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Dogger Bank South Offshore Wind Farm

Appendix J to the Natural England Deadline 3 Submission

**Natural England's comments on the In-Principle Monitoring Plan [APP-247] and
[REP2-044]**

For:

The construction and operation of the Dogger Bank South (East and West) Offshore Wind Farm located approximately 100-122 km off the North East Coast in the Southern North Sea.

Planning Inspectorate Reference EN010125

19th March 2025

Appendix J – Natural England’s Advice on the In-Principle Monitoring Plan at Deadline 3

In formulating these comments, the following documents have been considered:

- [APP-247] 8.23 In-Principle Monitoring Plan
- [REP2-044] 8.23 In Principle Monitoring Plan (Revision 2) (Tracked)

1. Introduction

1. Natural England welcomes the submission of the Dogger Bank South (DBS) In-Principle Monitoring Plan (IPMP) and relevant updates [APP-247, REP2-044] as part of the application. Further, we welcome the Applicant’s inclusion of the general guiding principles for proposed monitoring (Section 1.4). We also refer the Applicant to Natural England’s Best Practice Advice document which sets out our expectations in terms of monitoring. This document is available at: [Environmental considerations for offshore wind and cable projects - Phase IV Best Practice Advice for Post-Consent Monitoring, Version 1.0, July 2022.pdf](#). Relevant sections are also included in Annex A of this document for reference.
2. This document outlines Natural England’s overarching concerns with the IPMP [APP-247, REP2-044], particularly in relation to the overall aim of ensuring adaptive monitoring and remediation is secured within the DCO. In addition, this document provides further advice on each of the offshore nature conservation receptors: physical processes, benthic subtidal ecology, fish and shellfish ecology, offshore ornithology, and marine mammals.

2. Overarching Concerns with the IPMP

3. Natural England advises that this is a live document which is updated throughout Examination and post consent to reflect the outcome of discussions and/or monitoring.
4. In recognition of the emphasis being placed by projects currently in the post consent phase on the IPMP when setting the monitoring requirements and parameters; Natural England highlights the importance of this document. Natural England emphasises the requirement to agree the scope of the IPMP and hypotheses which will be tested by the monitoring as part of the consenting phase.

5. Overall, Natural England feels that much more detail is required than is provided in the IPMP in its current form. For example;

- What are the hypotheses the monitoring will be testing and how do they relate to the assessments undertaken in the ES?
- How will the monitoring be designed to ensure that the desired outcomes can be achieved i.e. is the monitoring fit for purpose?
- What are the indicative timings of the surveys?
- Can lessons be learnt from previous thematic surveys and how will modifications to surveys design be incorporated between survey campaigns?
- What does 'success' look like to demonstrate that no further monitoring is required?
- What happens if the results do not support the null hypothesis? Is further monitoring required (with/without modifications)? If impacts are greater than predicted, do actions need to be undertaken to address these impacts? How will further monitoring and actions be secured, is a change to the wording of the dML required? And if so, how will success of any action/s be monitored and what will be the success criteria before monitoring can cease?

To answer the above, Natural England considers the IPMP should focus on what the uncertainties and evidence gaps of the Environmental Impact Assessment (EIA) and/or Habitat Regulations Assessment (HRA) are, rather than solely the outcomes of the EIA and HRA. We consider that establishing and agreeing the uncertainties and evidence gaps of the EIA and/or the HRA is necessary to inform what monitoring should be undertaken.

6. Natural England advises an approach mechanism in which the Applicant presents a clearly defined hypothesis or null hypothesis of no impact would be beneficial. Monitoring thereafter would aim to test this. We advise a review period during which Statutory Nature Conservation Bodies (SNCBs) and regulatory bodies such as the Marine Management Organisation (MMO) are consulted by the Applicant to assess the results of the first period of monitoring. For example, one mechanism that could be introduced for particular receptors would be a live document which is reflective of what the monitoring is observing, including consideration of species/habitat recovery.

7. We advise that monitoring should be effective in providing sufficient evidence pre-construction to inform the deployment of mitigation measures, and similarly demonstrate the efficacy of mitigation measures during construction and post-construction. This is important to demonstrate compliance with the measures identified in assessments to mitigate significant impacts. It is also important to provide evidence to assess the significance of adverse effects, evaluate the success of mitigation measures and to help inform whether further remedial measures are required.
8. In relation to remedial measures, Natural England wishes to highlight the importance of ensuring that all relevant monitoring proposals for DBS (and/or associated DCO/dML conditions) consider the aim of securing a mechanism for **adaptive monitoring** when unforeseen impacts are detected. Thus, ensuring remedial measures (*i.e.*, **adaptive management**) are triggered should the results of monitoring demonstrate impacts that are significantly greater than predicted and/or incorrect assumptions were made following review of the conclusions of the environmental statement and supporting documents. We advise that the potential for certain monitoring to trigger the development of countermeasures (with associated monitoring of those measures) should be clearly stated in relevant tables of the IPMP and incorporated into the DCO conditions where relevant.
9. It is important to note that monitoring proposed within this IPMP is to determine and validate the impacts of two offshore windfarm (OWF) array areas and cable routes, which could come under separate ownership in the future (as was the case for Dogger Bank C and Sofia OWF, formerly Dogger Bank Teesside A&B). We therefore advise that monitoring plans should consider the impacts and predictions of each array area and cable route alone, and proposals should be sufficiently robust to address uncertainties and validate impacts for each separately. Where monitoring for one array or cable route is to be reliant on the other, it must be demonstrated that the sites/receptors are comparable. In addition, if the OWFs are built out separately, the implications of the different build out scenarios on the validity of the monitoring outcomes will also need to be considered as part of the IPMP.

3. Nature conservation thematic advice

Please note, Natural England's detailed advice on each thematic area is provided in Table 1 below.

3.1 [Section 1.6.1] Engineering related monitoring

10. It is unclear to Natural England if this also encompasses monitoring surveys to inform final project design including those required to inform mitigation measures such as avoidance of certain sensitive receptors particularly environmental ones. If so, it would be useful if the Applicant could specify the purpose of each aspect of the engineering and design related monitoring in full. We highlight that geotechnical investigations will be critical to inform the cable burial risk assessment and in relation to reducing the direct or indirect impacts to environmental receptors. We request that further details are provided to answer the questions posed in our overarching comments.

3.3 [Section 1.6.4] Benthic and Intertidal Ecology

11. Natural England welcomes that the Applicant intends to base proposals on best practice guidance (e.g. MMO's 2014 review of post-consent monitoring) and lessons learnt from the existing Dogger Bank projects. We highlight that Natural England and JNCC have produced a set of broad benthic monitoring objectives which cover the conservation objectives for the Dogger Bank Special Area of Conservation (SAC) and can be applied to developments across the Dogger Bank Zone. These objectives were used to inform the Benthic Monitoring Plans (BMP) of the existing Dogger Bank A, B, C and Sofia OWFs, as it was considered that an agreed approach to benthic monitoring objectives would improve both consistency and efficiency of advice when the SNCBs are approached for consultation. We have provided the objectives in Annex B of this Appendix, and we advise that it would be beneficial for the Applicant's to include these as a foundation for monitoring requirements when developing their monitoring proposals.

3.4 [Section 1.6.5] Marine Mammals

12. Natural England notes that the Applicant does not propose project specific monitoring for marine mammals within the Offshore IPMP. Natural England does not agree, that because no significant impacts are predicted, no monitoring is required. Currently the only post-consent monitoring that has been proposed is the industry-standard monitoring of underwater noise from the first four piles, and monitoring at a larger distance range to validate the underwater noise modelling. However, monitoring undertaken as part of the Marine Mammal Mitigation Protocol (MMMP) should not be considered post-consent monitoring as it does not meet the objective of validating impacts. Natural England is concerned that whilst the Applicant has shown interest in

participating in collaborative monitoring, there is currently no monitoring outlined that would evidence the impacts to marine mammals e.g. monitoring of animal responses to impacts, including mitigated impacts. We highlight that some of the impact pathway assessments factor in mitigation to conclude no significance, therefore validating the effectiveness of the mitigation is a reasonable aim for monitoring. In addition, there has been no consideration of the areas of the assessment where assumptions have been made and where the project could contribute to filling knowledge gaps that would inform the project's assessment.

13. Therefore, we advise that further detailed discussion is required on the monitoring plans. We understand that this is proposed to occur post-consent. However, at present we have limited understanding, and therefore low confidence, in how the monitoring will evidence the outcomes of the marine mammal assessments. Therefore, we advise that the Applicant should revise the In Principle Monitoring Plan (IPMP). Detailed requirements for In Principal monitoring (IPMP), can be found in: [Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards Phase IV: Expectations for monitoring and environmental requirements at the post-consent phase](#). This document outlines Natural England's recommendations for an effective IPMP and should be considered when planning monitoring post-consent.

3.5 Indirect effects

14. Natural England notes that the Applicant's IPMP doesn't include monitoring to validate the predictions made in the ES and HRA with respect to potential effects from indirect impacts on benthic Annex I habitats and linked receptor groups as relevant. This is particularly important in relation to the placement of infrastructure within Dogger Bank SAC and along the ECC where there is a potential impact pathway to Holderness Inshore MCZ. In addition, it is not clear within the IPMP how potential ecosystem impacts will be monitored i.e. changes to benthic habitats and/or marine processes receptors, causing changes to prey availability and therefore Annex I and Annex II mobile species.

Table 1 Natural England's Detailed Advice and Recommendations

Natural England's Advice				
NE Ref	Section	Comment	Natural England's Advice to Resolve Issue	Risk (RAG)
Marine Physical Environment				
1	1.6.3	Owing to the ecological importance of the Flamborough Front, and emerging evidence that suggests large OWF clusters (i.e. Dogger Bank) may result in substantial impacts on stratification, currents, and sediment resuspension; we advise that the Applicant should commit to monitoring potential changes to stratification, currents, and productivity (pre-construction, post-construction, lifetime). [R&I, B22]	As secured for Hornsea Project Four, we advise that it is important for a monitoring programme to be established to record changes to stratification and primary productivity, in the form of pre-construction, post-construction, and for the lifetime of the Projects. This should include trigger points' to allow interventions/remediation, if required. The results of monitoring should be combined with those from other nearby OWFs and with up-to-date research. We highlight that there are a number of research and monitoring programmes (e.g. Universities of Bangor and Hull) investigating the impacts of offshore windfarms on stratification and productivity which may also provide useful evidence.	
2	Table 1-2	The sensitivity of Dogger Bank (and Dogger Bank SAC) to changes in seabed level from certain construction activities has been assessed as negligible in the ES. We advise that these construction activities and similar O&M activities are likely to result in changes to the extent and distribution and physical structure of the site's sandbank feature. [R&I, B27]	We advise that pre- and post-construction monitoring should be committed to, to validate predictions of seabed elevation change, extent of deposition, sediment composition, distribution change, and seabed recovery across the Array Areas and Inter-Platform Corridor within Dogger Bank SAC. Should impacts be found to be greater than predicted then the necessary recourse should be taken.	
3	Table 1-2	One of the headline reasons for pre- and post-construction monitoring is given as 'sandwave/bank characterisation' and 'sandwave/bank recovery rates...', respectively. However, neither of these have been included in the monitoring proposals for pre- and post-construction stages. [R&I, B17, B27]	We advise that while hypotheses to be tested by the monitoring should be agreed as part of the IPMP, the final monitoring plan will need to demonstrate within the monitoring proposals how they will detect and monitor changes to seabed topography and trigger any necessary countermeasures. It should also state how sandwave/bank recovery will be assessed. This	

Natural England's Advice				
NE Ref	Section	Comment	Natural England's Advice to Resolve Issue	Risk (RAG)
			is important for testing the assumptions and predictions made within the ES. The IPMP should also consider the need for adaptive monitoring if unforeseen impacts are detected.	
4	Table 1-2	The Outline Scour Protection Plan [REP2-052] considers secondary scour and proposes monitoring of secondary scour, which we welcome. The updated IPMP [REP2-044] also states that post-construction monitoring will include 'consideration' of secondary scour. Given the high value of Dogger Bank SAC, it is important to ensure that the risk of potential impacts is managed as far as possible and that appropriate monitoring to detect changes and trigger any necessary counter measures is secured. [R&I, B47]	We advise that the Applicant should demonstrate within the IPMP what hypotheses will be tested and where possible, how they intend to achieve this. Furthermore, post construction monitoring should test the assumptions made within the ES regarding secondary scour.	
Benthic and Intertidal Ecology				
5	1.6.4.3	It is stated that no monitoring is proposed for Holderness Inshore and Offshore MCZs due to their being no direct impacts on the site. However, the potential for indirect impacts remains uncertain, particularly given the updates to the Cable Statement [REP2-040] suggesting greater areas of challenging burial conditions than previously predicted. See Table 2 in Appendix C3 of our Deadline 3 submission for further detail.	Natural England advise that monitoring for the MCZs should be revisited as needed following provision of the requested updated information on cable protection along the Export Cable Corridor.	
6	1.6.4.4	As advised in Appendix C2.1 to the Natural England Deadline 2 Submission, benthic monitoring should be secured via the IPMP to determine residual impacts in relation to ecological halo effects [R&I, C8]. Whilst Section 1.6.4.4 includes habitat loss and physical change to another seabed/sediment type, neither 1.6.4.4 or Table 1-3 expands on what this specifically involves.	Natural England advise that the IPMP is updated to include consideration of the impacts on benthic communities within Dogger Bank SAC sandbank feature, and the nature of that impact, as a result of changes to physical and biological processes following the placement of structures and cable/scour protection on the seabed.	
7	1.6.4.4	We highlight that there is no reference to monitoring of Invasive Non-Native Species (INNS) which can include both species that are non-native to UK waters and those	Natural England advise that the IPMP is updated to include consideration of INNS.	

Natural England's Advice				
NE Ref	Section	Comment	Natural England's Advice to Resolve Issue	Risk (RAG)
		that are non-native to the designated soft-substrate habitat (i.e. through colonisation of introduced infrastructure).		
8	Table 1-3	We welcome that pre- and post-construction grab sampling is proposed to capture localised, near-field, far-field and reference sites, however no detail has been included on the scale of sampling that will be delivered or how this will be determined. We note that following post-consent discussion on the BMPs for the existing Dogger Bank projects, a precedent was set by MMO that a minimum of 10% of turbines should be sampled per project (noting that DBS East and West comprises two projects), with final numbers dependent on the results of power analysis and requirements for habitat/biotope representivity within the site.	Natural England advise that the IPMP should commit hypothesis/hypotheses to be tested noting that for this monitoring to be scientifically robust, a sufficient number of turbine locations for localised sampling will be required.	
9	Table 1-3	Natural England notes that previous projects within the Dogger Bank SAC have been conditioned to monitor disposal mounds through the lifetime of the project, to validate predictions on dispersal. This is the case where any works could result in glacial clay sediments being deposited on the seabed.	Natural England advise that seabed deposits are monitored, in particular drill arisings, to inform seabed recovery.	
Fish and Shellfish				
10	Table 1-3	The Applicant has proposed pre- and post- construction habitat sampling to validate statements made regarding habitat suitability and recoverability for sandeel, however, no reference is made to monitoring changes to sandeel abundance and distribution resulting from infrastructure presence. The presence of infrastructure could affect marine processes or the presence of predators which could in turn impact on sandeel populations, as well as impacts from the direct loss of spawning habitat.	Natural England advise that the IPMP should set out specific hypotheses with respect to monitoring impacts to sandeel habitat, abundance and distribution.	
Marine Mammals				

Natural England's Advice				
NE Ref	Section	Comment	Natural England's Advice to Resolve Issue	Risk (RAG)
11	General	There has been no consideration in the IPMP of the areas of the assessment where assumptions have been made and where the project could contribute to filling knowledge gaps, for example, with regards to operational wind turbine generator (WTG) noise levels, or the assumed distribution of bottlenose dolphin close to the coast.	Natural England advise that the Applicant should demonstrate within the IPMP what hypotheses will be tested in relation to impacts to marine mammals.	
Ornithology				
12	1.6.7.1-2	Natural England notes s that we are unable to comment on the Applicant's conclusions at this time, due to issues with the assessment process.	To note.	
13	1.6.7.3	Natural England welcome the Applicant's stated commitment to ensuring that post-consent monitoring across the Dogger Bank projects is strategic and complementary.	We encourage the Applicant to continue to develop strategic and complementary post-consent monitoring plans in collaboration with the other Dogger Bank projects, and note that Dogger Bank D could also potentially be included.	
14	1.6.7.3	Natural England welcomes the Applicant's stated commitment to ensuring that monitoring of seabird breeding populations at FFC SPA continue, however there is a lack of clarity in the Applicant's statement that <i>"it is not expected that the Projects would be required to undertake additional monitoring"</i> . We note that monitoring seabird breeding populations is vital to understand how the impacts of projects may affect such populations.	Natural England advise the Applicant to continue to consult with Natural England on what FFC SPA colony monitoring may be appropriate as part of the Projects' post-consent monitoring programme.	
15	1.6.7.3	Natural England notes that the Applicant has not included monitoring to determine connectivity between the Projects and FFC SPA in its outline proposals. We note that connectivity is a key area of uncertainty in affecting how both collision and displacement impacts of the Projects are apportioned to colonies.	Natural England advise that the Projects consider monitoring to test this hypothesis and consideration should be given to incorporating tagging studies of key affected species to deliver this.	

Natural England's Advice				
NE Ref	Section	Comment	Natural England's Advice to Resolve Issue	Risk (RAG)
16	1.6.7.3	Natural England note that the Applicant has stated: <i>"A standalone offshore ornithological monitoring plan will be developed in the post-consent phase of the Projects in consultation with relevant stakeholders."</i>	Natural England encourages the Applicant to begin consultation with Natural England on the offshore ornithological monitoring plan as early as possible, as recommended in our Best Practice (Parker et al 2022d). We advise that the IPMP should be updated with the hypotheses to be tested to inform the development of the final IPMP.	
17	1.6.7.3 - Table 1.5	Natural England welcomes the inclusion of displacement effects in the Applicant's proposed post-consent monitoring, the inclusion of pre- and post-construction digital aerial surveys (DAS), and the consideration given to methods for investigating spatial distributions. Natural England advise that the Applicant also consider including habituation effects of displacement as a study aim, given that the extent to which habituation may or may not occur with displacement effects is a key source of uncertainty in this area.	Natural England advise that more detail is included on monitoring aims/hypotheses and potential study designs for these aspects.	
18	1.6.7.3- Table 1.5	Natural England welcome the inclusion of collision in the Applicant's proposed post-consent monitoring, the inclusion of a collaborative approach, and consideration of remote monitoring approaches. However, we note a lack of detail on the possible approaches to monitoring and recommend that the Applicant consider monitoring aims and potential study designs (including power analyses to inform study design) in more detail.	Natural England advises the Applicant includes more detail on hypotheses and possible approaches to monitoring.	
19	1.6.7.3- Table 1.5	Natural England notes that the Applicant has referred to monitoring the success of compensation measures as outlined in 6.2.1 and 6.2.2. We refer the Applicant to our comments on those documents at Relevant Reps and Deadline 2 where we request that more detail be provided during the Examination process.	We encourage the Applicant to ensure that post-consent monitoring and compensation monitoring plans are as complementary as possible.	

Natural England's Advice				
NE Ref	Section	Comment	Natural England's Advice to Resolve Issue	Risk (RAG)
20	1.6.7	Natural England notes that no consideration has been given to reporting of post-consent monitoring. Natural England advises that full analyses of post-consent monitoring data should be conducted after each year of monitoring and presented in an annual report (see Best Practice, Parker et al 2022d). We note that this allows for regular assessment of the robustness of the data and any necessary modifications to survey design or analytical approaches.	Natural England advise the Applicant includes details of proposed reporting methods and schedules in their post-consent monitoring plans.	

Annex A: Natural England's Advice on an In-Principle Monitoring Plan (IPMP) extracted and summarised from: [Environmental considerations for offshore wind and cable projects - Phase IV Best Practice Advice for Post-Consent Monitoring, Version 1.0, July 2022.pdf](#) (Parker et al 2022).

1. Purpose of the IPMP document

The outcomes of monitoring are necessary to:

- validate the predictions that were made during the consenting phase;
- mitigate against unforeseen impacts;
- evidence the effectiveness/success of mitigation measures;
- inform adaptive management strategies

Therefore, it is important that the IPMP represents a useful document that ensures the monitoring commitments are detailed and can be referred back to throughout the monitoring process.

2. Advice relating to post-consent monitoring (PCM)

The process and structure of the planning system, including post-consent monitoring, is currently under review by Government, Defra, Natural England and other bodies (see Section 3.1). Options for how PCM can be improved to increase our understanding of the marine environment, the effects of offshore wind development and provide information-rich data over relevant spatial and temporal scales are being considered, such as the promotion of strategic or collaborative monitoring (see Section 4.4). The following section provides Natural England's advice and recommendations for the production and delivery of receptor-specific monitoring plans at the post-consent phase.

3. Natural England's recommendations

- **Early and continued engagement with SNCBs** – engagement with the relevant SNCB(s) is recommended at the earliest possible opportunity to agree the focus of monitoring plans and to allow for continual engagement as plans evolve.
- **Clear aims, objectives and hypotheses** – post-consent monitoring plans should be targeted and have clear aims and hypotheses (Chambers et al. 2012; MMO, 2014; Lindeboom et al. 2015). Monitoring should be proportionate to the level of risk to biological receptors and should not be delivered for the sake of monitoring, but instead focus on sensitive receptors and be driven by a clear understanding of what the monitoring is seeking to address (MMO, 2014). This helps to collect data that is information rich, as well as data rich (Wilding et al. 2017). Early engagement with NE or relevant SNCB is recommended to help agree monitoring plans.

- **Detection of unforeseen impacts** – post-consent monitoring should be targeted, with clear monitoring aims and objectives. Whilst PCM plans should not be designed to detect unforeseen impacts, the analysis of the results of PCM may identify unforeseen impacts which arise during offshore wind farm development across relevant spatial and temporal scales (MMO, 2014). If detected, unforeseen effects can be investigated through adaptive monitoring (see Section 4.3). Participation in collaborative or strategic-level monitoring projects may be also appropriate for identifying long term and lasting effects to marine receptors as a result of offshore wind development.
- **Statistical power** – the ability of a survey to collect a sufficiently large amount of data to make robust statistical inferences about changes is known as its power (Maclean et al. 2006). Where possible, power analyses should be undertaken before monitoring commences to inform the design of PCM to ensure sufficient statistical power in subsequent analyses to detect meaningful changes (Bennet et al. 2016). Projects should also aim to reduce dependence within or between sampling units and plan the statistical tests and/or modelling approach so that the nature and quantity of data collected is suited to conduct the required tests/modelling (Bennet et al. 2016; Noble-James et al. 2018). Early engagement with Natural England is recommended when considering the statistical power of analyses and how this is used to inform survey design, or if power analyses indicate that the expected statistical power may not be sufficient to draw meaningful conclusions.
- **Uncertainty and significance** – as set out within MMO (2014), uncertainty and significance are two important considerations when designing and implementing PCM plans. Uncertainty reflects the extent of error or assumptions that were made when predicting impacts. There is a greater need to monitor topics if there is higher uncertainty regarding the effects of an impact or resulting recovery of receptors. The significance of an impact is another important consideration for PCM and helps to inform whether further management or remedial measures are required (MMO, 2014).

Sufficient duration – PCM should be of a suitable duration to capture lags in impacts to receptors being detected as some impacts may only be detectable after a duration of time, depending on the receptor and the monitoring objectives. In addition, PCM may be required to monitor the recovery of receptors after an impact has occurred (e.g., impacts from construction) or a compensation measure has been put in place. Monitoring plans should be designed to incorporate long term or lasting impacts to validate predictions made within the ES and to improve our understanding of long-term effects and recovery of marine receptors. Monitoring plans should also have a clearly defined criteria for when and how decisions will be

made on the conclusion of monitoring during the post-consent phase, for example when monitoring will be deemed to have met the objectives of the monitoring programme. Refer to the adaptive management approach principle below (Section 4.3).

- **Strategy for consequence** – a key role of post-consent monitoring is to validate the predictions of the Environmental statement (ES), HRA, EIA or Marine Conservation Zone (MCZ) Assessment (Section 4). Monitoring plans should therefore have a clear strategy for subsequent remedial action if the monitoring shows that the original conclusions are incorrect, such as the significance of an impact upon a receptor or the timeframe for its recovery (MMO, 2014). Thresholds can be used to set acceptable levels of change for some environmental indicators, which if exceeded, can trigger additional monitoring or the implementation of mitigation or management measures to avoid adverse effects (Bennet et al. 2016; Wilding et al. 2017).
- **Sharing of data** – to maximise the usefulness of post-consent monitoring, data and reports should be made publicly available and provided to the relevant data repositories, such as the Marine Data Exchange (MDE) and the Marine Environmental Data and Information Network (MEDIN). All reports should be supported by the source/raw data and provide a description of the collection methodology and protocols followed (MMO, 2014). Metadata and environmental metadata should also be made publicly available (Chambers et al. 2012). Natural England advise that PCM data should be shared within the relevant data repositories as a matter of best practice. This could be secured as a licence condition for projects.
- **Maximise use of baseline characterisation data and existing data** – where possible, data collected at the pre-application phase should be used to supplement post-consent monitoring data. The results of baseline characterisation surveys may also be useful to inform the design of post-consent monitoring plans (e.g., the key areas or receptors for monitoring to focus upon). There may also be suitable existing datasets which can be used to provide context or supplement site-specific monitoring data. However, the validity and suitability of existing datasets must be carefully considered if used beyond providing a historical context for subsequent monitoring data (Noble-James et al. 2018). Parker et al. (2022) provides advice and principles for the use of existing data to inform baseline characterisation surveys.
- **Comparable and standardised data** – data should be collected and presented in a consistent format which, where possible, enables effective comparisons with other datasets and other monitoring programmes. Consistent data standards may also allow for backwards/forwards compatibility of monitoring methods over time. Data collection should follow the MEDIN data standards and guidelines as a matter of best practice.^{9A} A consistent naming convention should

also be followed. Species should be recorded using the World Register of Marine Species (WoRMS) list of accepted scientific names and biotopes should be recorded using the EUNIS classification system (EEA, 2019). A consistent and comparable approach also enables effective cumulative and in-combination assessments and improves the functionality of data repositories.

- **Follow industry standards, methodologies and protocols** – monitoring programmes should follow the current industry standards, methodologies and protocols as a matter of best practice. This may apply to data collection, handling or analysis (Chambers et al. 2012). Receptor-specific advice is provided within the relevant sections below. Whilst this document will be periodically updated to reflect evolving best practice for industry standards and survey methodologies, Natural England would welcome the opportunity to discuss proposals to use the latest industry monitoring methods, standards or protocols.
- **Novel and emerging monitoring methods** – Natural England acknowledges the role of offshore wind farm developers in exploring and testing new monitoring methods. Natural England supports innovation and welcomes the exploration of novel and emerging monitoring methods, such as environmental DNA (eDNA), or passive monitoring methods. Although there can be challenges presented by the relative novelty of some techniques in early stages, collaborative working can unlock many wider benefits if planned carefully. Early engagement with Natural England is recommended if novel approaches are proposed.
- **Strategic / joined up approach** – a strategic, collaborative or joined up approach can deliver monitoring programmes of a greater scale and scope, thereby providing a greater understanding of ecological impacts, sensitivity or recovery (see Section 4.4). Natural England strongly supports strategic or collaborative monitoring proposals and can provide bespoke advice on a case-by-case basis.

4. Adaptive monitoring and discharge of conditions

Adaptive monitoring is the process of evaluating data collected to date, to help inform the duration and/or design of further monitoring (Bennet et al. 2016). It can also be used to assess whether monitoring should continue or if the relevant licence conditions can be discharged (MMO, 2014). Adaptive monitoring can also inform on the requirement for further mitigation, compensation or restoration measures. Adaptive monitoring is of particular importance for where there is scientific uncertainty regarding lasting impacts or recovery of receptors (Bennet et al. 2016) or where monitoring is seeking to validate predictions of the ES, EIA, HRA or MCZ Assessment.

Adaptive monitoring is relevant during the post-construction phase where monitoring is investigating changes to the natural environment and ecological receptors over an undefined timescale, such as until a receptor recovers. Licence conditions should incorporate flexibility over the duration of monitoring plans, to allow the results of monitoring surveys to inform the requirement for future surveys or the implementation of management measures (MMO, 2014). This helps to ensure monitoring programmes are delivering the agreed aims and objectives set out by the monitoring plans and ensure monitoring is proportionate to the level of data required. For example, if the ES predicted a full recovery of an MPA feature within a certain timeframe, monitoring may be required until full recovery has occurred and can be agreed between the applicant, SNCB and MMO as the relevant regulator. Conversely, if a receptor has demonstrated the predicted level of recovery, and if agreed by all parties, the requirement for additional post-construction surveys may be discharged early.

In addition, another aspect of adaptive monitoring is the flexibility of the monitoring plan. Due to the long timeframe between projects obtaining consent and completing PCM surveys after construction, monitoring plans need to capture the scope for changes to the methodology or focus of surveys over time. This may be due to new evidence or understanding of impacts to marine receptors, or due to new technology becoming available which enables more ambitious studies. For example, seabird tagging projects should allow for flexibility in methods as new tracking devices become available. Natural England can provide advice on a case-by-case basis.

5. Collaborative / strategic monitoring

Delivering monitoring projects collaboratively could have many benefits for the collection of post-consent monitoring data and can help to answer key evidence gaps or research priorities. Collaborative monitoring could include joint monitoring programmes across zones or regions where projects pool resources to achieve monitoring aims, or where key research questions are divided between projects within a zone or region to allow sufficient time and resources to be dedicated to each question. Collaborative monitoring could also comprise individual offshore wind projects contributing data, money or resources to a strategic research project led by another organisation, such as by ORJIP or ORSMRF, to address shared research questions or evidence gaps. Working collaboratively allows for the pooling of resources and/or division of labour, which enables monitoring programmes to be of a greater scale and scope than possible on a project-specific basis. This enables data collection to produce useful and information-rich data over sufficient spatial and temporal scales to enhance our understanding of the marine environment and the effect of offshore wind development upon ecological receptors (Wilding et al. 2017).

In addition, collaborative monitoring could be undertaken over larger spatial and temporal scales than project-specific monitoring plans, which could enable the detection of wider community changes, unforeseen or long-term effects, and allow for greater statistical power in subsequent analyses. Some projects have worked collaboratively to address key shared questions of mutual interest at the post-

consent phase (e.g., see Section 6.3.1). If implemented effectively, this allows for the division of labour and allows multiple projects to undertake more insightful monitoring programmes than possible on an individual project-level.

Whilst there is widespread agreement of the benefits of collaborative monitoring across sector groups, a framework is required to facilitate strategic monitoring programmes at the government level. Facilitating strategic monitoring is a key objective of Natural England's Approach to Offshore Wind (Natural England, 2021) and Natural England supports the implementation of strategic monitoring as a mechanism to address key evidence gaps and to deliver monitoring projects at scale. Natural England are also leading the Planning Offshore Wind Strategic Environmental Impact Decisions (POSEIDON) project. This is a multi-year project, funded through the Crown Estate's Offshore Wind Evidence and Change (OWEC) programme, which is seeking to address strategic data collection for offshore wind projects. The outputs of the POSEIDON project will be incorporated into this advice when available. Projects should consider whether data collection for some aspects of post-consent monitoring could be undertaken collaboratively with other regional projects in order to answer specific monitoring aims and priorities. Natural England strongly supports the implementation of collaborative monitoring programmes across projects, zones or regions, and can provide advice on a case-by-case basis

Annex B: NE and JNCC Benthic Monitoring Objectives for the Dogger Bank SAC

Objective 1: Determine the impacts on and recovery rates of sandbank physical features affected by wind farm installation, including large and fine scale topography, sediment composition and distribution

ES/HRA predictions: [Project specific]

JNCC SAC conservation objectives:

- Restore the extent and distribution of the feature (includes large-scale topography)
- Restore the physical structure of the feature: finer scale topography (i.e. sand waves and megaripples) and sediment composition and distribution
- Maintain hydrodynamic regime within the site

Objective 2: Characterise and identify impacts on benthic biodiversity and community structure as a result of windfarm installation, i.e. changes in abundance, composition and distribution of native communities

ES/HRA predictions: [Project specific]

JNCC SAC conservation objectives:

- Restore the biological structure of the feature: key and influential species, characteristic communities and their associated ecological functions
- Restore the extent and distribution of the feature (includes sediment composition and biological assemblages (biotopes))
- Maintain the hydrodynamic regime, water and sediment quality within the site
- Precautionary target of restore for some ecosystem functions (e.g. nutrition, climate regulation)

Objective 3: Determine the impacts of hard substrate infrastructure introduction on sedimentary benthic communities, including:

- **Identification of species non-native to UK waters in the wind farm sites**
- **Identification of species non-native to soft substrate habitats in the wind farm sites**

ES/HRA predictions: [Project specific]

JNCC SAC conservation objectives:

- Restore the biological structure of the feature: characteristic communities
- Restore the extent and distribution of the feature (includes sediment composition and biological assemblages (biotopes))

Objective 4: Assess the impact of Objectives 2 and 3 on the wider community and structure i.e. linked receptors groups including epifauna, fish and birds

ES/HRA predictions: [Project specific]

JNCC SAC conservation objectives:

- Restore the biological structure of the feature: characteristic communities
- Restore the extent and distribution of the feature (includes sediment composition and biological assemblages (biotopes))
- Precautionary target of restore for some ecosystem functions (e.g. nutrition, climate regulation)