.1.5 This Outline SNS SAC SIP also provides a framework for further consultation and discussion between the Applicant and the Marine Management Organisation (MMO), and the SNCB - Natural England, to reach agreement on the final details of any required project related mitigation measures through the drafting and approval of the SNS SAC SIP. The mitigation measures described in this Outline SNS SAC SIP will be reviewed and updated post-consent as part of the consultation process and in line with the approach and timeframe set out in this document. A final detailed SNS SAC SIP will be produced closer to the time of construction, following revision and consultation as per the outline in **Section 1.4**. As noted below in **Section 1.3**, the requirement for compliance with the SNS SAC SIP is provided for within the DCO.

1.3 Requirement for the SNS SAC SIP

1.3.1.1 The Applicant has, following consultation with Natural England and the MMO through the Evidence Plan process and through the Section 42 consultation process (informed by the PEIR) and on the draft RIAA), included a condition within the draft DCO (**C1.1: Draft DCO Including Draft DML**) that, in the event of driven or part-driven foundations, commits the Applicant to providing a SNS SAC SIP for the SNS SAC to the MMO for approval prior to the commencement of the relevant licensed activities (Schedule 11, Part 2 and Schedule 12, Part 2 Condition 13(1)(j)) of the draft DCO. The condition is worded as follows:

13.-(1) The licensed activities for each stage of construction of the project must not commence until the following (insofar as relevant to that activity or phase of activity) has been submitted to and approved in writing by the MMO, in consultation with, where relevant, Trinity House and the Maritime and Coastguard Agency (MCA) -

(j) in the event that driven or part-driven pile foundations are proposed to be used, the licenced activities, or any relevant stage of those activities must not commence until a site integrity plan for that stage which accords with the principles set out in the outline Site Integrity Plan has been submitted to the MMO and the MMO is satisfied that the plan provides such mitigation as is necessary to avoid adversely affecting the integrity (within the meaning of the 2017 [Offshore] Regulations) of a relevant site, to the extent that harbour porpoise are a protected feature of that site.

1.4 Consultation

1.4.1 Overview

1.4.1.1 Refinement of this Outline SNS SAC SIP will follow an iterative process as the Hornsea Four design is finalised following application, through the examination phase and following determination. The Applicant will continue to engage with the MMO and their advisors (Natural England) throughout this process and will seek to address any issues raised in relation to the SNS SAC SIP requirement and, following consent award, the discharge of the relevant DCO requirement prior to the commencement of construction.

1.4.1.2 Non-statutory stakeholders such as The Wildlife Trusts (TWT) and Whale and Dolphin Conservation (WDC) have an opportunity to provide comment on the Outline SNS SAC SIP as part of the DCO application and can also be provided with any future iterations for their information via the DCO Examination process by registering as Interested Parties, and through continued engagement via the Evidence Plan process (**B1.1.1: Evidence Plan**). The Applicant will continue to engage with all stakeholders, however ultimate responsibility in discharging the condition for the SNS SAC SIP lies with the MMO.

1.4.1.3 A summary of relevant consultation related to the development of the Outline SNS SAC SIP is summarised in **Table 1** below, along with a summary of how the Applicant has had regard to the comments raised.

Table 1: Summary of consultation relating to the development of the Outline SNS SAC SIP.

Consultee	Date and Forum of Consultation	Comment	Where addressed in the ES/Application
TWT	Section 42 consultation response	TWT welcomes the commitments in Co33, Co45 and Co86 for cables. We note that no commitments have been made in the register for disturbance impacts on marine mammals or the Southern North Sea SAC. Although we appreciate that the Commitments Register currently only applies to the EIA, mitigation documents to be produced for the Habitats Regulations Assessment (HRA), for example the Site Integrity Plan for the Southern North Sea SAC, are likely to be relevant to managing cumulative disturbance impacts assessed in the marine mammals chapter. Therefore, we suggest documents such as these should be included in the Commitments Register."	The requirement for a SNS SAC SIP is now included as a condition in the DCO, and an Outline SNS SAC SIP (this document) has been included with the DCO Application. The condition ensures the Applicant will develop and secure the approval of a SIP for the SNS SAC prior to the commencement of works (Condition 13(1)(j)) for both Schedule 11 and 12 of the draft DCO).
Evidence Plan – Marine Mammal Technical Panel (including the MMO, TWT and Natural England)	Meeting Six, 06 November 2019	TWT raised concerns over the Maximum Design Scenario (MDS) vs. Most likely piling scenario (Natural England confirmed that the MDS is captured in the DCO, but that a condition on MDS vs. most likely scenario would require some thought). TWT queried whether this could be linked to the SIP. All agreed that it would be useful for the MMO to provide a template for a SIP.	The Applicant has produced an Outline SNS SAC SIP as part of the DCO Application. The SNS SAC SIP condition in the DCO ensures the Applicant will develop and secure the approval of a SIP for the SNS SAC prior to the commencement of works (Condition 13(1)(j)) for both Schedule 11 and 12 of the draft DCO). As the SNS SAC SIP is a working post-consent document, it is reviewed against the final design information at key milestones, and a comparison between the parameters considered at application and final design will be undertaken to ensure the conclusions of the AA remain valid.
Evidence Plan – Marine Mammal	Meeting Eight, 04 June 2020	TWT raised concerns over the level of planned consultation with TWT on the development of the SIP.	The Applicant will continue to engage with all stakeholders throughout the SNS SAC SIP process,

Consultee	Date and Forum of Consultation	Comment	Where addressed in the ES/Application
Technical Panel (including the MMO, TWT and Natural England)	Draft Outline SIP submitted as part of the Meeting Eight Position Paper.	TWT requested to be consulted as part of the process, rather than just being informed at the development milestones in forming the final SIP. TWT also wished to see specific reference to monitoring, as well as mitigation, in the SIP, in order the understand the effectiveness of mitigation.	noting that drafts of the SNS SAC SIP will be provided to TWT who will be welcome to provide comments to the Applicant on these drafts. It is important to note that ultimate responsibility in discharging the condition for the SNS SAC SIP lies with the MMO. All monitoring related to Hornsea Four is set out in **F2.7: Outline Marine Monitoring Plan**.
Evidence Plan – Marine Mammal Technical Panel (including the MMO, TWT and Natural England)	Written consultation on the Draft Outline SIP between July and December 2020	TWT provided comment on the Draft Outline SIP, reiterating the points discussed in Meeting Eight.	

1.4.2 Timeframe to finalise the SNS SAC SIP

1.4.2.1 The exact dates for agreement and refinement of the final SNS SAC SIP cannot be determined at this stage since this relies on detailed consent, procurement and construction timescales, however, key milestones have been outlined in Table 2 to signpost the likely development of the SNS SAC SIP from the point of the DCO Application through to the start of offshore construction.

Table 2: Anticipated review and revision process for the SNS SAC SIP.

Development Stage	Indicative Date(s)	Applicant Actions	Relevant Statutory Authority/Advisor(s)
Post-application review of the Outline SNS SAC SIP through Relevant Representations and DCO Examination	Q4 2021 – Q3 2022	Review Outline SNS SAC SIP and identify (where necessary) any areas for revisions/updates.	The Examining Authority. Consultation with Natural England, MMO, TWT, WDC and any other relevant interested parties.
Consent decision and AA	Q4 2022	Review final DCO requirement relating to the development of a SNS SAC SIP.	N/A
Design optimisation	Pre-construction	Review the Outline SNS SAC SIP and potential mitigation and management options in the light of the refined project design information and scheduling, taking into account any refinements that may affect the conclusions of the AA.	N/A
Phase 1: First Draft of the SNS SAC SIP	Following Contracts for Difference (CfD) award/Final Investment Decision (FID) first draft submitted 12 months prior to construction with updated assessment and ground model.	Design optimisation work will inform the CfD bid for Hornsea Four. Following CfD award (or otherwise, where a CfD is not obtained, the FID) the project will be defined and level of activity on other plans/projects that will overlap will be more certain. Based on the final design optimisation, the Applicant will review the conclusions of the AA and, if necessary, undertake an assessment to determine the potential effects resulting from the final piling parameters (for the Project alone and in-combination). The review will consider the need for mitigation or management measures and provide detail on their efficacy in the context of the effects predicted. A draft SNS SAC SIP will be prepared for consultation. Any requirement for noise mitigation, or not as the case may be, shall be determined following confirmation of final hammer energies and foundation types, collection of additional survey	MMO in consultation with Natural England, with copies provided more widely to TWT and WDC who will be welcome to provide comments to the Applicant on these drafts.

Development Stage	Indicative Date(s)	Applicant Actions	Relevant Statutory Authority/Advisor(s)
		data (noise or geophysical data), and/or acquisition of noise monitoring data, the update of the project and location specific noise model(s) including information on maturation of emerging technologies. The mitigation measure (or suite of measures) that may be implemented during the construction of Hornsea Four will be determined in consultation with the regulator and relevant statutory nature conservation body.	
Phase 2: Review of the SNS SAC SIP	Final draft submitted at 4 months prior to construction. Consultation and updates will take place between 12 and 4 months with the MMO and relevant statutory nature conservation body. ~~Six to nine months prior to construction start~~	Following further (more detailed) planning and design optimisation, the Applicant will make any necessary refinements to the assessments presented within the SNS SAC SIP. If mitigation remains a requirement then proposals will be finalised within the SNS SAC SIP and sufficient detail will be presented to demonstrate how this mitigation will be implemented to reduce effects to acceptable levels	Consultation with Natural England and MMO, with copies provided more widely to TWT, WDC who will be welcome to provide comments to the Applicant on these drafts.
Finalisation and sign-off of the SNS SAC SIP	Prior to commencement of the relevant licensed activities	Update mitigation and management measures having regard to consultee comments.	MMO to approve the final SNS SAC SIP.

2 Final Design Plan

2.1.1 Maximum Design Scenario

2.1.1.1 This Outline SNS SAC SIP is based on the Hornsea Four Maximum Design Scenario (MDS), as defined within **Volume A1, Chapter 4: Project Description** and as defined by the parameters outlined within the draft DCO. A summary of the key parameters, as relevant to the SNS SAC, is provided in Section 6.4 of **B2.2: Report to Inform Appropriate Assessment**. These parameters are deemed relevant as they relate to those effects screened in for assessment as potential Likely Significant Effects (LSE), and assessed as resulting in no AEoI, either alone

or in-combination. The final Hornsea Four project design, that will be taken forwards to construction will lie within the limits dictated by the MDS as defined by the DCO.

2.1.1.2 The clearance of Unexploded Ordnance (UXO) prior to offshore construction is not included as a matter permitted under the DCO Application and will be subject to a separate Marine Licence application once future surveys have taken place to determine the likely number and nature of UXO present that will require clearance. The separate Marine Licence application will include due consideration of the SNS SAC, including the need for a SNS SAC SIP in relation specifically to UXO clearance activities if required.

2.1.1.3 The RIAA identified the following potential effects on the harbour porpoise qualifying feature of the SNS SAC, which required assessment (i.e. were screened in for potential LSE):

- Underwater noise (construction, operation & maintenance and decommissioning); and
- Long term physical loss of habitat (operation & maintenance).

2.1.1.4 It was concluded that all other potential effects would not give rise to a LSE at the HRA Screening stage and they were, therefore, not considered further in the assessment. Note that the only source of uncertainty identified during the preparation of the RIAA (and therefore requiring consideration in this Outline SNS SAC SIP) was in relation to underwater noise disturbance during construction (in-combination) – all other matters have been fully addressed within the RIAA (**B2.2: Report to Inform Appropriate Assessment**).

2.1.1.5 Those aspects of the MDS that are relevant to the assessment of the potential for underwater noise disturbance during construction are summarised in **Table 3** below. It is these parameters that will ultimately be confirmed through the final SNS SAC SIP drafting and approval process to provide certainty that the existing conclusions throughout the RIAA and AA for the project alone and in-combination ultimately remain valid (i.e. no AEoI) and, if any parameters have changed, to confirm that the assessment for the project alone remains valid (with application of mitigation measures if required).

Table 3: Maximum design scenario as relevant to the potential for underwater noise disturbance.

Maximum Design Scenario
Wind Turbine Generator (WTG) Foundations **Spatial maximum design:** - 180 WTGs on 15 m diameter monopile foundations; - 5,000 kJ hammer energy, 262.5 minutes piling duration per foundation including a 52.5 min soft-start and ramp up; and - 216 piling days over a 12-month construction period. **Temporal maximum design:** - 180 WTGs on piled jacket foundations, three 4 m diameter piles per jacket (540 piles in total); - 3,000 kJ hammer energy, 262.5 minutes piling duration per pile including a 52.5 min soft start and ramp up; and - 270 piling days over a 12-month construction period.

Maximum Design Scenario
Other Piled Infrastructure **Spatial maximum design:** - Three large offshore substations (OSS) on 15 m diameter monopile foundations; - Six small OSS on 15 m diameter monopile foundations; - One offshore accommodation platform on a 15 m diameter monopile foundation; - Three High Voltage Alternating Current (HVAC) booster stations (small OSS) on 15 m diameter monopile foundations; - 5,000 kJ hammer energy, 262.5 minutes per foundation piling duration including a 52.5 min soft start and ramp up; and - 16 piling days over a 12-month construction period. **Temporal maximum design:** - Three large OSS on piled jacket foundations, 16 3.5 m diameter piles per structure (48 piles in total); - Six small OSS on piled jacket foundations, 24 3.5 m diameter piles per structure (144 piles in total); - One offshore accommodation platform on a piled jacket foundation, 24 3.5 m diameter piles; - Three HVAC booster stations (small OSS) on piled jacket foundations, 24 3.5 m diameter piles per structure (72 piles in total); - 3,000 kJ hammer energy, 262.5 minutes piling duration per pile including a 52.5 min soft start and ramp up; and - 39 piling days over a 12-month construction period.
Simultaneous piling: Only two piles will be piled simultaneously within the Hornsea Four array and HVAC booster station search area.

2.1.1.6 With regard to the project in-combination assessment, the final SNS SAC SIP will confirm which plans and projects fall within the construction timeframe for Hornsea Four and therefore which plans and projects require further consideration in-combination with Hornsea Four. The purpose of the process being to confirm whether the conclusion of no AEoI in-combination is valid in the absence of additional mitigation, and if not, which measure(s) is required to provide that certainty. The in-combination aspect is addressed in more detail below in **Section 4**.

2.1.2 Commitments

2.1.2.1 The Hornsea Four commitments are described in **Volume A4, Annex 5.2: Commitments Register**, and the relevant commitments are described within **Volume A2, Chapter 4:**

Marine Mammals. For context, the commitments relevant to the control of the potential impacts of Hornsea Four on marine mammal receptors are summarised below:

- **Co85** – ~~No more than a maximum of two foundations are to be installed simultaneously;~~There will only be a maximum installation of 2 piled foundations within a 24 hour period. It is possible for installation of the two piled foundations to occur concurrently i.e. within a 24 hour period at up to two locations within the HVAC search area or up to two locations within the array. The two piled foundation locations may also be piled simultaneously.
- **Co108** - A Vessel Management Plan (VMP) will be developed pre-construction which will determine vessel routing to and from construction areas and ports to minimise, as far as reasonably practicable, encounters with marine mammals;
- **Co110** – A piling Marine Mammal Mitigation Protocol (MMMP) will be developed in accordance with the Outline MMMP and will be implemented during construction. The piling MMMP will include measures to ensure the risk of instantaneous permanent threshold shift (PTS) to marine mammals is negligible and will be in line with the latest relevant available guidance. The piling MMMP will include details of soft starts to be used during piling operations with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels.
- **Co111** - A Construction Project Environmental Management and Monitoring Plan (CPEMMP) will be developed and will include details of:
    - A marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents of the authorised project in relation to all activities carried out below Mean High Water Springs (MHWS);
    - A chemical risk review to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance;
    - A marine biosecurity plan detailing how the risk of introduction and spread of invasive non-native species will be minimised;
    - Waste management and disposal arrangements;
    - A vessel management plan, to determine vessel routing to and from construction sites and ports, to include a code of conduct for vessel operators; and
    - The appointment and responsibilities of a company fisheries liaison officer;
- **Co113** - A Decommissioning MMMP will be implemented during decommissioning. The Decommissioning MMMP will be approved by the MMO in consultation with Natural England. The Decommissioning MMMP will include measures to ensure the risk of instantaneous PTS to marine mammals is negligible and will be in line with the latest relevant available guidance.; and
- **Co181** - An Offshore Decommissioning Plan will be developed prior to decommissioning.

3 The Southern North Sea SAC

3.1 Introduction

3.1.1.1 The SNS SAC is the largest of the UK designated sites for the conservation of harbour porpoise. The only qualifying species of the site is harbour porpoise (the Habitats Directive Annex II species). The SNS SAC boundary is based on a modelling prediction of harbour porpoise habitat (Heinänen and Skov 2015), and harbour porpoise densities are linked to this modelled suitable habitat. JNCC (2015) have also defined seasonal (summer and winter) areas of the SAC reflecting how the importance of the site to harbour porpoise varies during the year (see **Figure 1**).

3.2 Conservation Objectives

3.2.1.1 The Conservation Objectives for the SNS SAC[1] are designed to ensure that the obligation of the Habitats Directive can be met. Article 6(2) of the Directive requires that there should be no deterioration or significant disturbance to the qualifying species or to the habitats upon which they rely. The SNS SAC SIP will set out how the project will identify, agree and implement suitable and appropriate measures to ensure that the Conservation Objectives are upheld.

3.2.1.2 The Conservation Objectives[2] of the site are as follows:

"To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters

In the context of natural change, this will be achieved by ensuring that:

- *Harbour porpoise is a viable component of the site;*
- *There is no significant disturbance of the species; and*
- *The condition of supporting habitats and processes, and the availability of prey is maintained."*

3.2.1.3 These Conservation Objectives are a set of specified objectives that must be met to ensure that the site contributes in the best possible way to maintain FCS of the designated site feature(s) at the national and biogeographic level.

3.2.1.4 This Outline SNS SAC SIP is concerned solely with the second of these objectives, that of significant disturbance, since that is where uncertainty has been identified within the RIAA (**B2.2: Report to Inform Appropriate Assessment**).

[1] As set out in 'Harbour Porpoise (*Phocoena phocoena*) Special Area of Conservation: Southern North Sea Conservation Objectives and Advice on Operation' March 2019.
[2] Please note that the official wording of the Conservation Objectives differs from that presented in 'Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland)' June 2020. Within the guidance document, it states that the Conservation Objectives are '*To ensure that the integrity of the site is maintained and that it makes* ***an appropriate*** *contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters'.*

4 Potential Mitigation and Management Measures

4.1.1 Overview

4.1.1.1 The RIAA includes existing mitigation commitments relevant to marine mammals which are described in **Section 2.1.2** above. Of particular relevance is the provision of **F2.5: Outline MMMP**, prepared and agreed in consultation with the MMO and Natural England. It is considered that these existing commitments provide sufficient mitigation to address the risk of mortality or injury in harbour porpoise from the project alone or in-combination (the first conservation objective) and no further mitigation would be required to address that risk. Furthermore, the RIAA concluded no AEoI alone or in-combination with respect to the third conservation objective (*the condition of supporting habitats and processes, and the availability of prey is maintained*).

4.1.1.2 Consideration of further mitigation and management measures made within this Outline SNS SAC SIP is therefore limited to addressing the potential disturbance of harbour porpoise only. Relevant SNCB advice (as detailed within the RIAA) defines significant disturbance in terms of thresholds, specifically when more than 20% of the relevant seasonal extent is disturbed within 24 hours or when more than 10% of the relevant seasonal extent is disturbed on average across that season.

4.1.1.3 With respect to the potential for an AEoI as a result of disturbance of harbour porpoise, the RIAA has concluded no AEoI for the SNS SAC for the project alone or in-combination. For the project alone, that conclusion is dependent on the MDS outlined in **Table 3** above and as outlined in **Volume A1, Chapter 4 Project Description**. No additional mitigation is required for the project alone to provide certainty in that conclusion.

4.1.1.4 For the assessment in-combination, certainty in the conclusion of no AEoI as regards disturbance of harbour porpoise by underwater noise during construction is provided by the inclusion of a requirement for a SNS SAC SIP to be approved prior to construction, included as a provision of the draft DCO.

4.1.1.5 The current understanding of relevant plans and projects to be considered as part of the in-combination assessment are outlined within **B2.2: Report to Inform Appropriate Assessment**. On this basis, the RIAA indicates that, on a worst-case scenario basis, there is a risk that thresholds could be exceeded in the absence of additional mitigation or management measures. The marine mammal in-combination assessment presented in the RIAA is based on a standard cumulative tiering approach, which takes account of the project certainty (i.e. the level of certainty that a project will come forward based on its status in the planning process), but cannot provide certainty on the eventual timeframe for construction of individual projects (beyond an often wide window described in project literature) nor the final project design.

4.1.1.6 This Outline SNS SAC SIP is intended to identify the available mitigation and management measures that could be brought forward during the development of the final SNS SAC SIP prior to the construction of Hornsea Four, that ensures that a conclusion of no AEoI can be maintained under all scenarios.

4.1.1.7 Table 2 of the JNCC's Advice on Activities for the SNS SAC (JNCC 2019) summarises available mitigation options with respect to disturbance and displacement effects in relation to piling. The first step relates to the following primary mitigation measures:

"By varying the schedule of piling, particularly if several developments are constructing at the same time and pile driving footprints do not overlap (i.e. maximising area from which porpoise are excluded). Limited spatio-temporal restrictions may be needed."

4.1.1.8 This is then followed by secondary mitigation measures:

"Other examples of mitigation include the use of sound dampers, methods that create a barrier to sound transfer (e.g. bubble curtains) and, more effectively, the use of alternative foundation types (e.g. gravity foundations, suction cups, floating turbines, drilling). Scheduling of activities may minimise cumulative exclusion from areas."

4.1.1.9 These mitigation measures for underwater noise-related disturbance effects are considered further in the sections below.

4.1.1.10 JNCC, Natural England & DAERA (2020) advises that enough time should be allowed between the assessment and the start of construction to allow for the effective implementation of any further mitigation and management measures considered necessary, which could include:

- Careful spatial planning and phasing of noisy activities (e.g. concurrent piling of adjacent foundations) in order to reduce footprint;
- Use of alternative foundations that do not require pile driving (e.g. suction buckets gravity bases), noting that these may have other impacts;
- Use of alternative methods of installation that would reduce the noise impact footprint; and
- Use of technology to reduce the sound levels at source or to minimise sound propagation and reduce the noise footprint.

4.1.2 Primary Mitigation – Management of Activities

4.1.2.1 In the hierarchy of available mitigation, the JNCC advice (JNCC 2019) suggests the need to consider whether project level programme commitments (management measures) could provide certainty of no AEoI. Such measures may, for example, relate to a limitation on project activities per day and/or per season, or refer to the location of works at a particular time or season (e.g. works in the HVAC area or works in the array boundary) or to a separation distance between activities.

4.1.2.2 The application of such management measures, where feasible and necessary, would be to ensure, in-combination, that the thresholds for significant disturbance (20% of the relevant seasonal extents of the SAC in a day and 10% of the relevant seasonal extents of the SAC across a season) would not be exceeded.

4.1.2.3 These management measures could be considered, for example, under the following scenarios:

- For individual days when risk of threshold exceedance is driven by activity undertaken by projects in-combination (i.e. Hornsea Four itself does not lead to exceedance of the thresholds, but acting in-combination with other plans/projects, a risk of AEoI remains) (e.g. limiting where or when project level activities take place relative to the SNS SAC boundary); and

- Where a risk of exceeding the seasonal threshold is identified (in-combination), by applying a limit on the project level activity sufficient to avoid the exceedance of the seasonal threshold.

4.1.2.4 As an example of how project level activity could be managed to ensure the thresholds are respected, the schedule of piling could be programmed, in consultation with and for approval by the MMO, having regard to other noise generating activity that could act in-combination with Hornsea Four. This could also include working with other projects and project proponents to develop workable solutions to the potential in-combination issues at a regional level (and working both within the offshore wind sector and with other sectors).

4.1.2.5 Ultimately, the need for any such management measures will be determined and confirmed through the development of the final SNS SAC SIP during the post consent phase and prior to the commencement of the relevant licensed activities following the process set out in **Table 2** above. This process will confirm whether any such mitigation or management measures are required and would provide certainty of no AEoI in-combination. It is noted that the SIP requirement has been applied to numerous recent offshore wind farm DCOs in relation to the SNS SAC and have, through the discharge of those requirements, acted to confirm the finding of no AEoI alone or in-combination.

4.1.3 Secondary Mitigation Options

4.1.3.1 Following the JNCC advice (JNCC 2019 and JNCC, Natural England & DAERA 2020), the Applicant might consider the use of secondary mitigation measures in developing the final SNS SAC SIP. These measures include a number of technical options which when applied individually or collectively, can act to reduce the noise emissions during the construction of Hornsea Four and therefore provide certainty of no AEoI as a result of the disturbance of harbour porpoise within the SNS SAC. These secondary mitigation options are set out in the following sections.

Alternative foundation types

4.1.3.2 The Applicant could consider whether it is possible (commercially and technically) to use alternative (i.e. non-impact piled) foundation types (within the consented MDS) during the final design process. This decision and design evaluation would be informed by post-consent site investigation and technology developments. In such an eventuality, the SNS SAC SIP would no longer be required as a condition as outlined in Part 2, Condition 13(1)(j) of Schedules 11 and 12 of the draft DCO.

4.1.3.3 The use of non-piled foundations could result in a significant reduction in subsea noise emissions during construction when compared to percussive piling and effectively result in no (or minimal) contribution to the potential disturbance of harbour porpoise in the SNS SAC - a (near) 100% efficacy option for providing certainty of no AEoI in respect of disturbance.

4.1.3.4 The alternative (non-piled) foundation types included within the Hornsea Four design envelop for the turbine installation include:

- Monopod suction caissons;
- Suction caisson jackets; and
- Gravity base structure (GBS).

Alternative piling systems

4.1.3.5 Advancements are also being made in relation to techniques for the installation of conventional monopile and pin pile foundations that replace conventional percussive piling techniques and thereby have the potential to reduce the level of subsea noise emissions and correspondingly the area of potential disturbance. The Applicant might consider whether it is possible (commercially and technically) to use such alternative piling systems during the final design process. This decision and design evaluation would be informed by post-consent site investigation and technology developments.

4.1.3.6 Currently, examples of such alternative piling methods (discussed in further detail within **Volume A1, Chapter 4: Project Description**) include:

- Assisted monopile installation (by water jetting or electro-osmosis);
- 'Blue Hammer' piling; and
- Vibro-piling.

4.1.3.7 It is widely acknowledged that such systems reduce the level of noise emitted (relative to piling without such systems); however, the efficacy in terms of the thresholds for harbour porpoise disturbance have not yet been defined. Therefore, the application of these systems (should they be deemed to be commercially and technically viable) would require discussion with the MMO and in consultation with Natural England to determine how they might reduce project level contribution to the daily and seasonal thresholds.

Noise mitigation systems

4.1.3.8 Noise mitigation systems are currently being developed that can, depending on the environment within which they are deployed, enable a reduction of pile-driving noise at source when conventional piling techniques are employed. A reduction in the noise at source would reduce the total area of potential disturbance to harbour porpoise. However, it should also be noted that these measures may also increase the total duration of disturbance from underwater noise during foundation installation (because their use slows the rate of installation extending the overall foundation installation programme) – a factor that requires consideration in the assessment of their efficacy in reducing levels of disturbance relative to the SAC thresholds.

4.1.3.9 It should be noted that the suitability of any noise mitigation system will be dependent on a number of factors for any given offshore wind farm project; these include (but may not be limited to) pile diameter and length, ground conditions, current speeds and water depth. These factors will need to be considered in any assessment of the efficacy of the measure. The information to inform this selection will be contingent on the final project design process and the supplier, available once construction contracts have been placed following FID.

4.1.3.10 Examples of noise mitigation measures currently available on the market include:

- Bubble curtains;
- Hydro-sound dampers; and
- Sound barriers, such as screens and tubes.

4.1.3.11 Recent SNCB guidance (JNCC, Natural England & DAERA 2020) indicates that the piling EDR could be reduced from 26 km (for non-mitigated monopile piling) to 15 km should noise

abatement be deployed during monopile installation, which would reduce the project level contribution to the thresholds.

Reduction in impacts through updated project design

4.1.3.12 This measure relates to changes to the project design that would reduce the levels of underwater noise emissions when compared to the MDS considered in the preparation of the EIA and RIAA. At the point of final project design, a project that is reduced by comparison to the MDS for piling would result in lesser impacts, either through a reduction in the spatial footprint of the disturbance effect, or a reduction in the temporal extent of disturbance. Reductions in the project design by comparison to the consented MDS typically arise from:

- A reduction in the maximum number of wind turbines to be installed (and therefore fewer foundations and piling events;
- The use of piles that have a smaller diameter than the maximum sizes considered as part of the MDS (Table 3); and
- The use of (in whole or part) non-piled foundation types.

4.1.3.13 The impact of the final project design (by comparison to the MDS considered as the basis for the EIA and RIAA assessments) would need to be assessed during the preparation of the final SNS SAC SIP and would clearly vary depending on the nature and scale of any reduction. By way of example, a reduction in foundation numbers would be likely to reduce the temporal duration of piling works (particularly beneficial for the 10% seasonal threshold). A combination of foundation types, including some non-piled foundations, could have a similar effect – as the number of foundations contributing to the thresholds would be reduced. A reduction in pile diameter could have an influence on the thresholds should pin piles be used in place of monopiles (which would reduce the EDR from 26 km to 15 km, based on current SNCB guidance (JNCC, Natural England & DAERA 2020).

Re-visiting the in-combination assessment against up to date information

4.1.3.14 Similarly, revisiting the information on other plans and projects that formed the basis of the in-combination assessment in the EIA and RIAA will also likely give rise to some change in the potential for AEoI when preparing the final SNS SAC SIP. For example, assumptions on other offshore wind farms (based for example on the consented design at the time of the assessments) should be updated to reflect the final design details for those schemes where they are available at the time of preparing the final SNS SAC SIP. A comparison between the consented envelopes of offshore wind farms and the as-built scenarios quickly reveals that few offshore wind farms in UK waters have been constructed to the full extent of their consent regarding piled foundations. Similarly, the project programmes for other plans or projects also vary and may cease to be relevant to the in-combination assessment when the final SNS SAC SIP is prepared (whilst other new projects may equally become relevant) as the dates for the construction of other offshore wind farms or oil and gas seismic surveys change over time.

Currently unforeseen future and emergent technologies

4.1.3.15 Finally, the SIP process also allows other relevant technologies or methodologies that may arise in the future to be considered and assessed. This will allow any new, currently unforeseen technologies or methods that may arise prior to construction to be considered.

4.1.3.16 Due to the time lag between the granting of a consent for an offshore wind farm and the start of offshore construction (which will typically be several years), together with the rapid rate of technological development in the market, it is possible that new measures may become available. The SNS SAC SIP should not be restricted to measures only available at the time of consent, provided that the emerging measures do not have other effects/parameters that would fall outside of the design envelope (MDS) of the consent. Inevitably no efficacy information is currently available for any such measures and their use and impact on the potential for AEoI will need to be considered within the final SNS SAC SIP and be subject to consultation with the MMO and Natural England.

Assessment of efficacy of measures and implementation

4.1.3.17 Before implementation of any project mitigation or management measures determined as necessary during the drafting of the final SNS SAC SIP, the efficacy of each measure (alone or in-combination with other measures) will need to be assessed to ensure that the proposed mitigation or management measure can be relied upon to achieve any required reduction in disturbance to harbour porpoise so that a conclusion of no AEoI is maintained.

4.1.3.18 The MMO, and their advisors (Natural England) would be consulted during this process to ensure that the mitigation and management measures and the assessment of their efficacy are appropriately robust.

4.1.3.19 Following the assessment and selection of any project mitigation and management measures considered necessary to avoid an AEoI on the SNS SAC (alone or in-combination), a final SNS SAC SIP would be submitted to the MMO for consideration (in consultation with Natural England) and, subject to any amendments required, would be submitted for approval by the MMO prior to the start of the relevant licensed activities.

4.1.3.20 The final SNS SAC SIP, for approval, would include details on the timescale for the delivery of any measures, an implementation plan for any measures, and any monitoring or reporting requirements. The implementation plan will detail the method for implementation of the measures, and how any non-compliance will be reported and rectified.

5 Additional Licensing Requirements

5.1.1.1 It is acknowledged that additional licenses will be required where relevant (noisy) activities are undertaken during the construction of Hornsea Four. As highlighted within the RIAA, such additional licences are expected to include (but may not necessarily be limited to):

- **European Protected Species (EPS) Licences** – It is expected that an injury licence will be required for UXO clearance (if required), and for percussive piling for foundation installations; and
- **Additional Marine Licence** – in the event that UXO clearance is required an application for a Marine Licence covering the proposed UXO clearance activities will be submitted to the MMO prior to the commencement of UXO clearance.

5.1.1.2 The above licences will be submitted to and discussed with Natural England and the MMO as part of the application processes.

6 References

Heinänen, S. and Skov, H (2015). The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, JNCC Report No.544 JNCC, Peterborough.

JNCC (2015) SAC selection; harbour porpoise *Phocoena phocoena*. Available at: http://jncc.defra.gov.uk/protectedsites/sacselection/species.asp?FeatureIntCode=S1351

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JNCC, Natural England & the Northern Irish Department of Agriculture, Environment and Rural Affairs (DAERA) (2020). Guidance for Assessing the Significance of Noise Disturbance Against Conservation Objectives of Harbour Porpoise SACs (England, Wales and Northern Ireland). JNCC Report No. 654, JNCC, Peterborough, ISSN 0963-8091.