AQUIND Limited

AQUIND INTERCONNECTOR

Consultation Report – Appendix 1.3M

Summary Note on Seabed Preparation and Deposit of Dredged Material

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Seabed Preparation and Deposit of Dredged Material Summary Note

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CONTENTS

1. INTRODUCTION

1.1.1. This summary note should be read in conjunction with the accompanying Figure 1: Proposed Dredge Disposal Area Map which identifies the areas within the Marine Cable Corridor (within the UK marine area) where deposit of dredged material is proposed, and which will be defined as a disposal site for the purposes of the AQUIND Interconnector.

1.1.2. Analysis of survey data received to date has identified indicative areas along the Marine Cable Corridor where seabed preparation is required. This note seeks to identify what seabed preparation activities may be required as part of the construction phases of the project with particular focus on clearance of large ripples and sandwaves.

1.1.3. Figure 1 also identifies the location of sandwaves and large ripples along the Marine Cable Corridor.

1.1.4. Upon completion of marine surveys and analysis of the data prior to cable installation, further detail will be available to refine the location and extent of these bedforms and the seabed preparation activities required. Due to their nature, mobile bedforms can move over time – documented estimates are approximately 100 - 365 m/year for large ripples and 10 m/year for sandwaves[1]. Therefore, the estimated locations and volumes are expected to be different at the time of installation. However, the current dredge and deposit volumes are based on the best available evidence (including geophysical and geotechnical data) and includes a conservative bulking factor of 30% to produce estimated volumes which will be used to inform the sediment plume modelling.

[1] Dorst, LL. (2009). Estimating sea floor dynamics in the Southern North Sea to improve bathymetric survey planning. Published PhD dissertation.

Knaapen, MAF. (2005). Sandwave migration predictor based on shape information. *Journal of Geophysical Research,* Vol 10.

Morelissen, R, Hulscher, SJMH, Knaapen, MAF, Numeth, AA, and Bijker, R. (2003) Mathematical modelling of sand wave migration and the interaction with pipelines. *Coastal Engineering,* 48.

2. POTENTIAL OPTIONS FOR SEABED PREPARATION ACTIVITIES

2.1.1. In order to receive advice from the MMO (in consultation with Cefas), Natural England and Environment Agency on the possible construction activities for AQUIND, the following section outlines potential options for seabed preparation. The options presented below are based on the current Project Description (Chapter 3) which is presented as part of the Preliminary Environmental Information Report (PEIR):

- **Post lay grapnel run (PLGR) -** A PLGR is commonly used at the start of cable installation to provide a cable route clear from obstacles or marine debris. The use of a PLGR is not considered to be a marine disposal activity but will be assessed within the EIA. Should any debris be brought to the surface this will be recycled or disposed of onshore.
- **Boulder Removal** - Two possible options are currently being considered; i) the use of a plough to clear boulders and/or ii) use of a grab to move to move boulders to the side. It is considered that this is not classed as a disposal activity and therefore will not be covered in the seabed characterisation report.
- **Use of a mass flow excavator (MFE) -** MFE is a form of jetting machine, which uses high flow water jets to temporarily displace and suspend seabed sediments to displace sandwaves and/or create a trench into which the marine cables will be installed. Once suspended, the seabed sediment is typically removed via tidal currents and re-deposited locally. The use of an MFE is not considered as a disposal activity.
- **Use of a trailer hopper suction dredger (TSHD) -** Dredging will likely be undertaken using a trailing suction hopper dredger ('TSHD') vessel. At the location where dredging is required, the TSHD will reduce its sailing speed and lower its suction pipe and draghead to the seabed. Depending on the vessel, the draghead is typically 4 – 5 m wide and able to penetrate 30 – 50 cm into the seabed. Once the draghead reaches the seabed, it is trailed along the seabed and suction pumps are used to suck up the sediment, typically a mixture of sand and seawater. The dredged material is loaded into the 'hopper' or hold of the vessel. Possible options for the dredged material include:
    - **Deposit within the red line boundary (RLB) of the Marine Cable Corridor –** Dredged material will be released from the dredger and deposited within the RLB. Following advice from MMO in December 2018 (PINS Scoping response) and in the meeting between Natural Power, WSP, HSF and MMO (January 2019), it is understood that MMO class this activity as disposal. As such, any areas where such activity may take place will need to be characterised and designated as a disposal site.
    - **Re-use of material –** Dredged material will be deposited on to the seabed and subsequently dredged back into the TSHD vessel to be used as backfill (e.g. at cable joints). The option to use the dredged material for beneficial use i.e.

beach replenishment etc. will also be kept under review. It is considered that these activities are not considered to be a form of disposal (but as re-use) and therefore, do not need to be covered by the site characterisation/disposal requirements.

3. SANDWAVES AND RIPPLES

3.1.1. Areas of mobile sediments (i.e. sandwaves and large ripples) are known to be present along the Marine Cable Corridor. Current data reveals that the extent of these bedforms differs from that known at the time of submission of the PEIR. These differences are highlighted below in Table 1, in terms of cumulative length, % of the Marine Cable Corridor and number of locations observed.

Table 1: Current data relating to bedforms

Category	PEIR (length, %, no)	Current (length, %, no)
Large Ripple	3.9 km, 3.6%, 8	0.7 km, 0.6%, 1
Sandwave	4.0 km, 3.7%, 9	3.6 km, 3.3%, 8

3.1.2. The locations of these bedforms based upon the most up-to-date information are detailed in Table 2 below.

Table 2: Location and profile of bedforms

KP Start	KP End	Section length (m)	Category	Wavelength (m)	Wave height (m)
31.49	32.17	680	Sandwaves	65-400	2-4
32.50	32.65	150	Sandwaves	65-300	1-2.5
33.67	34.5	830	Sandwaves	60-800	0.5-1.5
35.37	35.42	50	Sandwaves	40-100	1
45.35	46.05	700	Sandwaves	50-350	1-8.5
47.75	48.00	250	Sandwaves	250	3-15
47.99	48.69	700	Large Ripples	700-800	0.6-1.2
49.00	49.80	800	Sandwaves	250-800	2.5-10
54.63	54.72	90	Sandwaves	50-100	0.5-1

3.1.3. Where possible, the marine cables will be routed within the Marine Cable Corridor to avoid mobile bedforms and therefore minimise the requirement for clearance. This will initially be undertaken at the preliminary route engineering stage, before the procurement process.

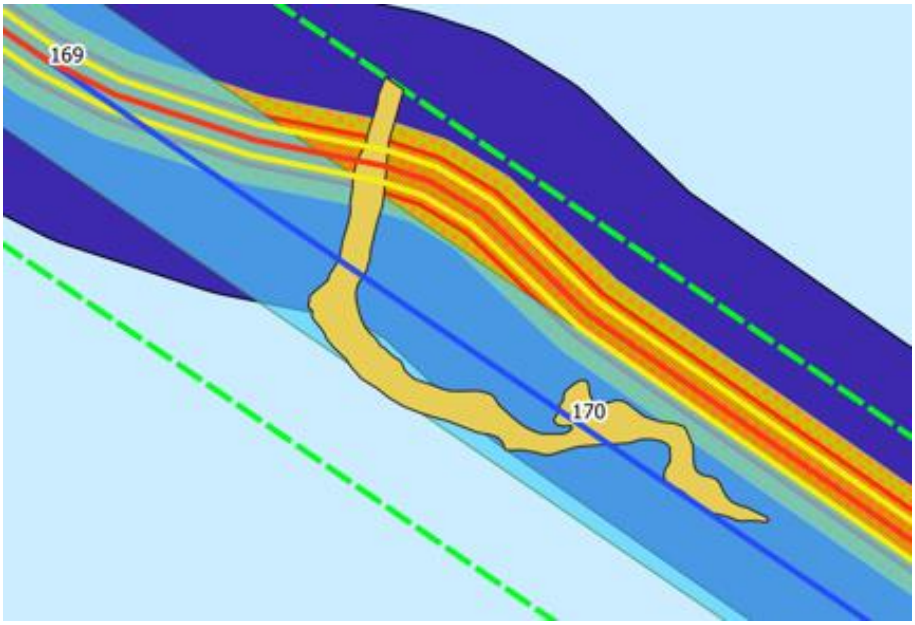


Plate 1: Illustrative example of preliminary routing to avoid bedforms (green line is marine cable corridor; blue line is Survey Centre Line; yellow lines are potential reroute to minimise sandwave interaction)

3.1.4. However, as large ripples and sandwaves are mobile, particularly within the Channel which has a robust hydrodynamic regime which effects sediment transport, it is envisaged that there may be a requirement for additional re-routing of the marine cable route after the pre-installation survey/s and prior to construction.

3.1.5. In areas where sandwaves and ripples are present and where re-routing of the marine cable to avoid such features is not possible, two clearance options are being considered to enable the cables to be buried to the required depth; use of an MFE and use of a THSD.

3.1.6. Clearance of areas of sandwaves and large ripples is required to reduce excessive inclines, creating a flatter alignment for the installation equipment and enable burial in the more stable sediment below the bedforms, thereby reducing the risk of future exposure of the marine cables.

3.1.7. Chapter 3 of the PEIR explains that it is anticipated that approximately 600,000 to 1,700,000 m^3 of sediment along the Marine Cable Corridor will need to be cleared by MFE and/or dredging. This volume also includes dredging/MFE required for other activities such as

installation of the HDD exit pits and omega cable joints. These volumes were calculated using a worst-case scenario whereby it was assumed that the feature took up the whole cross section of the Marine Cable Corridor. However, further refinement of these volumes has been undertaken using more realistic calculations based upon recategorisation of some seabed features following the geotechnical survey data results, geometrical review of the features to be dredged and avoidance of some features. Accordingly, a more realistic volume of material to be dredged is currently anticipated to be up to approximately 1,500,000 m^3. These volumes are still under review and may be refined during the pre-application process.

3.1.8. The latest values are compared against the PEIR values in Table 3 below.

Table 3: Current dredge and disposal volumes

	Dredge Volume (m3)
PEIR estimated dredge volume (large ripple / sandwave clearance, omega joint burial, HDD exit pit)	600,000 – 1,700,000
Revised dredge volume (large ripple / sandwave clearance, omega joint burial, HDD exit pit, including allowance for side slopes and bulking factor)	600,000 – 1,500,000

3.1.9. When using the TSHD, once fully loaded, there are several options for the discharge of the material from the vessel into the deposit locations. These include;

- deposit of the material onto the seabed via bottom opening doors; or
- deposit of the material onto the seabed using a fall pipe (or the suction pipe) below the sea surface.

3.1.10. The proposed areas for depositing dredged material are shown in Figure 1 (and depicted as the Proposed Dredge Disposal Area). It is proposed that disposal will occur within the Marine Cable Corridor within the UK marine area, except within the nearshore areas between KP 0 and KP 21, or at the location of the Atlantic Crossing cable crossing. The current locations of sandwaves and large ripples are shown on Figure 1 to be within the disposal area although the deposit of material would not occur over areas where subsequent dredging was required. However, the location and spatial extent of these bedforms may change within the intervening period between now and construction and therefore, the disposal area proposes to encompass the location of these bedforms to allow sufficient flexibility in the event of bedform migration or alteration.

3.1.11. Although Figure 1 shows that the majority of the Marine Cable Corridor is proposed as a disposal area, it is anticipated that, if bedforms largely remain in the same locations and new bedforms do not appear (which will be verified post consent through a pre-installation survey), that the deposit of dredged material will most likely occur between KP 21 to KP 80 in order to avoid dredger / hopper vessels transiting long distances to deposit material.

3.1.12. Accordingly, sediment plume modelling and the relevant ecological impact assessments (e.g. benthic ecology) will be undertaken for the area between KP 21 and KP 80 in a way that if disposal was subsequently required to occur between KP 80 and KP 109, then the worst-case scenarios for ecological assessments will already have been considered. Further detail on the approach to modelling and agreements on worst case scenarios can be discussed at a later date during a teleconference (see paragraph 4.1.7).

3.1.13. Worst case scenarios for other assessments (e.g. shipping and navigation) would consider the broader disposal area of the Marine Cable Corridor (KP 21-109) where appropriate.

3.1.14. Within the disposal area, it is proposed that material could either be discharged onto the seabed:

- in discrete locations which will eventually be dredged back into the TSHD vessel to be used as backfill (e.g. at cable joints). The option to re-use material as in-fill during cable burial operations will also be considered; or
- as material to be left at that location. It is likely that the sediment will be re-deposited naturally through local wave and tidal driven process.

4. IDENTIFICATION OF DISPOSAL AREA/S FOR DREDGED MATERIAL

4.1.1. Our current approach to the deposit of dredge material using a TSHD is based on:

- the use of the Marine Cable Corridor as a starting point for the proposed disposal area for dredge deposit;
- a constraints mapping exercise to refine the possible areas where dredge deposit will take place using a combination of engineering and environmental constraints;
- modelling of the possible suspended sediment plumes and sediment deposition resulting from the disposal activities and assess the resultant effects in EIA, HRA, and WFD terms;
- characterisation of the spatial extent of the proposed disposal area (the Characterisation Report will be submitted to support the DCO application); and
- inclusion of the designated disposal area and permission to deposit within this area as part of the deemed marine licence.

4.1.2. The deposit locations proposed in Figure 1 have been identified through a constraints mapping exercise which has identified both engineering and environmental constraints along the Marine Cable Corridor where deposit of dredged material is currently considered to be unsuitable.

4.1.3. Engineering marine constraints where disposal will not occur include;

- Deposit will not occur outside the RLB of the Marine Cable Corridor;
- Deposit will not occur at locations of existing large ripples or sandwaves to ensure that the deposited material does not unintentionally back fill the dredged area;
- Areas where water depth is too shallow for the dredger to operate;
- Area where HDD exit/entry location is and areas inshore of the HDD exit/entry point;
- Areas within 500 m of in-service cable crossings; and
- Areas within 100 m of identified potential wrecks (known as Archaeological Exclusion Zones (AEZs), which are currently proposed around four A1 anomalies).

4.1.4. Environmental marine constraints where disposal is not currently proposed to occur include;

- Deposit of material will not occur within or up to 3 km from any identified WFD water bodies in order to reduce potential impacts; and
- In order to avoid sensitive habitats, deposit will not occur within;
    - 500 m of habitat A5.445 (*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment); and

- 100 m of habitat A4.2 (moderate energy circalittoral rock).

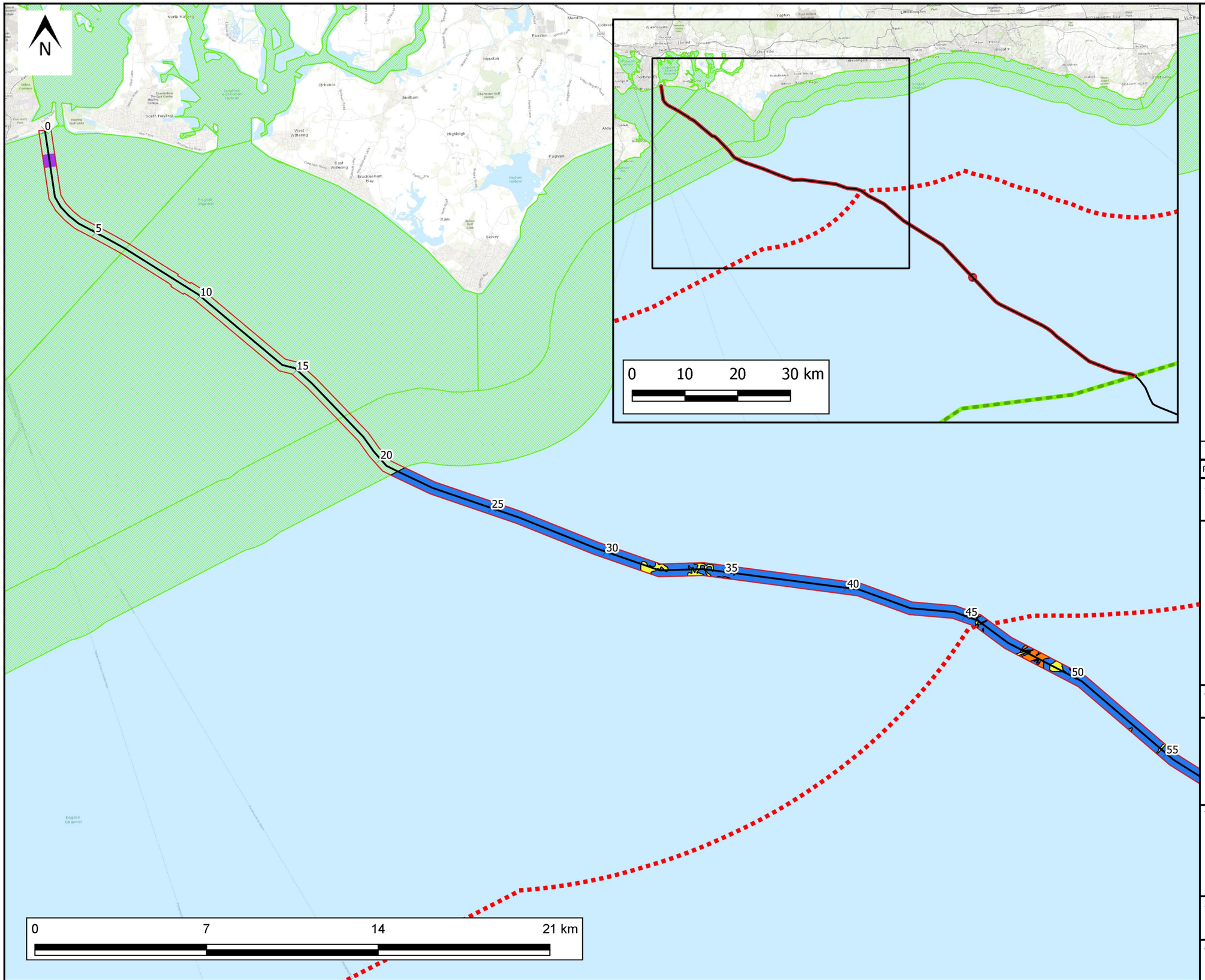
4.1.5. It should be noted that many of these constraints including non-disposal buffers around sandwaves/large ripples, and habitats A5.445 and A4.2 etc. will not be "removed" from the proposed disposal area but will make up a set of rules which will be applied as part of the disposal strategy to be agreed post-consent (see paragraph 4.1.6). Given the mobile nature of the sandwaves and ripples, and that construction is currently proposed to commence in 2021, it is important that flexibility in the spatial extent of the disposal area needs to be retained in order to allow for potential movement or alteration to the sandwaves/ripples.

4.1.6. However, in order to provide comfort to consultees the following approach is proposed:

- The sediment plume modelling will identify and model the release of dredged material at a number of locations within the proposed disposal area between KP21 and KP80. The modelling will consider the locations of seabed features, potential constraints, volumes of material to be dredged and TSHD hopper sizes in order to identify likely areas of deposit within the disposal area; and
- Commitment to the production of a disposal strategy document or method statement. Our disposal strategy will include a set of rules i.e. to avoid sensitive habitats and will be used to refine and identify areas within the broader disposal area, where deposit of material is required as part of construction. This strategy document will be produced in consultation with MMO and Natural England and will identify more refined disposal areas (within the broader disposal site) based upon more up to date pre-installation surveys to determine locations of seabed forms which cannot be avoided.

4.1.7. To shape our approach to the assessment of seabed preparation activities (particularly dredge disposal) please can you provide advice on the following;

- **Do you agree with how we have considered different seabed preparation activities with particular regards to whether they are classed as disposal activities? Where there is any disagreement, please clearly explain where this disagreement exists and provide clear rational as to why you disagree.**
- **Do you agree with our approach to identify and map constraints in order to refine the spatial extent of the proposed disposal area? If not, please clearly explain where you disagree and provide clear rational as to why you disagree. Do you have any further comments including the use of and commitment to a proposed disposal strategy document?**
- **Do you agree with our initial approach to modelling dredge disposal activities? If not, please explain why? Consultation on this can be facilitated through a teleconference where we can provide further detail on the approach.**
- **Please provide guidance and best practice examples of seabed characterisation reports used for similar types of projects e.g. construction projects requiring elements of seabed preparation.**



KEY:

- Survey Centre Line
- Marine Cable Corridor
- Exclusive Economic Zone
- UK 12 Nautical Mile Limit
- Proposed Dredge Disposal Area

Constraints

- Large Ripples
- Sand Waves
- HDD Entry / Exit Locations
- Cable Crossings 500m Disposal Exclusion Zone
- WFD Water Bodies with 3 km buffer

NOTES:

REV	DATE	BY	DESCRIPTION	CHK	APP
0.8	21/03/19	CP	DRAFT		CL

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PROJECT: UK - FRANCE INTERCONNECTOR

TITLE: FIGURE 1 PROPOSED DREDGE DISPOSAL AREA MAP
UK DRAWING 1 OF 2

SCALE @A3:	CHECKED:	APPROVED:
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	21/03/19	21/03/19

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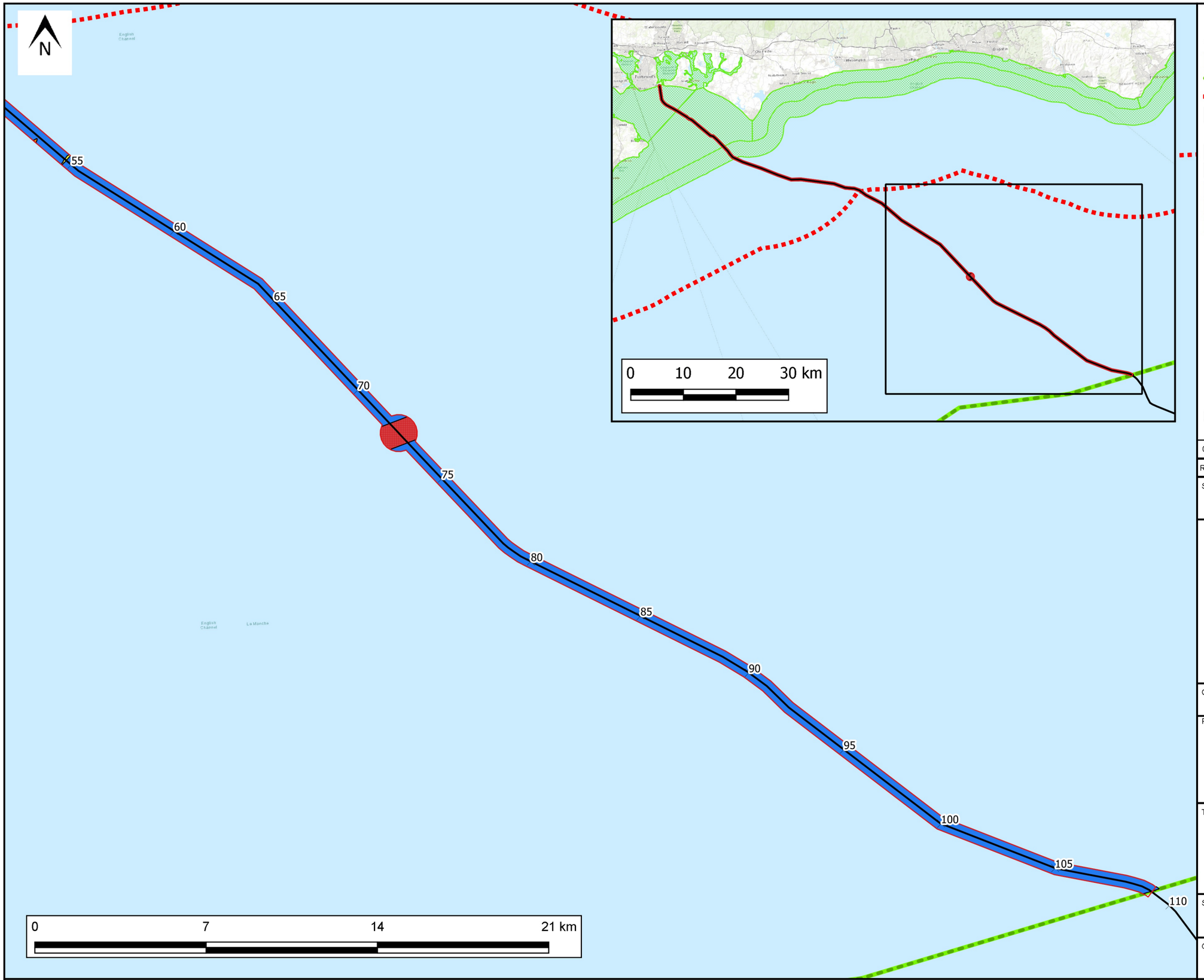

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TITLE: FIGURE 1 PROPOSED DREDGE DISPOSAL AREA MAP UK DRAWING 1 OF 2

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