Hornsea Offshore Wind Farm

Project Two

Marine Processes Clarification Note

Appendix L to the Response submitted for Deadline II

Application Reference: EN010053

10 August 2015

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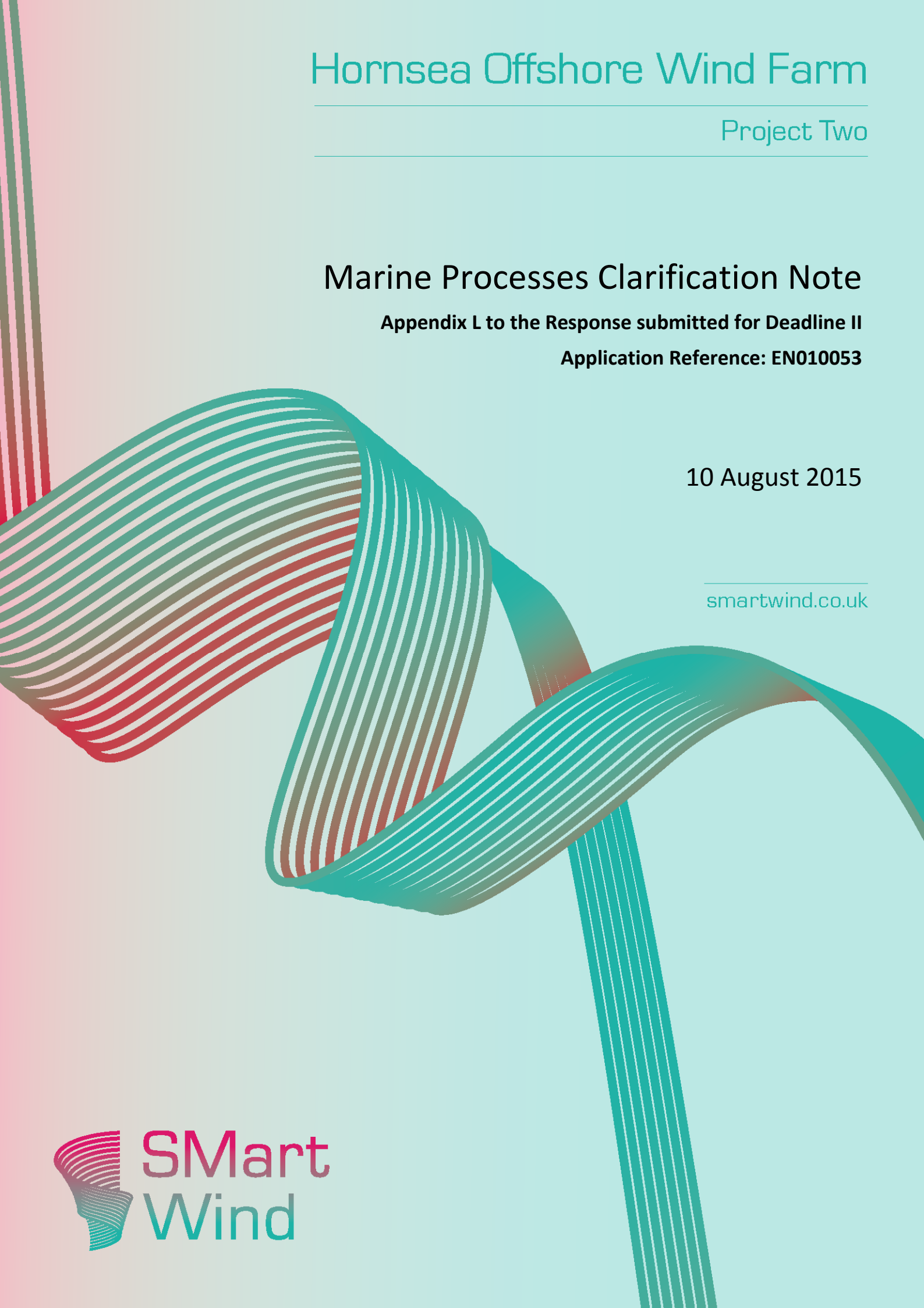

SMart Wind

Clarification Note on matters relating to Marine Processes as raised by the Environment Agency

1 Overview

1. The Applicant and the Environment Agency (EA) have entered into a Statement of Common Ground (SoCG), as submitted at Appendix NN of the Applicant's response to Deadline I. Within this SoCG a number of matters relating to Marine Processes (as raised within the EA's Relevant Representation) remained "Under discussion".
2. The EA has since provided further detail as to the nature of their outstanding concerns on these matters and this was reflected within their Written Representation as submitted by the EA at Deadline I.
3. This Clarification Note (which has been produced in support of the Applicant's comments on the EA Written Representation) responds directly these outstanding matters. Section 2 of the note summarises the matters raised and Section 3 provides the Applicant's response.

2. Summary of matters raised by the EA *(paragraph numbering as per EA's Written Representation)*

3.2 ***Consideration of tidal model sensitivity to climate change*** *- The Applicant refers to Lowe et al (2009) as the basis for their central estimate of sea level rise. The scientific communities understanding of climate change and sea level rise is constantly improving as further research is undertaken and evidence collected. This includes the work of Grinsted et al. 2010, Jevrejeva et al. 2010, 2012, and Church et al. 2013. Lowe et al (2009) focuses on providing a best-guess or a high- end estimate of future relative sea level rise, which does not have any probability attached. As such, it does not deal with the point raised in our representations about how the Applicant has addressed the potential impact of their development against potential changing climate change. They refer in Appendix D to the simple assumption that the sea level rise factor applied will apply equally across all tidal levels and to extreme sea levels. This takes no account of potential changes in storminess with climate change.*

3.3 From the evidence presented it does not appear that the Applicant has undertaken sensitivity analysis against the H++ scenario presented within the Environment Agency (2011) guidance to which they refer. In 2009 a new set of guidance, UKCP09 was published. This guidance included 3 different emissions scenarios (low, medium and high) – each scenario had lower and upper confidence intervals. The Environment Agency revised the PAG3 supplementary note on climate change with the Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (2011). That advice provides numbers to use for climate change in flood and coastal erosion risk management decision making and a methodology. The numbers used in the advice provide a representation of the uncertainty in the scientific knowledge of climate change, providing a change factor (the current best estimate of change) and an upper and lower end estimate to represent the majority of the range of confidence. For sea level rise, the 95 percentile of the

medium emissions scenario is used as the change factor as Greenland and Antarctic melting are not well represented in the UKCP09 sea level rise projections and the 50% was agreed as under-representing the risk.

3.4 Guidance for planners continues to reference Planning Policy Statement 25/PAG3 allowances, this is because a managed adaptive approach is not appropriate for development decisions and the old allowances are still thought a precautionary level to plan for. It should be noted though that sea level rise projections in UKCP09 although show close correspondence with the sea level rise allowances in PPS25/PAG3, UKCP09 does present a plausible high end scenario up to 1.9m for the UK. The older PAG3 guidance provided numbers for sea level rise, but not for changes to storm surge. The new advice does provide guidance for storm surges. The Applicant's assessment appears to have used the newer guidance but not to have taken account of the guidance on changes to storm surges and waves.

3.5 If the Applicant carried out some sensitivity analysis with the H++ scenario, this would result in the need to calculate sea level rise at 6mm per annum until 2025 and then rising at 12.5mm per annum from 2026 until 2050. In the Environment Agency (2011) guidance it also states that it is not possible to estimate how likely changes to storm surges are to occur but that the H++ storm surge scenario is considered to be more likely than the upper end of the H++ sea level rise range. As such we would have expected some assessment of this within the Environmental Statement (ES), especially if this has the potential to impact on the buried cable, or if this has the potential to interact with and potentially influence wave patterns as a consequence and hence flood risk (Volume 2 Chapter 1 - ES ref 7.2.01). It is our opinion that the assessment should include the 20cm during the 2020s, with 35 cm included in the assessment until the end of the life of the development.

3.6 ***Cable landfall burial depth and related assessment*** *- We welcome the clarification provided in Appendix D of our SoCG with regards to the cable landfall burial depth. However, the Applicant has yet to demonstrate what a potential revised beach profile, accounting for sea level rise and changes in elevation and shape of the foreshore in response to climate change, may look like and hence what the minimum level of cover over the cable in the longer-term will be. In paragraphs 3.5.124-3.5.125 of Volume 1, Chapter 3 (Project Description) of the ES, the Applicant refers to their preference to leave the cables in situ following decommissioning:*

> *Onshore decommissioning Cable landfall*
> *3.5.124 To minimise the environmental disturbance during wind farm decommissioning the preferred option is to leave cables buried in place in the ground with the cable ends cut, sealed and securely buried as a precautionary measure.*
> *3.5.125 Alternatively, partial removal of the cable may be achieved by pulling the cables back out of the ducts. This may be preferred to recover and recycle the copper and/or aluminium and steel within them.*

3.7 We request that the Applicant provides clarification as to what has been assessed, and present us with evidence to give confidence that the cables will remain buried to 2108 (which represents the lifetime of the Humber Flood Risk Management Strategy, which is 100 years from its publication in 2008). If it is the Applicant's intention to remove these cables and associated ducting following decommissioning of the wind farms, we would welcome clarification of this matter.

3. Applicant's response to EA's matters raised

Consideration of tidal model sensitivity to climate change

4. The Applicant acknowledges that a range of research and climate change scenarios are available and also that the subject of climate change is an evolving science.
5. Our previous response, to the Environment Agency's Relevant Representation (see Appendix D of Appendix NN of the First Response), referred to estimates of sea level rise as presented in Lowe *et al.* (2009) and the Environment Agency (2011) "Upper end estimate" scenario. If the Environment Agency's extreme H++ sea level rise scenario is applied (6 mm/year to 2025 and then 12.5 mm/year after that), and the upper end estimate for storm surge is also applied (20 cm to the 2020s and an additional 15 cm to the 2050s), the mean sea level rise including storm surges over the coming 25 years would be approximately 64 cm (assuming that the Project is operational from 2022), representing a maximum increase in water depth of approximately 2.5% at low tide. This would have a negligible effect on current speeds or wave heights, and on differences in current speeds or wave heights due to presence of the wind farm. It should be noted that this scenario is considered to be highly precautionary. Given these anticipated negligible effects, it is considered that over the lifetime of the project, climate change will be unlikely to have a material effect on the outputs of the tidal model.

Cable landfall burial depth and related assessment

6. Within paragraph 3.6, the Environment Agency's written representation suggests an approach whereby the Applicant should demonstrate how the (baseline) beach profile may change in response to climate change, with a view to understanding the implications for cable burial depths. In response to this the Applicant would highlight that the approach taken and presented in the ES (Volume 2, Chapter 1: Marine Processes (Doc ref No 7.2.1) does take account of the potential for changes on the intertidal to occur, and how any such changes may impact upon the burial of the cable/risk of cable exposure. This information is used specifically to inform a burial depth to avoid risk of cable exposure.
7. The approach that the Applicant has taken to this issue focusses on understanding the historic 'envelope' of changes across the intertidal and using this to inform the burial depth. This analysis is presented in full within the Landfall Assessment (see Section 3.6 of Volume 5, Annex 5.1.7: Landfall Assessment (Doc ref No 7.5.1.7)). The analysis allowed a quantified understanding to be developed of the historic variation in beach levels at the landfall site, to inform the consideration of a suitable burial depth.
8. Bi-annual topographic data from 1991 to 2012 was analysed at a number of relevant profile locations, together with available bathymetric data. The data

demonstrated different degrees of variability in beach levels along the length of the profiles. More specifically, bed level variations of around 0.5 m were recorded above Mean Sea Level (MSL), whilst between MSL and lowest astronomical tide (LAT) variations of up to 3 m were recorded and below LAT variations of up to 1 m were recorded over the 21 year period. The Marine Processes ES Chapter is based on a target burial depth of 2 m below the minimum recorded beach levels (as captured by the above analysis and presented in Volume 2, Chapter 1 and Volume 5, Annex 5.1.7 of the ES). Burial of the cable across the intertidal below the minimum recorded beach levels, allows for any future changes outside of the envelope of historic recorded change. Future changes in beach levels outside of the levels recorded historically could result from changes into the future due to climate change.

9. This approach has been used rather than attempting to predict the influence of climate change on the baseline environment at the shoreline. The Applicant would highlight that demonstrating the potential future influence of climate change at the shoreline has a high degree of uncertainty associated with it. This is especially the case where a quantified understanding is required.
10. At the location of the landfall, a 21 year time series of historic beach profile change is available from Environment Agency monitoring data providing further confidence in the understanding of past changes. Bearing in mind this availability of an evidence base in the form of recorded beach profile data and the uncertainties regarding predictions of climate change and their potential influence on beach morphology, the Applicant considers that the approach taken to understanding the required burial depth at the landfall to manage the risk of future exposure is appropriate. Furthermore, the Applicant notes that this matter has been agreed between the Applicant and Natural England (see Appendix 2 (Item 2.3) of Appendix XX of the First Response) and that Natural England note in their written representation that they are satisfied that climate change has been considered adequately within the assessment.
11. The Applicant would also highlight that burial depths are controlled, pursuant to Schedules I and K, Condition 10(2)(f) of the draft DCO, in terms of the pre-commencement approvals process via the Cable Specification and Installation Plan. This plan is required to include a detailed Cable Laying Plan and Cable Burial Depth Assessment.
12. Within paragraph 3.7 of the Environment Agency's written representation, the Environment Agency request evidence that the cable will remain buried for the lifetime of the Humber Flood Risk Management Strategy (100 years from its publication in 2088). The Applicant would highlight that, as noted above, a thorough assessment has been undertaken and presented using the best available data at the landfall. This assessment has been used to inform the burial depth.
13. In addition, paragraph 3.6 and 3.7 of the Environment Agency's written representation request clarification from the Applicant regarding the intentions for the cable at the landfall during decommissioning. The Applicant notes that Volume 1, Chapter 3: Project Description of the ES (Doc ref No 7.1.3) sets out details of the decommissioning of the Project. As noted in paragraph 3.5.120 of Volume 1, Chapter 3 of the ES, it is expected that most inter-array and export cables will be left in situ, however for the purposes of the EIA it has been assumed that all cables will be removed during decommissioning, to capture the worst case scenario.

14. Furthermore, the Applicant notes that, pursuant to Requirement 11 and Schedules H, I, J and K, Condition (19) of the draft DCO, a decommissioning programme and decommissioning plan will be developed by the Undertaker and submitted to the Secretary of State and the Marine Management Organisation (MMO) respectively for approval, prior to the construction of the Project. As noted in Appendix U of the First Response, the decommissioning programme and decommissioning plan will set out the means by which (together with technical detail) the scheme will be decommissioned, including whether the cables will remain in situ or removed.