Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Marine Processes Technical Note

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Glossary of Acronyms

CSCB	Cromer Shoal Chalk Beds
DEL	Dudgeon Extension Limited
DEP	Dudgeon Offshore Wind Farm Extension Project
DOW	Dudgeon Offshore Wind Farm
ECC	Export Cable Corridor
ES	Environmental Statement
ES	Environmental Statement
HDD	Horizontal Directional Drilling
LAT	Lowest Astronomical Tide
MCZ	Marine Conservation Zone
MPA	Marine Protected Area
NW	Northwest
OWF	Offshore Wind Farm
OWF	Offshore Wind Farm
PEIR	Preliminary Environmental Information Report
RIAA	Report to Inform Appropriate Assessment
SEL	Scira Extension Limited
SEP	Sheringham Offshore Wind Farm Extension Project
SOW	Sheringham Shoal Offshore Wind Farm
SSC	Suspended Sediment Concentration

Glossary of Terms

Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
DEP offshore site	The Dudgeon Offshore Wind Farm Extension consisting of the DEP wind farm site, interlink cable corridors and offshore export cable corridor (up to mean high water springs).
DEP North array area	The wind farm site area of the DEP offshore site located to the north of the existing Dudgeon Offshore Wind Farm
DEP South array area	The wind farm site area of the DEP offshore site located to the south of the existing Dudgeon Offshore Wind Farm
DEP wind farm site	The offshore area of DEP within which wind turbines, infield cables and offshore substation platform/s will be located and the adjacent Offshore Temporary Works Area. This is also the collective term for the DEP North and South array areas.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable route which would house HDD entry or exit points.
Infield cables	Cables which link the wind turbine generators to the offshore substation platform(s).
Interlink cables	Cables linking two separate project areas. This can be cables linking: 1) DEP South array area and DEP North array area 2) DEP South array area and SEP 3) DEP North array area and SEP 1 is relevant if DEP is constructed in isolation or first in a phased development. 2 and 3 are relevant where both SEP and DEP are built.
Interlink cable corridor	This is the area which will contain the interlink cables between offshore substation platform/s and the adjacent Offshore Temporary Works Area.
Landfall	The point at the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables at the transition joint bay above mean high water

Offshore cable corridors	This is the area which will contain the offshore export cables or interlink cables, including the adjacent Offshore Temporary Works Area.
Offshore export cable corridor	This is the area which will contain the offshore export cables between offshore substation platform/s and landfall, including the adjacent Offshore Temporary Works Area.
Offshore export cables	The cables which would bring electricity from the offshore substation platform(s) to the landfall. 220 – 230kV.
Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Shoal Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
SEP offshore site	Sheringham Shoal Offshore Wind Farm Extension consisting of the SEP wind farm site and offshore export cable corridor (up to mean high water springs).
SEP wind farm site	The offshore area of SEP within which wind turbines, infield cables and offshore substation platform/s will be located and the adjacent Offshore Temporary Works Area.
The Applicant	Equinor New Energy Limited. As the owners of SEP and DEP, Scira Extension Limited and Dudgeon Extension Limited are the named undertakers that have the benefit of the DCO. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of SEL and DEL as the undertakers of SEP and DEP.

1 Response to Natural England Comments

1. The comments received within Appendix E of Natural England's Relevant Representations [RR-063] which the Applicant considers are required to be addressed within this Technical Note are grouped into the following five categories.

- Baseline Characterisation of Bedforms (**Section 1.1**);
- Baseline Tidal Ellipses (**Section 1.2**);
- Marine Protected Areas (MPA) and the Zone of Potential Tidal Influence (**Section 1.3**);
- Potential Impacts on Suspended Sediment Concentrations (**Section 1.4**); and
- Local Changes to the Seabed Bathymetry at Dudgeon Offshore Wind Farm (DOW) Post Construction (**Section 1.5**).

2. See **The Applicant's Comments on Relevant Representations** [document reference 12.3] for the Applicant's point-by-point response to Appendix E of Natural England's Relevant Representation [RR-063]. Note that where references to comments at 'ID X' are provided, these are in relation to the rows within the Applicant's comments on Appendix E Marine Processes of Natural England's Relevant Representation [RR-063] located in the **Applicant's Comments on Relevant Representations** [document reference 12.3].

1.1 Baseline Characterisation of Bedforms

3. There are four related comments on the need for further detail on the baseline characterisation of bedforms and significant morphological features, particularly sandbanks and sandwaves. These are included below for ease of reference.

1.1.1 Natural England Comments at ID 3, ID 8, ID 21, and ID 28

4. *ID 3: The baseline characterisation is generally good, although characterisation of sandbanks, sandwaves and significant morphological features across the project area is inadequate. Please see our detailed comments and advice regarding baseline characterisation of sandbanks, sandwaves and seabed morphological features.*

5. *ID 8: Sandbanks: We advise that sandbanks, sandwaves and other significant morphological features have not been adequately characterised or assessed in the ES. Potential changes to these features through activities such sandwave levelling or operation of the [Offshore Wind Farm] OWF could indirectly influence the [Marine Conservation Zone] MCZ and/or East Anglia Coast. We advise that further consideration should be given to the characterisation of sandbanks, sandwaves and other significant morphological features, their migration rates, and recoverability over the lifetime of the project.*

6. *ID 21: The text describes a sandbank in [northwest] NW of DEP N array area and also a sandbank in the NW of DEP S array area. The bathymetry shows the presence of significant sandbanks, which are probably Cromer Knoll and Inner Cromer Knoll, but no information has been provided regarding their form, spatial extent, elevation, depth, rate of migration and stability. We would advise that in order*

to understand impacts of the development on these sandbank features, it is important to first characterise their form, extent, elevation, rate of migration and stability. Please can the Applicant provide this information in an updated chapter.

7. *ID 28: Natural England notes that the 'Sand banks (and associated sandwaves)' Receptor Group does not include any mention of Sheringham Shoal, Pollard Bank, Cromer Knoll, Inner Cromer Knoll, sandwaves in SEP, sandbanks situated at the NW of DEP N array and in DEP S, and in the north of the cable corridor between DEP N array and SEP. We advise that all sandbanks within the OLs for the project, should be included and named, where possible in an updated chapter.*

1.1.2 Response

8. This response provides more detail (where available) on the form, spatial extent, elevation, depth and migration of:

- Cromer Knoll Bank and associated sandwaves in the northwest of the DEP North array area and at the northern ends of the interlink cable corridors between the DEP North array area and SEP, and the DEP North array area and the DEP South array area (Figure 6.1 and Figure 6.3 of the Environmental Statement (ES) [APP-119]);
- Inner Cromer Knoll Bank and associated sandwaves in the northwest of the DEP South array area (Figure 6.1 of the ES [APP-119]);
- Sheringham Shoal (Figure 6.4 of the ES [APP-119]); and
- Pollard Bank (Figure 6.4 of the ES [APP-119]).

1.1.2.1 Cromer Knoll Bank and Sandwaves

9. About 5km (running northwest to southeast) of the Cromer Knoll Bank crosses the northwest of the DEP North array area, with a further 3km at the northern end of the interlink cable corridor between the DEP North array area and SEP, and 3km at the northern end of the interlink cable corridor between the DEP North and South array areas (Figure 6.1 and Figure 6.3 of the ES [APP-119]). All three parts of the bank recorded in these areas are covered in sandwaves with crests oriented northeast to southwest (approximately). Gradients of greater than 10° are observed on the flanks of the sandwaves (Gardline, 2020).

10. The crest of the bank inside the northwest part of the DEP North array area and at the northern end of the interlink cable corridor between the DEP North array area and SEP has a shallowest depth of 13m below Lowest Astronomical Tide (LAT) and is up to 9m above the surrounding seabed (Gardline, 2020). Sandwaves up to 4-5m high with wavelengths of around 250m are prevalent across the bank. The bathymetry across these sandwaves is shown in Figure 1, a side-scan sonar example in **Figure 2** and a sub-bottom profiler example in **Figure 3**.

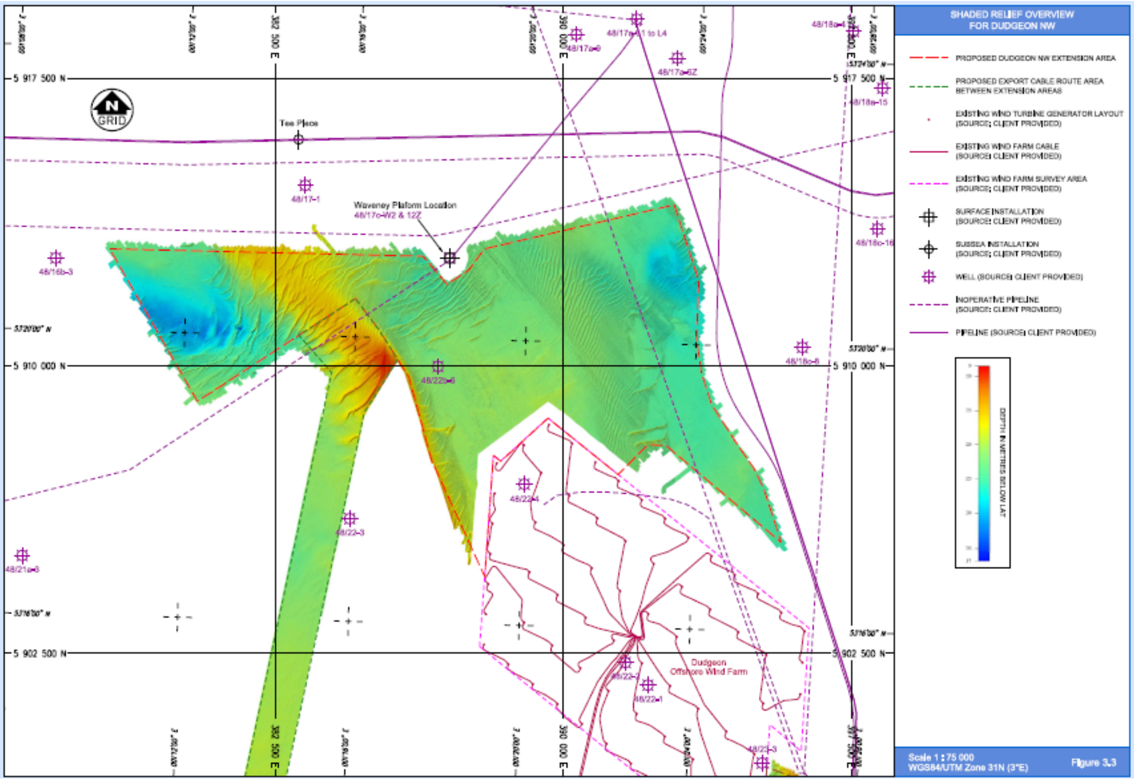

Figure 1 Bathymetry of the sandwaves across Cromer Knoll Bank at the northwest of the DEP North array area and at the northern end of the interlink cable corridor between the DEP North array area and SEP

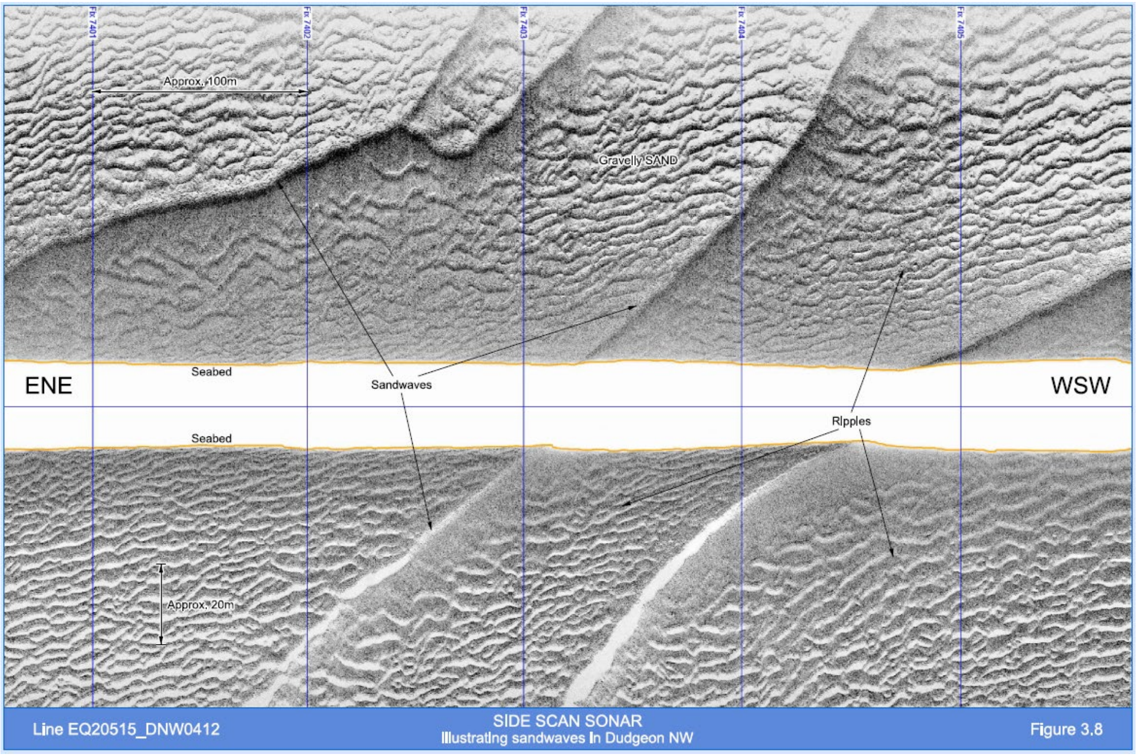

Figure 2 Side-scan sonar example of the sandwaves across Cromer Knoll Bank at the northwest of the DEP North array area and at the northern end of the interlink cable corridor between the DEP North array area and SEP

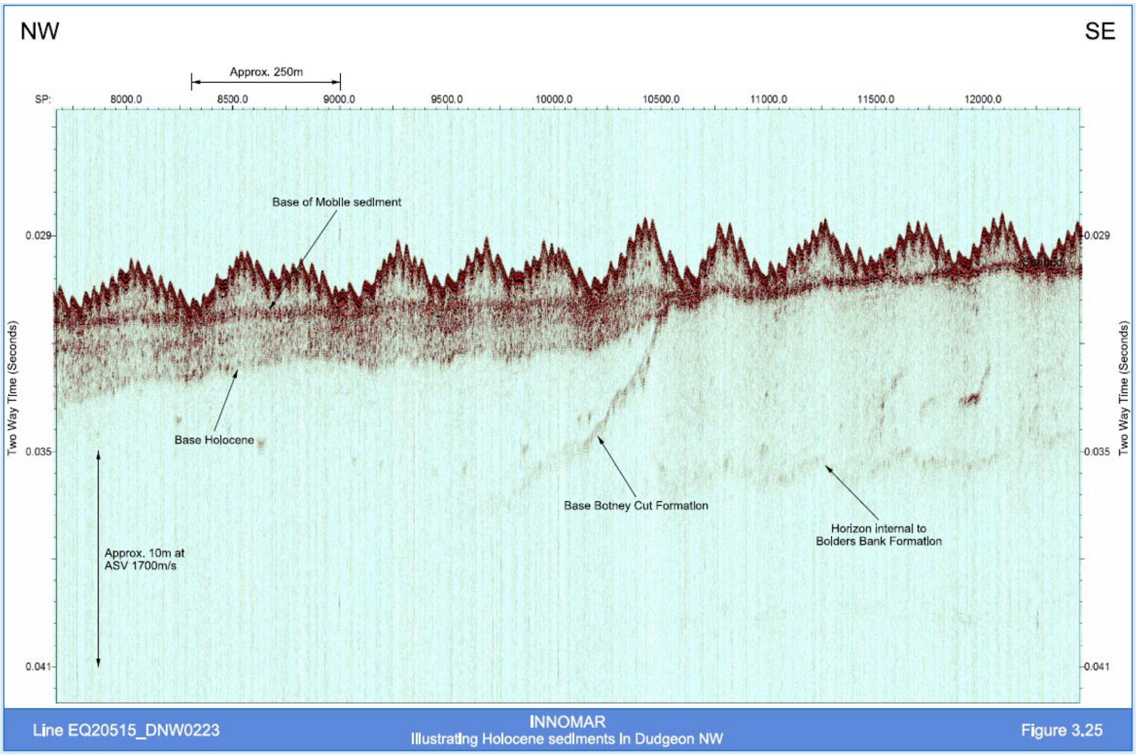

Figure 3 Sub-bottom profiler example of the sandwaves across Cromer Knoll Bank at the northwest of the DEP North array area and at the northern end of the interlink cable corridor between the DEP North array area and SEP

11. The bathymetry across the bank at the north end of the corridor between the DEP North and DEP South array areas is approximately 11-13m below LAT with superimposed sandwaves up to 3m high (DOW, 2009).

1.1.2.2 Inner Cromer Knoll Bank and sandwaves

12. The southeast 5km of Inner Cromer Knoll Bank (northwest to southeast oriented) is inside the northwest corner of the DEP South array area (Figure 6.1 of the ES [APP-119]). Here, the bank has a minimum depth of 11m below LAT and is about 4m above the surrounding seabed (Gardline, 2020).

13. This part of the bank is sculpted into a field of sandwaves with north-northeast to south-southwest crest orientations and heights of approximately 2-4m (with wavelengths of 250m), although they are more commonly 1-1.5m high (Gardline, 2020). Gradients of greater than 10° are observed on the flanks of the sandwaves (Gardline, 2020). The bathymetry across these sandwaves and a sub-bottom profiler example of them are shown in **Figure 4** and **Figure 5**, respectively.

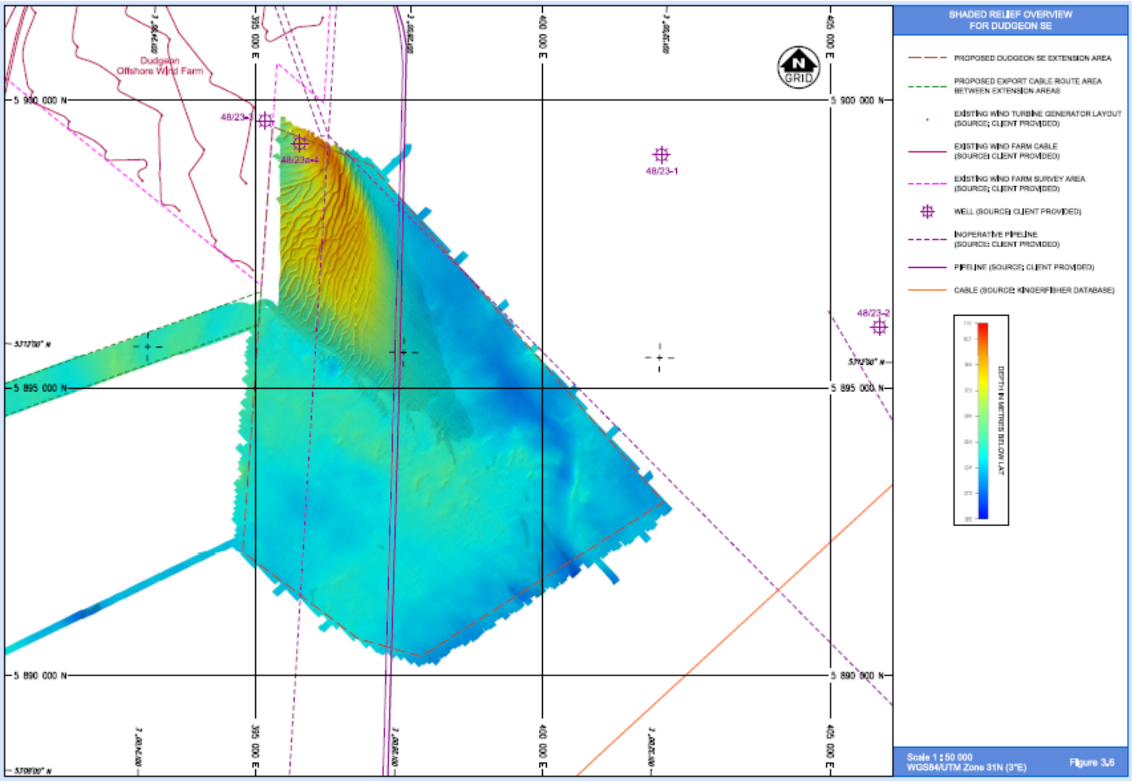

Figure 4 Bathymetry of the sandwaves across Inner Cromer Knoll Bank at the northwest corner of the DEP South array area

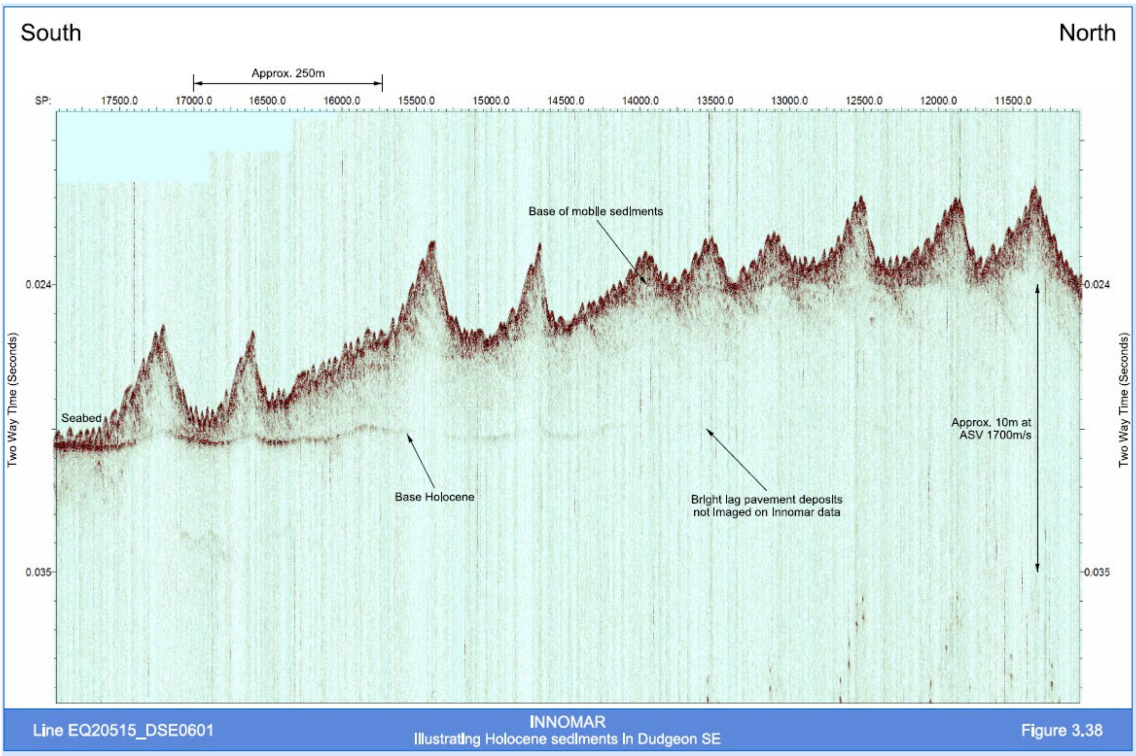

Figure 5 Sub-bottom profiler example of the sandwaves across Inner Cromer Knoll Bank at the northwest corner of the DEP South array area

1.1.2.3 Sheringham Shoal

14. The eastern tip of Sheringham Shoal Bank is inside the export cable corridor about 10km from the coast of north Norfolk. Here the bathymetry of the bank is about 16m below LAT (Gardline, 2019) (Figure 6). The crest of the bank is 8-14m thick inside the cable corridor (Figure 7 and Figure 8) but is much thicker to the west outside the cable corridor. It is covered in a field of megaripples, which are up to 0.5m high with wavelengths up to 16m, and crests typically oriented north-south or north-northeast to south-southwest (Gardline, 2019). The northern flank contains sandwaves with heights of about 3-4m, wavelengths up to 150m, and crests oriented approximately north-northeast to south-southwest (**Figure 9**). They are asymmetrical with their steeper sides facing east-southeast implying migration in the same direction.

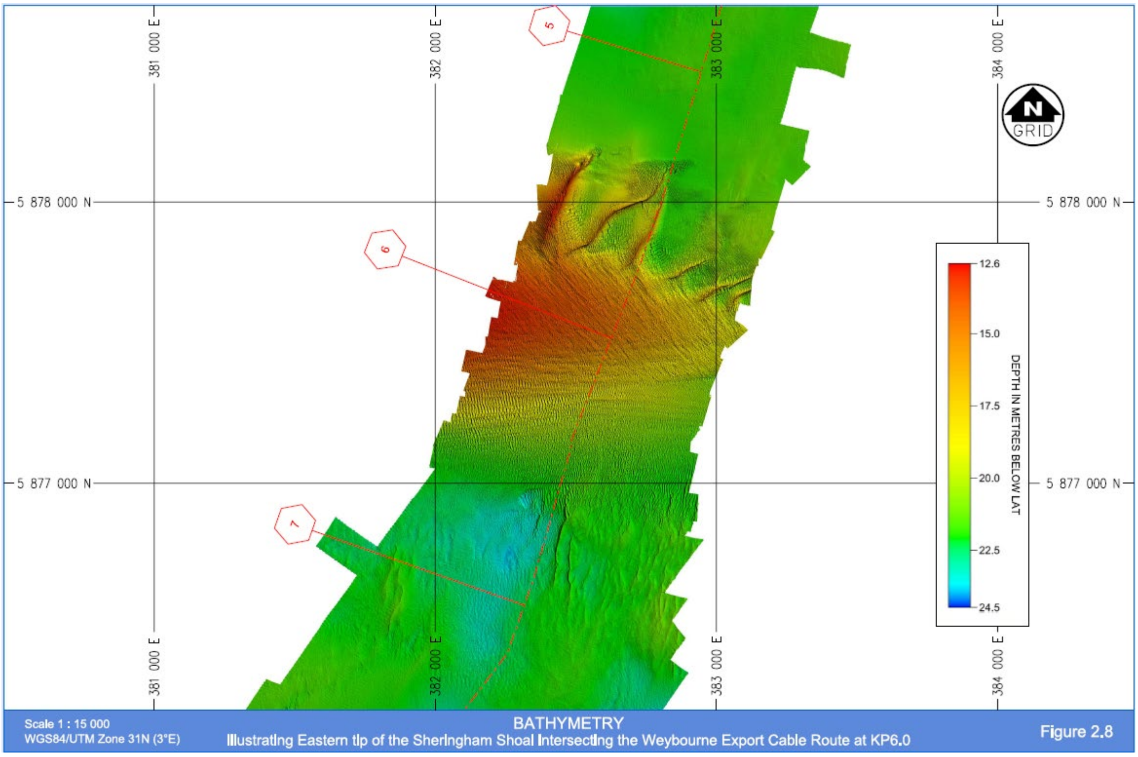

Figure 6 Bathymetry of the eastern tip of Sheringham Shoal Bank inside the export cable corridor

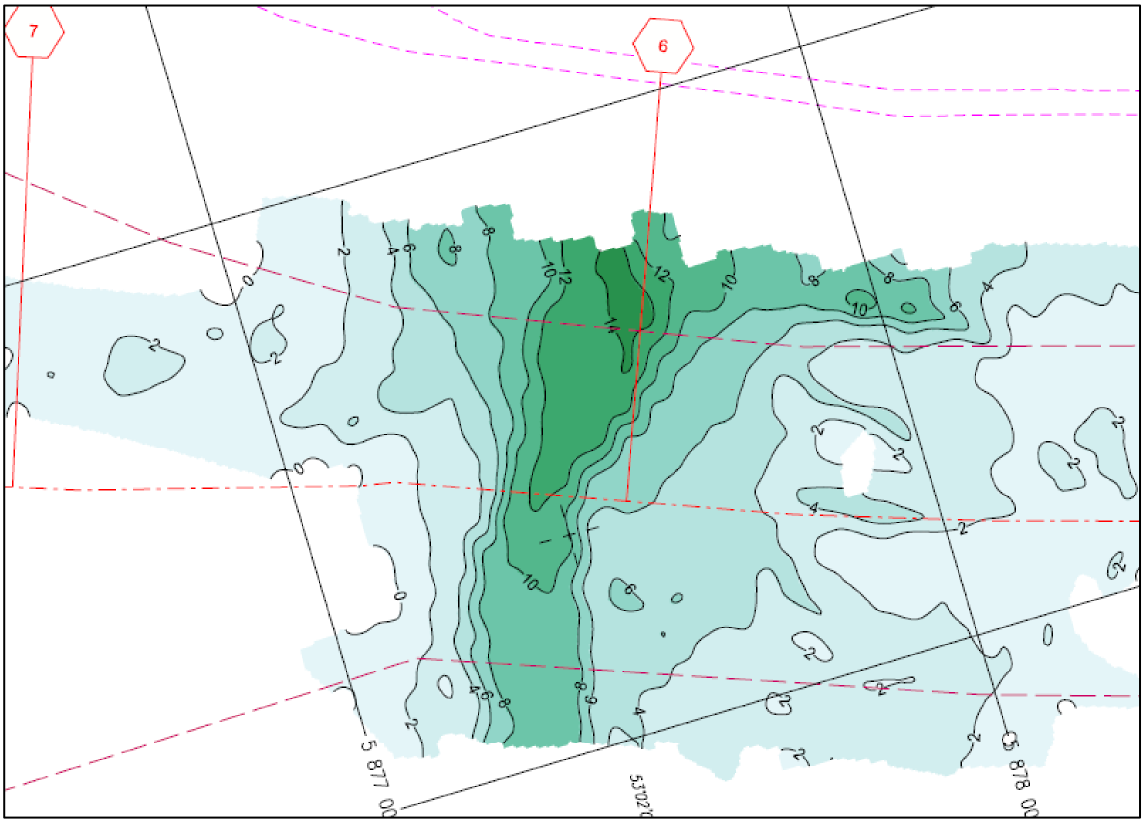

Figure 7 Thickness of the eastern tip of Sheringham Shoal Bank inside the export cable corridor

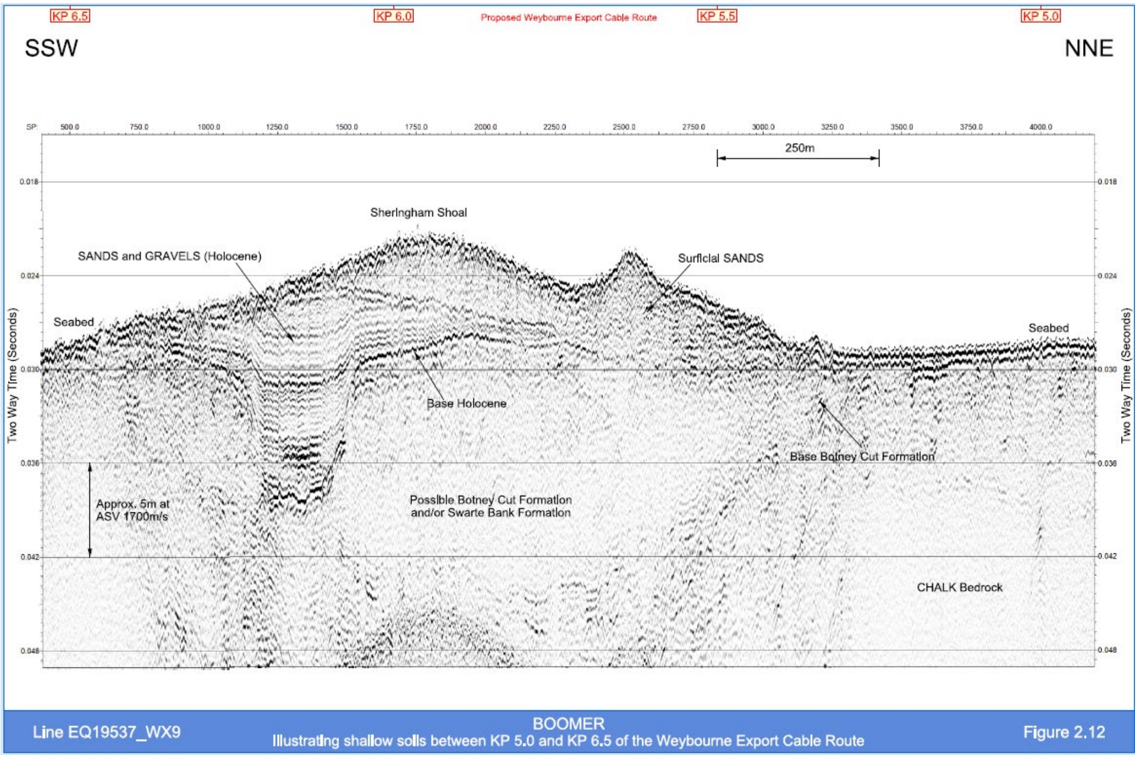

Figure 8 Sub-bottom profiler example across the eastern tip of Sheringham Shoal Bank inside the export cable corridor

1.1.2.4 Pollard Bank

15. Pollard Bank is about 3km offshore and is located to the west of the export cable corridor. The crest of the bank is about 8m below LAT. The approach to the southern flank is sculpted into southwest-northeast crest-aligned megaripples and sandwaves which are up to 1.6m high. The maximum thickness of sand in the bank is about 6m. The bank is asymmetric with the northern flank having a gentler slope than the southern flank implying migration south. The northern flank contains megaripples with crests oriented southwest-northeast. Pollard Bank disappears to the east and is not present inside the export cable corridor.

16. Fugro EMU (2016) compared 2015/2016 and 2008 bathymetry data across Pollard Bank. Migration of sandwaves over this seven-to-eight-year period is manifest as alternating areas of erosion (up to 1.3m) and accretion (up to 1.7m) (Figure 5.10 of ES Appendix 6.3 [APP-182]). Fugro (2019) also compared 2018 and 2008 bathymetry data. Seabed change occurred across Pollard Bank, with elevation changes of -1.3m (erosion) to +2.0m (accretion) (Figure 5.11 of Appendix 6.3).

1.1.2.5 Implications for Assessment

17. **Sections 1.1.2.1** to **1.1.2.4** above provide additional detail on the baseline characterisation of the bedforms across the array areas and interconnector cable corridors. The information supports the conclusion that in these areas, the seabed is dynamic and large-scale movement of sandwaves is occurring. There is no historic bathymetry data available from which rates of movement can be quantified, but evidence from sandwaves in DOW (located on the same sandbanks, see **Section 1.5**) indicate that average migration rates could range from 2.5m/year to 3.5m/year, with periods of accelerated migration up to 10m/year. This evidence of regional-scale change at SEP / DEP alongside evidence from pre- and post-construction monitoring at Race Bank and a sand wave study carried out for the Norfolk Vanguard and Norfolk Boreas Projects, reinforces the assessment in Section 6.6.4.9 of the ES [APP-092] that sandwaves in this area are mobile under natural conditions and would recover from any proposed levelling through re-establishment of sand transport pathways. This will be aided by the disposal of the dredged sand back on to the sandbank (as is proposed), allowing it to be become re-entrained in the sediment transport system.

1.2 Baseline Tidal Ellipses

18. There are two related Natural England comments on the need to provide a visualisation of tidal ellipses across the wind farm. These are included below for ease of reference.

1.2.1 Natural England Comments at ID 6, and ID 23

19. *ID 6: In addition, there does not appear to be a map showing the spring tidal ellipses across the study area.*

20. *ID 23: Natural England notes that the neap and spring tidal excursions have not been provided. The spring tidal excursion is useful for estimating the potential extent of direct changes to flows as well as the anticipated maximum zone of influence for*

sediment plumes. We advise that the Neap/spring tidal excursions should be quantified in an updated chapter. It would also be useful to provide a map showing the spring tidal ellipses across the study area.

1.2.2 Response

21. The spring tidal ellipses across the study area are provided in **Figure 9** below. The ellipses provide an indication of the maximum extent to which a particle of sediment in the water column could travel. However, given the relatively coarse nature of the sediment across the array sites, the small magnitude of the plume of fine sediment would mean that most particles would not achieve this maximum extent, as they would settle to the seabed a shorter distance from their release point (up to a kilometre along the axis of tidal flow) rather than travelling to the full extent of the ellipse. However, the lowest suspended sediment concentrations would extend further from the point of release, along the axis of predominant tidal flows (long axes of the ellipses), but the magnitudes would be indistinguishable from background levels.

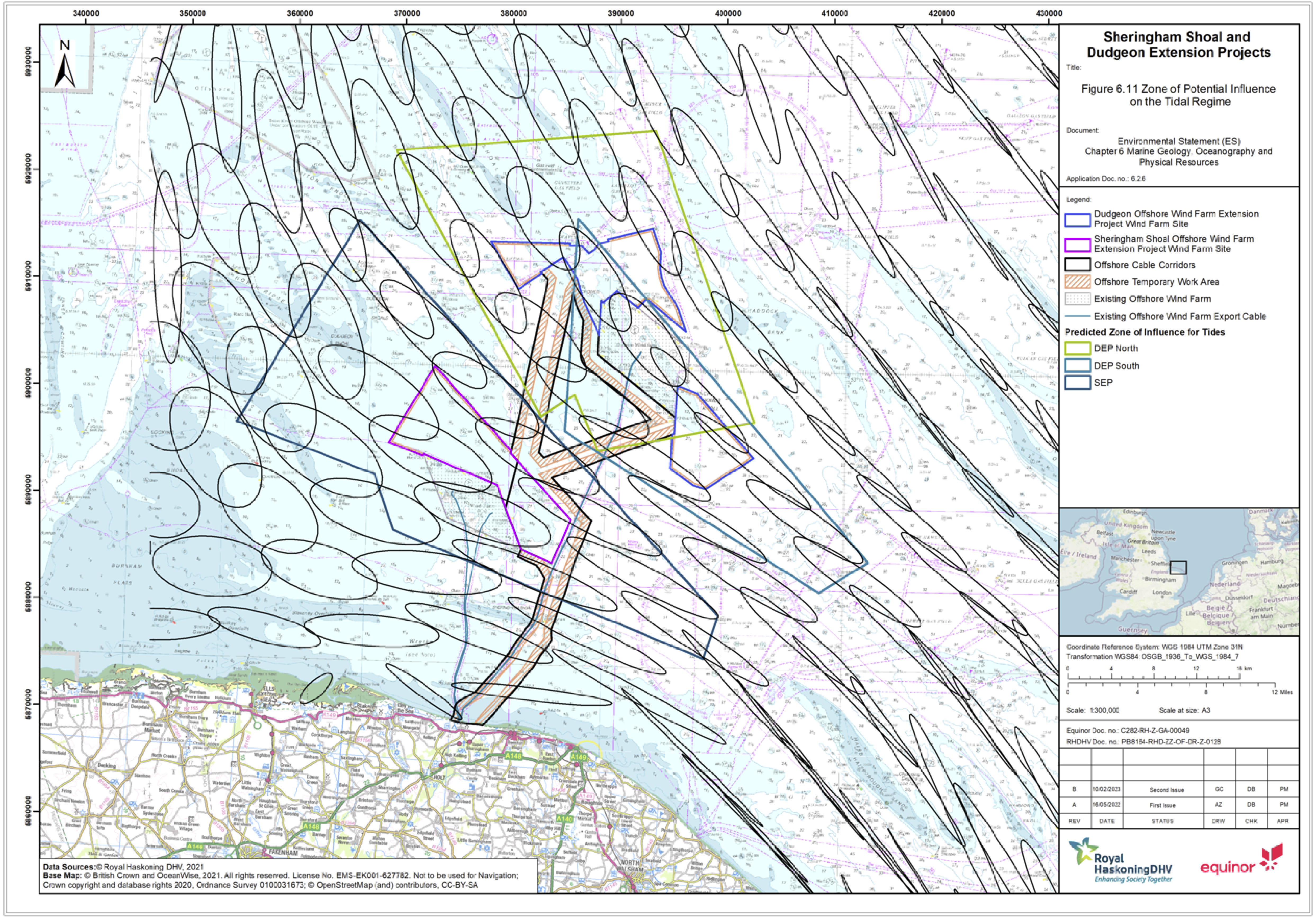

Figure 9 Zone of Potential Influence on the Tidal regime and spring tidal ellipses

1.3 MPAs and the Zone of Potential Tidal Influence

22. There is a single comment on the need to superimpose marine protected areas on the maximum zone of potential influence map (Figure 6.11 of the ES [APP-119]). This comment is included below for ease of reference.

1.3.1 Natural England Comment at ID 47

23. ID 47: *Point 316. The maximum zone of potential influence (ZoPI) on the tidal regime is presented in Figure 6.11, which we welcome. However, marine protected areas have not been identified on this map. It would be useful to identify marine protected areas on Figure 6.11 to show where they overlap with the ZoPI.*

1.3.2 Response

24. The updated Figure 6.11 is provided as **Figure 10** below. With respect to the overlap shown with the Inner Dowsing, Race Bank and North Ridge Special Area of Conservation (SAC), the potential increased suspended sediment concentrations (SSC) and deposition effects during construction, operation and decommissioning; and changes to physical processes resulting in changes to sediment supply (i.e. sediment transport effects) during operation (but in relation to the SEP wind farm site only), are assessed within the **Report to Inform appropriate Assessment (RIAA)** [APP-059].

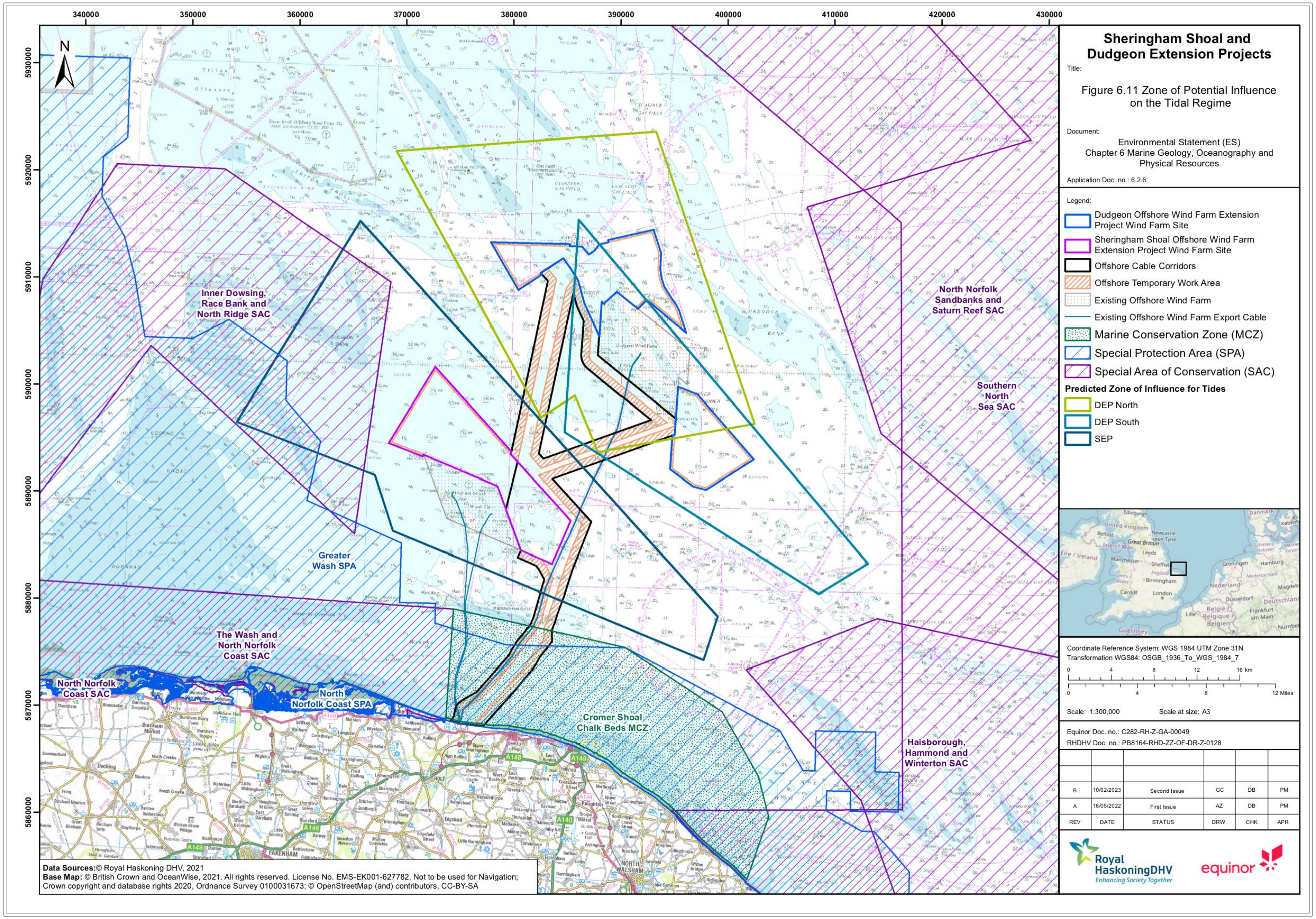

Figure 10 Zone of Potential Influence on the tidal regime in the context of marine protected areas

1.4 Potential Impacts on Suspended Sediment Concentrations

25. There are four related comments on the need to provide more detail on the assessment of effects on suspended sediment concentrations. These are included below for ease of reference.

1.4.1 Natural England Comments at ID 37, ID 38, ID 39, and ID 40

26. *ID 37: Points 239-241. The SOW and DOW-based model simulation quantification of magnitude of change are useful analogues for the SEPDEP export cable for sediment disturbed by export cable installation. However, it is not clear if/how the SOW/DOW max temporary disturbance widths for export cable installation and burial, or amount of sediment disturbed compare with those for SEP/DEP. This should be clarified. Furthermore, in Point 239, it is stated that although SSCs will be elevated they are likely to be lower than concentrations during storm conditions (including the Dec 2013 storm surge), which are likely to drive greater changes to the seabed than those due to the OWF infrastructure. Natural England advises that within an updated chapter it should be shown how the SOW/DOW trench size and amount of disturbed sediment compare with those for SEP/DEP. Quantitative evidence should be provided to support the predictions regarding SSCs.*

27. *ID 38: Point 245. It is noted that elevated SSCs above prevailing conditions are anticipated at the HDD exit point, but that they are also likely to remain within the range of background nearshore levels. This conclusion should be supported with quantitative estimates. Please see comment above.*

28. *ID 39: Points 255 & 256. Results from the sediment dispersion modelling for the SOW and DOW export cables (Points 170 & 171 in Chapter 6), suggest that suspended load for disturbed mud would extend as a plume over <2km for SOW, and <1km for silt in either direction. However, as noted above, there is no information on the max disturbance width or amount of sediment disturbed due to cable installation at DOW/SOW, compared with those at DEP/SEP. Please provide further clarification within an updated chapter.*

29. *ID 40: Point 255. Given that the [export cable corridor] ECC traverses the [Cromer Shoal Chalk Beds] CSCB MCZ, it would be very helpful if the plume model data for SOW/DOW could also be provided as predicted deposition footprints for representative locations between the HDD exit location and seaward boundary of the MCZ. These should be representative of the different sedimentary zones along the ECC within the MCZ and also include the HDD exit location. Furthermore, it is not stated what the estimated deposited sediment thickness may be for the different sediment fractions (i.e. fine/medium/coarse) due to export cable installation. Modelled deposition footprints and thickness should be provided for locations representative of the different sedimentary zones along the ECC within the MCZ and include the HDD exit location. Can estimated deposited sediment thickness be provided for the different sediment fractions?*

1.4.2 Response

30. Scira (2006) completed sediment dispersion modelling to define the extent of plume dispersion due to SOW export cable installation and the extent of the depositional

footprint. Given the similar positions of the SOW export cable corridor and the SEP and DEP export cable corridor, the modelling of the SOW installation was considered a suitable analogue for the potential effect of the installation of the SEP and DEP cables.

31. Scira (2006) defined the following parameters for the plume dispersion modelling for SOW:
    - cable burial depth of 1m;
    - 0.3m^3 of sediment disturbance per metre run; and
    - sediment size distribution of less than 4% fines.

32. Table 6-2 of the ES [APP-119] indicates that at SEP and DEP, the following trench sizes and sediment disturbance volumes were assessed for export cables:
    - cables buried up to 1m below the seabed using an indicative sediment displacement width of 1m and a v-shaped trench;
    - cable lengths of 62km for DEP and 40km for SEP;
    - displaced sediment of 31,000m^3 for DEP and 20,000m^3 for SEP;
    - mud content less than 5% outside the MCZ and mostly 0% inside the MCZ.

33. Translating these absolute volumes for SEP/DEP to sediment disturbance per metre run equates to 0.5m^3 per metre of export cable. This is approximately 1.6 times higher than the volume modelled for sediment dispersion for SOW.

34. **Figure 11** and **Figure 12** illustrate the results of the sediment dispersion modelling for the SOW export cable based on the parameters described by Scira (2006). They describe the footprint of dispersion that represents the peak increase of suspended sediment experienced at each point in the model domain over the full duration of the simulation. The minimum contour value is a 1mg/l increase as it is assumed that any value below this is negligible in relation to the background situation.

35. They show that the neap tide footprint is predicted to extend less than 2km, while the spring tide footprint is very small. The neap tide footprint is larger due to the lower rate of turbulent diffusion. If the extent of the footprint and magnitude of concentrations are upscaled by 1.6 times to account for the difference in sediment disturbance volumes between SEP/DEP and SOW, then the spread would be less than 3.6km on a neap tide and remain very small on a spring tide. Suspended sediment concentrations are likely to be higher, but would only be less than 10mg/l, conservatively.

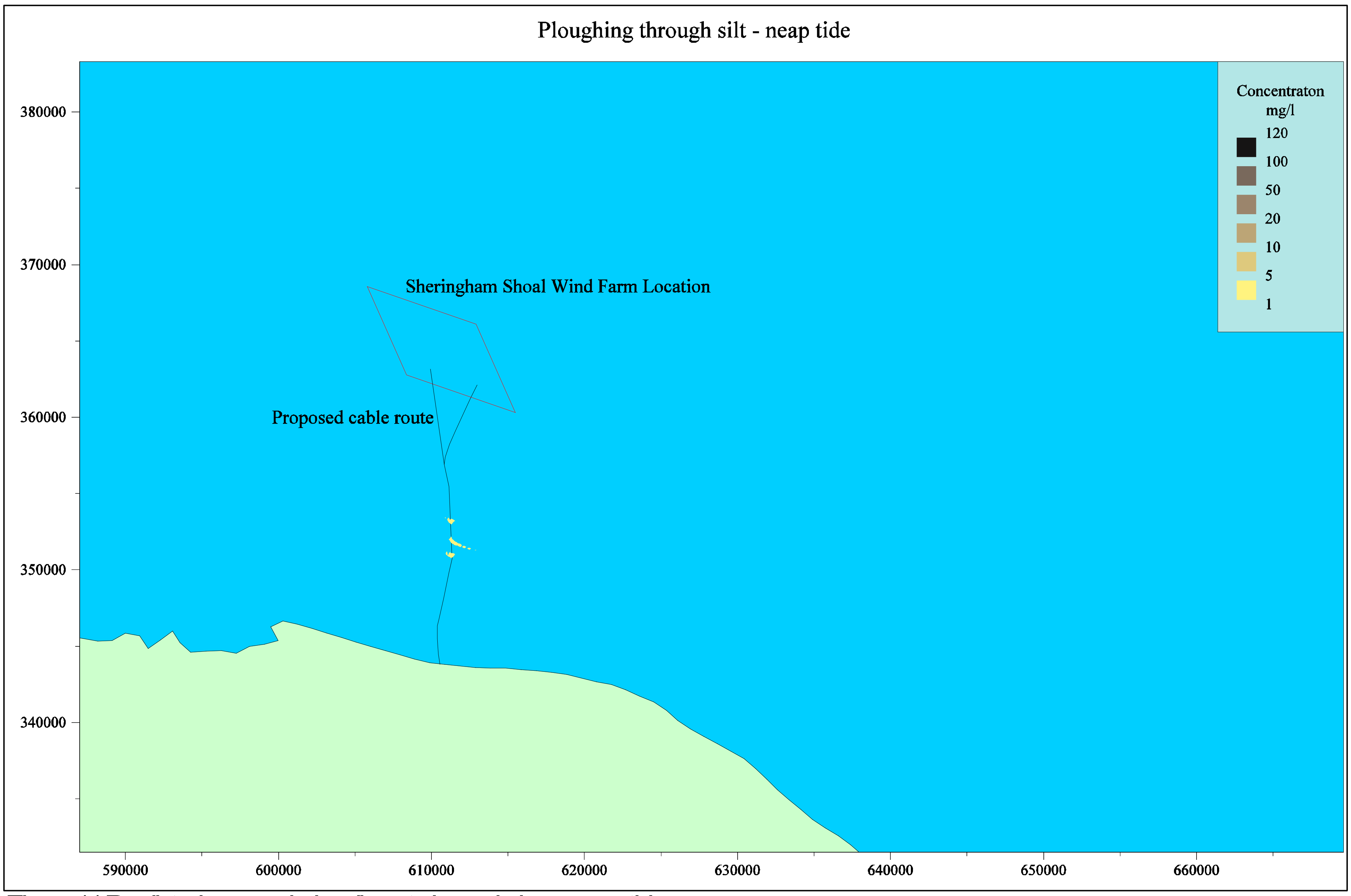

Figure 11 Predicted suspended sediment plume during a neap tide

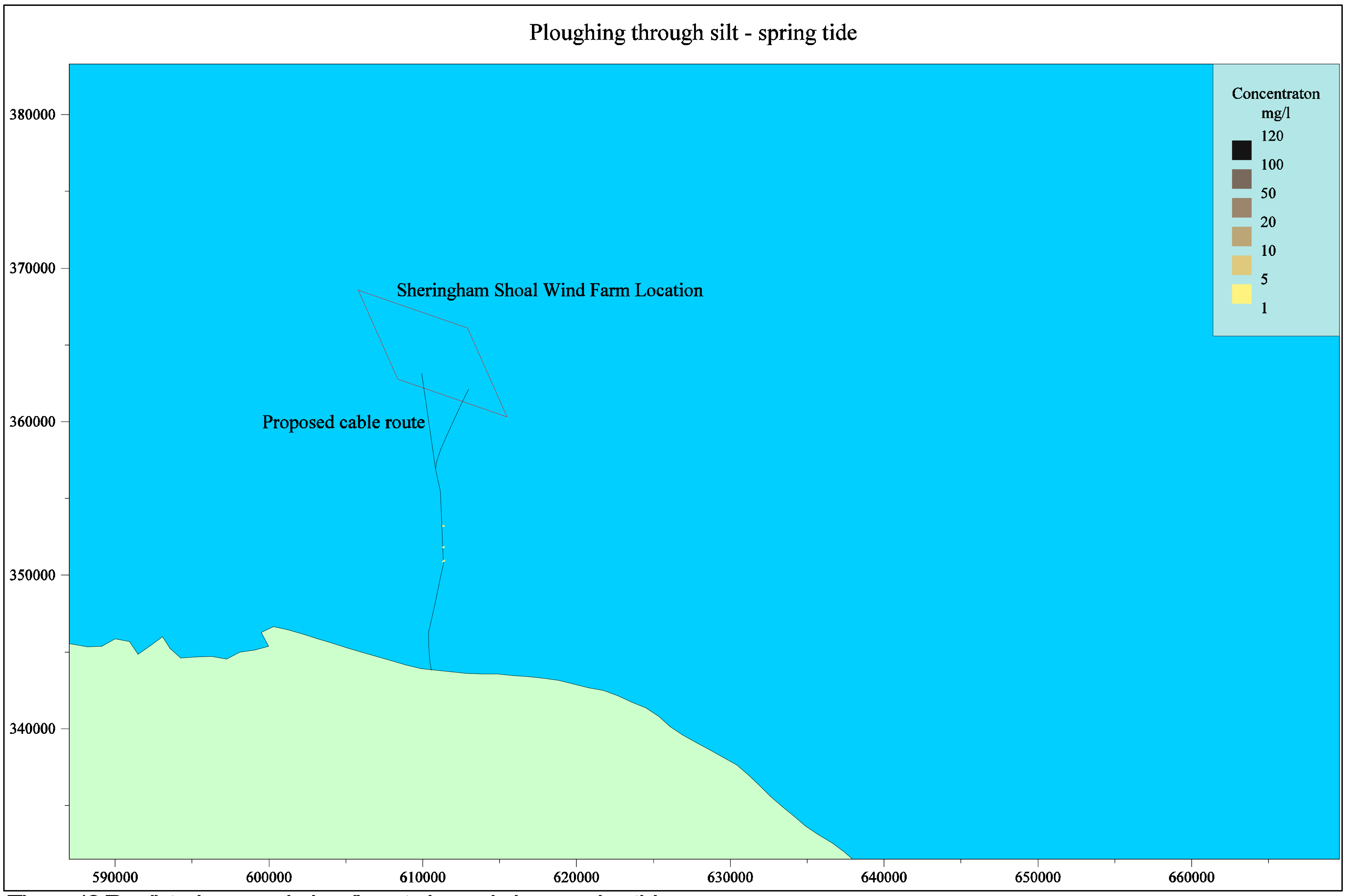

Figure 12 Predicted suspended sediment plume during a spring tide

36. In terms of the comparison of mud content, the SOW modelling is conservative (using 4%) compared to SEP/DEP because most samples inside the MCZ along the SEP/DEP export cable corridor do not contain any mud (the values are equivalent outside the MCZ).

37. Scira (2006) indicated that the predicted footprint of silt deposition extended over a wide area, but at an undetectable rate. Even under slack water conditions, the maximum rate of deposition over the six-tide simulation was less than 0.5mm in the areas of greatest deposition, and in most of the footprint area the rate was far less. This result is anticipated as the deposited fines will be re-suspended on each tide, with no measurable sediment left in place. No contour plots were presented.

38. If the predicted sediment thickness is increased to account for the difference in sediment disturbance volumes between SEP/DEP and SOW, then it would still be less than 0.8mm thick as a maximum and would be re-suspended on each tide. The time taken to reach a situation where there is no measurable sediment left on the seabed would take slightly longer to achieve.

1.5 Local Changes to the Seabed Bathymetry at DOW Post Construction

39. There are two related comments on the need to provide additional post-construction geophysical monitoring evidence of minimal changes to seabed bathymetry at DOW. These are included below for ease of reference.

1.5.1 Natural England Comments at ID 6 and ID 52

40. *ID 6: In addition, there does not appear to be DOW geophysical survey data to support conclusions that construction-related effects were minor and localised and that the seabed topography has not changed greatly.*

41. *ID 52: Point 337. Geophysical survey data from the existing OWFs are useful. However, it is stated that the DOW geophysical survey shows that only minor and localised effects remain from the wind farm construction, and that the 'overall topography of the seabed within DOW has not greatly changed'. However, it does not state when this survey was undertaken, nor what the minor and localised effects might be that remain, nor how the seabed is not greatly changed and since when. This should be made clearer as it is too vague to provide any useful comparison with SEPDEP. Furthermore, does the post-construction survey show any evidence of change to sandbank morphology or migration rate across DOW?*

1.5.2 Response

42. This response provides more detail on the evidence from the comparison of pre- and post-construction geophysical surveys.

43. MMT (2018) detailed the results of the year 1 post-construction geophysical survey performed from 15th August to 5th September 2018 at the Dudgeon Offshore Wind Farm, where the aim was to determine site topography, gradient, seabed mobility and seabed features compared to a number of surveys undertaken pre-construction. The geophysical information was collected using multibeam echosounder (bathymetry) and side scan sonar (seabed texture) in advance of an environmental survey.

44. MMT (2018) reported the results of a full site comparison between 2013 and 2018 and a sandwave migration analysis (between 2007 and 2018) across six sites within the DOW array area. **Figure 13** shows a difference plot between the 2013 and 2018 bathymetry datasets for the whole array. The data shows that, apart from the areas of mobile sandwaves, there has been little change in the overall seabed depth.

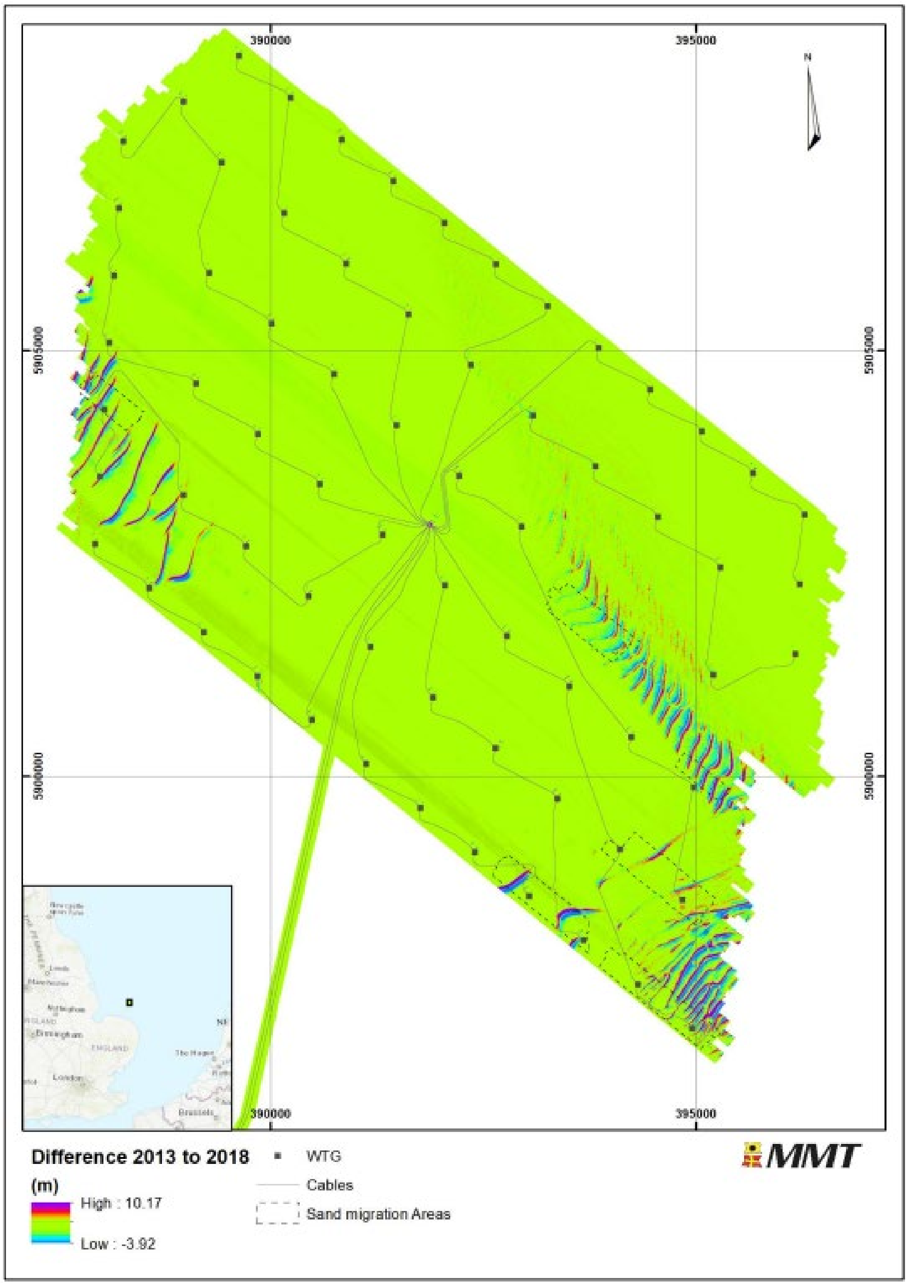

Figure 13 Difference in bathymetry between 2013 and 2018 across the DOW array area

45. There have been significant changes within the six sandwaves areas shown on Figure 14:

- sandwaves located in the southeast are migrating to the northwest (**Figure 15**). Rates of migration vary from an average of 2.5m/year over the 11-year period from 2007 to 2018, and an accelerated rate of about 10m/year between 2017 and 2018;
- sandwaves located in the west are migrating to the northwest (**Figure 16**). Rates of migration vary from an average of 3.5m/year over the 11-year period from 2007 to 2018, and an accelerated rate of about 6.5m/year between 2017 and 2018; and
- sandwaves located in the east are migrating (predominantly) to the southeast (**Figure 17**). The average rate of migration was 3.5m/year over the 10-year period from 2007 to 2017. Between 2017 and 2018, there appears to have been a reversal in migration direction with a rate of about 4.5m/year to the northwest.

46. The sandwave migrations are indicative of naturally occurring processes across the array site and are not driven by changes caused by DOW. This is evidenced by the absence of seabed change across the rest of the array site.

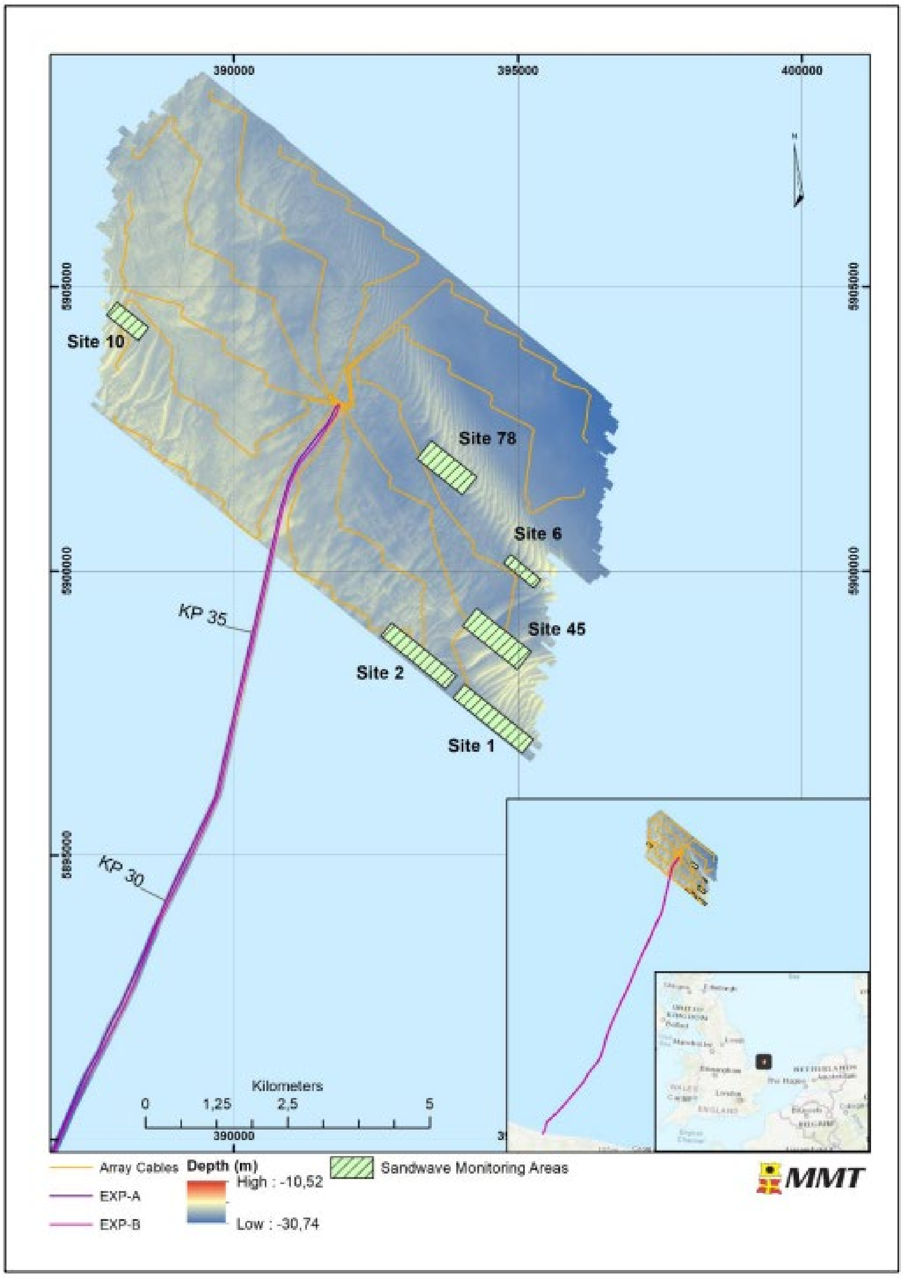

Figure 14 Locations of six sites for sandwave migration analysis within the DOW array area

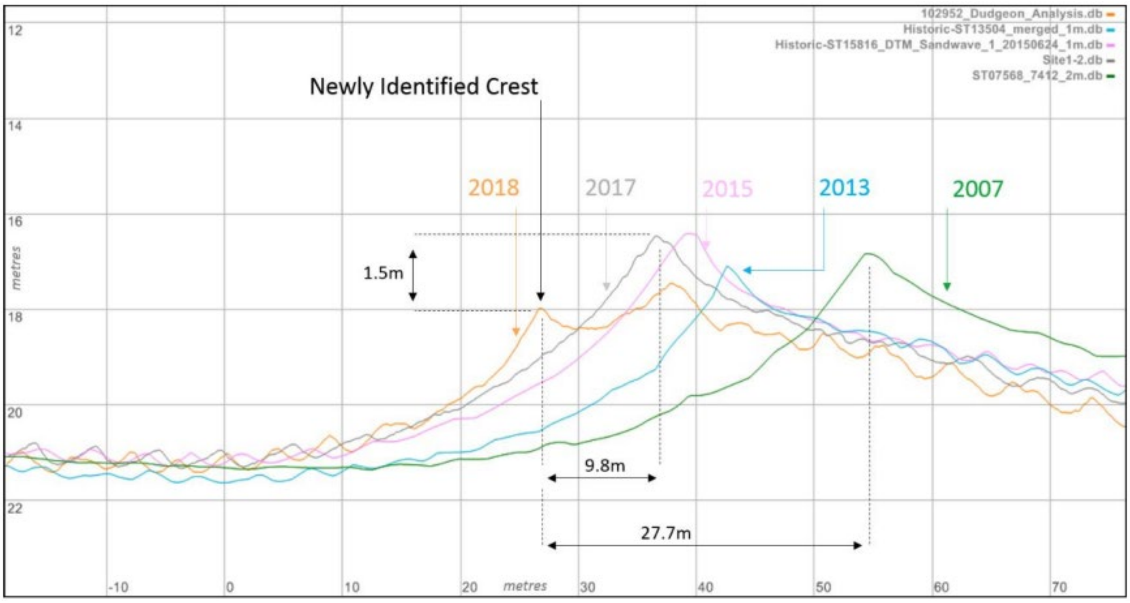

Figure 15 Site 1 seabed profile demonstrating sandwave migration over eleven years

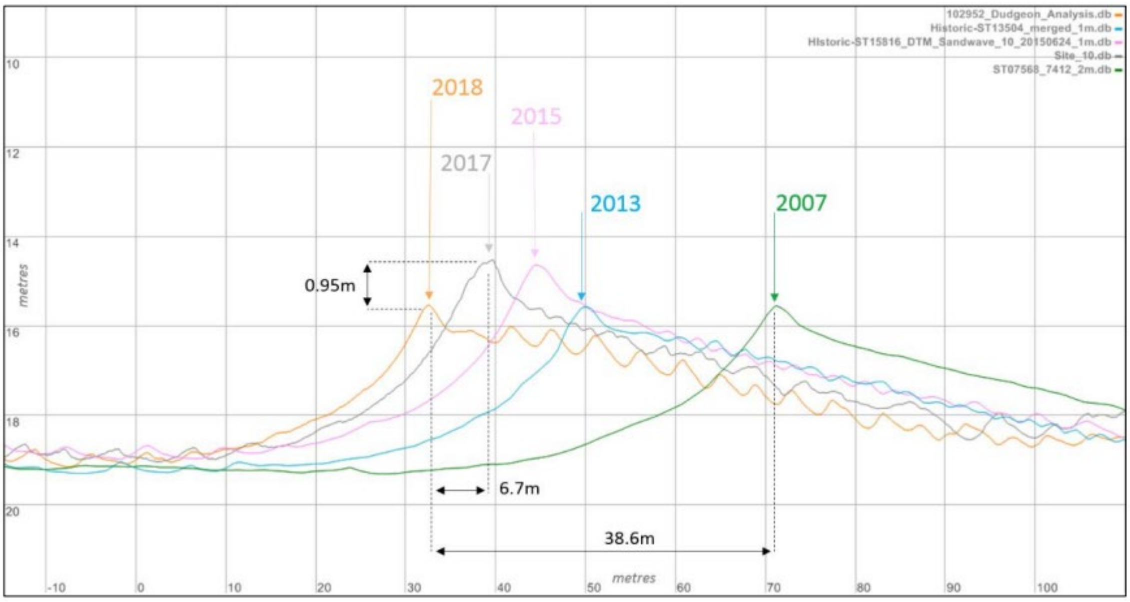

Figure 16 Site 10 seabed profile demonstrating sandwave migration over eleven years

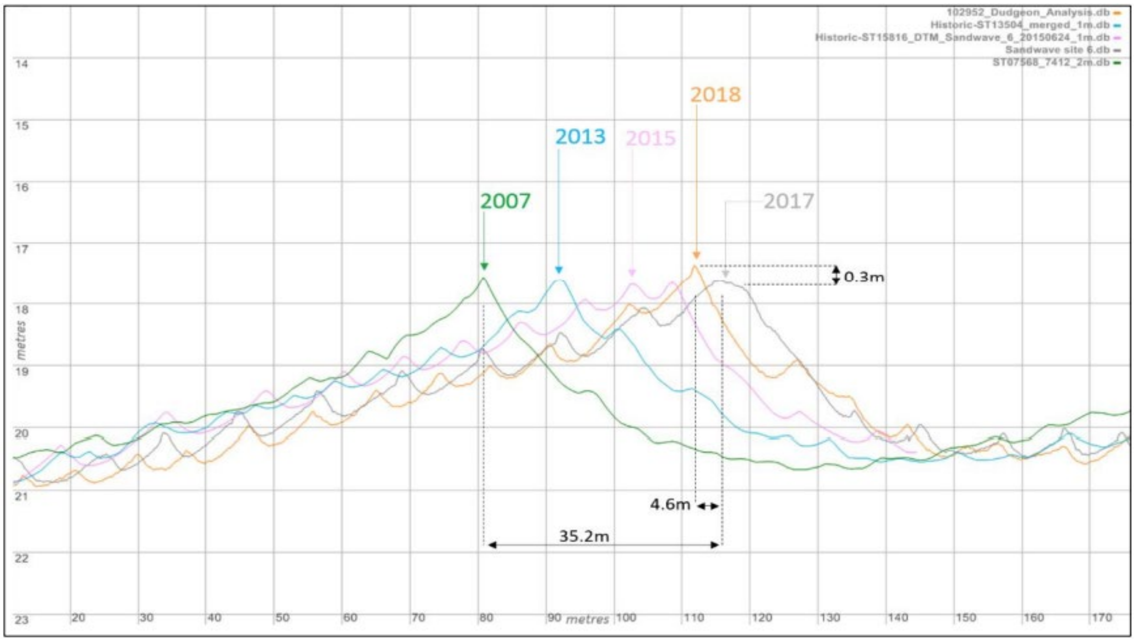

Figure 17 Site 6 seabed profile demonstrating sandwave migration over eleven years

2 Conclusions

47. Further detail in relation to the baseline characterisations of bedforms and updated figures showing MPAs and tidal ellipses have been provided. The baseline characterisation of the bedforms supports the conclusion that the sandwaves are mobile under natural conditions and would recover from any proposed levelling through re-establishment of sand transport pathways. The ellipses provide an indication of the maximum extent to which a sediment particle could travel in the water column. Most particles would not achieve this distance, because they would settle to the seabed closer to their release point (up to a kilometre along the axis of tidal flow) rather than travelling to the full extent of the ellipse.

48. Further detail on suspended sediment concentrations and interpretation of the SOW export cable plume dispersion modelling has been set out which shows that, if translated to SEP / DEP, the neap tide footprint is predicted to extend less than 3.6km, while the spring tide footprint is very small. Concentrations would be less than 10mg/l. The predicted footprint of deposition would extend over a wide area but would be an undetectable thickness.

49. Finally, further consideration of pre- and post-construction changes to seabed bathymetry at DOW has been provided, with results indicating that, apart from areas of mobile sandwaves (which are migrating under natural conditions), there has been little change in the overall seabed depth across the site.

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