NMC Application: Environmental Report

RE-PM763-RHDHV-00002

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Non Material Change Application – Environmental Report

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Glossary of Acronyms

µPa	Micro pascal
BEIS	Department for Business, Energy and Industrial Strategy
CGNS	Celtic and Greater North Seas
dB	Decibels
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
dML	deemed Marine Licence
EDR	Effective Deterrent Radius
ES	Environmental Statement
FCS	Favourable Conservation Status
GW	Gigawatts
HF	High-frequency
HRA	Habitats Regulations Assessment
INSPIRE	Impulsive Noise Propagation and Impact Estimator
JNCC	Joint Nature Conservation Committee
kJ	Kilojoules
km	Kilometre
km^2	Kilometre squared
LF	Low-frequency
m	meter
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MU	Management Unit
NMC	Non-Material Change
NMFS	National Marine Fisheries Services
NPL	National Physical Laboratory
OWF	Offshore Wind Farm
PTS	Permanent Threshold Shift
RoC	Review of Consents
SAC	Special Area of Conservation
SCANS	Small Cetaceans in the European Atlantic and North Sea
SCOS	Special Committee on Seals
SEL	Sound Exposure Level
SEL_{ss}	Sound Exposure Level for single strike
SEL_{cum}	Cumulative Sound Exposure Level
SIP	Site Integrity Plan
SNCBs	Statutory Nature Conservation Bodies
SPL	Sound Pressure Level
TTS	Temporary Threshold Shift

1 Introduction

Dogger Bank Wind Farms is a Joint Venture between SSE and Equinor, which has been set up to take forward the development of the Dogger Bank Teesside A Project (herein referred to as 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 Development Consent Order (DCO) also authorised the Dogger Bank Teesside B Offshore Wind Farm (now known as the Sofia Offshore Wind Farm (Sofia)). The DCO was subsequently amended by The Dogger Bank Teesside A and B Offshore Wind Farm (Amendment) Order 2019 (the Amendment Order) in March 2019[1]. The Amendment Order did not make any amendments to Teesside A: it only made amendments to 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 (**Figure 1.**).

The DCO states that construction must have commenced on or before the 25th August 2022. The Project Team is now progressing with the Project to meet this commencement date, with the expectation that the Teesside A onshore works will start in early 2022. It is likely that the earliest offshore construction would begin is 2023.

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. These advances are based on the size of wind turbine generators that are available, or that are likely to become available during the course of the development programme. As some of these would require a limited number of changes to the consented parameters (Section 2), the Project Team is looking to make a non-material change (NMC) to the DCO as amended to enable the Project to be constructed in the most efficient and cost-effective manner. A NMC application has already been submitted for an increase in turbine rotor diameter and removal of the stated gross electrical output capacity of up to 1.2 gigawatts (currently awaiting determination) as well as a NMC application 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 and clarify responsibilities (also awaiting determination). A further NMC application is now being sought for the Project to increase the consented maximum hammer energy for monopiles. This further NMC application only relates to Teesside A.

The purpose of this report is to:

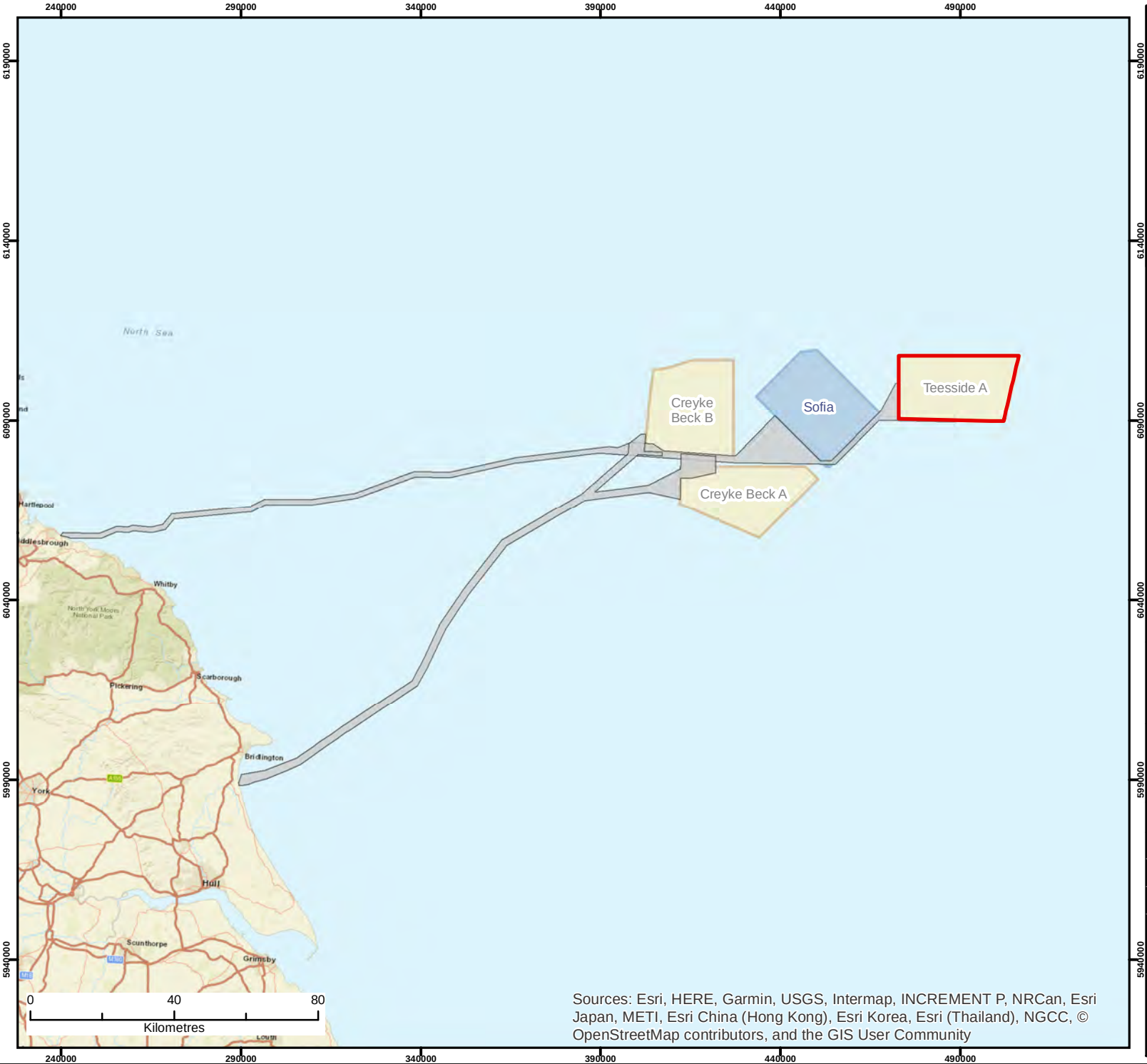
1. Provide information on the nature of the proposed change;
2. Describe the predicted effects of the change alongside the outcome of the original assessments that informed the DCO;
3. Set out why it is considered appropriate for the Application to be determined as a NMC to the DCO; and
4. Ensure compliance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

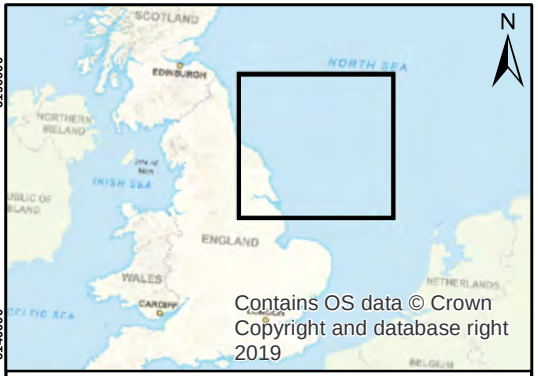
An application to vary the deemed marine licences (dMLs) has been made to the Marine Management Organisation (MMO) in parallel to the NMC application. Details of these changes are set out in the covering letter provided to the MMO separately. This report is also intended to support that application.

[1] Further information on the amendments to Sofia can be found on the Planning Inspectorate website at: https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/dogger-bank-teesside-a-sofia-offshore-wind-farm-formerly-dogger-bank-teesside-b-project-previously-known-as-dogger-bank-teesside-ab/?ipcsection=docs&stage=7&filter1=Non-Material+Change

The report is structured as follows:

- **Section 2 Details of Proposed Change** – Overview of the proposed change;
- **Section 3 Consultation** – Consultation undertaken prior to submitting the NMC application and the proposals for consultation on the application once submitted;
- **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 receptors screened in;
- **Section 7 Assessment of Materiality** – Test of materiality; and
- **Section 8 Conclusions** – Clear account of assessment outcomes.





Legend:

- Dogger Bank Teesside A
- Dogger Bank Wind Farms
- Sofia Offshore Wind Farm
- Export Cable Corridor

Client:	Project:
SSE & Equinor	Dogger Bank Teesside A

Title: Location of Dogger Bank Teesside A Offshore Wind Farm

Figure:	Drawing No:
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Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	26/09/2019	GC	GC	A4	1:1,500,000

Co-ordinate system: WGS84 UTM 31N

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DOGGER BANK WIND FARMS
sse equinor

2 Details of Proposed Change

There is now the potential for larger wind turbines to be available to the Project compared to those previously considered, which the Project Team would like the option to use. This NMC application is therefore for an increase to the consented parameters for hammer energy whilst leaving all other DCO parameters unchanged.

Table 1 summarises the currently consented parameters relevant to the NMC and the particular parameter where an amendment to the DCO is being sought.

To support the NMC application a review of the proposed amendment has been undertaken to confirm that the proposed change would not give rise to new or materially different likely significant effects or invoke the need for a new Habitats Regulations Assessment (HRA). To inform this review a comparison with the consented Project has been being undertaken on a like for like basis with the Environmental Statement (ES) (Forewind, 2014) and the Habitats Regulations Assessment (HRA) (DECC, 2015) that informed the DCO. In addition, the Department for Business, Energy and Industrial Strategy (BEIS) Review of Consented (RoC) Offshore Wind Farms (OWFs) in the Southern North Sea (SNS) harbour porpoise Special Area of Conservation (SAC) has also been considered to ascertain whether there would be any change to its outcomes.

It should be noted that both the requirement for and scale of the change proposed have been subject to careful consideration to ensure that the minimum level of change is being sought in order to achieve the required gains in efficiency discussed above.

Table 1 Proposed Teesside A consent amendment and associated parameters

Parameter	Consented Envelope	Proposed Amendment
Maximum hammer energy – monopile	3,000kJ	Up to 4,000kJ
Monopile diameter	Up to 12m	No change
Number of turbines	Up to 200 turbines	No change

3 Consultation

This section provides a summary of the consultation that has been carried out on the proposed amendment prior to submission of the NMC application. Further details will be provided within the Consultation and Publicity Statement that will be submitted following submission of the application.

An introductory email was sent to all those persons proposed to be consulted on the application, providing an update on the Project and the proposed amendment.

Stakeholders were identified as either being key to agreeing procedure and approach for the NMC application (e.g. BEIS and the Planning Inspectorate) or having a key interest in relation to the topics which may be affected by the proposed amendment as a result of their consultation responses to previous NMC applications for Dogger Bank that initially sought approval for an increase to hammer energy.

3.1 Consultation on the Application

A reduced and focused scope of consultation from that carried out with respect to the DCO application was agreed with BEIS through a request in accordance with Regulation 7(3) of the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 (the 2011 Regulations). This provided a targeted list of consultees for consultation on the NMC application.

Letters to inform consultees that the NMC application has been made will be sent following the submission of the application. This will include the application documents and will explain how consultees can make a representation. The Project Team will publicise the application in accordance with the 2011 Regulations.

4 Methodology

4.1 Approach to the Assessment

A screening exercise has been undertaken of all of the topic areas that were considered in the ES which supported the grant of the DCO to determine if there could be potential for any new or materially different likely significant effects as a result of the proposed DCO amendment. This approach has enabled this report to focus on the receptors that 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 which confirmed that the proposed change will not give rise to any additional or materially different significant effects. This has been achieved by undertaking a like for like comparison with the ES which informed the grant of the DCO.

Alongside this, consideration is also given to the HRA undertaken by the Secretary of State to inform the grant of the DCO in order to determine whether the proposed DCO amendment has the potential to affect designated sites. This includes all the sites that were considered at the time of the granting of the DCO. A comparison with the BEIS (2018) draft RoC HRA has been included in the Marine Mammal Technical Report (**Appendix 1**).

5 Screening of Environmental Impacts

This section 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 (**Table 2**). Where it could not be immediately ruled out that a receptor would not be affected by the proposed amendment this topic is 'screened in' and further assessed in Section 6.

Table 2 Screening table

Topic area from ES	Potential change in effect	Screened in/out
Chapter 8 – Designated Sites	Potential effects of the increase in hammer energy on marine mammals is considered under Marine Mammals (Section 6.1).	Out
Chapter 9 – Marine Physical Processes	No effect on this topic from an increase in hammer energy as there is no impact pathway.	Out
Chapter 10 – Marine Water and Sediment Quality	No effect on this topic from an increase in hammer energy as 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
Chapter 12 – Marine and Intertidal Ecology	No effect on this topic from an increase in hammer energy as there is no impact pathway.	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 effect on this topic from an increase in hammer energy as there is no impact pathway.	Out
Chapter 17 – Other Marine Users	The ES does not identify a worst case scenario for noise. It does however assess the impact of piling noise on oil and gas seismic surveys. The increased hammer energy is associated with the installation of larger turbines with a higher maximum capacity. As the maximum	Out

Topic area from ES	Potential change in effect	Screened in/out
	generating capacity of each wind farm and total rotor-swept area will remain the same it is possible this will lead to a reduction in the number of piled structures. This would result in fewer piling events and a consequent overall reduction in any impact on seismic surveys. There will be no other effects on this topic from an increase in hammer energy as there is no impact pathway.	
Chapter 18 – Marine and Coastal Archaeology	No effect on this topic from an increase in hammer energy as there is no impact pathway.	Out
Chapter 19 – Military Activities and Civil Aviation	No effect on this topic from an increase in hammer energy as there is no impact pathway.	Out
Chapter 20 – Seascape and Visual Character	No effect on this topic from an increase in hammer energy as there is no impact pathway.	Out
Chapter 21 – Landscape and Visual	No effect on this topic from an increase in hammer energy as there is no impact pathway.	Out
Chapter 22 – Socio-economics	No effect due to the increase in hammer energy as there is no impact pathway (for clarity, the proposed amendment does not alter the potential Project duration or the construction and operation scenarios).	Out
Chapter 23 – Tourism and Recreation	No effect due to the increase in hammer energy as there is no impact pathway.	Out
Chapter 24 – Geology, water resources and land quality Chapter 25 – Terrestrial Ecology	No effect due to the increase in hammer energy as there is no impact pathway.	Out

Topic area from ES	Potential change in effect	Screened in/out
Chapter 26 – Land Use and Agriculture Chapter 27 – Onshore Cultural Chapter 29 – Noise and Vibration Chapter 30 – Air Quality		
Chapter 28 – Traffic and Access	No effect due to the increase in hammer energy as there is no impact pathway.	Out
Chapter 32 – Transboundary Effects	Any transboundary issues in relation to marine mammals and fish are considered, where appropriate, in Section 6. No additional impacts from the proposed amendment are predicted in relation to transboundary effects as the total area of the Project will not change.	Out

6 Assessment

6.1 Marine Mammals

The ES assesses 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 as identified in the ES, which 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 was carried out on a like for like basis with the existing assessment that informed the ES. Underwater noise propagation modelling for the original assessment was carried out by the National Physical Laboratory (NPL) to assess the effects of noise from the construction of the Dogger Bank Teesside A offshore wind farm. Since the NPL modelling was completed for the ES, NPL no longer conduct noise modelling for individual projects so the updated noise modelling has therefore been undertaken by Subacoustech Environmental Ltd.

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 Annex 1 Subacoustech Report.

Therefore, for the proposed increase in hammer energy, underwater noise modelling has been undertaken to:

(i) Compare the NPL model used in the original assessment and Subacoustech INSPIRE model used in this assessment to ensure the models are comparable. This is presented in **Appendix 1 Marine Mammal Technical Report**, **Annex 1 Subacoustech Report**[2].
(ii) Replicate underwater noise modelling undertaken for the original assessment, for equivalent inputs and scenarios to enable a like for like comparison to be made between the consented hammer energy of 3,000kJ and the proposed increase to 4,000kJ.
(iii) Update the underwater noise modelling based on the latest inputs and scenarios for increased hammer energy using the latest (Southall *et al.*, 2019) thresholds and criteria for PTS and TTS.

This aim of this assessment is to determine whether there are any new or materially different likely significant effects in relation to marine mammals when using the proposed maximum hammer energy of 4,000kJ compared to the currently consented maximum hammer energy of 3,000kJ. Modelling has been undertaken at two locations over the Teesside A site identified in the NPL Report (locations ID1 and ID5 in Table 4.1 of Annex 1 of Appendix 1). These locations have been chosen as they are used for detailed analysis within the NPL Report and therefore assessed in the original ES. The locations encompass the worst-case scenario and include a wide area of the Teesside A site

[2] The Subacoustech modelling presented in Annex 1 was also undertaken for a hammer energy of 5,400kJ. This was originally a consideration, but a Project decision was taken not to progress this hammer energy, therefore this assessment, and the NMC application is only for 4,000kJ.

including both deep and shallow water areas. The updated model location (ID1) was chosen as a representative worst case modelling location with the greatest potential impact ranges (location shown on Figure 1-1 in **Annex 1 of Appendix 1**). This provides the worst-case scenario for all locations and therefore a precautionary view of potential impacts. Modelling for the other location within the Teesside A site is presented in Annex 1 of Appendix 1.

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

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.

Comparison of results

This was undertaken based on the Subacoustech modelling of the predicted impact ranges for the maximum hammer energy of 3,000kJ and 4,000kJ using the same parameters, including density estimates and reference populations, as used in the original ES assessment. This allows for a like for like comparison of the potential impacts of increasing the maximum hammer energy to 4,000kJ compared to the currently consented maximum hammer energy of 3,000kJ. Each comparison considers in turn:

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

In relation to each of the potential impacts for each species, the comparison demonstrates that for all species there is no difference in the impact significance between the impacts as assessed under the original assessment and the updated assessment for PTS, TTS and likely or possible avoidance. This demonstrates that an increase in maximum hammer energy from 3,000kJ to 4,000kJ would not alter the outcomes of the original assessment made within the ES, including the cumulative and transboundary impact assessment and, where relevant, the HRA. A summary of the results is provided in **Table 3**.

Table 3: Summary of the comparison of the predicted impact ranges, number of marine mammals and % of reference population (based on values used in ES) and impact assessment for maximum hammer energy of 3,000kJ in ES and proposed increased maximum hammer energy of 4,000kJ

Species	PTS		TTS / fleeing response		Behavioural response	
	3,000kJ in ES	4,000kJ	3,000kJ in ES	4,000kJ	3,000kJ in ES	4,000kJ
Harbour porpoise[1]	<700m 1.1 harbour porpoise (0.0005%) Negligible	880m 1.7 harbour porpoise (0.0008%) Negligible	5.5km 59 harbour porpoise (0.03%) Negligible	7km 107 harbour porpoise (0.05%) Negligible	33km 1,920harbour porpoise (0.84%) Negligible	34km 2,148 harbour porpoise (0.95%) Negligible
	No significant difference		**No significant difference**		**No significant difference**	
White-beaked dolphin[2]	<100m 0.0005 white-beaked dolphin (<0.00001%)	<50m 0.00015 white-beaked dolphin (0.0000009%)	<200m 0.002 white-beaked dolphin (<0.0001%)	170m 0.001 white-beaked dolphin (0.000008%)	8.5km 3 white-beaked dolphin (0.02%)	11km 5 white-beaked dolphin (0.03%)

Species	PTS		TTS / fleeing response		Behavioural response	
	3,000kJ in ES	4,000kJ	3,000kJ in ES	4,000kJ	3,000kJ in ES	4,000kJ
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	No significant difference		**No significant difference**		**No significant difference**	
Minke whale[3]	<100m 0.0003 minke whale (<0.00001%) Negligible	60m 0.00009 minke whale (0.0000004%) Negligible	<400m 0.004 minke whale (<0.0001%) Negligible	480m 0.006 minke whale (0.00003%) Negligible	41km 34 minke whale (0.15%) Negligible	41km 35 minke whale (0.15%) Negligible
	No significant difference		**No significant difference**		**No difference**	
Grey seal[4]	<200m 0.01 grey seal (<0.00001%) Negligible	180m 0.002 grey seal (0.000007%) Negligible	<1.7km 0.8 grey seal (<0.003%) Negligible	1.7km 0.2 grey seal (0.0007%) Negligible	N/A	
	No significant difference		**No significant difference**			

[1]based on Lucke *et al*. (2009) unweighted criteria for instantaneous PTS (SEL_{ss} 179 dB re 1 μPa^2s); TTS / fleeing response (SEL_{ss} 164 dB re 1 μPa^2s); and possible avoidance (SEL_{ss} 145 dB re 1 μPa^2s). ES harbour porpoise density = 0.7161/km^2; ES harbour porpoise reference population = 227,298.

[2]based on Southall *et al*. (2007) M-weighted criteria for instantaneous PTS (SEL_{ss} 198 dB re 1 μPa^2s); TTS / fleeing response (SEL_{ss} 183 dB re 1 μPa^2s); and possible avoidance (SEL_{ss} 160 dB re 1 μPa^2s). ES white-beaked dolphin density = 0.01487/km^2; ES white-beaked dolphin reference population = 15,895.

[3]based on Southall *et al*. (2007) M-weighted criteria for instantaneous PTS (SEL_{ss} 198 dB re 1 μPa^2s); TTS / fleeing response (SEL_{ss} 183 dB re 1 μPa^2s); and possible avoidance (SEL_{ss} 142 dB re 1 μPa^2s). ES minke whale density = 0.00866/km^2; ES minke whale reference population = 223,168

[4]based on Southall *et al*. (2007) M-weighted criteria for instantaneous PTS (SEL_{ss} 186 dB re 1 μPa^2s); TTS / fleeing response (SEL_{ss} 171 dB re 1 μPa^2s); and possible avoidance ES grey seal density = 0.02131/km^2; ES grey seal reference population = 28,989.

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 using the latest (Southall *et al*., 2019) thresholds and criteria for PTS and TTS. As with the like for like comparison set out above, each assessment considers in turn:

- The change 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-III survey for cetaceans (Hammond *et al*., 2017) and the latest Sea Mammal Research Unit (SMRU) seal at-sea usage maps (Russell *et al*., 2017). Further details are provided in the Marine Mammal Technical Report (**Appendix 1**).

In relation to each of the potential impacts for each species, the updated assessment based on the latest criteria (Southall *et al*., 2019) demonstrates that there is no difference in the impact significance between the impacts as assessed for the consented maximum hammer energy from 3,000kJ and the proposed increased hammer energy of 4,000kJ for any of the assessed receptors. A summary of the results is provided in **Table 4**.

Conclusions of Assessments

The assessments undertaken demonstrate that there is no difference in the impact significance between the impacts as assessed under the original assessment and the updated assessment. Therefore, the assessments demonstrate that an increase in maximum hammer energy from 3,000kJ to 4,000kJ does not affect impact significance on any of the assessed receptors.

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 alone or in-combination. 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 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."* It is clear from the Guidance that it is the likely significant effect (LSE) of the variation or amendment to the DCO that needs to be considered, and not the LSE of the DCO as amended. Based on both the like for like 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, no more than the consented impacts (either alone or in-combination). Therefore, the implications of the Project on the Southern North Sea SAC will continue to be considered as part of the BEIS review of consents. This is a separate process.

A comparison with the BEIS (2018) draft RoC HRA indicates that the maximum predicted PTS impact ranges for the updated noise modelling for a maximum hammer energy of 4,000kJ are within the maximum predicted PTS ranges in the BEIS (2018) draft 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 Teesside A (as described in **Appendix 1**). The draft RoC HRA assumes a worst case hammer energy for the Project of 5,500kJ and concludes that Teesside A alone and in combination with Sofia would not have an adverse effect on site integrity.

Table 4: Summary of the predicted impact ranges, number of marine mammals and % of reference population (based on updated values) and impact assessment for updated assessment of maximum hammer energy of 3,000kJ and 4,000kJ

Species	PTS		TTS / fleeing response	
	3,000kJ	4,000kJ	3,000kJ	4,000kJ
Harbour porpoise[1]	480m (0.73km^2) 0.61 harbour porpoise (0.0002% MU) Negligible	610m (1.2km^2) 1.0 harbour porpoise (0.0003% MU) Negligible	1.1km (3.7km^2) 3.1 harbour porpoise (0.0009% MU) Negligible	1.4km (5.9km^2) 4.9 harbour porpoise (0.0014% MU) Negligible
	No significant difference		**No significant difference**	
White-beaked dolphin[2]	<50m	<50m	<50m	<50m
	No difference		**No difference**	
Minke whale[3]	160m (0.07km^2) 0.001 minke whale (0.000004% MU) Negligible	200m (0.12km^2) 0.002 minke whale (0.000009% MU) Negligible	1.7km (8.5km^2) 0.17 minke whale (0.0007% MU) Negligible	2.1km (13km^2) 0.26 minke whale (0.001% MU) Negligible
	No significant difference		**No significant difference**	
Grey seal[4]	50m (<0.1km^2)	70m (<0.1km^2)	180m (0.1km^2) 0.002 grey seal (0.000008% of ref. pop.; 0.00002% of SE MU)	230m (0.16km^2) 0.003 grey seal (0.00001% of ref. pop.; 0.00003% of SE MU)
	No significant difference in impact area		**No significant difference**	
Harbour seal[4]	50m (<0.1km^2)	70m (<0.1km^2)	180m (0.1km^2) 0.000004 harbour seal (0.000000008% of ref. pop.; 0.00000008% of SE MU)	230m (0.16km^2) 0.000006 harbour seal (0.00000001% of ref. pop.; 0.0000001% of SE MU)
	No significant difference in impact area		**No significant difference**	

[1]based on the Southall *et al*. (2019) unweighted SPL_{peak} criteria for PTS (202 dB re 1 µPa) and TTS (196 dB re 1 µPa). SCANS-III harbour porpoise density = 0.837/km^2; SCANS-III harbour porpoise reference population = 345,373.
[2]based on the Southall *et al*. (2019) unweighted SPL_{peak} criteria for PTS (230 dB re 1 µPa) and TTS (224 dB re 1 µPa). SCANS-III white-beaked dolphin density = 0.002/km^2; white-beaked dolphin reference population = 15,895.
[3]based on the Southall *et al*. (2019) weighted SEL_{ss} criteria for PTS (183 dB re 1 µPa^{2}s) and TTS (168 dB re 1 µPa^{2}s). SCANS-III minke whale density = 0.02/km^2; minke whale reference population = 23,528.
[4]based on the Southall *et al*. (2019) unweighted SPL_{peak} criteria for PTS (218 dB re 1 µPa) and weighted SEL_{ss} criteria for TTS (170 dB re 1 µPa^{2}s)

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 wind turbines (200) being installed on jacket / multi-pile foundations with a maximum of six pin-piles per foundation. This was based on a maximum hammer energy of 2,300kJ (Chapter 13, Table 5.2 of the ES). Whilst it was acknowledged that the installation of monopiles would result in the greatest associated impact range, given the significantly higher number of piling events associated with installation of jackets / multi-pile foundations (up to four piling events per foundation) in comparison to monopiles (one piling event per foundation), use of jackets / multi-pile foundations were considered the worst case.

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.

In the ES the worst case was based on the number of piles rather than the hammer energy of each during installation of jacket / multi-pile foundations and the proposed amendment does not alter these parameters so on that basis there is no alteration to the worst case assessed with respect to fish. However, to ensure the increased hammer energy does not alter this, the updated underwater noise modelling carried out for a 3,000kJ hammer energy and the increase to 4,000kJ for the installation of monopiles has been assessed.

With regard to operational noise the worst case scenario was assumed to be the minimum spacing between turbines of 700m and a maximum of 26 vessels a year 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.

Underwater noise modelling

Underwater noise propagation modelling for the original assessment was carried out by the National Physical Laboratory (NPL) (Forewind 2014b) to assess the effects of noise from the construction of the Dogger Bank Teesside A offshore wind farm. **Table 5** and **Table 6** provide details of the criteria used for the modelling work. Modelling was undertaken at a number of locations within Teesside A with impact ranges provided in terms of both injury and behavioural effects for pelagic and demersal fish using different hammer energies (300kJ, 1900kJ, 2300kJ and 3000kJ).

Table 5: Summary of injury criteria used for fish

Species	Dual injury criteria (PTS)	
	Peak SPL**(dB re 1 µPa)[3]	SEL*** (dB re 1 µPa² s)[4]
Fish* (Popper *et al*. 2006 and Carlson *et al*. 2007)	206	187

* Applicable to all fish species with a mass of over 2g.
** Sound Pressure Level
*** Sound Exposure Level

[3] SPL: Sound Pressure Level, measure of the received acoustic energy at the receptor. Unit: dB re 1 µPa^2·s
[4] SEL: Sound Exposure Level: Sound Exposure Level, a measure of the received acoustic energy at the receptor. Unit: dB re 1 µPa^2·s

Table 6: 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

Since the NPL modelling was completed for the ES, NPL no longer conduct noise modelling for individual projects. In addition, new criteria have been developed by Popper *et al.* (2014). As such, the updated noise modelling has been undertaken on a like for like basis to allow direct comparison with the ES and also based on the new criteria.

Outcomes of updated underwater noise modelling

Table 7 provides a comparison of the outcomes of the ES and the updated modelling based on a 4,000kJ hammer energy. 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 fish 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 existing scheme due to the proposed amendment.

Table 7: Predicted fish impact ranges like for like assessment as per the ES at Teesside A

Impact criterion	3,000kJ	4,000kJ
Instantaneous injury/PTS (peak pressure level 206 dB re 1 µPa)	250	370m
Startle response (peak pressure level 200 dB re 1 µPa)	650m	820m
Possible avoidance of area* (peak pressure level 168 -173 dB re 1 µPa)	10.0 – 21.0km	14.0 – 21.0km

*Noise insensitive species of fish will exhibit avoidance behaviour at lesser ranges

In addition to the like for like comparison, consideration has also been given to the new criteria, which also describes potential mortality/injury in eggs and larvae (Popper *et al.* 2014). The modelling for this has been carried out based on the hammer energies used in the ES and for the increase in hammer energy to 4,000kJ.

The results of this are shown in **Table 8** and **Table 9**. This is based on the worst case scenario (termed Scenario 3 in the ES) in terms of piling duration for the installation of a single monopile foundation. This also demonstrates that the difference in impact ranges for a 3,000kJ and 4,000kJ hammer energy is small. In this case the ranges are smaller than those predicted in the ES on account of the different criteria being applied.

The impact ranges for fleeing fish in **Table 9** have assumed a conservative fleeing speed of 1.5 m/s (Hirata, 1999).

Table 8: Predicted unweighted SPLpeak impact ranges for fish using criteria from Popper et al. (2014) for maximum hammer blow energies at Teesside A

Fish - impact criterion		3,000kJ hammer energy	4,000kJ hammer energy
Injury (fish: no swim bladder) unweighted SPL_{peak} (213 dB re 1 µPa)	Maximum	100m	130m
	Minimum	100m	130m
	Mean	100m	130m
Injury (fish: with swim bladder) unweighted SPL_{peak} (207 dB re 1 µPa)	Maximum	240m	310m
	Minimum	240m	310m
	Mean	240m	310m
Injury (eggs and larvae) SPL_{peak} (207 dB re 1 µPa)	Maximum	240m	310m
	Minimum	240m	310m
	Mean	240m	310m

Table 9: Predicted unweighted SEL_{cum} impact ranges for fish using criteria from Popper et al. (2014) assuming a fleeing speed of 1.5 m/s for piling sequence 3 at Teesside A. Fleeing speed taken as a conservative number from Hirata (1999).

Fish – impact criterion		3,000kJ hammer energy	4,000kJ hammer energy
Mortality (fish: no swim bladder) SEL_{cum} (> 219 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
Recoverable injury (fish: no swim bladder) SEL_{cum} (> 216 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
Mortality (fish: swim bladder not involved in hearing) SEL_{cum} (210 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
Mortality (fish: swim bladder involved in hearing) SEL_{cum} (207 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
Recoverable injury (fish: with swim bladder) SEL_{cum} (203 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
Mortality (eggs and larvae) SEL_{cum} (210 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m

Fish – impact criterion		3,000kJ hammer energy	4,000kJ hammer energy
TTS (all fish) SEL_{cum} (186 re 1 μPa^2s)	Maximum	15.0km	18.0km
	Minimum	12.0km	13.0km
	Mean	14.0km	16.0km

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 at SEL_{cum} as high as 210 dB re 1 $\mu Pa^2 \cdot s$. 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 (zero flee speed) fish based on research from Hawkins *et al.* (2014). However, basing the assessment on a stationary 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}. These modelling results are shown in **Table 10** and complement the information presented in **Table 9**.

Table 10: Predicted unweighted SEL_{cum} impact ranges for stationary fish using criteria from Popper et al. (2014) for piling sequence 3 at Teesside A

Fish – impact criterion		3,000kJ hammer energy	4,000kJ hammer energy
Mortality (fish: no swim bladder) SEL_{cum} (> 219 dB re 1 μPa^2s)	Maximum	600m	760m
	Minimum	590m	750m
	Mean	600m	760m
Recoverable injury (fish: no swim bladder) SEL_{cum} (> 216 dB re 1 μPa^2s)	Maximum	960m	1200m
	Minimum	950m	1200m
	Mean	960m	1200m
Mortality (fish: swim bladder not involved in hearing) SEL_{cum} (210 dB re 1 μPa^2s)	Maximum	2.3km	2.9km
	Minimum	2.3km	2.9km
	Mean	2.3km	2.9km
Mortality (fish: swim bladder involved in hearing) SEL_{cum} (207 dB re 1 μPa^2s)	Maximum	3.5km	4.3km
	Minimum	3.5km	4.2km
	Mean	3.5km	4.3km
Recoverable injury (fish: with swim bladder) SEL_{cum} (203 dB re 1 μPa^2s)	Maximum	5.9km	7.1km
	Minimum	5.7km	6.8km
	Mean	5.8km	6.9km

Fish – impact criterion		3,000kJ hammer energy	4,000kJ hammer energy
Mortality (eggs and larvae) SEL_{cum} (210 dB re 1 μPa^2s)	Maximum	2.3km	2.9km
	Minimum	2.3km	2.9km
	Mean	2.3km	2.9km
TTS (all fish) SEL_{cum} (186 re 1 μPa^2s)	Maximum	28.0km	30.0km
	Minimum	23.0km	25.0km
	Mean	25.0km	28.0km

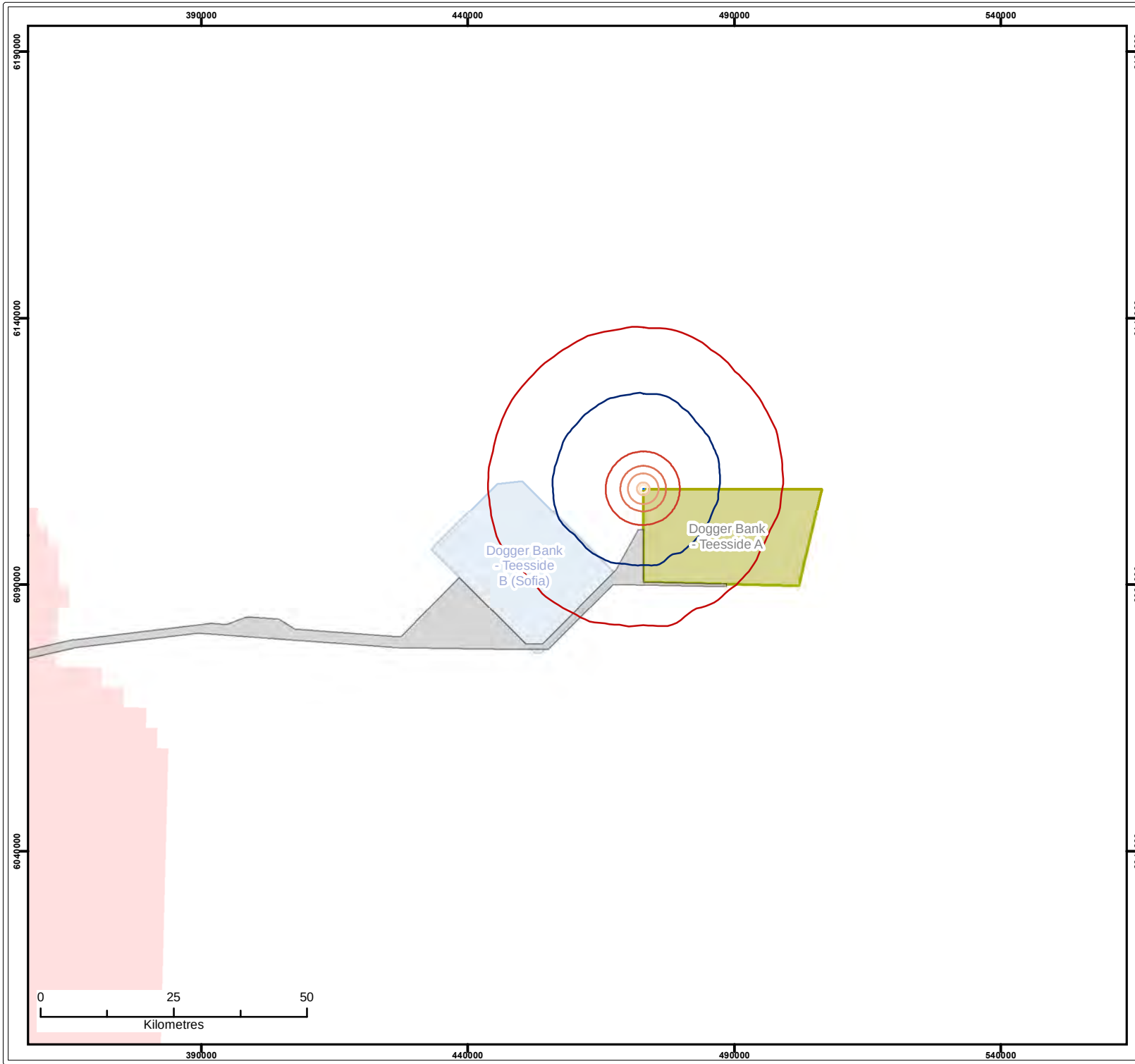
The worst case in the ES was based on the maximum number of wind turbines being installed on jacket / multi-pile foundations with a maximum of six pin-piles per foundation due to the increased time that fish would potentially be displaced from the area. Following the assessment of the updated hammer energies for monopiles as detailed within this document, it is concluded that the maximum number of turbines on jacket / multi-pile foundations remains the worst case scenario and so there is no change to the worst case assessment as presented in the ES. Therefore, as the 'peak' impact scenario is not altered due to the proposed non-material change application (which relates only to monopile foundations) and no updated modelling was deemed necessary for this scenario.

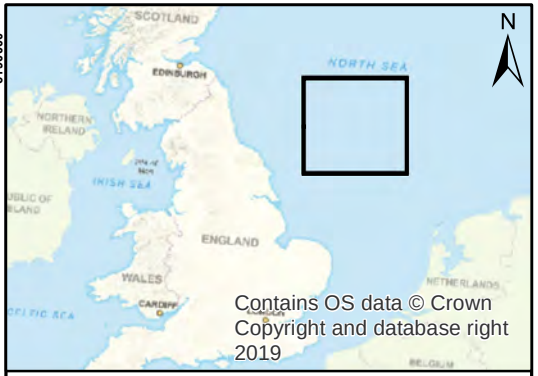
In relation to the Flamborough Head spawning grounds, the Project windfarm array is located approximately 163km from the high-density spawning grounds (**Figure 2**). This is based on 10 years of International Herring Larvae Survey data (ICES, 2018). **Figure 2** also highlights the modelled maximum ranges of impact arising from the 4,000 kJ hammer energy, both for fleeing and stationary fish. These ranges are located at 154km (fleeing) and 143km (stationary) distance from the herring spawning grounds. As such, the proposed change does not present any risk to herring eggs or larvae in this area.

The modelling demonstrates that the potential impact ranges from piling have only slightly increased due to the increase in hammer energy. Within the ES and DCO examination, no issues were raised regarding piling noise and potential impacts on the Flamborough Head spawning ground, due to the distance between the wind farm array site and the inshore spawning grounds. The NMC application does not alter this. The above demonstrates that there is no pathway for effect on the Flamborough Head spawning ground, resulting from piling activities at the wind farm array.

Additionally, in the array site, the ES describes a minor adverse 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.

Based on the information above, and the fact that the worst case scenario in relation to construction noise has not altered due to the proposed amendment, it is concluded that there will be no new or materially different likely significant effects compared to the consented scheme. The conclusions of the ES that fish and shellfish impacts are not significant for the Project alone or cumulatively with other projects remain. 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.





Legend:

- Dogger Bank Wind Farms
- Export Cable Corridor
- Sofia Offshore Wind Farm

ICES herring data from 2008 – 2017

Eggs & Larvae Count

- 0.50 - 5

Teesside A ID1 4000kJ Unwtd SELcum Seq 3 (Fleeing)

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

Teesside A ID1 4000kJ Unwtd SELcum Seq 3 (Stationary)

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

Client:	Project:
SSE & Equinor	Dogger Bank Teesside A

Title:
Predicted noise contours and impact ranges for fleeing and stationary fish at the Teesside A and Sofia wind farms, location ID1

Figure:	Drawing No:
1	PB9446-RHD-ZZ-OF-DR-Z-0002

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	21/02/2020	GC	KC	A4	1:1,000,000

Co-ordinate system: WGS84 UTM 31N

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Enhancing Society Together

DOGGER BANK WIND FARMS
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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 are 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. The following characteristics are stated to indicate that an amendment is more likely to be considered material.

1. A change should be treated as material if it would require an updated ES (from that 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 DCO in relation to the hammer energy has been considered in light of these four characteristics as 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 in respect of EIA considerations.

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 new HRA required.

In relation to the Southern North Sea SAC, it is noted that the proposed amendment to 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 SAC designation invokes the need for BEIS (as the competent authority) to undertake a review of existing licences and consents that are 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), however it would not be appropriate to regard the proposed amendment as material for this reason.

As previously outlined, a comparison with the BEIS (2018) draft RoC HRA indicates that the maximum predicted PTS impact ranges for the updated noise modelling for a maximum hammer energy of 4,000kJ are within the maximum predicted PTS ranges in the BEIS (2018) draft 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

Teesside A (see **Appendix 1**). The draft RoC HRA assumes a worst case hammer energy for the Project of 5,500kJ and concludes that Teesside A alone and in combination with Sofia would not have an adverse effect on site integrity.

In addition, the current draft guidelines for the assessment of disturbance from piling is to use a 26 km effective deterrent range (EDR) for monopiles (JNCC *et al*, 2020). It is acknowledged that draft guidance has a precautionary EDR for monopiles with noise abatement of 15km (JNCC *et al*., 2020), however the assessment has been based on the potential worst-case of monopiles with 26 km EDR. 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, based on current Statutory Nature Conservation Bodies (SNCBs) guidance.

Teesside A is not located within the Southern North Sea SAC, but it is within the disturbance range of 26km for monopiles (24km at closest point to the summer area). Based on the 26km EDR for monopiles, there would be no difference in the disturbance to harbour porpoise within the Southern North Sea SAC, as a result of piling at Teesside A, for any hammer energy used for monopiles and given the distance of the Teesside A project to the SAC, there would no potential for any adverse effect on the Southern North Sea SAC.

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 proposed change applies to activities being undertaken within the existing DCO Order limits and on land that will be leased to the Project by The Crown Estate. As such, 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 from shore.

8 Conclusions

This Environmental Report has reviewed the potential effects of the proposed NMC application on all the topics considered in the ES and the HRA. A screening exercise was undertaken which identified marine mammals and fish and shellfish ecology as 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 re-modelled the impacts on marine mammals and fish and shellfish which could arise from the proposed amendment to Teesside A on a like for like basis 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 on a like for like basis with the original consent showed that there was no significant difference between the potential impact for a maximum hammer energy of 3,000kJ compared to 4,000kJ. Therefore, the proposed increase in maximum hammer energy from 3,000kJ to 4,000kJ 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 monopile hammer energy to 4,000kJ compared to the consented monopile hammer energy of 3,000kJ.

The assessments undertaken demonstrate that there is no difference in the impact significance between the impacts as assessed under the original assessment and the updated assessment. Therefore, the assessments demonstrate that an increase in maximum hammer energy from 3,000kJ to 4,000kJ does not significantly impact any of the assessed receptors.

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 alone or in-combination 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 is appropriate for the application to amend the maximum hammer energy and to be consented as an NMC to the DCO.

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