Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Appendix 7 to Deadline 8 Submission: Response to Deadline 7 submissions on Fish Ecology

Relevant Examination Deadline: 8

Submitted by Vattenfall Wind Power Ltd

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Revision A

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1 Deadline 7 submissions on Fish Ecology

1 This document provides a detailed response to matters raised by the MMO at Deadline 7 with regards fish ecology.

2 Table 1 of this document provides a point by point response to the MMO's representation. The response highlights that in the Applicant's view, through reference to a substantive body of evidence, including revised modelling of highly precautionary scenarios (stationary receptor), there are no significant effects predicted on spawning herring or spawning sole.

3 The conclusions drawn by the Applicant are underpinned by a robust analysis of spawning distribution, and highly precautionary noise modelling outputs; as such there is high confidence in the findings. Given the confidence in the assessment, and the lack of a predicted significant effect, it is the Applicant's position that there is no justification for a seasonal restriction to be implemented.

Table 1 Point by point response to MMO on fish ecology matters

MMO D7 position	Applicant D8 Position
The MMO would add however that in respect of the Applicant's comment that: "Natural England have confirmed the modelling and assessment to be fit for purpose for HRA" – please note that Natural England (NE) is not responsible for providing advice in respect of these specific matters for TEOWF. Indeed, NE would look to the MMO to comment on issues outside of Marine Protected Areas.	The Applicant has sought to identify an apparent difference evidence required for EIA and HRA. Given clupeid fish form part of the Habitats Directive annex 2 species, noting herring is not one of the protected species, the Applicant considers it reasonable to identify as a parallel consideration. The Applicant considers this clarification to have been made explicit within its representations.
2.2 R17Q4.1.1 Sub-question a) Does the MMO hold any further evidence from its advisors or stakeholders on this matter that could usefully be submitted into the examination for consideration by the ExA? If so, please submit it at D7. (This could include scientific advice from CEFAS and/or comments from fishing and fisheries representative bodies.)	The Applicant welcomes confirmation from the MMO that impact in terms of injury is low. The Applicant can confirm that the Margate Sands complex forms a barrier to noise, as has been evidenced in multiple submissions. As is illustrated in Annex A of the MMO's submission (taking outputs from the Applicant's submissions) an illustrated output of noise levels at 150dB clearly demonstrates an

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The MMO advises that it has submitted all the available evidence in order to justify how its position has been reached. Notwithstanding, there have been further discussions and questions raised by both the Applicant and ExA prior to this deadline. As such, please see final points of consideration below. The MMO also directs the ExA to its extensive commentary submitted at deadline 6 which is not reproduced in full in this submission. Behavioural Impacts The MMO acknowledge that based on the updated modelling for a stationary receptor, the potential risk of significant impact in terms of injury or TTS for the Thames Estuary (Herne Bay) herring sub-stock is likely to be low. However, as previously advised, behavioural effects are more of a concern, hence the rationale for the proposed piling restriction. Behavioural changes can have a significant impact to a population if noise causes fish to move away from foraging or breeding grounds or to cease reproductive activities.	absence of interaction with anything to the west of the sandbank complex. The Applicant does not consider a demonstrable absence of any interaction to warrant mitigation such as a piling restriction.
The MMO previously requested that the Applicant should model the received levels of single pulse Sound Exposure Level (SELss) at the spawning grounds and that the modelled piling location/s should be based on the worst-case scenario. This would enable assessment of the potential risks of impact e.g. based on peer reviewed literature available. Following the MMO's comments, the Applicant submitted a number of clarifications to address concerns with respect to assessing behavioural impacts, these are discussed further as follows. The Applicant states that they have provided the peak Sound Pressure Level (SPL) which is recognised as more precautionary than SELss in the sense that for a single strike/single pulse the area	The Applicant has provided modelling outputs of all requested metrics, including SELss, and has presented an assessment according to the illustrated outputs. The Applicant welcomes confirmation that SPL is more precautionary than SELss. At no stage have the MMO requested that all contour plots be illustrated against herring spawning grounds. The Applicant agreed with the MMO and their scientific advisers to focus assessment on agreed metrics, as derived from the NOAA/NMFS criteria and the wider literature.

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ensonified is greater. The Applicant is correct in that the peak SPL is more precautionary than the SELss in this case due to the way this metric is modelled. The MMO acknowledge that the Applicant has provided the peak SPL contours in Annex 6-3 Underwater Noise Assessment (APP-086). This assessment was previously reviewed as part of the MMO's consultation on the Environmental Statement and nonetheless concerns were raised at the time with respect to behavioural impacts Figures 4-3 (Appendix A) and 4-4 of Annex 6-3 show contour plots for the modelled unweighted SPLpeak values for installing a monopile using a hammer energy of 5,000 kJ, for the East and South West locations respectively. Figures 4-5 and 4-6 show the SPLpeak contours for installing pin piles with the lower hammer energy of 2,700 kJ. However, these maps should show the spawning grounds/International Herring Larvae Survey (IHLS) data, so it is clear what noise levels spawning herring are predicted to be exposed to. Secondly, the Applicant has advised that the SELss metric was not remodelled (as requested) as part of the post application phase but was included in Annex 6-3 in addition to SPLpeak. "The SELss contours are shown in page 37 et seq of the report and demonstrate clearly that there is no effect receptor pathway between the proposed project and the Thames stock….I trust this addresses the behavioural concerns with regards the Thames stock west of the Margate Sands sandbank". The MMO acknowledge that some figures showing SELss contours have been provided in Annex 6-3. However, the SELss contour plots the Applicant is referring to relate to various (and limited) SELss	The Applicant notes that this was agreed under the auspices of the EIA Evidence Plan (App Ref 8.5) with explicit refence made to agreement being reached on "Fish ecology baseline characterisation and assessment scope". The Applicant welcomes confirmation provided in the MMO's D6 submission that the change in policy reflects an apparent concern over other developer submissions rather than anything based within the scientific literature that would drive a change in policy. The Applicant maintains its disappointment that matters agreed under the evidence plan have resulted in significant discussion due to a change in approach that is seemingly not underpinned by science but rather approaches taken on other developments. Notwithstanding this the Applicant provided the cross references to demonstrate that the SELss and SPL had both been modelled as requested. At this late stage in the examination the Applicant is surprised to have a request asking for illustrations of isopleths that have no relevance in the literature, in order to understand a potential effect on fish behaviour against an undefined metric for which there is limited scientific evidence. The Applicant can confirm that the SELss and SPLpeak metrics were not remodelled. This is because they were provided with the application. The illustrations referred to reflect unweighted thresholds, which were requested for marine mammals by Natural England (with MMO present). Because the metrics are unweighted

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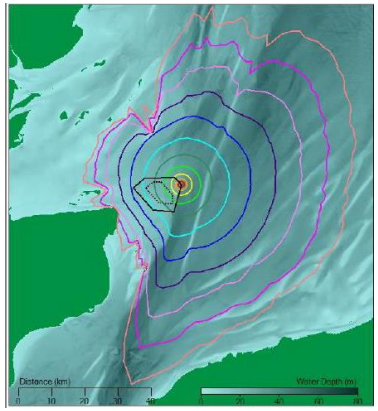
thresholds based on marine mammal noise exposure criteria (i.e. see Figure A5 in Appendix A showing the 179 dB and 145 dB SELss contours). As above, the herring spawning grounds should be clearly shown. To fully assess impact the Applicant should provide a figure (similar to Figure 4-3) of the modelled incremental SELss isopleths/contours, which include the noise levels at the herring spawning grounds.	they apply generally, and are not weighted to particular marine mammal noise exposure criteria. The Applicant's position is that incremental contours, whilst applicable to marine mammals, are simply not relevant for fish species in this context. The agreed noise criteria (Popper et al 2014, etc) agreed for fish are the best available evidence on which to base an assessment, and the Applicant is unclear why a range of isopleths are being requested at this late stage.
The Applicant questions what the merit of further SELss would be, and on what scientific evidence the request is made on. Should the MMO receive the appropriate information, it can determine whether a piling restriction is considered necessary for the Thames stock. Essentially, the MMO requires sight of either the modelled SPLpeak or SELss noise isopleths overlaid onto herring spawning grounds/appropriate IHLS data for the two modelled locations, in order to make an informed judgement on the potential risk of behavioural effects on spawning herring. Based on the evidence submitted by the Applicant to date, it is currently difficult to ascertain what the predicted noise levels will be at the spawning grounds. In the circumstances, the MMO must adopt a precautionary approach and maintain that the proposed restrictions are fully justified.	The Applicant considers there to be no appropriate evidence demonstrating that a behavioural effect would be experienced at the Thames spawning ground. The illustrations provided below clearly demonstrate that the Margate Sands complex forms a barrier to noise. For the avoidance of doubt the comparative figures below illustrate the historical herring grounds as defined by Coull et al (1998), and illustrated in the ES chapter, against the unweighted SPLpeak incremental contours. There is demonstrably no interaction and as such the Applicant considers any mitigation to be entirely unsupported.

MMO D7 position	Applicant D8 Position
	  The noise contours (right) clear show attenuation to the west of the project which is as a result of the Margate Sands complex. The Thames Stock spawning ground (Coull et al 1998), illustrated to the west of Thanet Extension (Downs stock to the east), is therefore well outside of the noise contour and would not be affected by piling.

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The MMO advise that the updated modelling clearly shows there is overlap with lower density spawning habitat (based on the 10-year IHLS dataset, see Figure 2 in Appendix A for reference). Whilst the MMO acknowledge the primary spawning (higher larval abundance) is further south, the IHLS data indicates that there is still spawning further north (9,400.1 – 27,700 total larval abundance per m2) close to (and actually within) the wind farm boundary. The MMO believe this alone should warrant a precautionary approach. As previously stated it is not possible to quantify spawning ground movement either spatially (e.g. km2) or over distance (e.g. km2). However to provide further clarity to the ExA and illustrate the point, the MMO have provided IHLS larval density maps from ICES (Appendix B), which demonstrate the extent to which the locations and concentrations of larval densities can vary from year to year. The maps provided cover a period from 2009 – 2017 (except for the 2014-15 survey when 2 out 3 surveys were cancelled due to inclement weather) with surveys being undertaken in three stages (16th - 31st December, 1st – 15th January and 16th – 31st January each year). This further illustrates the dynamic nature and variability of the spawning grounds.	The Applicant notes the MMO's submission of the IHLS larval density maps and can confirm that this data is the same as that used to produce the composite herring larval density charts according to the ORJIP methodology. The composite nature of the charts is designed to develop an understanding of spawning grounds and habitats. The Applicant notes however that of the figures produced there is a clear trend with the area surrounding the Thanet Extension project being of notably low density when compared wider component of the spawning stock. Whilst the Applicant agrees with the MMO that there is an overlap with the lower density areas of herring larvae, it is important to consider that the density at the higher end of the category is less than 1/10 of the peak density areas, (i.e. 9,400-27,700 vs 266000-314000 ind/m^2) and as such clearly of a far lower importance. The Applicant notes that the assessment has not considered there to be no impact, but that it considers the impact to be of minor significance, which is not significant with regards the EIA Regulations. The scale of effect predicted is clearly not significant.

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In addition, whilst it has not been possible in the time allotted to establish the extent to which IHLS sampling locations in the Southern North Sea have been reduced, the MMO can provide the follow comments extracted from the following ICES papers in relation to the IHLS surveys: · 'However, since the middle of the 1990s, IHLS survey participation and effort is too low to monitor the whole spawning season. In the last two decades, almost only the Netherlands and Germany participated in the herring larvae surveys' (ICES 2015). · 'The IHLS has changed over time and for the last decades is being run on a reduced spatial coverage. In addition, there is the perception that the spawning or hatching time of herring in, especially the southern North Sea is more variable if not changing' (ICES 2016). · 'The Downs TAC was set up to conserve the spawning aggregation of Downs herring. Uncertainties concerning the status of, and recruitment to, this component of the North Sea herring stock are high, and HAWG is not aware of any evidence to suggest that this measure is inappropriate' (ICES 2018). Consequently, as expanded on further in deadline 6, the MMO cannot agree that a particular percentage of a spawning stock affected by noise impact thresholds in any one year is accurate.	The Applicant considers this information to underpin its own assessment in drawing together a 10 year dataset rather than relying on a single dataset (as per the Cefas endorsed Ellis et al/Coull et al 1998 data). The Applicant has however provided a comparative assessment using the IHLS data to contextualise an impact on what is published as a spawning area. The Applicant's conclusions of no significant effect are based on the more precautionary spawning stock as published by Cefas, and the conclusions can be given weight because of the long term dataset which indicates that the use of the Coull et al 1998 spawning ground is likely to give an over estimate of the scale of effect. The assessment is therefore highly precautionary as it is based on the maximum design scenario on a discrete ground, rather than the effect associated with a maximum design scenario on the full Downs stock, which would intuitively be significant lower.
Sub-question b) The TOWF licence referred to a seasonal restriction period 'between mid-February and the end of April'. In the interests of precision and enforceability in this case, can the MMO specify particular dates for such restrictions? If so, what would they be and on what basis?	The Applicant notes, as published by the MMO and provided by the Applicant at Deadline 6A, that the seasonal restriction for the existing Thanet OWF was removed. The seasonal restriction was removed on the basis of the reasons laid out by the Applicant at Deadline 6A, notably that the Applicant had provided modelled outputs demonstrating an absence of effect-receptor pathway. The

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The MMO advises specific dates, suggested condition wording for the DMLs and justification for the restrictions suggested are supplied at 3.10 at section 3 – commentary on the Applicant's latest iteration of the dDCO. Sub-question c) As granted, the TOWF licence restricted noisy activities in the mid-February to end of April period, so as to avoid the main spawning period for Thames herring. In addition to a similar provision for this case, the MMO is also recommending a restriction from the end of November to January for the Downs stock. Could the MMO set out the reasons for the different approach in this case? The MMO advises that the restriction for the Downs stock and Thames stock relate to different potential impacts, namely injury and TTS with respect to the Downs stock and behavioural effects for the Thames stock. Regarding the differing recommendations between TOWF and TEOWF this has understandably been raised by the Applicant and is discussed in detail at 2.3.5 in response to sub-question 'e'. Sub-question d) If the MMO remains of the view that seasonal restrictions are necessary in this case, please could it provide draft wording for inclusion in the DMLs that it considers would provide appropriate security?	Applicant for Thanet Extension has provided equivalent, though based on more recent underwater noise metrics.
Sub-question e) The Applicant contends that the seasonal restriction forming part of the marine licence condition for the TOWF (referred to in (c) above) was subsequently removed, citing the following document by way of reference ('Review of Environmental Data Associated with Post-Consent Monitoring of Licence Conditions of Offshore Wind Farms', MMO, April 20141 at pg 87). Can the MMO	The Applicant can confirm that it considers there to be several parallels between the provided text and the proposed Thanet Extension project. These were made clear at Deadline 6A. The Applicant can also confirm that it suggested a suitable and proportionate compromise position would be to address certain residual components of the TOWF rationale for removal of the seasonal restriction by committing to piling only taking place over a

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please confirm whether this was indeed the case, and if so, when and why the condition was removed? The MMO confirms that the piling restriction licence condition was subsequently removed from TOWF in the year 2008. The MMO in consultation with Cefas agreed to removal of the piling restriction providing the following criteria were met: · It is based on the construction of up to 100 turbines. · That construction will be completed during 1st September 2008 and 30th September 2009. · All pile driving will be completed by 30th May 2009. · All foundations are to be installed by pile driving. · Pile driving does not overlap with construction of any other offshore wind farm developments in the outer Thames area during the spawning season. · Only one pile driving vessel is in operation at any point in time during the spawning season. · Pile driving is to start on 1st September 2008. · Piles are inserted at a frequency of approximately 1 every 2-3 days (The duration of piling per foundation to be approximately 5-7 hours). · Cefas would suggest that the developer provides the MFA and Cefas with a weekly update on progress during the spawning season (e.g. number of piles installed per row, rough duration of pile driving activity per pile and any problems or requirements to amend installation schedule). Noise measurements during the pile driving activities would be a useful addition to the monitoring programme and TOW are committed to undertaking underwater noise monitoring along transects 'West 270-1' and 'West 270-2' for the	single year as per the TOWF commitment, i.e. not piling in multiple winters. Given the availability of robust internationally respected herring larval data (IHLS) the Applicant does not feel it appropriate or proportional to undertake additional surveys.

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first four monopile installations. Cefas would also suggest monitoring of underwater noise during the spawning season. The methodology for the monitoring would need to be agreed with MFA and Cefas in advance. · A third spawning survey (if possible) during construction would be more statistically robust if all surveys show similar spawning patterns, post construction surveys for up to 3 years after construction would show whether the pile driving has any effect on the distribution and abundance of spawning fish (the type, timing and frequency of such surveys should be agreed with Cefas to minimise any potential adverse impacts on the viability of the spawning population).	
The Applicant has questioned, given some similarities with TOWF, whether the proposed piling restrictions for TEOWF are justified. To ensure clarity and context, whilst each case has been reviewed on its own merit, the MMO wish to highlight some important points which should be considered when comparing the applications and advices provided for TOWF and TEOWF: i. In TOWF application, two seasons of trawl surveys of the Thames herring spawning ground were provided as part of their evidence-based approach to seeking a removal of the condition. ii. TOWF had undertaken a noise modelling study of the potential attenuating effects of the Margate Sands complex in relation to the spawning area. The MMO advise that using the licence application, ES and licence conditions applied to TOWF as rationale and justification to support an application for TEOWF is not appropriate for the following	The Applicant's position set out at Deadline 6A was in response to the MMO's suggestion that a seasonal restriction should be applied because of TOWF having a seasonal restriction (for Feb-Apr, not Nov to Jan, and not for sole). The Applicant has made limited reference to the existing TOWF project, until the MMO brought the issue of TOWF to its attention, and then becoming aware that the seasonal restriction had been removed. At that point the Applicant has sought to highlight this with the MMO and the ExA. It is therefore entirely incorrect to suggest that the Applicant is relying on 10 year old advice instead of the robust assessment submitted with the application. This clarification aside the Applicant notes that there are clear similarities, and it would not be reasonable to overlook them. 1. The Thanet Extension project has identified and utilised 10 years of IHLS data. The same data that has been agreed with

MMO D7 position	Applicant D8 Position
reasons: Technical advice is sought on a case by case basis using best available evidence in order to consider the potential impacts of a project/development based on the proposed activities specific to that project. The MMO would expect an Applicant to do the same for their EIA rather than depend on old assessments/old data and refer to TOWF advice which is over 10 years old. The additional 34 WTGs being installed for TEOWF will require installation of piles over a wider area, i.e. placement of turbines will extend further North, South, East and West surrounding TOWF, creating an overall larger footprint, and consequently noise and vibration from piling is likely to propagate over a wider area. Consequently, the scale of impacts has the potential to increase when compared to that originally assessed for TOWF. The advice provided for TOWF was based on best available evidence at that time but there are some key differences to the way in which EIAs have changed since this time: · It is not clear that IHLS data in heat-mapped form was used to demonstrate concentrations of larval densities for the Downs stock to inform the assessment of impacts from noise. The use of IHLS data is now commonplace for applications for OWFs and aggregate licence applications. · If IHLS data were used to support the assessment of impacts to the Downs herring population for TOWF, then the data are now over 10 years old and not considered recent enough to support the assessment for TEOWF. · A key point to note is that the underwater noise modelling	Cefas as appropriate, and the same data used to manage herring stocks at a North Sea and regional scale. 2. Thanet Extension has undertaken and submitted a comprehensive body of underwater noise modelling. This demonstrates, as illustrated in this document, that the Margate Sands complex attenuates noise. The Margate Sands complex has not stopped attenuating noise in the interim period between the TOWF project and the TEOWF application. 3. The Application for Thanet Extension has been underpinned by the best available data (IHLS and Cefas data) and modelling undertaken of all relevant metrics, including highly precautionary assumptions regarding no fleeing response. 4. The statement regarding installation over a wider area, because of Thanet Extension surround the existing OWF, and therefore having a larger footprint would be accurate if the project was proposing simultaneous piling at more than one WTG location. It is not. The Application is for single piling events and as such the scale of impact relates to a sequence of single piling locations. Given the individual WTG piling durations for the projects are the same, sequential piling for 100 WTGs inherently takes a longer period of time that a sequence of piling events for 36 WTGs. Sequential piling time is critical when considering the impact on a discrete spawning season, hence the Applicants utilisation of spawning potential which incorporates both space and time. 5. The use of IHLS data by TOWF, or not, seems to have limited relevance for comparison – the Thanet Extension project is

MMO D7 position	Applicant D8 Position
undertaken for the EIA for TOWF was done using dBht. The use of the dBht metric is no longer considered appropriate in noise impact assessments.	using IHLS data to confirm a seasonal restriction is not needed. 6. The relevance of dBht is also unclear. The Applicant recognises dBht as a metric is now infrequently used, and has not sought to use it for the Thanet Extension project, instead relying on the best available evidence, guidance, and agreement with the MMO and Cefas as part of the evidence plan.
Sub-question f) Does the MMO consider that it is necessary to impose any seasonal restrictions in relation to noise effects on sole spawning grounds? If so, on what basis and what, precisely, would be the restriction period? At deadline 6 the MMO advised that to date the Applicant had not provided certain elements of modelling prior to that deadline, in order to draw a fully informed conclusion. The Applicant submitted a number of clarifications in order to try and address this. The Applicant's clarifications do not negate the need for the evidence requested. Specifically, a figure showing noise contours overlaid onto identified sole spawning grounds is required. To fully assess the impacts to sole the Applicant should provide a figure showing the noise modelling (based on a stationary receptor) for the East and South-West locations overlaid onto identified sole spawning grounds data. The responses provided by the Applicant in relation to sole so far have focused on the use of calculation of total spawning habitat which, as stated most recently at deadline 6 (REP6-0XX) is not supported for reasons expanded on in that commentary.	The Applicant has confirmed that the assessment as presented at Deadline 4C was based on a static receptor. For the avoidance of any doubt the Applicants Appendix 7 to its Deadline 4C submission stated (at paragraph 25 in relation to sole): Taking the worst-case modelled range at 186 dB SELcum, *and assuming that an adult fish will not respond to the stimulus* this covers an area of approximately 1,224 km2, the effect on spawning potential for sole is limited to 0.786% of the higher intensity spawning grounds in the region (which cover approximately 31,866 km2). Assuming a more robust approach, which incorporates the likely scenario that the fish will flee the source of noise, the potential impact on sole spawning potential is limited to a maximum of 0.105%.

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Additionally, as stated previously the MMO do not support the assumption of a fleeing fish for use in modelling. The suggestion of fish fleeing from their spawning grounds is one of concern and the MMO would not consider this “a more robust approach”’ as stated in paragraph 26 of Appendix 7 to their Deadline 4c submission and Annex A.	

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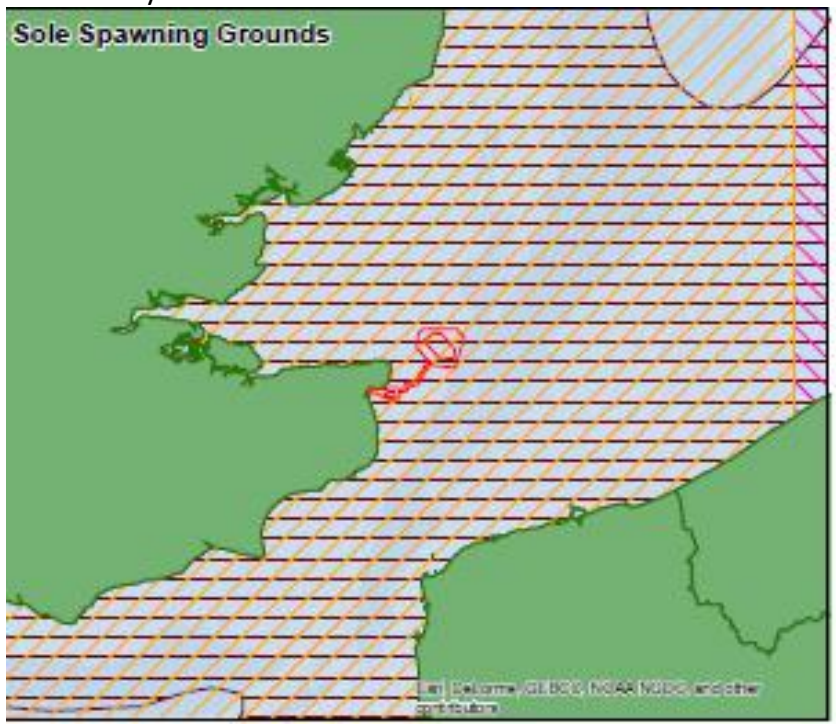
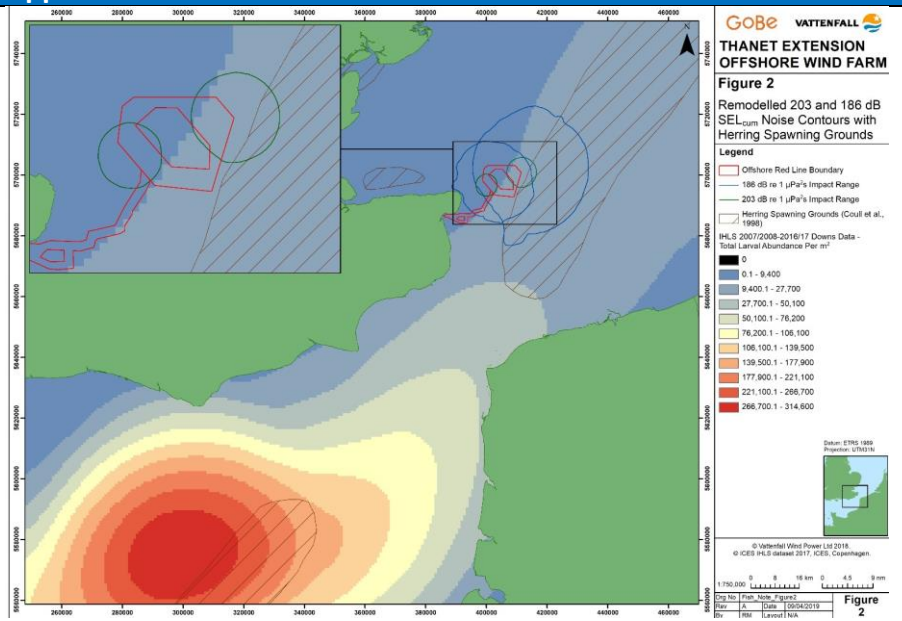
The noise contours depicted in Figure 3-4 (Appendix A) indicate that noise propagation will travel in a West to East direction i.e. away from the Thames Estuary sole spawning grounds. However, as stated above, as the noise contours have not been overlaid onto identified sole spawning grounds data it is not possible to tell the extent to which sole spawning grounds are likely to be affected. Furthermore, Figure 3-4 is for the East modelling location only, the South-West modelling location is also required due to its proximity to the Thames Estuary and sole spawning grounds. Based on the current evidence using best judgement and existing knowledge of the extent of high intensity sole spawning grounds within the Thames Estuary, the MMO is inclined to believe that as noise propagation is travelling away from the estuary, a piling restriction may not be necessary for sole. However, the MMO position is that this should be verified through presentation of the appropriate East and South-West noise contour maps with sole spawning grounds data overlaid as outlined in points 5-6. This will provide, the most suitable depiction of the potential impacts of noise in support of concerns raised by the MMO as well as that of other consultees and stakeholders who have a vested interest. In absence of further modelling to fully assess the possible impacts, the MMO has to adopt a precautionary approach and recommend that a seasonal restriction for sole is imposed at this time – please see details of the restriction at 3.10 of section 3.	The Applicant has based its assessment on the worst case spatial effect on spawning sole. The spawning grounds being determined through an open and transparent presentation of Cefas published data (illustrated below as an excerpt from Figure 6.4 of chapter 6.2.6). Given the spatial extent of the sole spawning grounds as illustrated below it is the Applicant's position that in the absence of more refined spawning ground data the WTG location with the maximum zone of effect (the deepest WTG) is the most appropriate measure by which to consider an assessment. 

MMO D7 position	Applicant D8 Position
	Notwithstanding this the Applicant has presented an assessment of effect on spawning potential which considers a maximum design scenario (deepest/worst case location) and a minimum design scenario (best case location/shallowest) and then presented a 'mean' or average impact (Annex A to Appendix 7 of the Applicants D4C submission). The conclusion, assuming the maximum design scenario for all 36 piling locations (highly precautionary and practically unrealistic) for a non-fleeing receptor, is an impact of 0.786% of spawning potential. The Applicant considers this to be negligible and would note that there are no recent or historic precedents within the region. The Applicant notes and welcomes the MMO's confirmation that a seasonal restriction may not be necessary on confirmation that the east and south-west noise contours are illustrated to demonstrate that the dominant direction of noise propagation is away from the estuary. The Applicant has provided evidence of this previously in this document and would note that the MMO provided a similar figure within their D7 submission. Notwithstanding this, the Applicant considers the figure presented in Appendix 7 of the Applicant's D4C submission to clearly demonstrate that the dominant direction of travel for the noise contours at both the SW and E noise modelling location is away from the estuary:

MMO D7 position	Applicant D8 Position
	

MMO D7 position	Applicant D8 Position
2.3 R17Q4.1.2 Potential Construction Noise Effects on Fish: submissions and evidence from the Applicant Further the issue raised in R17Q4.1.1, in the absence of agreement, the following evidence is sought from the Applicant at D7 with comments from the MMO by D8: *Sub-question d) The Applicant's reservations about the effectiveness and justification for the use of bubble curtains are noted from responses to ExQ1 [REP1- 024] and Appendix 27 Annex A of the Applicant's D6 submission. However, could bubble curtains or other 'at source' mitigation techniques be used to remove or limit the extent of seasonal restrictions? If so, how would they be secured within the DCO/DML?* The MMO agrees that, in principle, bubble curtains and other at source mitigation techniques could be used to remove or limit the extent of seasonal restrictions. However the MMO is unable to assess the extent of impact and provide information on the circumstances of deployment, methodology and effectiveness on TEOWF without further evidence from the Applicant.	The Applicant has provided a clear and robust assessment, the conclusions of which are based on appropriate evidence and methods agreed with the stakeholders. The Applicant's evidenced view is that there is a complete absence of effect-receptor pathway for the Thames spawning stock. The Applicant's evidence view is that the interaction with the Downs stock is negligible when considering the discrete spawning ground published by Cefas. The potential impact on eggs and larvae, when assessed using agreed metrics, and a method of calculation that is well established, is 0.07% of the discrete spawning ground. When considered against the wider Downs spawning stock any interaction is considered likely to be to be *de minimis*. The Applicant has presented all information as requested by the MMO and have provided relevant information with regards the likely behavioural effects on herring. Fundamentally it is the Applicant's position that a seasonal restriction or other form of significant mitigation should only be applied where there is risk of a significant adverse effect on a receptor – such as spawning. Given the absence of any behavioural criteria, or suggestion that there is a negative behavioural impact on spawning stock that is identified within the long term IHLS datasets which correspond with long term periods of OWF construction, there is limited scientific or policy justification for such mitigation to be implemented. Any such mitigation measure would be disproportionate when considered against the scale of effect and is not supported scientifically or in policy.

MMO D7 position	Applicant D8 Position
Should piling restrictions be conditioned on the marine licence as per the MMO's recommendations, the MMO is willing to consider changes to any conditions through a variation mechanism in light of new supporting evidence. The MMO advises that bubble curtains or other mitigation techniques would be best secured through inclusion in an existing or new pre-construction plan or document. This would secure the need to implement specific mitigation measures whilst enabling approval of the methodology by the MMO in consultation with the relevant stakeholders prior to commencement of the licensed activities.	The Applicant has provided full and detailed evidence in support of the application and has demonstrated that no such mitigation is warranted. The Applicant notes that MMO's position appears to be that this issue is not based on new scientific evidence but rather a change in policy driven by other developments. It remains the Applicant's position that given the absence of any new scientific evidence underpinning the change in policy it is not appropriate to retrospectively apply it. Notwithstanding this, and the methodological concerns the Applicant has about apply unrealistic levels of precaution, the Applicant has sought to provide the information requested at Deadline 4C and has repeatedly requested meetings to discuss these matters with the scientific advisers at Cefas, however these has not been forthcoming.
Proposed DCO wording	
Taking final matters into account and further to commentary provided at section 2 - response to the ExA's final written questions, the MMO advise that mitigation for herring and sole spawning grounds should be secured on the DMLs in the form of seasonal restrictions. Such restrictions should be drafted as conditions on the DMLs as follows:	Specific points addressed below
Downs (North Sea) herring stock: "No pile driving works shall be carried out by or on behalf of the undertaker as part of or in relation to the authorised scheme between 1st November and 31st January each year unless the MMO provides written confirmation to the undertaker beforehand that	The Applicant considers the body of evidence submitted before the ExA to clearly demonstrate that there is no interaction with the Downs Herring stock. The parallels between the TOWF case and the Thanet Extension project are such that the ExA can apply weight to this position with confidence. Notwithstanding this the Applicant

MMO D7 position	Applicant D8 Position
such works can take place, in all or in a specified part of the site, during this period or a part of this period." Reason: to minimise the risk of potential impact from underwater noise resulting from piling operations on the Downs herring stock.	would be willing to accept wording within the DCO requiring piling to be complete within one year and not to extend beyond a single winter. This wording could be added to the current construction monitoring programme condition of each DML (Condition 13 and 11 of the generation and export cable DML respectively) to alter part (b)(iv) to read: (b) A construction programme and monitoring plan to include details of— (iv) an indicative written construction programme for all wind turbine generators, offshore substation, meteorological mast *(restricting piling works to not extend beyond a single winter)*, buoys and cables comprised in the works at paragraph 1 of Part 3 (licenced activities) of this Schedule (insofar as not shown in paragraph (ii) above);
Thames herring stock: "No pile driving works shall be carried out by or on behalf of the undertaker as part of or in relation to the authorised scheme between 1st February and 30th April each year unless the MMO provides written confirmation to the undertaker beforehand that such works can take place, in all or in a specified part of the site, during this period or a part of this period." Reason: to minimise the risk of potential impact from underwater noise resulting from piling operations on the Thames herring stock.	The Applicant considers the body of evidence submitted before the ExA to clearly demonstrate that there is no interaction with the Thames Herring stock. The parallels between the TOWF case and the Thanet Extension project are such that the ExA can apply weight to this position with confidence.
Dover sole stock: "No pile driving works shall be carried out by or on behalf of the undertaker as part of or in relation to the authorised scheme between 1st March and 30th April each year unless the MMO provides written confirmation to the undertaker beforehand that	The Applicant considers the evidence provided, and the confirmation provided by the MMO, that a seasonal restriction for sole may not necessary to provide confidence in the detailed assessment presented.

MMO D7 position	Applicant D8 Position
such works can take place, in all or in a specified part of the site, during this period or a part of this period." Reason: to minimise the risk of potential impact from underwater noise resulting from piling operations on the Dover sole stock.	The Applicant has provided the evidence requested by the MMO to conclude that a seasonal restriction for sole would not be required, and has complemented it within this document and therefore considers a seasonal restriction for sole to not be required.