East Anglia ONE North and East Anglia TWO Offshore Windfarms

Applicant's Responses to Relevant Representations

Appendix 5
Outer Thames Estuary Cabling Note

Applicant: East Anglia ONE North Limited
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Applicable to East Anglia ONE North and East Anglia TWO

Revision Summary				
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Glossary of Acronyms

CD	Chart Datum
ExA	Examining Authority
EIA	Environmental Impact Assessment
ES	Environmental Statement
HDD	Horizontal Directional Drilling
Km	Kilometre
MDD	Maximum Dive Depth
Mg	Milligrams
MMO	Marine Management Organisation
NE	Natural England
PINS	Planning Inspectorate
RMS	Root Mean Squared
SPA	Special Protection Area
SPL	Sound Pressure Level
SSC	Suspended Sediment Concentrations
TTS	Temporary Threshold Shift

Glossary of Terminology

Applicant	East Anglia ONE North Limited
Construction, operation and maintenance platform	A fixed offshore structure required for construction, operation, and maintenance personnel and activities.
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia ONE North project	The proposed project consisting of up to 67 wind turbines, up to four offshore electrical platforms, up to one construction operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia ONE North windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach to the EIA and the information required to support HRA.
Horizontal directional drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
Inter-array cables	Offshore cables which link the wind turbines to each other and the offshore electrical platforms, these cables will include fibre optic cables.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land and connect to the onshore cables.
Offshore	Area to seaward of nearshore in which the transport of sediment is not caused by wave activity.
Offshore cable corridor	This is the area which will contain the offshore export cables between offshore electrical platforms and landfall.
Offshore development area	The East Anglia TWO / East Anglia ONE North windfarm site and offshore cable corridor (up to Mean High Water Springs).
Offshore electrical platform	A fixed structure located within the windfarm area, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Offshore export cables	The cables which would bring electricity from the offshore electrical platforms to the landfall. These cables will include fibre optic cables.
Offshore platform	A collective term for the construction, operation and maintenance platform and the offshore electrical platforms.
Platform link cable	Electrical cable which links one or more offshore platforms, these cables will include fibre optic cables.
Safety zone	A marine area declared for the purposes of safety around a renewable energy installation or works / construction area under the Energy Act 2004.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water.

1 Introduction

1. This document is applicable to both the East Anglia ONE North and East Anglia TWO applications, and therefore is endorsed with the yellow and blue icon used to identify materially identical documentation in accordance with the Examining Authority's (ExA) procedural decisions on document management of 23rd December 2019. Whilst for completeness of the record this document has been submitted to both Examinations, if it is read for one project submission there is no need to read it again.

2. Natural England (NE) provided their relevant representation (Section 56 response) on the proposed East Anglia ONE North and East Anglia TWO windfarm projects (the Projects) to the Planning Inspectorate on 27th January 2020.

3. NE had comments relating to the potential impacts of seabed preparation, cable laying and cable protection activities on the supporting habitats of the Outer Thames Estuary SPA and prey species for red-throated diver *Gavia stellata*. This has been considered in the EIA across several thematic areas and including physical processes, benthic ecology and fish and shellfish ecology. The Applicant has assessed the supporting habitat effects within the EIA, but the supporting habitat was not screened into the Habitats regulations assessment (HRA).

4. The purpose of this technical note is to provide clarity on the points made by NE in their relevant representation, drawing on the assessments and conclusions (and associated figures) made within the following ES documents:

- ***Chapter 4 Site Selection and Assessment of Alternatives*** (APP-052)
- ***Chapter 6 Project Description*** (APP-054)
- ***Chapter 7 Marine Geology, Oceanography and Physical Processes*** (APP-055),
- ***Chapter 9 Benthic Ecology*** (APP-057),
- ***Chapter 10 Fish and Shellfish Ecology*** (APP-058);
- ***Chapter 12 Offshore Ornithology*** (APP-060);
- ***Appendix 7.2 Individual Project and Cumulative Wave Modelling*** (APP-455);
- ***Appendix 11.4 Underwater Noise Assessment*** (APP-468)
- ***Appendix 10.2 Fish and Shellfish Ecology Technical Appendix*** (APP-463);
- ***Figure 10.14*** Herring Spawning and Nursery Grounds (APP-142);

- ***Figure 10.26*** Sandeel Spawning and Nursery Grounds (APP-154);
- ***Figure 10.45*** IHLS Herring Small Larvae Abundance (2006-2017) in Relation to Worst Case Noise Impact Contour (APP-173); and
- ***Site Characterisation Report (Offshore Cable Corridor)*** (APP-593)

2 Assessments of the Outer Thames Estuary Supporting features within the EIA

5. The following sections of the Environmental Statement directly assess the supporting features of the Outer Thames Estuary SPA:

- ***Chapter 7 Marine Geology, Oceanography and Physical Processes***
    - Supporting features (sandbank habitat) have been considered within the assessment of effects on the 'Suffolk' Natura 2000 site within the following sections:
        - ***Section 7.6.1.5*** Changes in Suspended Sediment Concentrations During Export Cable Installation
        - ***Section 7.6.1.6*** Changes in Sea Bed Level due to Export Cable Installation
        - ***Section 7.6.2.7*** Morphological and Sediment Transport Effects due to Cable Protection Measures for Export Cables
        - ***Section 7.7*** Cumulative Impacts
- ***Chapter 9 Benthic Ecology***
    - Supporting features (sandbank habitat) have been considered in the following sections:
        - ***Section 9.6.1.5*** Potential Impacts on Sites of Marine Conservation Importance
        - ***Section 9.6.2.8*** Potential Impacts on Sites of Marine Conservation Importance
        - ***Section 9.7.2.5*** Impacts Upon the Outer Thames Estuary SPA during Construction (cumulative)
- ***Chapter 10 Fish and Shellfish Ecology***
    - Supporting features (prey species) have been assessed in the following section:
        - Impacts on sandeel and other fish species associated with the site are presented in ***sections 10.6.1*** and ***10.6.2***.

2.1 East Anglia TWO worst case cable route

6. The proposed East Anglia TWO project includes two potential offshore cable corridor routes from the landfall to the East Anglia TWO windfarm site (see ***Figures 1-3***). The northern route would allow for a connection to an offshore

electrical platform in the north of the East Anglia TWO windfarm site. The southern route allows for connection to an offshore electrical platform in the centre or south of the East Anglia TWO windfarm site and covers a maximum area of 98.9km^2. The northern route has sufficient width within the cable corridor to include export cables for both the proposed East Anglia TWO project and the proposed East Anglia ONE North project and therefore represents the worst-case in terms of maximum offshore cable corridor area (137.6km^2). The northern route also represents the worst case in terms of interaction with the Outer Thames Estuary SPA and therefore all areas of interaction in this note are based upon the northern route. 81.9% of the offshore cable corridor area is located within the SPA.

7. The East Anglia TWO DCO application includes both routes, however only one route will be used for the proposed East Anglia TWO project (***section 6.5.1*** of ***Chapter 6 Project Description***).

2.2 East Anglia ONE North worst case cable route

8. The proposed East Anglia ONE North project includes one potential offshore cable corridor route from the landfall to the East Anglia ONE North windfarm site (***Figures 1-3***) which covers a maximum area of 133km^2 (***section 6.5.1*** of ***Chapter 6 Project Description***). 85.1% of this offshore cable corridor area is located within the SPA.

2.3 Sand Wave Levelling Worst-case

9. It is intended that the cables for the Projects would be buried below the sea bed at depths of 1 to 3m. The actual depths would be determined following detailed investigations and design. Details of this will be provided post-consent in the Design Plan (Conditions 17 of the generation DML and 13 of the transmission DML) and other documents such as the cable laying plan. In some areas, where large sand waves or megaripples are present, sea bed levelling may be required before the cables can be installed. Such levelling would only be intended to prevent exposure of the cables and the formation of free-spans.

10. As described in ***section 7.3.2.5.1*** of ***Chapter 7 Marine Geology, Oceanography and Physical Processes***, worst-case indicative volumes of sediment removed for sand wave levelling (pre-sweeping) would be up to1,000,000m^3 *for the entire offshore cable corridor* for a single project This volume is based on the under-construction East Anglia ONE project which is similar in scale and has a similar geographical area to the Projects. This is based upon:

- The profile of levelling works along export cables would be 60m wide, with an average depth of 2.5m, a slope gradient of 1:4 and a worst-case assumption of 10km sand wave levelling / pre sweeping being required, resulting in an area of sea bed of up to 800,000m^2 being affected.

11. There may also be a requirement for backhoe dredging in the offshore cable corridor, for example, at the Horizontal Direct Drilling (HDD) pop-out location or in areas of difficult ground, which would result in a maximum volume of 68,800m^3 of sediment displacement for two export cables. This is based upon:

- Up to 2.5% (2km) of each export cable may require dredging. This would be up to a max width of 8.6m and a depth of 4m in a v-shaped trench cross section, resulting in a maximum area of sea bed disturbance of 34,400m^2.

12. Any required sand wave levelling is anticipated to be in discrete areas and not along the full length of the corridor. Sand wave levelling could be required at any location across the offshore cable corridor, however, for the purpose of this clarification note, the worst-case assumed that this was all within the SPA. For East Anglia ONE North and East Anglia TWO, 85.1% and 81.9% of the cable corridor area is actually within the SPA respectively.

13. The sediment would be removed using a modern, commercial scale trailer hopper suction dredger (THSD) (see ***Chapter 6 Project Description, section 6.5.10.15***). The THSD would then release the dredged materials in a licensed disposal area (see the ***Figure 1*** in the ***Site Characterisation Report (Offshore Cable Corridor)***). It is envisaged the vessel would dispose sediment in transit to aid dispersion, a process which will also be aided by natural processes. This approach will ensure material is dispersed across the whole disposal site to reduce mounding. An indicative total capacity of the THSD would be 25,000m^3 which could be deposited in a single dispersive disposal event.

2.4 Disturbance to Supporting Habitats

2.4.1 Direct Impacts on Supporting Habitat

14. There are areas of sandbank habitat inshore of the offshore cable corridor which are supporting features of the Outer Thames Estuary SPA (designated for red throated diver). Direct impacts on the mapped sandbanks[1] have been avoided through the site selection process (***Chapter 4 Site Selection and Assessment of Alternatives***) (see ***Figure 1***) however there is potential for smaller unmapped sandbanks and sand waves to be encountered during preconstruction surveys which may potentially require to be levelled to ensure the export cable(s) is

[1] The mapped sandbanks are taken from the SNCB data layer ‘Annex 1 Sandbanks in the UK v2’. Available at: https://data.gov.uk/dataset/d19f631c-27c0-4c74-804f-d76a4632b702/annex-i-sandbanks-in-the-uk-v2-public

installed at a depth below the sea bed surface that is unlikely to require its reburial throughout the life of the project.

15. Shallow sand banks would be avoided as far as possible by micro-siting, however there is potential for portions of these and smaller sand waves to be levelled during export cable installation. In terms of direct impact (see ***Chapter 9 Benthic Ecology, section 9.6.1.5***), the removal of sand waves could potentially result in a temporary reduction or change in location of the food sources of red throated diver (but see ***section 2.4.2***, below). The overlap of the offshore cable corridor with the SPA (i.e. area of the SPA included within the offshore cable corridor) is shown in ***Table 1*** below:

Table 1: Overlap of Offshore Cable Corridors and direct disturbance within the Outer Thames Estuary SPA (SPA area of 3792.68km^2)

Project	Overlap of cable corridor with SPA (worst case) (km^2)	Overlap of cable corridor (worst case) (% of SPA)	Direct disturbance within the SPA (km^2)	Direct disturbance within the SPA (% of SPA)
East Anglia ONE North	113.5	2.99	3.84	0.098
East Anglia TWO	112.7[2]	2.97	3.6	0.09

16. The overlap of the offshore cable corridor with the SPA is 113.5 and 112.7km^2 respectively for East Anglia ONE North and East Anglia TWO. Direct disturbance within the offshore cable corridor however would be significantly smaller (3.84km^2 and 3.6km^2 respectively) and relates only to the area disturbed during installation of each export cable within the wider corridor.

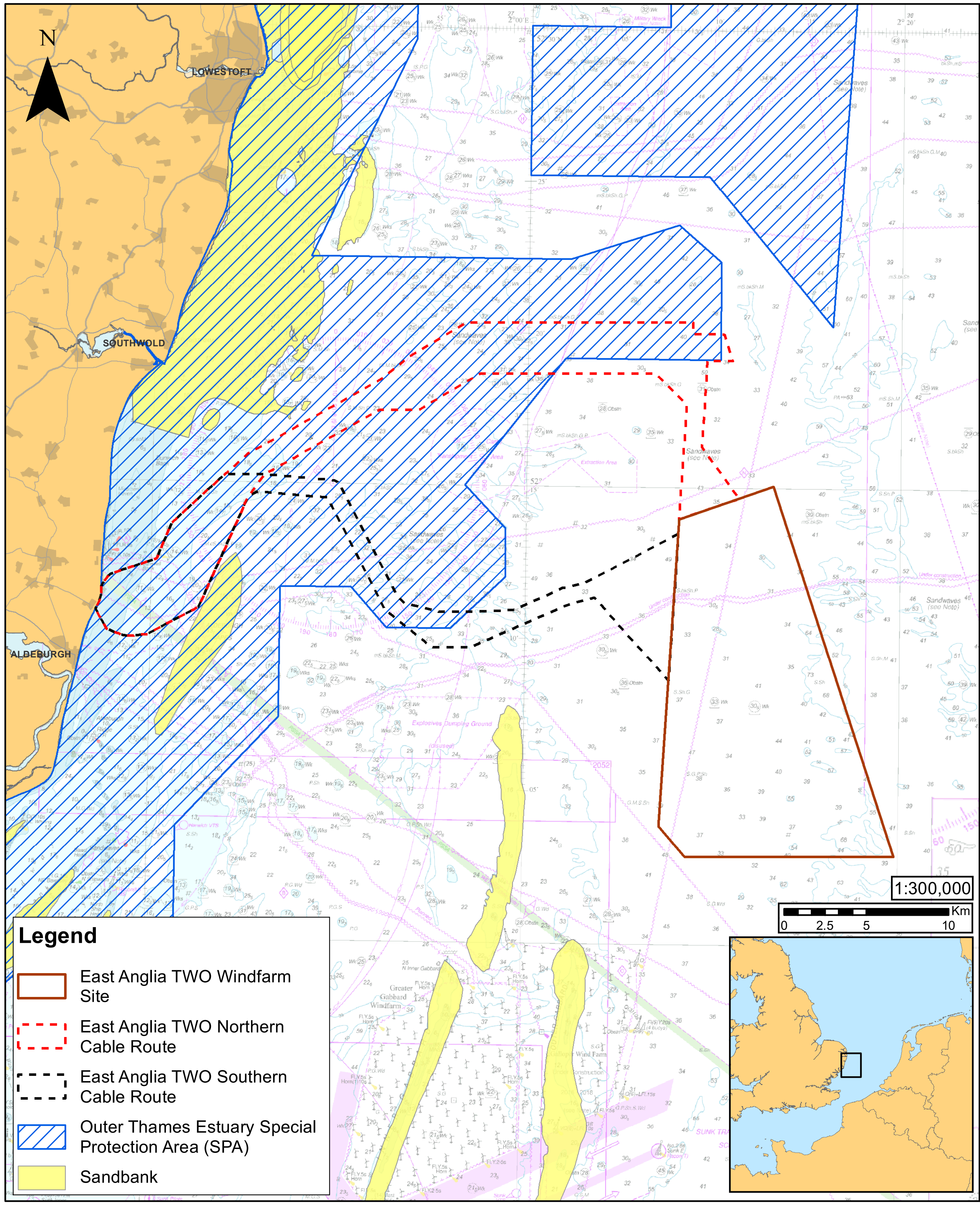
17. Therefore, the area of direct impact upon supporting habitat is negligible (<0.1% of the SPA area) in comparison with the overall resource.

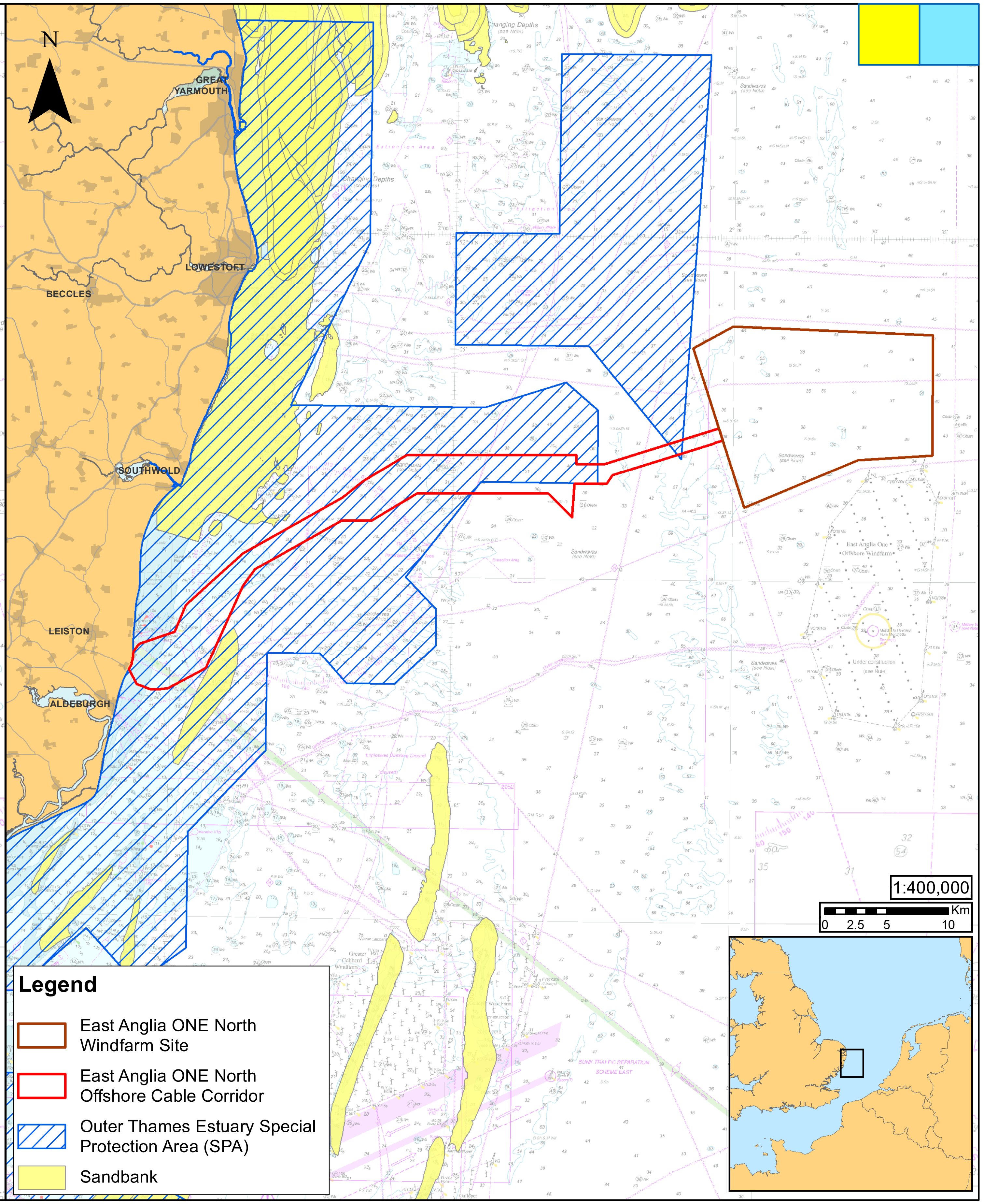
18. This area of the southern North Sea is naturally dynamic, experiencing strong tidal currents and mobile sediments and therefore the fish and crustacean species (i.e. the prey of red throated diver) present in the area, would be expected to be largely tolerant to the anticipated levels of disturbance caused by sand wave levelling (***section 10.6.1.1*** of ***Chapter 10 Fish and Shellfish Ecology***).

[2] The northern route of the offshore cable corridor for East Anglia TWO is considered worst case and the area of overlap with the SPA is 112.7km^2. An approximated overlap area of 132km^2 was cited in ***section 4.3.1.2*** of ***Information to Support Appropriate Assessment Report*** (APP-043) however this was based on the southern and northern route combined.

Please also note that the figure of 137.6km^2 referenced in ***section 7.3.2.5.1*** of ***Chapter 7 Marine, Geology, Oceanography*** and ***section 9.3.2.4.3*** of ***Chapter 9 Benthic Ecology*** is the entire East Anglia TWO northern cable corridor route and is inclusive of the area outside of the SPA.

19. Over time, sand waves would be expected to re-form and the area to return to baseline conditions. Sand wave levelling would only be in discrete areas along the export cable route and the extent of this activity is considered to be small in relation to similar available habitat within the wider Outer Thames Estuary SPA. Overall, the direct removal / levelling of sand waves from within the Outer Thames Estuary SPA would therefore result in an impact of **negligible adverse** significance (***section 9.6.1.5*** of ***Chapter 9 Benthic Ecology***).





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East Anglia TWO and East Anglia ONE North

Sub-tidal Sandbank Features and Outer Thames Estuary SPA

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Rev	1
Date	24/02/20
Figure	1

Datum: WGS 1984
Projection: Zone 31N

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2.4.2 Impacts on Prey Species for Red Throated Diver

20. Red-throated diver mainly forage for fish that live near the surface or in the main water column, although in the winter they will sometimes take bottom-dwelling fish (Natural England, 2012). Their diet can also include crustaceans, molluscs and marine worms (Natural England, 2012).

21. In terms of bottom-dwelling fish, herring and sandeel are substrate specific spawners and therefore are potentially more susceptible to any impacts relating to physical disturbance and temporary habitat loss. Herring spawn on coarser substrates such as coarse sand, gravel, shells and pebbles (***section 10.2.5*** of ***Appendix 10.2 Fish and Shellfish Ecology Technical Appendix*** (APP-463) while for sandeel, the greater the percentage of coarse sands relative to the percentage of silt and fine sands, the greater the potential for the substrate in a given area to constitute a preferred sandeel habitat (***section 10.2.4.3*** of ***Appendix 10.2***).

22. ES ***Figure 10.26*** shows that the offshore development area overlaps with sandeel spawning and nursey grounds identified by Coull et al. (1998) and low intensity sandeel spawning and nursery grounds identified by Ellis et al. (2010) however the main North Sea sandeel habitats depicted by Jensen et al. (2011)[3] do not overlap with the offshore development area. The spawning and nursery grounds identified by Coull et al. (1998) and Ellis et al. (2010) are very broad and extend into the Outer Thames Estuary SPA. Due to the limited mobility of sandeels, and in view of their ecological and conservation status and their overall spatial distribution throughout the North Sea, they are considered to be of medium sensitivity.

23. In the case of herring, as shown by ES ***Figure 10.14***, the offshore development area overlaps with nursery grounds but does not overlap with spawning grounds as defined by Coull et al. (1998). These nursery grounds are extensive and extend into the Outer Thames Estuary SPA. ES ***Figure 10.45***[4] also presents International Herring Larvae Surveys data in the form of a heat map where low abundances of larvae are also evident, with peak larval abundance associated with the Downs Stock further south in the English Channel.

2.4.2.1 Physical impacts on herring and sandeel species and habitat

24. As described in ***section 7.5.6*** of ***Chapter 7 Marine Geology, Oceanography and Physical Processes***, the sea bed across the offshore development area is relatively homogeneous and is characterised predominantly by sand, with some

[3] Jensen et al (2011) used detailed information collected directly from sandeel fisheries to map fishing grounds, which were then assumed to reflect the foraging habitat of sandeel.
[4] See also ***section 2.1*** and ***Figures 1-3*** of the ***Fish and Shellfish Ecology Clarification Note*** Appendix 3 of the Applicant's Relevant Representation response to the Marine Management Organisation (Ref xx)

muddy sand, and does not represent suitable habitat for herring spawning. As stated in the section above, the main North Sea sandeel habitats depicted by Jensen et al. (2011) do not overlap with the offshore development area. The magnitude for physical disturbance and temporary loss of habitat for the offshore development area is considered as low. Therefore, for both herring and sandeels, an impact of **minor adverse significance** would be expected for the installation associated with the offshore cable corridor (***section 10.6.1.1.1*** of ***Chapter 10 Fish and Shellfish Ecology***).

25. As discussed in ***section 2.4.1***, the area of direct impact upon supporting habitat within the SPA is small. In addition, Duckworth et al. (2020) show that during foraging, almost all dives by red-throated diver had a maximum dive depth (MDD) of <20 metres, with 2-6 metres being the most frequent MDD. ***Figure 2*** shows the bathymetry along the offshore cable corridor route. The percentage of the SPA overlapped by the offshore cable corridor and which is <20m is 0.85% for both East Anglia ONE North and East Anglia TWO.

26. As with the area of direct disturbance, the area of seabed within the offshore cable corridor which is likely to be feeding habitat (i.e. shallower than 20m based on the latest study by Duckworth et al (2020)) is a very small percentage of the SPA. Thus, the area where there is potential for actual direct effect on prey is small and the magnitude of effect would be negligible.

2.4.2.2 Underwater noise

2.4.2.2.1 Seabed preparation for cable installation and rock dumping

27. ***Section 10.6.1.5*** of ***Chapter 10 Fish and Shellfish Ecology*** considers the underwater noise impacts to hearing sensitive species from sea bed preparation, cable installation and rock dumping.

28. The limited underwater noise modelling specific to fish receptors that has been carried out to date in respect of cable laying activities and vessel noise, suggests that behavioural impacts on fish species would be expected to occur in localised areas in the immediate proximity of the activities/vessels (i.e. from tens to few hundred metres) (MORL 2012; Statoil 2014).

29. For other construction activities, including vessel noise, underwater noise modelling was undertaken to determine the potential impact ranges on fish species from other construction activities. The modelling found that for all fish species, the impact range for recoverable injury would occur within 30m of dredging. It should be noted that all other impact ranges modelled, including for drilling, cable laying, rock placement and trenching had smaller impact ranges than for dredging (***Appendix 11.4 Underwater Noise Assessment***).

30. The underwater noise modelling undertaken for the impact of vessel noise on fish shows that for all fish species, the impact of recoverable injury would occur within 2m of large vessels only, and the potential for temporary threshold shift[5] (TTS) onset in all fish species would occur within 13m for large vessels (***Appendix 11.4 Underwater Noise Assessment***).

31. Considering the limited areas potentially affected and the temporary nature of the construction phase, the magnitude of the impact is considered to be low. Taking account of the comparatively wide distribution ranges of fish and shellfish species in the context of the small areas potentially affected, their sensitivity is considered to be low, resulting in an impact of **minor adverse** significance. Therefore, no significant impacts are predicted on prey species such as sandeel and herring due to underwater noise.

2.4.2.2.2 UXO Clearance

32. There is the potential requirement for UXO clearance prior to construction. Whilst any underwater UXO that are identified would preferentially be avoided, it is necessary to consider the potential for underwater UXO detonation where avoidance is not possible. Whilst it is well established that explosions can result in potential mortality or injury to fish species at close range, there are no data on the effects of explosions on fish hearing (e.g. TTS) or behaviour currently available. Given the short and intermittent nature of this activity (limited to instant when detonation of UXO is required) and the fact that for the most part any effects would be limited to the vicinity of the area where the detonation takes place, the magnitude of the effect is considered to be low. The impact of this on potential prey species has been considered in ***section 10.6.1.6*** of ***Chapter 10 Fish and Shellfish Ecology*** and the assessment determined **minor adverse** significance.

33. A MMMP for UXO clearance will be developed in the pre-construction period (in consultation with the relevant Statutory Nature Conservation Bodies (SNCBs) and the Marine Management Organisation (MMO)), detailing the required mitigation measures to minimise the potential risk of physical and auditory injury to marine mammals as a result of underwater noise during UXO clearance. This would potentially reduce the risk to fish and shellfish species. A ***Draft Marine Mammal Mitigation Protocol*** has been provided as part of the DCO application (APP-591).

2.4.2.2.3 Piling

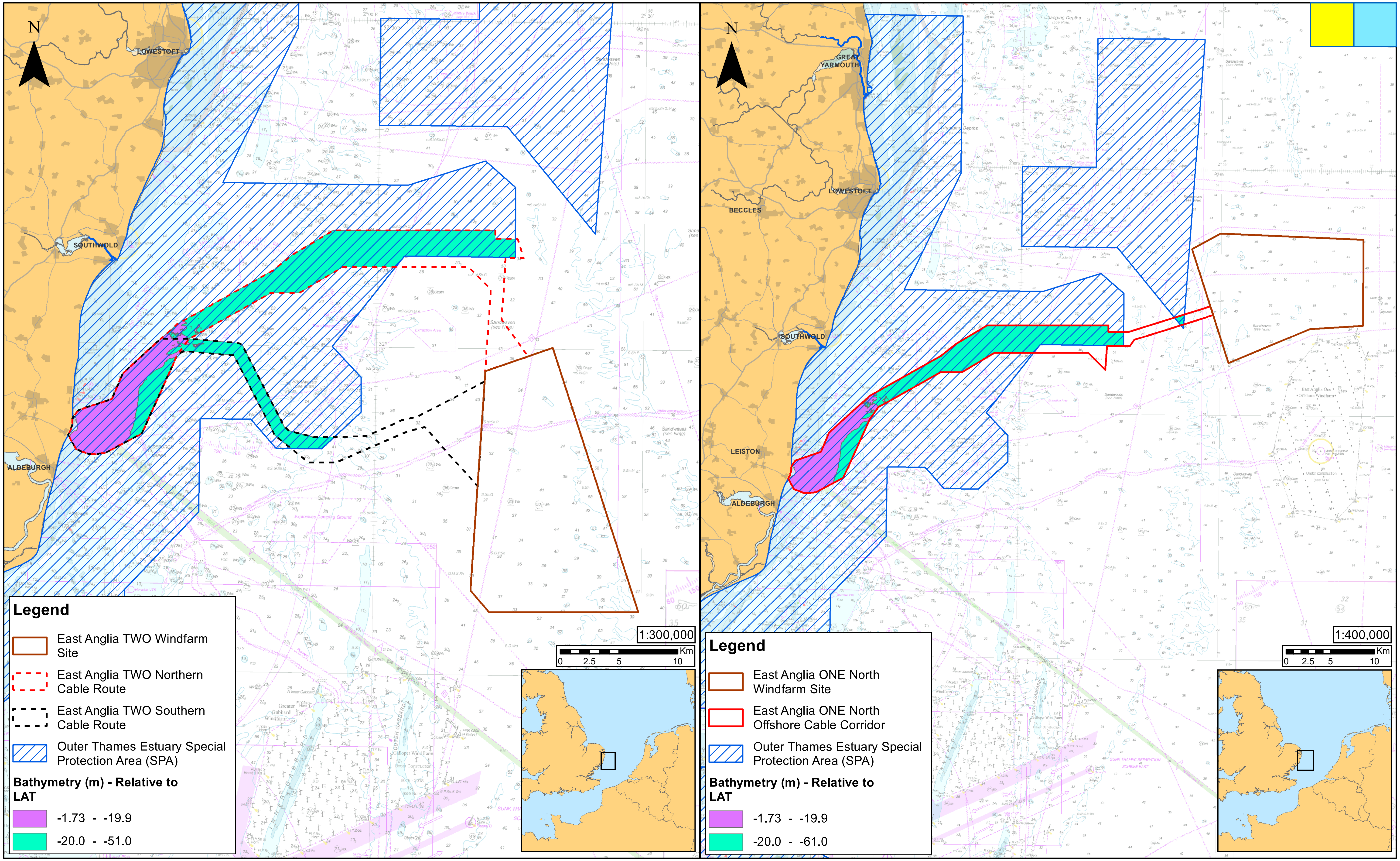
34. ***Section 10.6.1.4 Impact 4: Underwater Noise Impacts to Hearing Sensitive Species during Foundation Piling*** of ***Chapter 10 Fish and Shellfish Ecology*** considers the potential impact from piling on herring and sandeel. The outputs of

[5] TTS is a temporary shift in the auditory threshold of fish. This may occur suddenly after exposure to high levels of noise and results in temporary hearing loss.

the noise modelling for the spatial worst-case scenario indicate that TTS may occur at distances of up to 29km for all the fish groups modelled. Behavioural responses are anticipated to occur within this range and potentially in wider areas depending on the hearing ability of the species under consideration. As discussed previously, red throated diver are most likely to be feeding in waters of <20m which are over 38km from the East Anglia ONE North windfarm site and 24km from the East Anglia TWO windfarm site respectively.

35. Taking account of the spatial extent of the impact and the overall short duration of piling (a maximum of 938 hours as shown in ***Table 10.2*** of ***Chapter 10 Fish and Shellfish Ecology***) and its intermittent nature together with the fact that any effect associated with TTS and behavioural impacts would be temporary, the magnitude of the impact is considered to be low.

36. Given the overlap of the extensive spawning (sandeel only) and nursery (sandeel and herring) areas with the Outer Thames Estuary SPA there is potential for prey effects within the SPA. However, whilst it is recognised that there may be behavioural impacts on herring and sandeels (***section 10.6.1.4.5.2*** of ***Chapter 10 Fish and Shellfish Ecology***), significant impacts **have not** been identified for these species.



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East Anglia TWO and East Anglia ONE North

Bathymetry along the Offshore Cable Corridor Based on Duckworth *et al.* (2020)

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Rev	1
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Figure	2

Datum: WGS 1984
Projection: Zone 31N

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2.4.3 Indirect Impacts on Supporting Habitat

37. There would also be potential for indirect impacts on supporting features of the Outer Thames Estuary SPA caused by sand wave levelling and the associated sediment resuspension, movement in tidal currents and subsequent deposition. The potential impact of changes in suspended sediments / sediment transport on the supporting features of the Outer Thames Estuary SPA have been considered in ***section 9.6.1.5*** of ***Chapter 9 Benthic Ecology***.

38. Sediment transport modelling undertaken for East Anglia ONE, East Anglia TWO and cumulatively for the former East Anglia Zone (see ***Chapter 7 Marine Geology, Oceanography and Physical Processes***) found that coarse sediment would settle out rapidly (within 1km) where disturbed (or dredged material). For finer materials, deposition could occur at up to 50km from the source however the deposited sediment layer across the wider sea bed would be generally less than 0.2mm thick and would not exceed 2mm. Additionally, wave modelling (see ***Appendix 7.2***) determined that under all wave directions modelled, the zone of effects from the Projects are small, resulting in changes in baseline wave height of less than ±1% and therefore **not significant** and would not affect these sandbanks.

39. Sand wave levelling and subsequent disposal activities would avoid sensitive features and this will be set out in the PEMP which is secured in conditions 17(1)(e) of the generational DML and 13(1)(e) of the transmission DML. The overall volumes of sediment release would result in a low magnitude of impact on benthic receptors (***section 9.6.1.5*** of ***Chapter 9 Benthic Ecology***). Therefore, considering the low sensitivity of receptors, this would result in an overall impact of **minor adverse** significance.

2.4.4 Indirect Impacts on Prey Species

40. As sandeels spend a major proportion of their life cycle buried within the sea bed, increased suspended sediment concentrations (SSCs) and sediment re-deposition have the potential to adversely impact this species. Sandeels deposit eggs on the sea bed in the vicinity of their burrows between December and January. Cable installation is a relatively short-term activity and therefore the effects of increased SSCs is generally relatively short-lived. ***Section 10.6.1.2*** of ***Chapter 10 Fish and Shellfish Ecology*** provides further detail regarding potential SSC concentrations against background levels. In the shallowest section of the offshore cable corridor SSCs would approach 400mg/l at their peak.

41. Any plumes would be localised to within 1km of the release location and would persist for no longer than a few hours. After 180 hours following cessation of installation activities any plume would have been fully dispersed. Research by Behrens et al. (2007) suggests that sandeel adults have a comparatively high

tolerance to SSCs and sediment re-deposition but in view of their limited mobility and substrate dependence, the sensitivity of sandeels to these effects is considered to be medium in EIA terms. However, the main sandeel habitats depicted by Jensen et al. (2011) are a great distance from the offshore development area and in view of the minimal overlap and short duration of the effect, the impact significance is assessed as **minor adverse (*section 10.6.1.2.3*** of ***Chapter 10 Fish and Shellfish Ecology*).**

42. With respect to indirect impacts on the eggs and larvae of prey species, grains of sand may become attached to the adhesive egg membranes. Tidal currents can cover sandeel eggs with sand to a depth of a few centimetres, however experiments have shown that the eggs are capable of developing normally and hatch as soon as currents uncover them again (Winslade 1971). Buried eggs experiencing reduced current flow, and therefore lower oxygen tension, can have delayed hatching periods, which is considered a necessary adaptation to survival in a dynamic environment (Perez-Dominguez and Vogel 2010, Hassel et al. 2004).

43. Laboratory studies have established that herring eggs are tolerant to elevated SSCs as high as 300mg/l and can tolerate short term exposure at levels up to 500mg/l (Kiørboe et al. 1988). These studies concluded that herring eggs suffered no adverse effects from suspended sediment concentrations in excess of the maximum levels expected from mining, dredging and similar operations. Herring eggs have been recorded to successfully hatch at SSCs up to 7000mg/l (Messieh et al. 1981).

44. The sensitivity of herring and sandeel eggs and larvae is taken as medium in EIA terms. Taking into account the low magnitude of effect predicted, the impact of increased SSCs on fish eggs and larvae (inclusive of prey species for red-throated diver) is assessed to be of **minor adverse** significance (***section 10.6.1.2.1*** of ***Chapter 10 Fish and Shellfish Ecology***).

2.5 Cable Protection

2.5.1 Cable Protection Worst-case

45. Cable protection will be required for areas of the offshore cable corridor where burial depth between 1 to 3m is not possible (typically in areas of exposed bedrock). Up to 5% of the length of each export cable may require protection, as a worst case assumption, resulting in a footprint of 68,000m^2 and 64,600m^2 for East Anglia TWO and East Anglia ONE North respectively. In addition, cable protection will be required at locations of export cable crossings, resulting in a footprint of 40,800m^2 and 46,240m^2 for East Anglia TWO and East Anglia ONE North respectively against the worst-case assumption for the number of potential cable crossings required (***section 9.3.2.4.3*** of ***Chapter 9 Benthic Ecology***).

46. The total footprint which could be subject to permanent habitat loss during operation of the export cables is therefore 108,800m^2 for East Anglia TWO and 110,840m^2 for East Anglia ONE North (***section 9.3.2.4.3*** of ***Chapter 9 Benthic Ecology***). Assuming a worst case, all of this could be within the Outer Thames Estuary SPA, which would equate to 0.003% of the SPA seabed, which would be negligible.

2.5.2 Physical Processes

47. The maximum height of cable protection above the sea bed would be up to 2.25m. As stated previously, cable protection would only be applied in areas where burial is not possible i.e. in areas where the proposed cables are required to cross existing cables or in areas of hard ground. Any areas of hard ground would, by definition, not be the sandbanks (SPA supporting features).

48. However, there may be potential indirect effects upon morphological and sediment transport from cable protection. This has been assessed for the 'Suffolk Natura 2000 Sites' receptor (which includes the supporting sandbanks and associated channels of the Outer Thames Estuary SPA) in ***section 7.6.2.8*** of ***Chapter 7 Marine Geology, Oceanography and Physical Processes***. This primarily relates to potential interruption of sediment transport processes due to linear protrusions and the footprint they present on the sea bed.

49. There is likely to be a difference in effect depending on whether the cable protection works are in 'nearshore' or 'offshore' areas within the offshore cable corridor (and SPA). Nearshore comprises areas within the closure depth (i.e. shallower than -5m CD) or within the active circulatory pathway between the coast and sandbanks (i.e. shallower than -10m CD). Offshore comprises sections of the offshore cable corridor located seaward of the closure depth and/or the active circulatory pathway between the coast and sandbanks.

50. Any protrusions from the sea bed associated with cable protection measures offshore are unlikely to significantly affect the migration of sand waves, since their heights would in most areas where they are present, exceed the likely height of cable protection works (up to 2.25m). There may be localised interruptions to bedload transport in some areas, especially at cable crossings, but the gross patterns of bedload transport would not be affected significantly.

51. Cable protection in nearshore areas have the potential to affect alongshore sediment transport processes and circulatory pathways across the nearshore banks and those areas further offshore potentially affecting sediment transport processes across the sea bed.

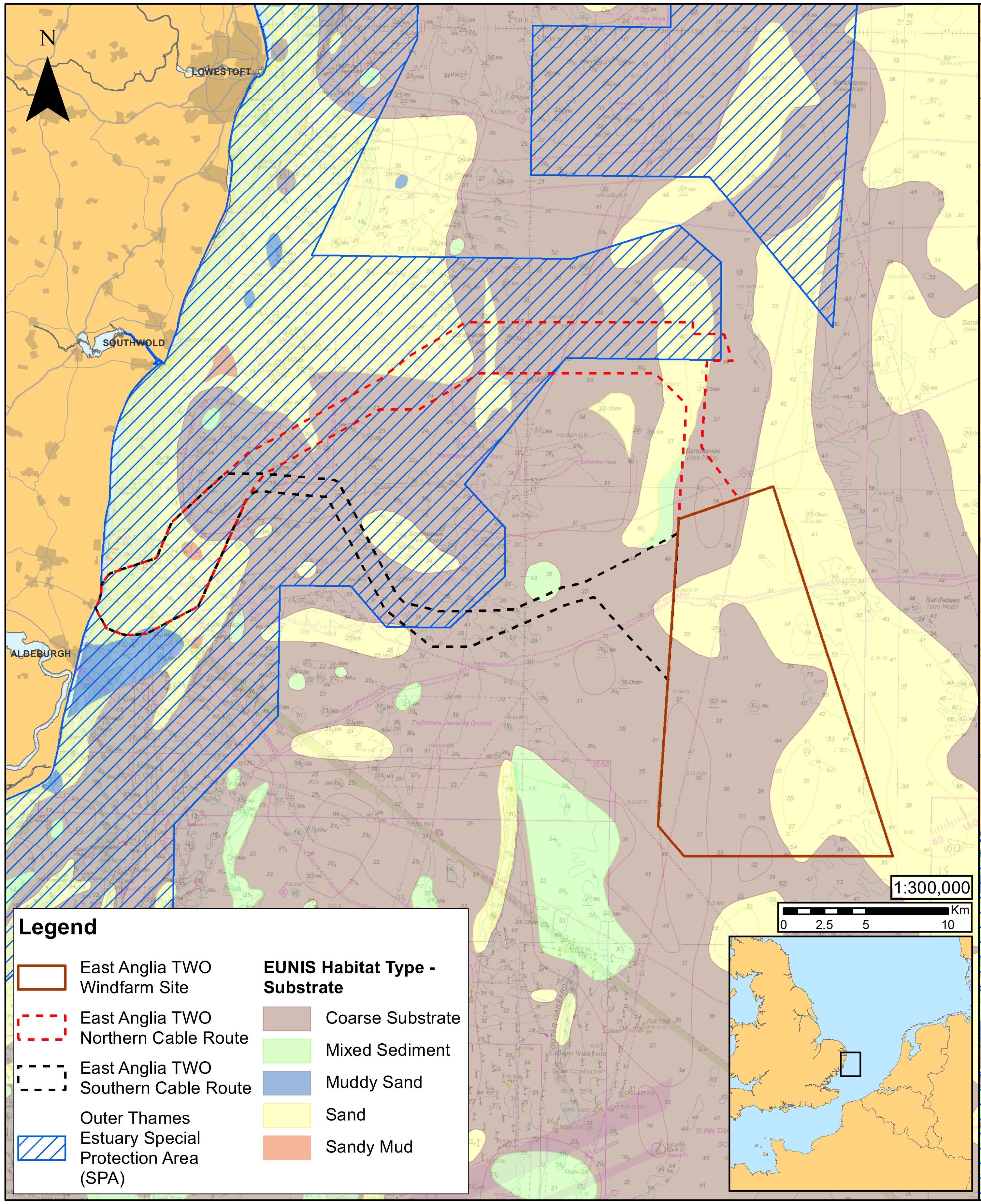
52. The siting of the landfall location and offshore cable corridor has been influenced by efforts to minimise sediment transport effects as far as practically achievable.

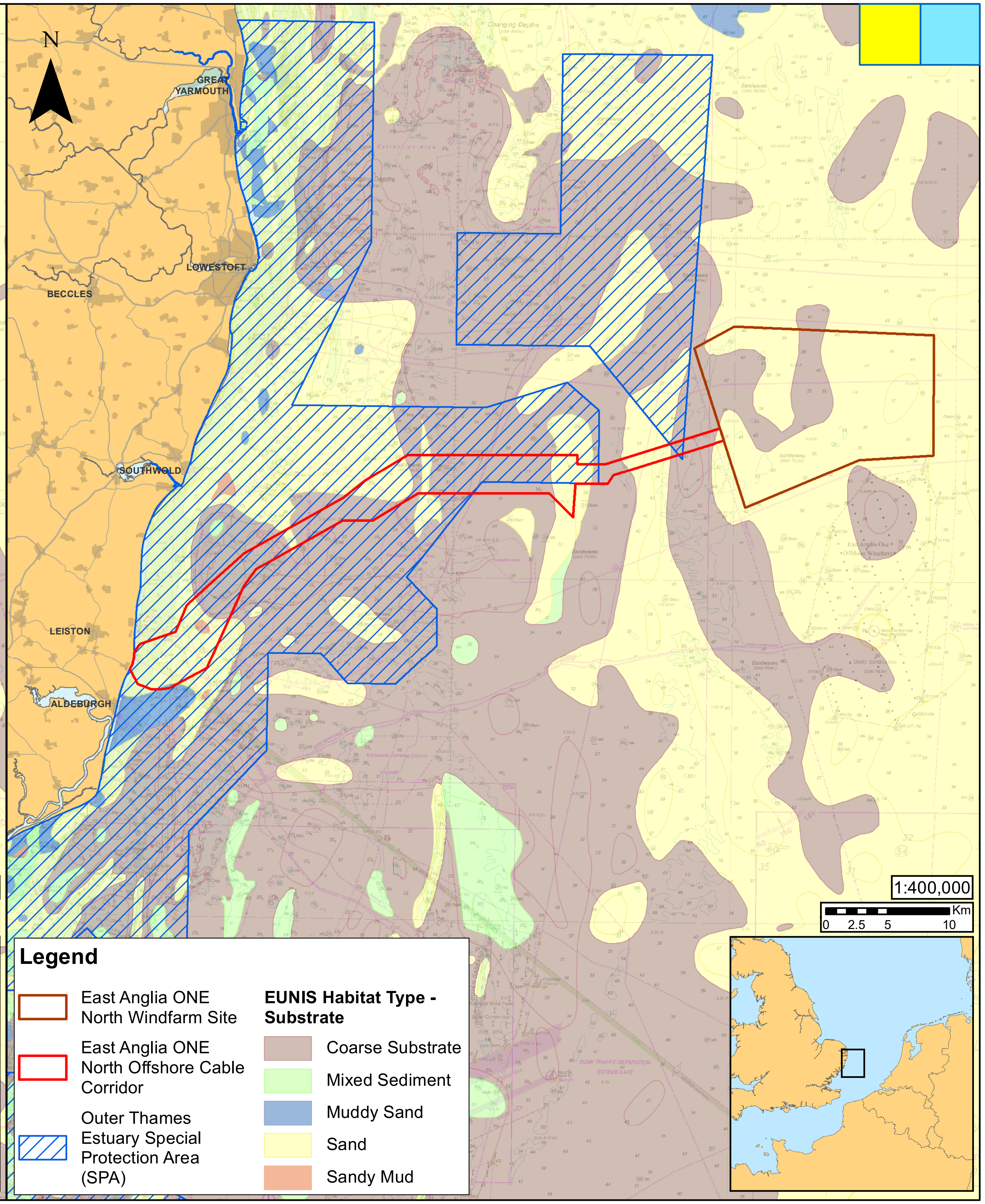
The commitment by the Applicant to install the export cable at landfall using horizontal directional drilling (HDD) techniques offers benefits with respect to supporting SPA habitat which are:

- HDD will minimise disturbance to important marine geological and geomorphological features including the outcrop of Coralline Crag, the ness at Thorpness and the nearshore Sizewell and Dunwich Banks.
- Minimising disturbance will avoid the need for cable protection in the intertidal and shallowest nearshore zones. As shown in ***Figure 3***, most of the sandy substrata is located in the nearshore zone where HDD techniques will be employed.
- HDD pop-out location would be in water depths greater than -2m CD (although most likely greater than -5m CD) and to the south of the outcrop of Coralline Crag. Hence, there would be no interruption of the circulatory sediment transport pathways between the coast and Sizewell Bank and there is a strong likelihood of the export cable requiring no protection measures within the closure depth of the active beach profile, due to the presence of sand on the sea bed in this location.

53. In areas inshore of the closure depth and/or within the active circulatory sediment transport pathways between the coast and Sizewell Bank there would be direct impacts of **negligible significance** on the ‘Suffolk Natura 2000’ receptor and these, in turn, would cause **no change** or indirect impacts of **negligible significance** on the East Anglia coast due to interruptions to sediment transport processes.

54. Offshore of the closure depth and/or beyond active circulatory sediment transport pathways between the coast and Sizewell Bank, the effects on sea bed morphology and sediment transport arising from the presence of export cable protection measures would not extend far beyond the direct footprint. Therefore, there is **no impact** in these locations since these are located remotely from this zone of potential effect (***section 7.6.2.7.1*** of ***Chapter 7 Marine Geology, Oceanography and Physical Processes***).





SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment		
				Prepared:	FC
1	24/02/2020	FC	First Issue.	Checked:	PM
				Approved:	PP

Scale @ A3

East Anglia TWO and East Anglia ONE North

Offshore Cable Corridor Substrata

Drg No	EA1N-EA2-DEV-DRG-IBR-001099
Rev	1
Date	24/02/20
Figure	3

Datum: WGS 1984
Projection: Zone 31N

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2.5.3 Benthic effects

55. ***Section 9.6.2.1.2*** of ***Chapter 9 Benthic Ecology*** details the assessment of direct habitat loss that would occur where cable protection is placed. **Minor adverse** significance was determined however this again does not directly translate to all areas of supporting habitat of the Outer Thames Estuary SPA. This is due to cable protection mostly being required in areas of hard substrate, which is not the supporting habitat of red-throated diver. As referred to regarding physical processes, most of the sandy substrate is located in the nearshore zone where HDD techniques will be employed (***Figure 3***). This will minimise disturbance and avoid the need for cable protection in the intertidal and shallowest nearshore zones.

2.5.4 Fish and Shellfish effects

56. As previously stated, red-throated diver mainly forage for fish that live near the surface or in the main water column, although in the winter they will sometimes take bottom-dwelling fish and their diet can also include crustaceans, molluscs and marine worms (Natural England, 2012).

57. Sandeels are dependent on the presence of an adequate sandy substrate in which to burrow, have a high level of site fidelity and little ability as re-colonisers (Jensen et al. 2011). Direct impacts on this habitat have been largely avoided through the site selection process as the export cable route avoids known sandbanks (***Figure 1***). Furthermore, any areas of hard ground requiring cable protection would, by definition, not be the sandbanks (SPA supporting features).

58. As stated above in ***section 2.5.1***, even assuming a worst case of the maximum requirement for cable protection and all of this being located within the SPA, this would only equate to 0.003% of the seabed area of the SPA. The introduction of hard substrate including cable protection has been assessed in ***section 9.6.2.4*** of ***Chapter 9 Benthic Ecology*** and ***10.6.2.5*** of ***Chapter 10 Fish and Shellfish Ecology***. Both assessments determined **minor adverse** significance.

2.6 EIA Summary

59. This document has aimed to address comments received by Natural England on the potential impacts (both direct and indirect) of sea bed preparation, offshore export cable installation and cable protection on supporting habitats and features of the Outer Thames Estuary SPA. Several thematic areas have been considered, encompassing marine geology, oceanography and physical processes, benthic ecology and fish and shellfish ecology receptors.

60. The Applicant has considered the potential impacts on supporting features and habitats of the Outer Thames Estuary SPA and has demonstrated that impacts would be no greater than **minor adverse** in EIA terms.

61. The Applicant will produce a detailed Design Plan post-consent which will be submitted to the MMO for approval. The Design Plan will be informed by the results of the pre-construction surveys which will identify any sensitive features that may require avoidance. This commitment is secured through Conditions 17 of the generation DML and 13 of the transmission DML, and serves as an effective mechanism to refine project parameters in order to avoid and minimise potential impacts on supporting and qualifying features of the Outer Thames Estuary SPA.

2.7 Implications for the HRA

2.7.1 Project alone

62. The area of direct impact from cable installation upon the seabed of the SPA is negligible, <0.1% of the SPA seabed area would be directly affected by cable installation (see ***section 2.4.1***). In addition:

- Known sandbank habitat has been avoided in the routeing of the cable corridor;
- The areas most likely to be used for feeding by red-throated diver (i.e. those in <20m depth) are confined to the nearshore areas of the cable corridor (see ***section 2.4.2.1*** and ***Figure 2***). Therefore, of the <0.1% of the seabed directly impacted it is only likely that the nearshore portion of that is relevant to red-throated diver foraging.

63. Assuming a worst case in which all cable protection required for the offshore cable corridor was within the SPA, this would equate to 0.003% of the SPA seabed, which would be negligible (see ***section 2.5.1***).

- Physical processes effects have been assessed for the 'Suffolk Natura 2000' receptor as negligible (see ***section 2.5.2***)
- Cable protection is unlikely to be required in soft sediment areas and therefore unlikely to affect supporting habitat with implications for either fish or benthos (see ***sections 2.5.3*** and ***2.5.4***).

64. Indirect impacts from increases in suspended sediments would be distributed along the onshore cable corridor and result in non-significant effects upon receptors (see ***sections 2.4.3*** and ***2.4.4)***.

65. Noise impacts upon potential prey species were assessed in the EIA for the extensive nursery and spawning areas in the southern North Sea which extend into the SPA. Given that these effects at the wider scale are not significant and that red-throated diver are most likely to be foraging in nearshore waters which are at or beyond the distance of likely effect from impulsive noise sources (i.e. piling or UXO clearance) it is not considered that there would be a significant effect (see ***section 2.4.2.2***).

66. In, summary, given that the direct and indirect effects on supporting habitat and prey are minimal, it is considered that there is no pathway for likely significant effects upon the supporting features of the Outer Thames Estuary SPA.

2.7.2 In-combination

67. Reviewing ***section 10.7 Cumulative Impacts*** of ***Chapter 10 Fish and Shellfish Ecology*** the only relevant projects which have potential overlaps with the Outer Thames Estuary SPA are East Anglia THREE, ONE North and TWO. No other windfarms have direct spatial interaction (or potential indirect interaction as demonstrated by ***Chapter 7 Marine Geology, Oceanography and Physical Processes***).

68. Although there is potential for consecutive construction between these projects, it is unlikely that there would be concurrent cable laying within the SPA and no concurrent piling between East Anglia ONE North and TWO. East Anglia THREE is over 30km from the SPA therefore any noise impacts are not relevant.

69. In the event of concurrent cable laying activities within the SPA, effects would still be limited to less than a fraction of 1% of the seabed area. In the more likely case, effects would be of a similar magnitude to the project alone case but expressed on several occasions. In either case, it is considered that there is no pathway for likely significant effects upon the supporting features of the Outer Thames Estuary SPA.

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