Project Name	Dogger Bank C Offshore Wind Farm
Date:	July 2024

Dogger Bank Offshore Wind Farm

Dogger Bank C Non-Material Change Application for Increase in Pin-Pile Hammer Energy: Environmental Report

Rev	Prepared By	Sign Off	Checked By	Sign Off	Approved By	[redacted]	Date of Issue
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Table of Contents

1 Introduction 3
2 Details of Proposed Change 6
3 Consultation 6
3.1 Pre-Application Consultation 6
3.2 Post-Application Consultation 7
4 Approach to Assessment 7
5 Screening 8
6 Assessment 10
6.1 Marine Mammals 10
6.1.1 Results of the updated assessment based on latest criteria 16
6.2 Fish and Shellfish Ecology 17
6.2.1 Outcomes of Environmental Assessment 17
7 Assessment of Materiality 26
7.1 EIA Considerations 26
7.2 HRA and European Protected Species Considerations 26
7.3 Compulsory Acquisition of Land 27
7.4 Implications on Local People 27
8 Conclusions 27
9 References 29

1 Introduction

Dogger Bank Offshore Wind Farm Project 3 Projco Limited is a Joint Venture between SSE, Equinor and Vårgrønn ('the Applicant'), which has been set up to take forward the development of the Dogger Bank C Project (herein referred to as 'DBC' or 'the Project'). Development consent was granted for the Project in August 2015 under The Dogger Bank Teesside A and B Offshore Wind Farm Order 2015 ('the DCO'). The Project was at that time going to be called the Dogger Bank Teesside A Offshore Wind Farm. The DCO also authorised the Dogger Bank Teesside B Offshore Wind Farm (now known as the Sofia Offshore Wind Farm ('Sofia')). The Project will comprise one offshore wind farm located within the eastern portion of the Dogger Bank Zone. It covers 560km^2 and is 196km from shore at its closest point (the location of the project is shown in Error! Reference source not found.**).**

The DCO has been subsequently amended by non-material change (NMC) applications for the following:

- To permit an increase in turbine rotor diameter and removal of the stated gross electrical output capacity of up to 1.2 gigawatts (Dogger Bank Teesside A and B Offshore Wind Farm (Amendment) Order 2020/851);
- To reflect that the Sofia and Teesside A projects are being taken forward by separate project companies and make the necessary changes to the DCO to facilitate the delivery of the projects (Dogger Bank Teesside A and B Offshore Wind Farm (Amendment) (No. 2) Order 2021/71 and 2021/39);
- To increase the maximum hammer energy for monopiles from 3,000 kJ up to 4,000 kJ for the wind turbine generators (Dogger Bank Teesside A and B Offshore Wind Farm (Amendment) (No. 2) Order 2021/71).

Since the DCO was granted there have been a number of advancements in technology that would make the wind farm more efficient and cost effective. To make the installation of the Offshore Substation Platform (OSP) more efficient, the Applicant is applying to allow an increase in the hammer energy for pin-piles. This document demonstrates that the increase would be an NMC.

The purpose of this report is to provide the environmental information to support the NMC application by:

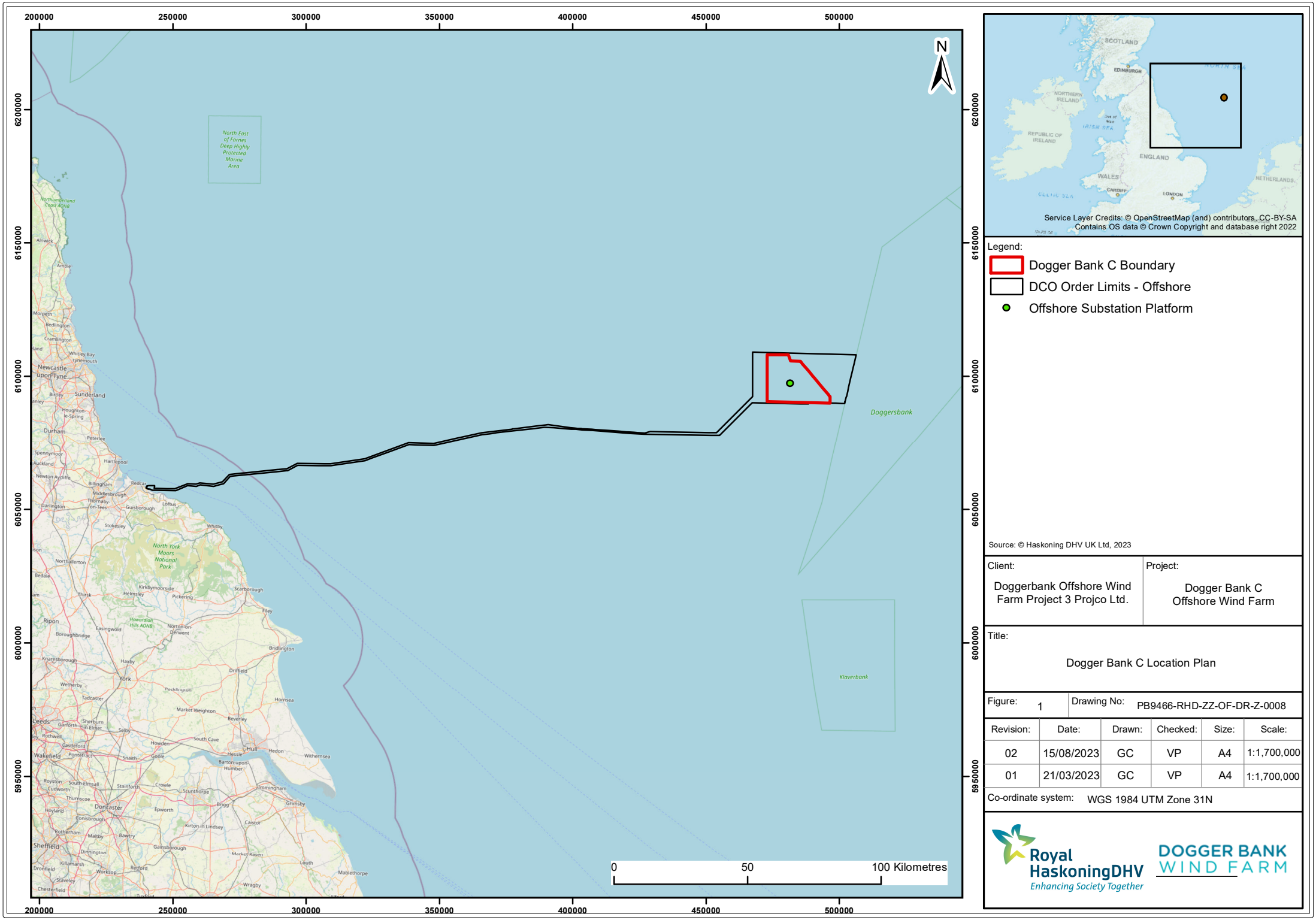
1. Providing information on the nature of the proposed change;
2. Describing the predicted effects of the change alongside the outcome of the original assessments that informed the DCO;
3. Setting out why it is considered appropriate for the Application to be determined as a NMC to the DCO; and
4. Ensuring compliance with relevant nature conservation legislation, in particular amendments made by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

An application to vary the deemed marine licences (dMLs) will be made to the Marine Management Organisation (MMO) in parallel to the NMC application. Details of these changes will be set out to the MMO separately. This report is also intended to support that application.

The report is structured as follows:

- **Section 2 Details of Proposed Change** – Overview of the proposed change;

- **Section 3 Consultation** – Summary of pre-application consultation undertaken and the consultation that will be undertaken upon submission of the NMC application;
- **Section 4 Methodology** – Approach to considering the effects of the proposed change;
- **Section 5 Screening of environmental impacts** – Screens in/out all receptors based on the effects that may result from the proposed change;
- **Section 6 Assessment** – Assessment of possible impacts on receptors screened in;
- **Section 7 Assessment of Materiality** – Test of whether the proposed change has a material impact;; and
- **Section 8 Conclusions** – Clear account of assessment outcomes.



Legend:

- Dogger Bank C Boundary
- DCO Order Limits - Offshore
- Offshore Substation Platform

Source: © Haskoning DHV UK Ltd, 2023

Client:	Project:
Doggerbank Offshore Wind Farm Project 3 Projco Ltd.	Dogger Bank C Offshore Wind Farm

Title: Dogger Bank C Location Plan

Figure:	Drawing No:
1	PB9466-RHD-ZZ-OF-DR-Z-0008

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
02	15/08/2023	GC	VP	A4	1:1,700,000
01	21/03/2023	GC	VP	A4	1:1,700,000

Co-ordinate system: WGS 1984 UTM Zone 31N

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2 Details of Proposed Change

Table 2.1 summarises the currently consented parameters of the Project which are the subject of the Application. The specific amendments that are being requested are set out in the draft amendment order submitted with this application.

While the term “non-material” is not defined for the purposes of the Planning Act 2008, there are recognised indicators relevant to the Application:

- Change to significance of impacts recorded in an Environmental Impact Assessment (EIA); and
- Change to outcomes of any Habitats Regulations Assessment (HRA) carried out.

To support this application a comparison with the consented Project has been undertaken using the Environmental Statement (“ES”) (Forewind, 2014) and the Habitats Regulations Appropriate Assessment (“HRA”) (DECC, 2015) on which the DCO was based.

The requirement for and scale of the change under consideration has been the subject of careful consideration resulting in the minimum amount of change being sought that can achieve the required gains in efficiency discussed above. The only change relates to hammer energy and not the diameter or number of pin piles.

Table 2.1 Proposed DCO Amendment

Parameter	Consented Envelope	Proposed Amendment	Where in the ES the parameter is secured
Maximum hammer energy – pin-pile	1,900 kJ	Up to 3,000 kJ	Chapter 5

3 Consultation

3.1 Pre-Application Consultation

The Applicant has informed some consultees of the nature of the proposed amendments in advance of the formal consultation period (described in **Section 3.2**) in email communications to confirm that they would like to be consulted during this application and that submission of the application by email is suitable. **Table 3.1** below provides a summary of this engagement undertaken by the Applicant.

Table 3.1 Summary of pre-application non-statutory consultation responses*

Consultee	Date of response	Summary of consultation
Joint Nature Conservation Committee	10/11/2023	No further consultation required
Natural England	07/11/2023	Included as a consultee via email
MMO	08/11/2023	Included as a consultee via email
Maritime and Coastguard Agency	08/11/2023	No further consultation required
The Crown Estate	14/11/2023	Included as a consultee via email
The Wildlife Trust	14/11/2023	Included as a consultee via email
Orsted	10/11/2023	Included as a consultee via email
Redcar and Teesbay Fishermens Association	07/11/2023	No further consultation required

* All consultees who didn't respond to the non-statutory pre-application consultation will continue to be consulted via email. Full consultee details can be found in the Regulation 7(3) letter.

3.2 Post-Application Consultation

Regulations 6 and 7 of the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 prescribe the requirements for publication and consultation relating to an NMC application. Regulation 6 requires the Applicant to publish a notice for at least two successive weeks in one or more local newspapers circulating in the vicinity of the land where the Project is situated. They must also publish the notice in any other publication that is necessary to ensure that notice is given in the vicinity of the land. The Regulation 6 Notice will be published in the following newspapers:

- Evening Gazette
- Fishing News

In addition, Regulation 7 requires the Applicant to consult the persons who have the benefit of the DCO, each person that was notified of the DCO application and any other person who may be directly affected by the changes proposed in the Application. Regulation 7(3) allows for this list of consultees to be reduced with the consent of the Secretary of State.

4 Approach to Assessment

A screening exercise (**Section 5**) has been undertaken to identify any of the topics considered in the ES (Forewind, 2014a) which supported the making of the DCO to determine if there could be any potential for new or materially different significant effects as a result of the proposed DCO amendment. Following an explanation of the screening process, this report then focuses on the receptors which could be affected by the proposed DCO amendment, alongside providing a clear rationale for those receptors where no effects are predicted.

For the receptors that were not screened out of this assessment, a review of the proposed amendment has been undertaken to confirm that the proposed change will not give rise to new or materially different significant effects. This has been undertaken by carrying out comparison with the ES.

Alongside this, consideration is also given to the AA undertaken by the Secretary of State to inform the making of the DCO in order to determine whether the proposed DCO amendment has the potential to impact designated sites. This includes all the sites that were considered at the time of the making of the DCO and changes to the Marine Protected Area Network since the DCO was made.

5 Screening

This section (**Table 5.1**) sets out the environmental topics (receptors) as they were assessed in the ES and considers whether the proposed amendment will lead to any new or materially different likely significant effects. Where it could not be immediately ruled out that a receptor would not be impacted, by the proposed amendment, this topic is 'screened in' and further assessed in **Section 6**.

Table 5.1 Screening table

Topic area from ES	Potential change in effect because of an increase in hammer energy	Screened in/ out
Chapter 8 – Designated Sites	Potential effects of the increase in hammer energy is considered under Marine Mammals (**Section 6.1**).	The only designated site for which there is a pathway for effect is the Southern North Sea (SNS) SAC designated for harbour porpoise. Impacts of noise on harbour porpoise are considered under impacts to marine mammals in **Section 6.1** and in the HRA assessment
Chapter 9 – Marine Physical Processes	No there is no impact pathway.	Out
Chapter 10 – Marine Water and Sediment Quality	No there is no impact pathway.	Out
Chapter 11 – Marine and Coastal Ornithology	Consideration of the effects on the prey species of birds due to the increase in hammer energy is provided under Fish and Shellfish (**Section 6.2**)	Out, the only pathway for effect is through the effect on prey species of birds, impacts on fish and shellfish are considered in **Section 6.2**.
Chapter 12 – Marine and Intertidal Ecology	No there is no impact pathway.	Out

Topic area from ES	Potential change in effect because of an increase in hammer energy	Screened in/ out
Chapter 13 – Fish and Shellfish	Potential change in effect due to an increase in underwater noise from the increase in hammer energy on fish species: considered further in **Section 6.2**.	In (see **Section 6.2**)
Chapter 14 – Marine Mammals	Potential change in effect due to an increase in underwater noise from the increase in hammer energy: considered further in **Section 6.1**.	In (see **Section 6.1**)
Chapter 15 – Commercial Fisheries	Potential changes in impacts on fish receptors from underwater noise caused by the increase in hammer energy: considered under Fish and Shellfish (**Section 6.2**).	Out
Chapter 16 – Shipping and Navigation	No as there is no impact pathway.	Out
Chapter 17 – Other Marine Users	No as there is no other infrastructure in the vicinity of the OSP.	Out
Chapter 18 – Marine and Coastal Archaeology	No as there is no impact pathway.	Out
Chapter 19 – Military Activities and Civil Aviation	No as there is no impact pathway.	Out
Chapter 20 – Seascape and Visual Character	No as there is no impact pathway.	Out
Chapter 21 – Landscape and Visual	No as there is no impact pathway.	Out
Chapter 22 – Socio-economics	The proposed amendment does not alter the potential Project duration or the construction and operation scenarios and therefore there will be no effect due to the increase in hammer energy.	Out

Topic area from ES	Potential change in effect because of an increase in hammer energy	Screened in/ out
Chapter 23 – Tourism and Recreation	No as there is no impact pathway.	Out
Chapter 24 – Geology, water resources and land quality	No as there is no impact pathway.	Out
Chapter 25 – Terrestrial Ecology	No as there is no impact pathway.	Out
Chapter 26 – Land Use and Agriculture	No as there is no impact pathway.	Out
Chapter 27 – Onshore Cultural	No as there is no impact pathway.	Out
Chapter 29 – Noise and Vibration (onshore)	No as there is no impact pathway.	Out
Chapter 30 – Air Quality	No as there is no impact pathway.	Out
Chapter 28 – Traffic and Access	No as there is no impact pathway.	Out
Chapter 32 – Transboundary Effects	Total area of the Project will not change therefore no additional impacts from the proposed amendment on transboundary effects.	Out

6 Assessment

6.1 Marine Mammals

The ES assessed the potential impact on marine mammals from permanent auditory injury, temporary auditory injury and likely or possible avoidance of an area in respect of the relevant receptors, the marine mammals considered were:

- Harbour porpoise *Phocoena phocoena*;
- White-beaked dolphin *Lagenorhynchus albirostris*;
- Minke whale *Balaenoptera acutorostrata*;

- Grey seal *Halichoerus grypus*; and
- Harbour seal *Phoca vitulina*.

To confirm what the effects of the proposed increase in hammer energy would be, updated underwater noise modelling has been carried out. National Physical Laboratory (NPL) undertook the original underwater noise propagation modelling to assess the effects of noise which informed the ES (Forewind, 2014c). NPL no longer conduct noise modelling for individual projects and therefore DBC have commissioned Subacoustech Environmental Ltd to provide updated noise modelling to support this NMC Application.

In addition, since the underwater noise modelling was completed for the ES, new noise thresholds and criteria have been developed by the United States (US) National Marine Fisheries Service (NMFS, 2018) for both permanent threshold shift (PTS) where unrecoverable hearing damage may occur, as well as temporary threshold shift (TTS) where a temporary reduction in hearing sensitivity may occur. These have since been published by Southall *et al*., (2019), which uses identical thresholds to those from the NMFS (2018) guidance for marine mammals, although there are some differences in the category names as outlined in **Appendix 2** Subacoustech Report.

Therefore, for the proposed increase in hammer energy, assessments have considered:

- The increase in predicted impact range and area; ;
- A comparison of the level of magnitude of the proposed hammer energy results compared to those reported in the ES; and
- The maximum number of individuals and percentage of the reference population that could potentially be impacted.

The assessment outcome and conclusion is based on the number of individuals and percentage of the reference population.

The originally consented maximum hammer energy of 1,900kJ is most comparable with the modelled hammer energy of 2,000kJ in this updated underwater noise modelling (Subacoustech, 2023). The results for the 2,000 kJ and 3,000 kJ hammer energies are used in the assessments and compared against each other in this section, as well as against the original ES assessed levels of magnitude.

As previously outlined, there have been changes to the modelling, threshold criteria, species density estimates and reference populations since the ES and so this assessment is not a 'like for like' comparison; However, for the purposes of an NMC a like for like comparison is not required because, what is being considered is a comparison of the impact significance and overall outcomes of the original assessments in the ES (Forewind, 2013), on which the DCO was based, with the impact significance and overall outcomes of the updated assessments for the increase in hammer energy. A summary of the results is provided in **Table 6.1**.

6.1.1 Outcomes of the Assessment

The results presented in this section provide a summary of the information provided in the Marine Mammal Technical Report (**Appendix 1**) where a full description of the results is provided.

Table 6.1 Summary of the comparison of the predicted impact ranges (and impact area), number of marine mammals (and % of reference population) and magnitude of effect for maximum hammer energy of 2,000kJ (1,900kJ was the original value consented for in the ES) and proposed increased maximum hammer energy of 3,000kJ

Species		Permanent Threshold Shift		Temporary Threshold Shift		Disturbance	
		2,000kJ	**3,000kJ**	**2,000kJ**	**3,000kJ**	**2,000kJ / ES findings**	**3,000kJ**
Harbour porpoise [1]	Predicted impact ranges	390m (0.47 km^2)	450 m (0.64 km^2)	970 m (2.9 km^2)	1,100 m (3.9 km^2)	30,000 m (2,300 km^2)	33,000 m (2,600 km^2)
	Number of marine mammals	0.4 harbour porpoise	0.5 harbour porpoise	2.3 harbour porpoise	3.1 harbour porpoise	1,848 harbour porpoise	2,089 harbour porpoise
	Percentage of MU	(0.0001%)	(0.0002%)	(0.0007%)	(0.0009%)	(0.5%)	(0.6%)
	Magnitude of Effect	Negligible	Negligible	Negligible	Negligible	Medium	Medium
		No significant difference		**No significant difference**		**No significant difference**	
White-beaked	Predicted impact ranges	<50 m (<0.01 km^2) 0.00007	<50 m (<0.01 km^2) 0.00007	<50 m (<0.01 km^2) 0.00007	<50 m (<0.01 km^2) 0.00007	5 – 7 km	6 – 8.5 km

[1] Based on Southall *et al*. (2019) unweighted criteria for instantaneous PTS (SPL_{peak} 202 dB re 1 µPa); TTS / fleeing response (SPL_{peak} 196 dB re 1 µPa) Based on Lucke *et al*., (2009) possible avoidance unweighted (SEL_{ss} 145 dB re 1 µPa^{2}s). ES harbour porpoise density = 0.7161/km^2; ES harbour porpoise reference population = 227,298.

Species		Permanent Threshold Shift		Temporary Threshold Shift		Disturbance	
		2,000kJ	**3,000kJ**	**2,000kJ**	**3,000kJ**	**2,000kJ / ES findings**	**3,000kJ**
dolphin[2]	Number of marine mammals	white-beaked dolphin	white-beaked dolphin	white-beaked dolphin	white-beaked dolphin	3 white-beaked dolphin	1.5 white-beaked dolphin
	Percentage of MU	(<0.00001%)	(<0.00001%)	(<0.00001%)	(<0.00001%)	(0.2%)	(0.003%)
	Magnitude of Effect	Negligible	Negligible	Negligible	Negligible	Negligible	Minor adverse
		No significant difference		**No significant difference**		**No significant difference**	
Minke whale[3]	Predicted impact ranges	<50 m (<0.01 km^2)	<50 m (<0.01 km^2)	70 m (0.02 km^2)	80 m (0.02km^2)	23 – 35.5 km	26.5 – 41 km
	Number of marine mammals	0.0002 minke whale	0.0002 minke whale	0.0003 minke whale	0.0003 minke whale	34 minke whale	60 minke whale
	Percentage of	(<0.00001%)	(<0.00001%)	(<0.0001%)	(<0.0001%)	(0.02%)	(0.3%)

[2] based on Southall *et al*., (2019) unweighted criteria for instantaneous PTS (SPL_{peak} 230 dB re 1 µPa); TTS / fleeing response (SPL_{peak} 224 dB re 1 µPa). Based on Lucke *et al*., (2009) possible avoidance unweighted (SEL_{ss} 145 dB re 1 µPa^{2}s). ES white-beaked dolphin density = 0.01487/km^2; ES white-beaked dolphin reference population = 15,895.

[3] based on Southall *et al*., (2019) unweighted criteria for instantaneous PTS (SPL_{peak} 219 dB re 1 µPa); TTS / fleeing response (SPL_{peak} 213 dB re 1 µPa). Based on Lucke *et al*., (2009) possible avoidance unweighted (SEL_{ss} 145 dB re 1 µPa^{2}s). ES minke whale density = 0.00866/km^2; ES minke whale reference population = 23,169.

Species		Permanent Threshold Shift		Temporary Threshold Shift		Disturbance	
		2,000kJ	**3,000kJ**	**2,000kJ**	**3,000kJ**	**2,000kJ / ES findings**	**3,000kJ**
	MU Magnitude of Effect	 Negligible	 Negligible	 Negligible	 Negligible	 Negligible	 Minor adverse
		No significant difference		**No significant difference**		**No significant difference**	
Grey seal[4]	Predicted impact ranges Number of marine mammals Percentage of MU Magnitude of Effect	<50 m (<0.01 km^2) 0.000001 grey seal (<0.00001%) Negligible	<50 m (<0.01 km^2) 0.000001 grey seal (<0.00001%) Negligible	80 m (0.02 km^2) 0.000002 grey seal (<0.00001%) Negligible	100 m (0.03 km^2) 0.000003 grey seal (<0.00001%) Negligible	 Negligible	25 km (EDR) 0.2 grey seal (0.0003% total population; 0.0006% SE MU) Negligible
		No significant difference		**No significant difference**		**No significant difference**	
Harbour	Predicted impact ranges	<50 m (<0.01 km^2)	<50 m (<0.01 km^2)	80 m (0.02 km^2)	100 m (0.03 km^2)		25 km (EDR)

[4] based on Southall *et al*., (2019) unweighted criteria for instantaneous PTS (SPL_{peak} 218 dB re 1 µPa); TTS / fleeing response (SPL_{peak} 212 dB re 1 µPa). Based on Lucke *et al*., (2009) possible avoidance unweighted (SEL_{ss} 145 dB re 1 µPa^{2}s). ES grey seal density = 0.02131/km^2; ES grey seal reference population = 28,989.

Species		Permanent Threshold Shift		Temporary Threshold Shift		Disturbance	
		2,000kJ	**3,000kJ**	**2,000kJ**	**3,000kJ**	**2,000kJ / ES findings**	**3,000kJ**
seal[5]	Number of marine mammals	0.0000002 harbour seal	0.0000002 harbour seal	0.0000004 harbour seal	0.0000006 harbour seal		0.04 harbour seal
	Percentage of MU	(<0.00001%)	(<0.00001%)	(<0.00001%)	(<0.00001%)		(0.0008% total population and SE MU)
	Magnitude of Effect	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
		No significant difference		**No significant difference**		**No significant difference**	

[5] based on Southall *et al*., (2019) unweighted criteria for instantaneous PTS (SPL_{peak} 218 dB re 1 µPa); TTS / fleeing response (SPL_{peak} 212 dB re 1 µPa). Based on Lucke *et al*., (2009) possible avoidance unweighted (SEL_{ss} 145 dB re 1 μPa^2s); ES harbour seal reference population = 3,567.

6.1.1 *Results of the updated assessment based on latest criteria*

The underwater noise modelling for this assessment was undertaken based on the latest inputs and scenarios for increased hammer energy. In relation to each of the potential impacts for each species, the updated assessment used the most recent thresholds and criteria for PTS and TTS which are presented in Southall *et al*., 2019. As with the comparison set out above, each assessment considers in turn:

- The potential increase in impact range; and
- The number of individuals and percentage of the reference population at risk.

Since the ES was completed, updated information on the density estimates and reference populations (Management Units (MU)) for marine mammals in the Dogger Bank area has become available. Therefore, the most recent density estimates have been used for the updated assessment based on the SCANS-IV survey for cetaceans (Gilles *et al*., 2023) and the latest Sea Mammal Research Unit (SMRU) seal at-sea usage maps (Carter *et al*., 2022). Further details are provided in the Marine Mammal Technical Report (**Appendix 1**).

Based on the latest criteria (Southall *et al*., 2019) the new assessment demonstrates that there is no difference in the impact significance between the impacts as assessed for a maximum hammer energy from 1,900 kJ to 3,000 kJ for any of the assessed receptors. This is true for each of the potential impacts and for all species assessed. A summary of the results is provided in **Table 6.1**. The only slight difference seen in the results were for minke whale and white-beaked dolphin where disturbance was originally assessed as negligible in the ES but were assessed as minor adverse in the updated assessment. However, it must be noted that the impact ranges and areas provided within the ES were for monopiling as a worst case scenario, so these results are highly precautionary and are expected to be lower for the pin-piling OSP hammer energies. Therefore, the disturbance differences have still been considered as not significant.

It is therefore concluded that as there is no significant material difference between the impacts assessed in the ES and those resulting from the proposed amendment to the Project, the conclusions of the ES and its associated documents are not affected by the proposed change and that the recommendations of the Examining Authority and, as is further explained below, the conclusions of the HRA AA which underpins the DCO are similarly not affected. The proposed change does not have the potential to give rise to likely significant effects on any European sites (**Section 7.2**). Therefore, the proposed amendment to the DCO will not give rise to any new or materially different likely significant effects (LSE) in relation to marine mammals and no further assessment is required for marine mammals in support of the proposed amendment to the DCO. In light of this, no new or additional mitigation will be required in relation to marine mammals other than that which is already secured through the DCO.

The May 2016 BEIS “Guidance on when new marine Natura 2000 sites should be taken into account in offshore renewable energy consents and licences” (DECC, 2016) states that as a matter of government policy where an amendment is sought to a DCO, pSPAs and pSACs should be considered as if they are designated/classified and "any possible likely significant effects (and adverse effects on integrity) of the proposed changes in the variation or amendment would need to be considered.” Based on both the comparison and the updated assessment using the latest criteria, it is concluded that the proposed change would not give rise to likely significant effects on the Southern North Sea SAC, further to the consented impacts (either alone or in-combination).

The maximum predicted PTS impact ranges for the updated noise modelling for a maximum hammer energy of 3,000kJ remain within the maximum predicted PTS ranges in the BEIS (2020) RoC HRA. Differences in the maximum predicted impact ranges of possible avoidance of harbour porpoise reflect differences in the noise modelling conducted for the RoC HRA and DBC (as described in **Appendix 1**).

6.2 Fish and Shellfish Ecology

For the proposed amendment the increased hammer energy has been screened in for further consideration on fish and shellfish receptors (**Section 5**). This is considered further below.

6.2.1 *Outcomes of Environmental Assessment*

Within the ES the worst case scenario in terms of construction noise was based on a maximum number of platforms (up to four collector platforms and one converter platform) being installed with a maximum of 24 pin-piles per foundation. This was based on a maximum hammer energy of 1,900 kJ (Chapter 14, Table 5.2 of the ES).

The outcomes of the ES for construction noise, based on the worst case as described above, concluded that there would be negligible to minor adverse effects (which are not significant in EIA terms) on fish and shellfish.

With regard to operational noise the worst case scenario was assumed to be a maximum of 26 vessels on site at any one time for the noise associated with vessel movement. The proposed amendment will not alter this worst case. Therefore, operational noise is not considered further in this assessment.

6.2.1.1 ES Underwater noise modelling

Underwater noise propagation modelling for the original assessment was carried out by the National Physical Laboratory (NPL) (Forewind 2014c) to assess the effects of noise from construction. **Table 6.2** and **Table 6.3** provide details of the criteria used for the modelling work. Modelling was undertaken at a number of locations within the DCO Order Limits offshore (**Figure 1**) with impact ranges provided in terms of both injury and behavioural effects for pelagic and demersal fish using different hammer energies (300 kJ, 1,900 kJ).

Table 6.2 Summary of injury criteria used for fish

Species	**Dual Injury Criteria (PTS)**	
	Peak SPL(dB re 1 µPa)[6]**	**SEL*** (dB re 1 µPa² s)[7]**
Fish* (Popper et al. 2006 and Carlson et al. 2007)	206	187

* Applicable to all fish species with a mass of over 2 g.

[6] SPL: Sound Pressure Level, a measure of the received acoustic energy at the receptor. Unit: dB re 1 µPa2·s
[7] SEL: Sound Exposure Level: a measure of the received acoustic energy at the receptor. Unit: dB re 1 µPa2·s

Table 6.3 Summary of behavioural criteria for generic fish species

Potential response	**Behavioural response criteria for generic fish species**
	Peak SPL (dB re 1 µPa)
Possible moderate to strong avoidance (McCauley et al. 2000)	168-173*
Startle response or C-turn reaction (Pearson et al. 1992)	200

* These levels have been established from seismic airgun and should therefore only be applied for impulsive sound sources for fish that are sensitive to sound below around 500Hz.

As stated in **Section 6.1**, NPL no longer conduct noise modelling for individual projects and therefore DBC have commissioned Subacoustech Environmental Ltd. to provide updated noise modelling to support this NMC. In addition, new criteria have been developed by Popper *et al*. (2014). As such, the updated noise modelling has been undertaken to allow a direct comparison with the ES based on the new criteria.

It should be noted that as no piling along the export cable corridor will take place, this area was not included in the underwater noise modelling. Piling will only be undertaken within the offshore wind farm array site.

Table 6.4 provides a summary of the predicted impact ranges which were reported in the ES, the impact ranges are based on criteria described in **Table 6.2** and **Table 6.3**.

Table 6.4 Predicted fish impact ranges as per the ES

Impact criterion in the ES	1,900 kJ hammer energy Impact Range
Instantaneous injury/PTS (peak pressure level 206 dB re 1 µPa)	< 200 m
Startle response (peak pressure level 200 dB re 1 µPa)	< 500 m
Possible avoidance of area* (peak pressure level 168 -173 dB re 1 µPa)	8.0 – 17.5 km

* Some particularly insensitive species of fish might only exhibit avoidance behaviour at lesser ranges

6.2.1.2 Outcomes of updated underwater noise modelling

Table 6.5, Table 6.6 and

Table 6.7 provide a summary of the updated modelling based on a 3,000 kJ pin-piling hammer energy.

Table 6.5 Predicted unweighted SPL_{peak} impact ranges for fish using criteria from Popper *et al*. (2014) for a maximum hammer blow energy at DBC

Fish - impact criterion		3,000 kJ hammer energy Impact Range
Injury (fish: no swim bladder) unweighted SPL_{peak} (213 dB re 1 µPa)	Maximum	80 m
	Minimum	80 m
	Mean	80 m
Injury (fish: with swim bladder) unweighted SPL_{peak} (207 dB re 1 µPa)	Maximum	210 m
	Minimum	210 m
	Mean	210 m
Injury (eggs and larvae) SPL_{peak} (207 dB re 1 µPa)	Maximum	210 m
	Minimum	210 m
	Mean	210 m

The impact ranges for fleeing fish in **Table 6.6** have assumed a conservative fleeing speed of 1.5 m/s (Hirata, 1999).

Table 6.6 Predicted unweighted SEL_{cum} impact ranges for fish using criteria from Popper *et al*. (2014) assuming a fleeing speed of 1.5 m/s at DBC for 4 pin-piles installed sequentially in 24 hours. Fleeing speed taken as a conservative number from Hirata (1999).

Fish – impact criterion		3,000 kJ hammer energy Impact Range
Mortality (fish: no swim bladder) SEL_{cum} (> 219 dB re 1 μPa^2s)	Maximum	<100 m
	Minimum	<100 m
	Mean	<100 m
Recoverable injury (fish: no swim bladder) SEL_{cum} (> 216 dB re 1 μPa^2s)	Maximum	<100 m
	Minimum	<100 m
	Mean	<100 m

Fish – impact criterion		3,000 kJ hammer energy Impact Range
Mortality (fish: swim bladder not involved in hearing) SEL_{cum} (210 dB re 1 μPa^2s)	Maximum	<100 m
	Minimum	<100 m
	Mean	<100 m
Mortality (fish: swim bladder involved in hearing) SEL_{cum} (207 dB re 1 μPa^2s)	Maximum	<100 m
	Minimum	<100 m
	Mean	<100 m
Recoverable injury (fish: with swim bladder) SEL_{cum} (203 dB re 1 μPa^2s)	Maximum	<100 m
	Minimum	<100 m
	Mean	<100 m
Mortality (eggs and larvae) SEL_{cum} (210 dB re 1 μPa^2s)	Maximum	<100 m
	Minimum	<100 m
	Mean	<100 m
TTS (all fish) SEL_{cum} (186 re 1 μPa^2s)	Maximum	10 km
	Minimum	7.6 km
	Mean	8.7 km

With regard to larval and eggs sensitivity criteria, the Popper *et al*. (2014) criteria used are based on work by Bolle *et al*. (2012) who reported no damage to larval fish subjected to an SEL_{cum} as high as 210 dB re 1 μPa^2s. Therefore, the levels adopted in Popper *et al*. (2014) are likely to be conservative. Given that the levels proposed in Popper *et al*. (2014) are similar to those described for fish species with a swim bladder not involved in hearing (210 dB SEL_{cum} or >207 dB SPL_{peak}) the modelled impact ranges for this category can be used to provide an indication of the potential impacts on fish, their eggs and larvae.

Additionally, noise modelling was also carried out for stationary fish. However, basing the assessment on a stationary (zero flee speed) receptor is likely to greatly overestimate the potential risk to fish species, especially when considering the precautionary nature of the parameters already built into the cumulative exposure model. The impact ranges for stationary fish used the criteria in Popper *et al* (2014) unweighted SEL_{cum}.

Table 6.7 Predicted unweighted SEL_{cum} impact ranges for stationary fish using criteria from Popper *et al*. (2014) for 4 piles installed sequentially in 24 hours at DBC

Fish – impact criterion		3,000 kJ hammer energy Impact Range
Mortality (fish: no swim bladder) SEL_{cum} (> 219 dB re 1 µPa^{2}s)	Maximum	900 m
	Minimum	850 m
	Mean	870 m
Recoverable injury (fish: no swim bladder) SEL_{cum} (> 216 dB re 1 µPa^{2}s)	Maximum	1,400 m
	Minimum	1,300 m
	Mean	1,300 m
Mortality (fish: swim bladder not involved in hearing) SEL_{cum} (210 dB re 1 µPa^{2}s)	Maximum	3.1 km
	Minimum	3.0 km
	Mean	3.1 km
Mortality (fish: swim bladder involved in hearing) SEL_{cum} (207 dB re 1 µPa^{2}s)	Maximum	4.6 km
	Minimum	4.3 km
	Mean	4.5 km
Recoverable injury (fish: with swim bladder) SEL_{cum} (203 dB re 1 µPa^{2}s)	Maximum	7.4 km
	Minimum	6.9 km
	Mean	7.1 km
Mortality (eggs and larvae) SEL_{cum} (210 dB re 1 µPa^{2}s)	Maximum	3.1 km
	Minimum	3.0 km
	Mean	3.1 km
TTS (all fish) SEL_{cum} (186 re 1 µPa^{2}s)	Maximum	32.0 km
	Minimum	25.0 km
	Mean	28.0 km

6.2.1.3 Comparison of results

Due to differences in criteria used for the modelling a 'like for like' comparison cannot be made.

However, when comparing the SPL_{peak} impact ranges between what was previously consented and the proposed hammer energy, the updated impact ranges have decreased. As seen in **Table 6.4** and **Table 6.5** the SPL_{peak} ranges for the consented 1,900 kJ hammer energy were between <200 – 500 m, for the proposed 3,000 kJ hammer energy the SPL_{peak} ranges are between 80m – 210 m. The decrease in impact range despite the increase in hammer energy is likely due to the new threshold criteria being applied to the modelling. However, this demonstrates that for the increase in hammer energy the difference in the spatial extent of the impact ranges modelled is small. At the onset of soft start piling with initial hammer energies of 10 % of the maximum, the ranges for injury would be much smaller, allowing some sound-sensitive fish species to flee the area before peak noise levels are reached. Based on this, it is concluded that there will be no new or materially different likely significant effects compared to the original assessment due to the proposed amendment.

In the previously consented 1,900 kJ hammer energy modelling, a range of SPL_{peak} thresholds (168 – 173 dB re 1 µPa) were used to assess possible avoidance ranges, based on McCauley et al. (2000). As SPL_{peak} is an instantaneous metric, no consideration of fleeing or stationary receptors was needed in the modelling. However, the updated modelling for a 3,000 kJ hammer energy considers both SPL_{peak} and SEL_{cum} thresholds (186 – 219 re 1 μPa^2s) for injury and TTS for fleeing and stationary fish, based on Popper et al. (2014). The impact ranges reported in the ES were between 8 km – 17.5 km, whereas the impact ranges for the proposed 3,000 kJ hammer energy were between 870 m – 28 km (based on the worst case of stationary fish).

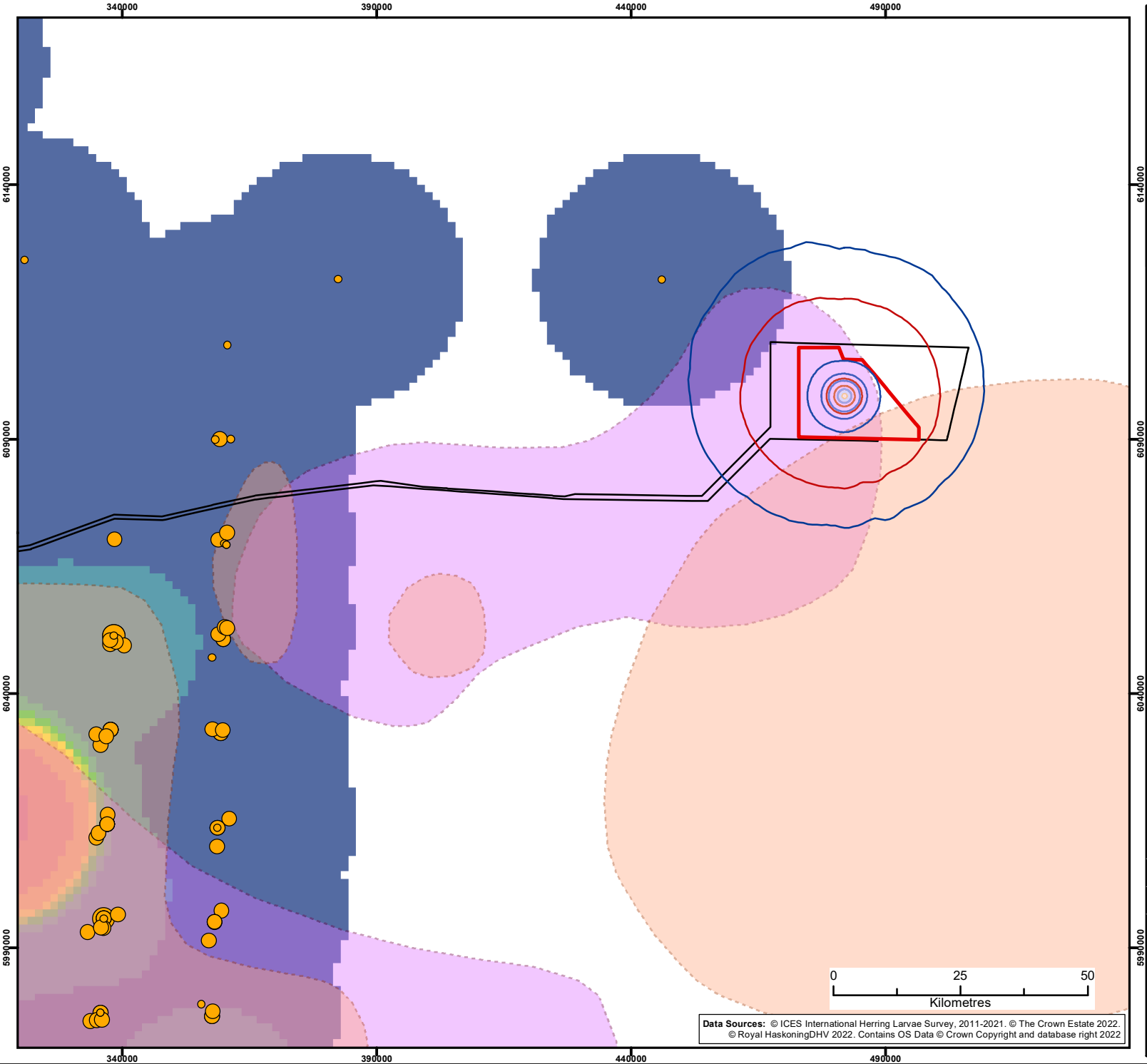
The Project is located within sandeel *Ammodytidae sp.* spawning grounds and the OSP location is approximately 6.2 km from herring *Clupea harengus* spawning grounds (Coull *et al*., 1998). The OSP location is also approximately 180 km from high-density herring spawning grounds, based on 10 years of International Herring Larvae Survey data (ICES, 2018). The modelled maximum ranges of impact arising from the 3,000 kJ hammer energy, both for fleeing and stationary fish show no close proximity to the high-density herring spawning ground, with the maximum impact range being 32 km. As such, the proposed change does not present any risk to herring eggs or larvae in this area.

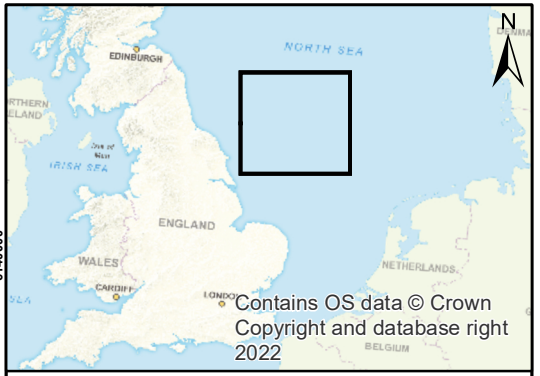
The updated modelling for 3,000 kJ hammer energy demonstrates that only when looking at the stationary TTS SEL_{cum} (186 re 1 μPa^2s) potential impact range is there an increase due to the increase in hammer energy. The modelling for TTS indicates the maximum impact range is between 25 – 32 km (see

Table 6.7). The highest impact range of the 1,900 kJ hammer energy results were between 8 – 17.5 km (peak pressure level 168 -173 dB re 1 µPa) (see **Table 6.4**). It should be noted a 'like for like' comparison between these results can't be made as SEL_{cum} values were not reported in the ES. When compared to instantaneous peak sound thresholds such as the SPL_{peak} used in the ES, cumulative sound exposure modelling will inevitably result in larger impact ranges. For this reason, the maximum SEL_{cum} impact ranges presented in this report cannot simply be compared to the maximum SEL_{peak} ranges presented in the ES.

Due to low vulnerability and high recoverability, as reported in the ES, all fish and shellfish receptors have a low sensitivity except larvae and herring which have a medium sensitivity. SPL_{peak} impact ranges for lethal injury of both larvae and sound-sensitive adults such as herring show little difference between the 1,900 kJ and 3,000 kJ modelling results. Additionally, the ES describes a **negligible** impact given the relatively small area around each pile driving operation where larval mortality may potentially occur and the short term intermittent nature of the activity. As such, it is concluded that there will be no impact on eggs and larvae as a result of the proposed increase in hammer energy.

There is the potential for the updated noise impact ranges to overlap with sandeel and herring spawning grounds **(Figure 2**), however this was also the case for the consented 1,900 kJ hammer energy. The piling works proposed for the OSP will be short term as it will only take place over 24 hours. It has also been proposed for the piling to be carried out in March or April 2025, these months do not overlap with sandeel or herring spawning seasons (Coull et al.,1998; Ellis et al., 2010). The potential impact ranges have increased for the 3,000 kJ hammer energy, however due to the short-term nature of the OSP works and no overlap with spawning seasons the level of magnitude is assessed as low.





Legend:

- Dogger Bank C Boundary
- DCO Order Limits - Offshore
- Herring Spawning Ground (Coull, 1998)
- Sandeel Spawning Ground (Coull, 1998)

DBC-OSP PinWC x4 Unwtd SELcum (St)

- 186
- 203
- 207
- 210
- 216
- 219

DBC-OSP PinWC x1 Unwtd SELcum (St)

- 186
- 203
- 207
- 210
- 216
- 219

Small Herring Larvae Abundance (n/m²)

- 1.00
- 1.01 - 500.00
- 500.01 - 10,000.00
- 10,000.01 - 20,000.00
- 20,000.01 - 56,258.00

Average Small Herring Larvae Abundance <11mm - ICES 2011 - 2021

Density per km²

- 0.9 - 1
- 1.1 - 5
- 5.1 - 10
- 10.1 - 15
- 15.1 - 20
- 20.1 - 25
- 25.1 - 50
- 50.1 - 100
- 100.1 - 200

Data Sources: © ICES International Herring Larvae Survey, 2011-2021. © The Crown Estate 2022. © Royal HaskoningDHV 2022. Contains OS Data © Crown Copyright and database right 2022

Client: Doggerbank Offshore Wind Farm Project 3 Projco Ltd.

Project: Dogger Bank C Offshore Wind Farm

Title: Modelled contours of noise impact thresholds for pin piles for fish with 1,900 and 3,000 kJ hammer energies, at Dogger Bank C

Figure: 1

Drawing No: PB6994-RHD-ZZ-OF-DR-Z-0011

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	06/12/2023	GC	HC	A4	1:1,060,000

Co-ordinate system: WGS84 UTM31N

Royal HaskoningDHV
Enhancing Society Together

DOGGER BANK WIND FARM

Within the ES and during the DCO examination, no significant piling noise potential impacts on the on high-density inshore spawning grounds were found. The changes proposed by this NMC Application does not alter this outcome. The above demonstrates that there is no pathway for effect on the high-density spawning ground located 180 km from the Project, even with the cumulative exposure impact ranges, resulting from piling activities at the wind farm OSP. Therefore, the level of magnitude for the increased OSP pin-pile hammer energy is low. The significance of effect for the increase in pin-pile hammer energy to 3,000 kJ has been assessed as **minor adverse**.

Based on the information above, it is concluded that there will be no new or materially different effects on fish and shellfish receptors compared to the consented scheme. The conclusions of the existing ES that fish and shellfish impacts are not significant for the Project alone and cumulatively with other projects are not affected. The proposed change does not have the potential to give rise to likely significant effects on any European sites. The worst case position remains the same and no further assessment is required for fish and shellfish in support of the proposed change to the DCO.

7 Assessment of Materiality

There is no statutory definition of what constitutes a material or non-material amendment for the purposes of Schedule 6 of the Planning Act 2008 and Part 1 of the 2011 Regulations.

However, criteria for determining whether an amendment should be material or non-material is outlined in the Department for Communities and Local Government (DCLG) guidance "Planning Act 2008: Guidance on Changes to Development Consent Orders" (December 2015) (the Guidance). Paragraphs 9 -16 of the Guidance sets out the four characteristics which act to provide an indication on whether a proposed change is material or non-material. As noted in the Guidance there may be certain characteristics that indicate that a change to a consent is more likely to be treated as a material change:

1. A change should be treated as material if it would require an updated Environmental Statement (from the version available at the time the original DCO was made) to take account of new, or materially different, likely significant effects on the environment.
2. A change is likely to be material if it would invoke a need for a Habitats Regulations Assessment. Similarly, the need for a new or additional licence in respect of European Protected Species (EPS) is also likely to be indicative of a material change.
3. A change should be treated as material that would authorise the compulsory acquisition of any land, or an interest in or rights over land that was not authorised through the existing DCO.
4. The potential impact of the proposed changes on local people will also be a consideration in determining whether a change is material.

The proposed amendment to the Project in relation to the hammer energy has been considered in light of these four characteristics and is presented in the following sections.

7.1 EIA Considerations

The information provided in **Sections 5** and **6** demonstrates that the proposed amendment will not give rise to new or materially different likely significant effects on the environment. As such, the proposed amendment can be viewed as a non-material change to the DCO.

7.2 HRA and European Protected Species Considerations

The information presented in Section 6 demonstrates that the conclusions of the HRA which underpin the DCO are not affected by the proposed amendment and the proposed change does not have the potential to give rise to likely significant effects on any European sites. As such there will be no requirement to undertake a HRA for this NMC application.

In relation to the Southern North Sea SAC, it is noted that the proposed amendment to increase hammer energy does not have the potential to give rise to any likely significant effects in itself so does not invoke the need for HRA (see Section 6.1.1). The Department for Business, Energy and Industrial Strategy (BEIS) (now Department for Energy Security and Net Zero (DESNZ)) (as the competent authority) undertook a review of existing licences and consents that were likely to have a significant effect, either alone or in combination with other plans and projects, on harbour porpoise in accordance with The Habitats Regulations (see **Section 6.1**). As part of the review it was concluded that for projects not yet constructed, a new condition within the projects' Deemed Marine Licences would be added. The DML condition requires projects to produce and implement a Site Integrity Plan (SIP) before the

commencement of any offshore activities with the potential to adversely affect the Southern North Sea SAC. The DBC SIP (Document reference: LF700013-CST-DOG-MEM-0003) was approved by the MMO on 27th November 2023. The Proposed Amendment does not affect the conclusions of the SIP and will not necessitate an update to the SIP .

As previous outlined, a comparison with the BEIS (now DESNZ) (2020) RoC HRA indicates that the maximum predicted PTS impact ranges for the updated noise modelling for a maximum hammer energy of 3,000 kJ are within the maximum predicted PTS ranges in the BEIS (2020) RoC HRA. Differences in the maximum predicted impact ranges of possible avoidance of harbour porpoise reflect differences in the noise modelling conducted for the RoC HRA and DBC (see **Appendix 1**).

In addition, the current advice from the Statutory Nature Conservation Bodies (SNCBs) is that pin-pile installation equates to an Effective Deterrence Range (EDR) of 15 km (disturbance area of 706.86 km^2). Therefore, increasing the hammer energy will result in no changes to the outcomes of any HRA assessment in relation to disturbance on the SNS SAC as the EDR would not even overlap with the SAC, based on current published SNCB guidance.

In relation to in-combination assessments, whilst new projects have entered the consenting process, these projects would have had to consider the DBC project as part of their own in-combination assessments.

As the conclusions of the ES and HRA remain unchanged, it is not considered that there is a need for any new or additional licences in respect of European Protected Species.

7.3 Compulsory Acquisition of Land

The possible requirement for compulsory acquisition does not arise.

7.4 Implications on Local People

The proposed amendment will have no effect on the local population, given the distance of the Project's OSP from shore.

8 Conclusions

This Environmental Report reviews the potential effects of changes to the Project which are subject of the NMC Application on all the topics considered in the ES and the HRA. A screening exercise has been undertaken which identified marine mammals and fish and shellfish ecology as the only receptors requiring more detailed consideration with respect to the proposed amendment to increase the maximum hammer energy.

This report and associated appendices have reviewed and modelled the impacts on marine mammals and fish and shellfish which could arise from the proposed amendment to DBC to compare with the modelling that informed the ES and HRA which underpin the DCO. In addition, due to the change in noise thresholds and criteria that have occurred since the project was consented, an assessment of the potential impacts based on these has also been undertaken.

The modelling carried out to compare with the original consent modelling showed that there was no significant difference between the potential impact for a maximum hammer energy of 1,900 kJ compared to 3,000 kJ. Therefore, the proposed increase in maximum hammer energy would not alter the outcomes of the original assessment made within the ES, including the cumulative impact assessment and, where relevant, the HRA.

In addition, the updated underwater noise modelling (applying the latest criteria) also showed that there is no predicted difference in the potential impacts on marine mammals, or fish and shellfish, from increasing the maximum pin-pile hammer energy to 3,000kJ compared to the consented pin-pile hammer energy of 1,900kJ.

It is therefore concluded that as there is no material difference between the impacts assessed in the ES and those resulting from the proposed amendment to the Project, the conclusions of the ES and its associated documents are not affected by the proposed change and that the recommendations of the Examining Authority and the conclusions of the HRA which underpin the DCO, are similarly not affected. The proposed change does not have the potential to give rise to likely significant effects on any European sites (including the Southern North Sea SAC). Therefore, the proposed amendment to the DCO will not give rise to any new or materially different likely significant effects in relation to marine mammals or fish and shellfish, and no further assessment is required for marine mammals in support of the proposed amendment to the DCO.

Therefore, it would be appropriate for this application to amend the maximum pin pile hammer energy to be consented as an NMC to the DCO.

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