FOREWIND

DOGGER BANK
TEESSIDE A & B

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Environmental Statement Chapter 13 Appendix G Habitats Disturbance Calculations Report

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Dogger Bank Teesside A and Dogger Bank Teesside B Offshore Wind Farms

Calculation of areas of overlap of Dogger Bank Teesside Project areas with herring spawning grounds and areas of sandeel preferred habitat.

Reference	Issue Type	Date Issued	Checked	Approved
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1. Introduction

1.1 The following technical report provides a description of the method used to calculate the relative areas of overlap of Dogger Bank Teesside A, Dogger Bank Teesside B and the Dogger Bank Teesside A & B Export Cable Corridor with defined spawning grounds of herring *Clupea harengus* and preferred habitat areas of lesser sandeel *Ammodytes marinus*. These values are considered in the assessment of impacts in **Chapter 13 Fish and Shellfish Ecology**.

1.2 The distribution of herring spawning grounds, as defined by Coull *et al.*(1998), in relation to the location of Dogger Bank Teesside A and Dogger Bank Teesside B is shown in Figure 1. The Export Cable Corridor traverses the defined Flamborough Head coastal herring spawning grounds (A) and a smaller area of offshore grounds (B). Dogger Bank Teesside A overlaps a relatively small section of former (historic) offshore spawning grounds (C). Current research indicates that spawning of the Banks herring stock is confined to small areas along the English east coast, from the Farne Islands to the Dowsing area, from August to October (ICES 2010).

1.3 Baseline surveys have shown that sandeel are patchily distributed within Tranche A and less abundant within Tranche B. The highest densities occur along the western boundary of Tranche A, outside the footprint of the foundation layout of Dogger Bank Teesside A& B. Sandeel foraging habitat is widespread, covering approximately 5% of the total area of the North Sea (Jensen *et al*. 2011) and the distribution of sandeel fishing effort (as shown by the intensity of Danish fleet VMS data) indicates that there is widespread availability of preferred habitat adjacent to areas which may sustain temporary or permanent loss of seabed habitat resulting from the construction of the wind farm.

1.4 ICES ceased to treat lesser sandeels in the North Sea as a single stock in 2011, following a review of evidence on habitat, larval drift, and regional growth differences that indicated that there were seven subpopulation regions that differed in their vulnerability to exploitation (ICES, 2010). These seven subpopulations are considered to be reproductively isolated and the assessment areas chosen by ICES were determined in order to relate local recruitment with spawning stock biomass. Dogger Bank Teesside A &B and the Dogger Bank Teesside A & B Export Cable Corridor fall within the extensive boundaries of the Dogger Bank Sandeel Area (SA1) as defined by ICES (see Figure 2).

2. Method

2.1 Herring

2.1.1 The area of overlap of Dogger Bank Teesside A (including the 1km construction buffer) with the former herring spawning grounds was calculated using ArcGIS v10 (ESRI 2011). The maximum areas of the Flamborough Head grounds and the offshore grounds intersected by the Export Cable Corridor were estimated by calculating the length of cable overlap in ArcGIS and multiplying the result the width of the hard substrate required to cover two trenches for two export cables (i.e. 31m). This is a worst case scenario which assumes that the pair of HVDC export cables will be unbundled for their entire length.

2.2 Lesser sandeel

2.2.1 The distribution of sandeel fishing in the Dogger Bank and the wider North Sea, based on Danish VMS data (average 2008-2012), is given in Figure 2. The highest fishing intensity in the Dogger Bank Zone is distributed along the western boundary of the zone. In general terms, there is little sandeel fishing conducted within Tranche B while relatively high levels of intensity are recorded in Tranche A, particularly along the western and eastern sections, with fishing also occurring, to a lesser extent, along the northern boundary. A relatively low level of fishing intensity occurs within Dogger Bank Teesside A and Dogger Bank Teesside B with the exception of a localised patch of high intensity fishing focused in a small area in the eastern sector of Dogger Bank Teesside B.

2.2.2 The approach to the estimation of the area of preferred sandeel habitat followed the method of Jensen *et al.,* (2011). Medium to high intensity sandeel fishing, as represented by Danish VMS values greater than 10 (averaged for the years 2007-2011) were assumed to provide a proxy for areas of preferred sandeel habitat. Total areas with VMS intensity greater than 10 within the Dogger Bank SA1 sandeel management area, Dogger Bank Teesside A, Dogger Bank Teesside B and the Dogger Bank Teesside A & B Export Cable Corridor were calculated in ArcGIS v.10 (ESRI 2011).

2.3.2 The use of Danish VMS data as a proxy for the spatial extent of suitable sandeel habitat assumes that the fishing grounds are believed to represent the major areas of sandeel distribution in the North Sea, however, it reasonable to expect that smaller patches of additional suitable habitat exist (Bergstad *et al.* 2001)

3. Results

3.1 The values used in the estimation of the relative areas of overlap are presented in Table 1. An estimated area of 168 km^2 of the south eastern sector of Dogger Bank Teesside A overlaps with the historic herring spawning ground. No active herring spawning has been recorded in this area since the late 1970s. The total area of the historic ground as defined by Coull et al. (1998) is estimated as 14,858 km^2 therefore the maximum area of the historic grounds potentially affected by physical disturbance/habitat loss is equivalent to 1.13% of the total historic spawning area of the Banks herring stock.

Table 1 Estimates of spatial overlap with herring spawning areas.

	Herring spawning grounds (see Figure 1)		
Measurement	Flamborough Head (A)	Offshore (B)	Historic (C)
Total area (km^2)	10 512	504	14 858
Length of Export Cable overlap (km)	27	11	-
Width hard substrate (m) for 2 trenches	31	31	-
Area of overlap (km^2)	0.84 (Export Cable)	0.34(Export Cable)	168.46*(Teesside A)
Relative area of overlap (%)	0.01%	0.07%	1.13%

* No herring spawning activity has been recorded in this area within the last 40 years

3.2 The Dogger Bank Teesside A & B Export Cable Corridor traverses a length of 27km through the inshore Flamborough herring spawning area as defined by Coull *et al*. (1998). Assuming trenching and a 15.5m wide corridor of hard substrate as a worst case scenario, the cable corridor will potentially impact an area of 0.84km^2, equivalent to 0.01% of the total area of the inshore Flamborough spawning grounds. The Dogger Bank Teesside A & B Export Cable Corridor also passes through 11km of the offshore spawning ground and (as previously, assuming a worst case scenario of trenching and hard substrate protection for 2 cables) will overlap 0.34km^2 or 0.07% of this offshore spawning ground.

3.3 Sandeel is a demersal spawner and the results of fish and shellfish characterisation surveys show that they are patchily distributed in tranches A and B. No areas of sandeel preferred habitat were identified within Dogger Bank Teesside A. Dogger Bank Teesside B falls within a high intensity spawning habitat for sandeel. The estimates presented in Table 2 indicate that Dogger Bank Teesside B overlaps an area of 71km^2 of sandeel preferred habitat which is equivalent to 0.56% of the estimated total area of preferred habitat for the Dogger Bank sandeel stock in the SA1 management area. Physical disturbance due to construction activities will occur along a length of 22.6km of the Dogger Bank Teesside A & B Export Cable Corridor which is equivalent to a VMS density of 59km^2. This is a precautionary estimate since it reflects the resolution of the VMS data. It is expected that the actual area of physical disturbance resulting from the installation of two trenches and the introduction of hard substrate will be considerably less.

Table 2 Estimates of spatial overlap with areas of preferred sandeel habitat.

Area (see Figure 2)	Total area of preferred habitat within each area (km^2)	Relative area of overlap (%)
SA1 (total area= 151 284 km2)	12 675	
Dogger Bank Teesside A	0	0%
Dogger Bank Teesside B	71	0.56%
Dogger Bank Teesside A & B Export Cable Corridor	59	0.47%

4. Conclusion

The method used here for calculating the spatial extent of sandeel preferred habitat produced similar estimates to those reported by Jensen et al., 2011 and therefore this approach is considered to provide a reasonable estimate of the areas of sandeel preferred habitat impacted by Dogger Bank Teesside A, Dogger Bank Teesside B and the Dogger Bank Teesside A & B Export Cable Corridor.

Construction activities in Dogger Bank Teesside A, Dogger Bank Teesside B and the Dogger Bank Teesside A & B Export Cable Corridor have the potential to impact a very small proportion the areas of current and historic Banks herring spawning grounds and SA1 sandeel preferred habitat in the Dogger Bank zone.

References

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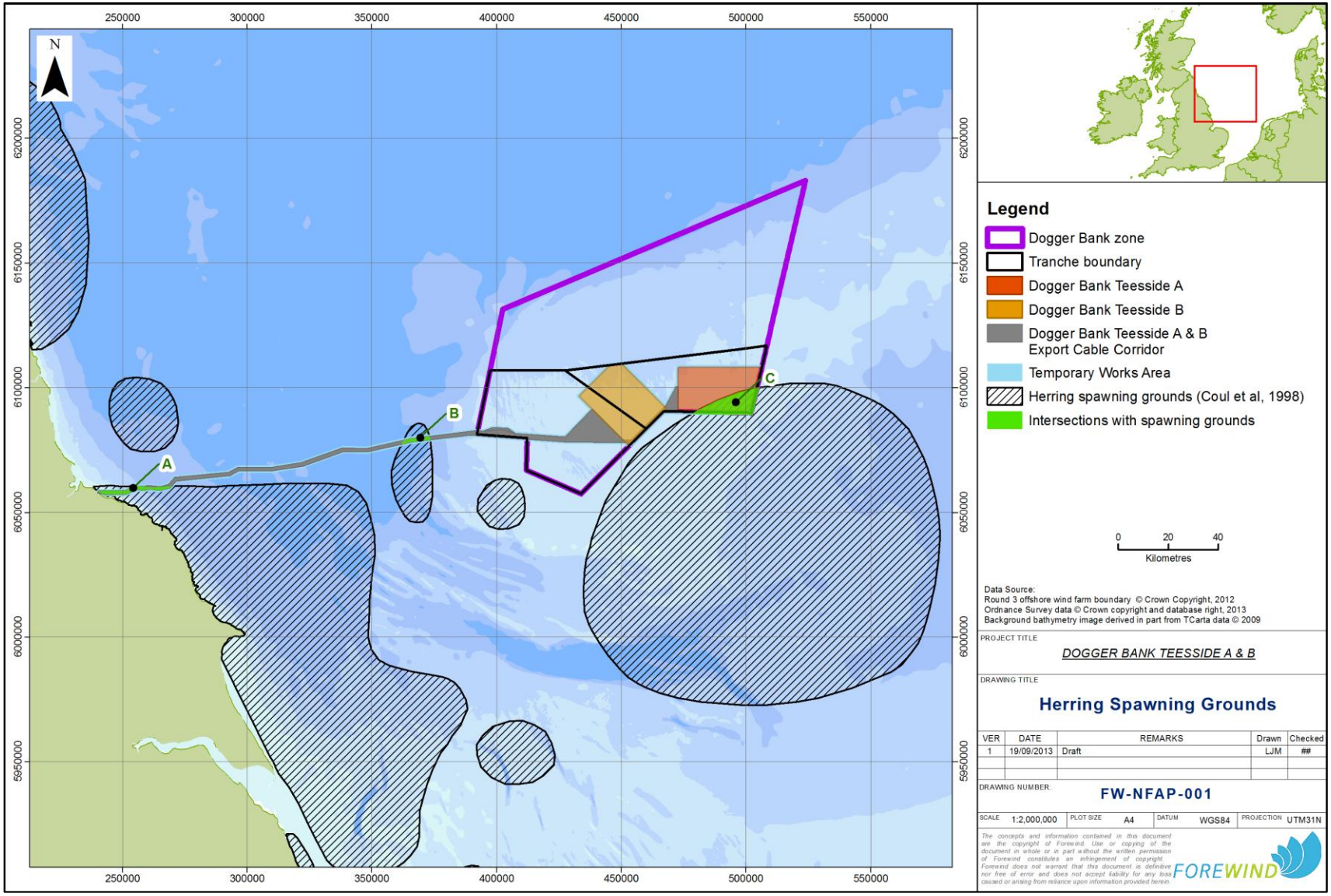

Figure 1 Herring spawning grounds relative to Dogger Bank Teesside A & B

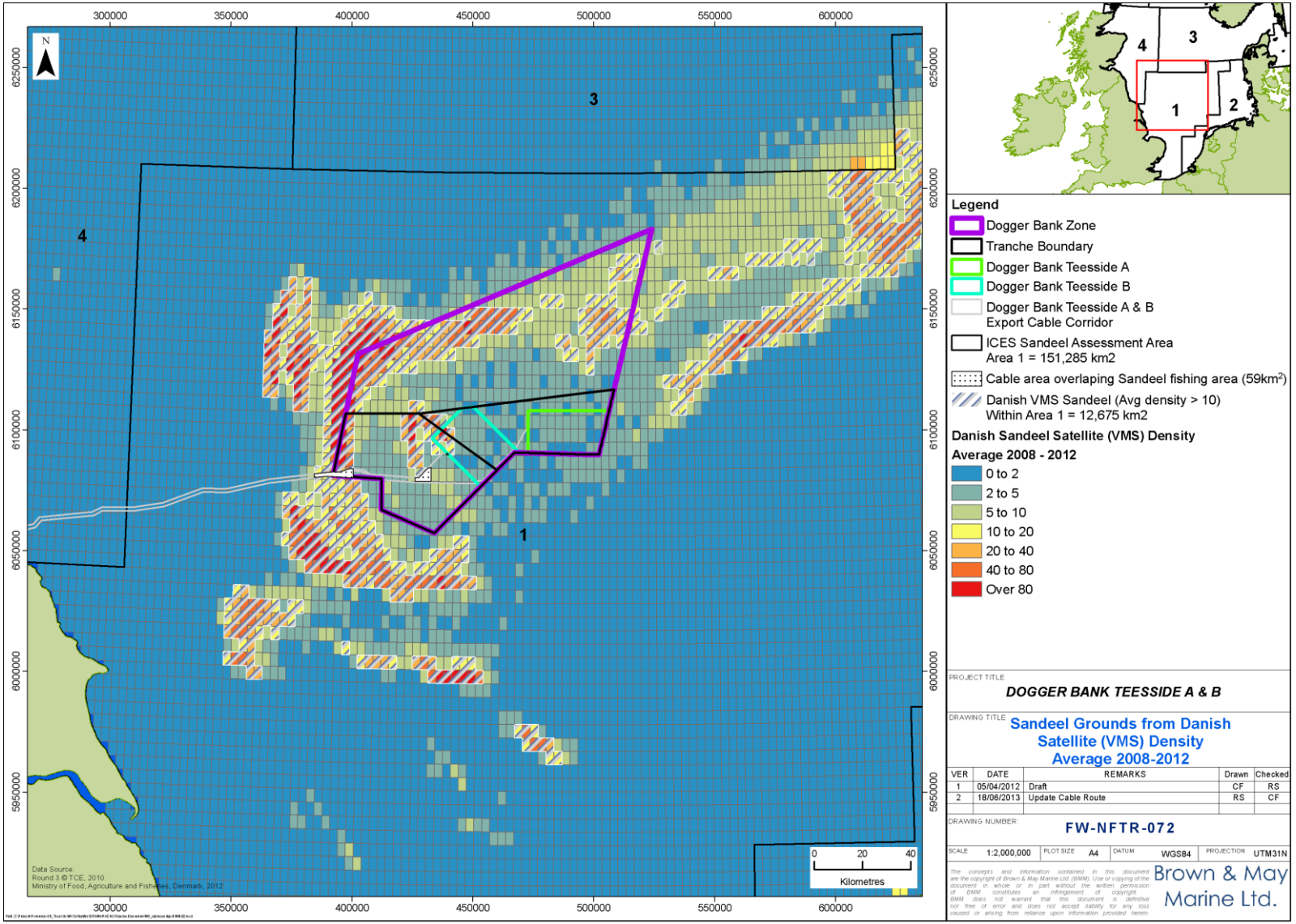

Figure 2 Danish sandeel fleet VMS intensity relative to Dogger Bank Teesside A & B