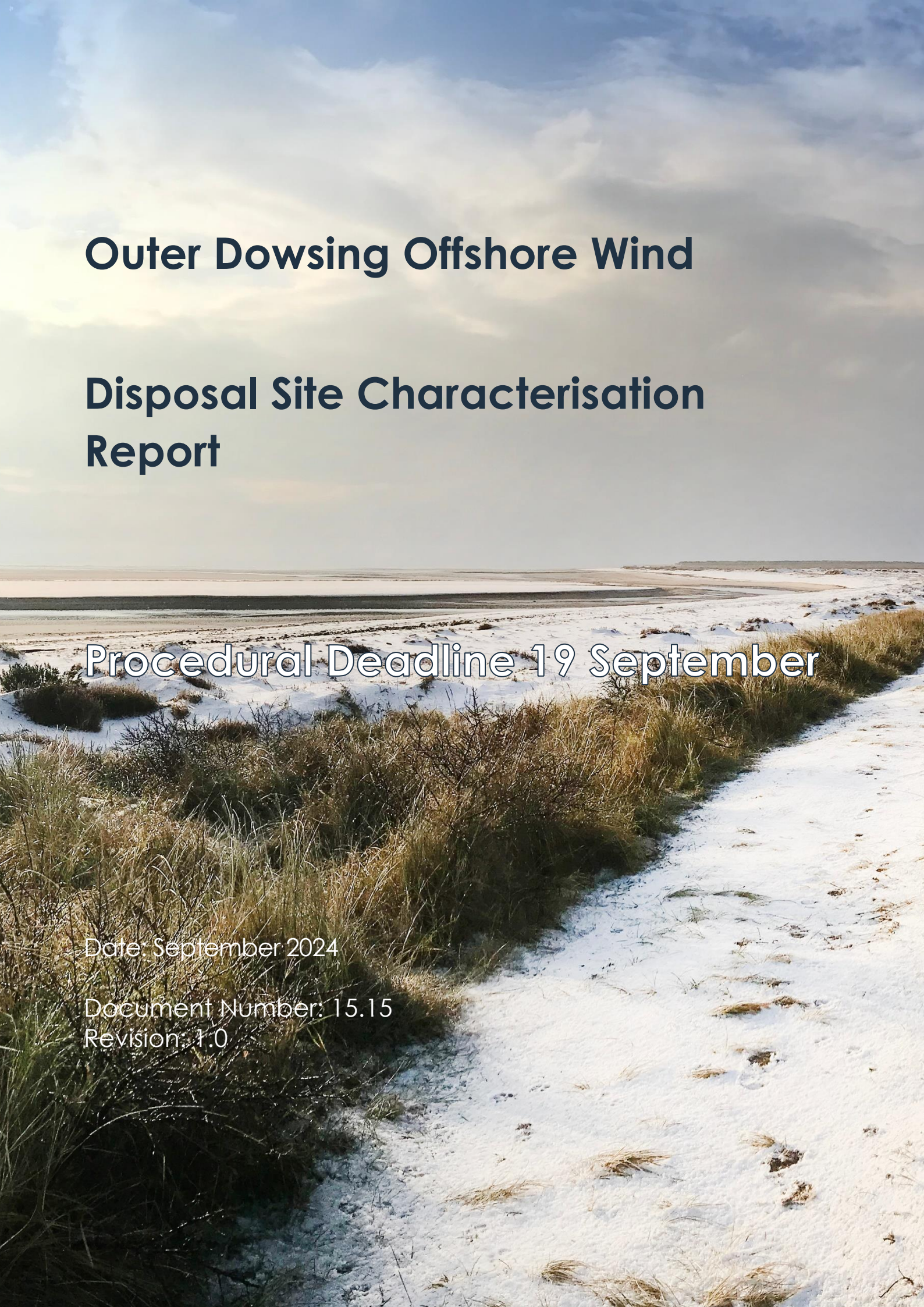

Outer Dowsing Offshore Wind

Disposal Site Characterisation Report

Procedural Deadline 19 September

Date: September 2024

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Revision: 1.0

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Acronyms & Definitions

Abbreviations / Acronyms

Abbreviation / Acronym	Description
ANS	Artificial Nesting Structure
BEIS	Department for Business, Energy & Industrial Strategy (now the Department for Energy Security and Net Zero (DESNZ))
BGS	British Geological Survey
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
EC	European Commission
ECC	Export Cable Corridor (offshore ECC or indicative onshore ECC)
EEC	European Economic Community
EIA	Environmental Impact Assessment
ES	Environmental Statement
EU	European Union
GBS	Gravity Base Structure
GT R4	The Applicant making the application for a DCO. The Applicant is GT R4 Limited (a joint venture between Corio Generation, TotalEnergies and Gulf Energy Development (GULF)), trading as Outer Dowsing Offshore Wind. The project is being developed by Corio Generation (a wholly owned Green Investment Group portfolio company), TotalEnergies and GULF.
HDD	Horizontal Directional Drilling
HRA	Habitats Regulations Assessment
ICES	International Council for the Exploration of the Sea
JNCC	Joint Nature Conservation Committee
JUV	Jack Up Vessel
LAT	Lowest Astronomical Tide
LCLP	London Convention and Protocol
LWT	Lincolnshire Wildlife Trust
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MPA	Marine Protected Areas
NERC	Natural Environment and Rural Communities
NSIP	Nationally Significant Infrastructure Projects
ORCP	Offshore Reactive Compensation Platform
OSPAR	Offshore Reactive Compensation Platform
OSS	Offshore Substation
OWF	Offshore Wind Farm
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation

Abbreviation / Acronym	Description
SPA	Special Protection Area
SPM	Suspended Particulate Matter
SSC	Suspended Sediment Concentration
TCE	The Crown Estate
TSHD	Trailer Suction Hopper Dredger
UK	United Kingdom
WTG	Wind Turbine Generator

Terminology

Abbreviation / Acronym	Description
Array Area	The area offshore within which the generating station (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling will be positioned.
Bedforms	Features on the seabed (e.g. sandwaves, ripples) resulting from the movement of sediment over it.
Benthic	A description for flora and fauna associated with the seabed. Flora and fauna that lie in, on or near the seabed are termed 'benthos'.
Biotope	The combination of physical environment (habitat) and its distinctive assemblages of conspicuous species.
deemed Marine Licence	A marine licence set out in a Schedule to the Development Consent Order and deemed to have been granted under Part 4 (marine licensing) of the Marine and Coastal Access Act 2009.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP).
Maximum Design Scenario (MDS)	The project design parameters, or a combination of project design parameters that are likely to result in the greatest potential for change in relation to each impact assessed
Habitat	The place in which an animal or plant lives. In the marine environment, this is defined according to geographical location, physiographic features and the physical and chemical environment, including salinity, wave exposure, tidal currents, geology, substrate, biological zone, features and modifiers.
Hydrodynamic	Of or relating to the motion of fluids and the forces acting on solid bodies immersed in fluids and in motion relative to them.
Offshore Export Cable Corridor	The Offshore Export Cable Corridor (Offshore ECC) is the area within the Order Limits within which the export cables running from the array to landfall will be situated.
Offshore Reactive Compensation Platform (ORCP)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents) housing electrical reactors and switchgear for the purpose of the efficient transfer of power in the course of HVAC transmission by providing reactive compensation

Abbreviation / Acronym	Description
Offshore Substation (OSS)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents), containing— (a) electrical equipment required to switch, transform, convert electricity generated at the wind turbine generators to a higher voltage and provide reactive power compensation; and (b) housing accommodation, storage, workshop auxiliary equipment, radar and facilities for operating, maintaining and controlling the substation or wind turbine generators
Outer Dowsing Offshore Wind (ODOW)	The Project.
Order Limits	The area subject to the application for development consent. The limits shown on the works plans within which the Project may be carried out
The Project	Outer Dowsing Offshore Wind, an offshore wind generating station together with associated onshore and offshore infrastructure.
Subtidal	The region where the seabed is below the lowest tide.
Suspended Sediment Concentration	Mass of sediment in suspension per unit volume of water.
Wind turbine generator (WTG)	A structure comprising a tower, rotor with three blades connected at the hub, nacelle and ancillary electrical and other equipment which may include J-tube(s), transition piece, access and rest platforms, access ladders, boat access systems, corrosion protection systems, fenders and maintenance equipment, helicopter landing facilities and other associated equipment, fixed to a foundation

1 Introduction

1.1 Project Background

1. GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop Outer Dowsing Offshore Wind (hereafter referred to as 'the Project').
2. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm) approximately 54km offshore of the Lincolnshire coast, export cables to landfall, Offshore Reactive Compensation Platforms (ORCPs), onshore cables, connection to the electricity transmission network, ancillary and associated development and areas for the delivery of up to two Artificial Nesting Structures (ANS) and the creation of a biogenic reef (if these compensation measures are deemed to be required by the Secretary of State) (see Volume 1, Chapter 3: Project Description (document reference 6.1.3) for full details).
3. The Project applied to the Planning Inspectorate for development consent under the Planning Act 2008 on 19th March 2024.
4. Since the application was submitted, the Applicant has proposed to introduce an Offshore Restricted Build Area (ORBA) over the northern section of the array area where no wind turbine generators (WTGs), offshore substation (OSS) or accommodation platform (collectively referred to as Offshore Platforms (OPs)) would be installed; the area may still be used for cable installation and ancillary activities (including disposal). Furthermore, the Applicant has refined the offshore Export Cable Corridor (ECC), to exclude the route option which passed through the Area 1805 Option and Exploration aggregate site. This area is now excluded from the Order Limits as the developer of the aggregate site has extended the lease and applied for a Marine Licence for aggregate extraction over the whole area; as such, the Applicant is unable to secure a lease from The Crown Estate for this cable route and so can no longer progress with this route.
5. It should be noted that any disposal materials from the installation of the ANS will be included in an updated disposal characterisation report, when the data is available to inform the assessments.

1.2 Scope and Purpose of the Document

6. This document has been prepared to provide the Marine Management Organisation (MMO) with the necessary information to designate disposal sites for the disposal of seabed and sub-bottom geological material that may arise during the construction and operation of the offshore elements of the Project.

7. The proposed marine disposal sites will be used for the spoil materials and drill arisings generated from the construction activities. Site characterisation is the process in which a proposed marine disposal site is described in terms of existing environment, using all available data sources. It is a requirement of the MMO, and their scientific advisor, Cefas (the Centre for Environment, Fisheries and Aquaculture Science), to inform the decision-making process and to allow the licensing of the disposal site as well as facilitating the consideration of the need for any relevant conditions in relation to the disposal activity within the deemed Marine Licences (DMLs) for the Project. The following information is provided:
    - The need for the new disposal site;
    - The dredged and/or drilled material characteristics;
    - The disposal site characteristics;
    - A summary of the assessment of the potential effects of onsite disposal assessed within the ES; and
    - The site selection reasoning.
8. This document outlines the site characteristics for the following four proposed Project disposal sites that are illustrated in Figure 1.1.
    - Array Area Disposal Site: the full extent of the Project array area (as defined in Works Plan Offshore (DCO Application document reference 2.2)); and
    - Offshore Export Cable Corridor (ECC) Disposal Sites: the three sites will be: landward of the Inner Dowsing, Race Bank and North Ridge (IDRBNR) Special Area of Conservation (SAC); within the IDRBNR SAC; and seaward of the IDRBNR SAC. This will cover the full extent of the offshore ECC and Offshore Reactive Compensation Platforms (ORCPs) search area (as defined in as defined in Works Plan Offshore (document reference 2.2))
9. The disposal activity will involve the deposit of native sedimentary material originating from the following activities associated with the construction of the Project within the proposed Order Limits:
    - Construction drilling;
    - Cable installation preparation;
    - Seabed preparation for foundation works; and
    - Excavation of the horizontal directional drilling (HDD) exit pits.
10. Noting that all the information required for site characterisation to support a disposal application is contained within the Project's Environmental Statement (ES), this report avoids duplication, by providing a summary of the key points relevant to site characterisation and refers the reader back to the more detailed information and data presented within various sections of the ES. This document provides a standalone characterisation but should be read in conjunction with the ES.

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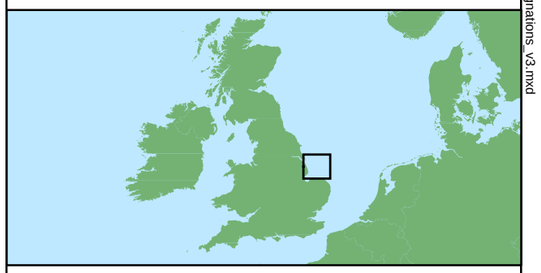
Inner Dowsing, Race Bank and North Ridge SAC

Legend

- Array Area
- Offshore Export Cable Corridor
- Array Area Disposal Site
- Inshore ECC Disposal Site
- Within IDRBNR SAC ECC Disposal Site
- Offshore ECC Disposal Site
- ORCP Search Area
- Special Area of Conservation



Coordinate System: WGS 1984 UTM Zone 31N

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A3 Page Size

Disposal Site Characterisation Report

Location of the Proposed Disposal Sites

Figure 1.1

OUTER DOWSING OFFSHORE WIND

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Revision: 0.1

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1.3 Project Overview

11. The Project will consist of up to 100 WTGs and their associated foundations. These will be connected to up to four OSSs via array cables. There may also be interlink cables between the OSSs and the accommodation platform within the array area. There will be up to four export cables that will transfer power from the OSSs within the array area to the landfall. At the landfall, the export cables will be joined to the onshore export cables at the transition joint bays (TJBs).
12. Within the array area there will be up to four OSSs and one accommodation platform. Within the offshore ECC there will be up to two ORCPs.
13. The following foundation types are being considered for all platform types:
    - Monopile;
    - Gravity base structure (GBS);
    - Pin piled jacket; and
    - Suction bucket jacket.
14. The final selection of foundation types will be dependent on a range of factors including turbine and platform size, seabed conditions, water depth, environmental considerations and supply chain considerations. Therefore, the type(s) of foundation will be confirmed post consent at the final design phase. Seabed preparation may be required for all foundation options considered and for cable installation activities. This may include sandwave clearance and boulder clearance, as detailed in Volume 1, Chapter 3: Project Description (document reference 6.1.3). If debris is present below the surface of the seabed, excavation may be required for access and removal.
15. The Project may also include the construction of up to two ANSs. Material generated from the construction of these structures are not included within this disposal site characterisation report due to no site specific surveys having been undertaken within those locations at this stage.

1.4 Consultation

16. A summary of the key issues raised during consultation to date, specific to the Project disposal sites is outlined in Table 1.1 below.

Table 1.1: Consultation responses received relating to the Project disposal sites

Consultee	Consultation type	Comment	How this is addressed
MMO	Section 42 Consultation	It is noted that the report does not specify the need for a disposal site to be designated for these works. However, as per the UK's obligations under the London Convention and Protocol (LCLP) and OSPAR, any disposal of material below MHWS must be to a licenced disposal site, and the volumes of material disposed under such operations must be reported annually. The seabed preparation works detailed within the report, particularly as it refers to the use of Trailing Suction Hopper Dredgers (TSHD), would fall under this requirement, and therefore the MMO recommends this need is identified within the Environmental Statement (ES). A Site Characterisation Report must be submitted to enable the MMO to designate one or more disposal sites.	The Applicant is submitting this Disposal Site Characterisation Report to the MMO in parallel to the DCO application.
MMO	Section 42 Consultation	Drill arisings must be included within the Chapters and be included in any disposal site worst case scenario figures.	Consideration of drill arisings has been given within the relevant ES chapters and within this Site Disposal Characterisation Report (sections 1, 4 and 5).
Lincolnshire Wildlife Trust	Section 42 Consultation	Dredging and Disposal of Dredged Material: LWT is particularly concerned with the statement that, 'any material dredged from within the SAC will deposited back within the SAC' (Section 9.7.8). While LWT appreciates the reasoning behind this—likely an attempt to minimise harm to SAC sandbank features—we are nonetheless concerned with the redeposition of sediment across Annex 1 habitat (H1110 Sandbanks and/or H1170 Reefs), as this would greatly impact benthic and pelagic communities that rely on these unique and important ecosystems.	Revised physical processes modelling has been undertaken to inform the location of disposed material along the offshore ECC, with the relevant impact assessments updated accordingly, including the potential for impacts to the sandbanks (Part 6, Volume 1, Chapter 7: Marine Physical Processes; Chapter 9: Benthic Subtidal and Intertidal Ecology; and Part 7, Document 7.1: Report to

Consultee	Consultation type	Comment	How this is addressed
		Given the above concerns for direct impact and loss of important spawning habitat for sandeel, LWT would recommend minimising the need for dredging within the Inner Dowsing, Race Bank and North Ridge SAC, and any other unprotected Annex 1 sandbank, (avoidance) and mitigating the disposal of dredged material either outside of the SAC or outside of important spawning seasons. We anticipate a full evaluation of the impacts of dredging and sediment redeposition on these and other receptors in the ES, as well as due diligence towards the mitigation hierarchy for any projected impacts."	Inform Appropriate Assessment) and spawning habitats (Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology). No specific mitigation beyond the previously identified commitment to the retention of material within the IDRBNR SAC was identified as required by the assessment process. Additionally, engineering work was undertaken to refine the worst-case scenarios for impacts to sandbanks within the IDRBNR SAC and the whole Project combined. The revised parameters for the disposal as part of the Project has been included within this characterisation document.
Natural England	Section 42 Consultation	Natural England considers that the figures provided here should match with the figures provided within the Environmental Statement (ES). If these figures change during the pre-application process the DCO must be updated. Further it is noted there does not appear to be a figure included here detailing the volume of dredge material or volume of material for disposal. All details within the detailed offshore design parameters requirement within the DCO application should be cross checked against the figures provided within the ES and other supporting documents (such as the disposal site characterisation report). To ensure all documents are providing the same figures. The figures	This document has been produced in parallel to the ES and updated accordingly to the Project design refinement and introduction of the Offshore Restricted Build Area (ORBA) and removal of the norther ECC route. Therefore, it is informed by the assessments and the same design parameters

Consultee	Consultation type	Comment	How this is addressed
		for the maximum amount of disposal should also be included within the parameters provided. Natural England recommendation: All details within the detailed offshore design parameters requirement within the DCO application should be cross checked against the figures provided within the ES and other supporting documents (such as the disposal site characterisation report) to ensure all documents are providing the same figures. The figures for the maximum amount of disposal should also be included within the parameters provided.	
Natural England	Section 42 Consultation	As per the comment on the offshore design parameters it is important to ensure the details of the project are correct and updated if any changes are made. Further it is noted that the details of disposal are only provided in Part 1 of this schedule covering the total amount of disposal across the entire project. The maximum disposal volume for this Schedule should be provided here as well.	
MMO	Relevant Representation	MMO raised previous comments concerning the Preliminary Environmental Information Report (PEIR) with regard to whether a change in the number of gravity bases, would require an increase in the need for scour protection (rock dumping) due to the change in foundations. MMO notes that full descriptions of scour by foundation type are provided in Chapter 3 and in the approach in the outline scour management plan (document 8.2.1). There is also a consideration of the need for disposal sites as part of the updated assessment presented in the ES and a disposal site characterisation report has been provided alongside	This comment is noted by the Applicant.

Consultee	Consultation type	Comment	How this is addressed
		the DCO application. This provides clarification sought by MMO's previous comments on the PEIR.	
MMO	Relevant Representation	The applicant identifies embedded mitigation to physical process, namely with regard to dredge and disposal and chemical risks are those for Landfall using Horizontal Directional Drilling and the fact that for the foundations and offshore cables etc., the dredged material from construction will be deposited within an area of similar sediment characteristics in close proximity to the dredge location to retain sediment within the sediment transport system, which seems appropriate.	This comment is noted by the Applicant.
MMO	Relevant Representation	There is a comprehensive list of nearby projects under construction/consideration. There is an adequate description of the potential cumulative and inter-related impacts and effects on the physical and biological environment in relation to impacts of dredge and disposal.	This comment is noted by the Applicant.
Natural England	Relevant Representation	Natural England advises that disposals sites for dredged material should be agreed as part of the consenting process. Disposal sites within the IDRBNR SAC should be upstream of the sandbank to help facilitate recovery.	The Applicant has proposed and assessed that the whole of the order limits be used for disposal activities, to ensure that material can be deposited close to the area from which it was taken. Section 5.2 of the outline Cable Specification and Installation Plan (APP-278) confirms that any material dredged from within the Inner Dowsing, Race Bank and North Ridge Special Area of Conservation (SAC) will be deposited back within the Inner Dowsing, Race Bank and North Ridge SAC. Section 7 of the outline PEMP (APP-

Consultee	Consultation type	Comment	How this is addressed
			277) confirms that, in the event that disposal of dredged sediment (associated with seabed preparation works or cable installation) is required, material will be deposited within an area of similar sediment characteristics, in close proximity to the dredge location in order to retain sediment within the sediment transport system. No material will be deposited outside the agreed disposal sites. Additionally, the Applicant has submitted this Disposal Site Characterisation Report to the MMO alongside a request for the designation of the proposed disposal sites.

2 Predicted Source of Spoil and Estimated Quantities for Disposal

2.1 Sources of Spoil

17. Spoil will be generated from the installation of cables (inter-array, export and interlink) and the foundations from the WTGs, ORCPs, OSSs and accommodation platform. This will be from the drilling and any seabed preparation that is required.

2.1.1 Foundation Installation – Seabed Preparation and Drilling

18. Some form of seabed preparation may be required for each foundation type. Seabed preparation is the clearing of soft, mobile or uneven sediment in the area of installation, creating an area of firm, stable and level seabed prior to foundation installation. This may involve seabed levelling and removing surface and subsurface debris such as boulders, as well as removing existing seabed debris such as lost fishing nets or lost anchors (debris will be recovered for appropriate disposal and not disposed of in the marine environment). If debris is present below the seabed surface, then excavation may be required for access and removal.
19. Initial investigations conducted (see Volume 1, Chapter 7: Marine Processes (document reference 6.1.7)) have shown the following seabed characteristics:
    - Offshore Array Area
        - Characterised by underlying Cretaceous Chalk in the western half of the array area, and mudstones, limestones and sandstones in the eastern half.
        - Chalk bedrock is located between approximately 5 and 30m below the seabed and overlain by stiff Pleistocene sediments, overlain in turn by a layer of Holocene sediments approximately 0 and 5m thick.
    - Offshore Export Cable Corridor
        - Characterised mainly by Pleistocene deposits present above Cretaceous Chalk bedrock, overlain in turn by a veneer of Holocene sediments.
        - Surficial sediments are characterised mainly by sandy gravel, with some mud component to the south of Inner Silver Pit.
    - Coast
        - Coastal bedrock geology composed of Burnham Chalk, overlain by marine sand deposits. No evidence of bedrock within the first 12m below surface.
20. Depending on the ground conditions encountered at specific locations within the array area and the ORCP area, drilling may be required to install foundation piles (monopiles or pin piled jacked) to the target depth.

21. Spoil as a result of drilling is typically disposed of adjacent to the foundation location, being discharged at the surface where it settles rapidly to the seabed. Drill arisings comprise of inert sub-bottom geological material. Therefore, this will not result in the introduction of anthropogenic contaminants into the marine environment. This method has been used on existing windfarms such as, for example, Hornsea Project One. The monitoring of benthic communities at offshore wind farm sites where drill arisings have been deposited has not indicated any long-term adverse effects on the overall benthic ecology of the study area (Joint Nature Conservation Committee (JNCC) 2013).

2.1.1.1 Cable Installation – Sandwave Clearance and Pre-trenching

22. Prior to the installation of offshore cables (i.e. array, export, and interlink cables), seabed preparation in the form of sandwave clearance and pre-trenching may be required. This is to facilitate the use of cable installation equipment within its operational tolerances and to reduce stress on the cable by maximising the bending radius. These activities are also intended to ensure that the installation of the cables achieves the intended target burial depth and the future security of the buried cables.
23. Similar to the foundation seabed preparation described above, sandwave clearance may be undertaken by suction hopper dredger, which will subsequently release material at the sea surface or via discharge pipes, the deposited material being composed of surficial sediments. Alternatively, the seabed may be levelled by the use of Controlled Flow Excavation (CFE).

2.1.1.2 Excavation of HDD exit pits

24. There will be up to six HDD exit pits excavated, allowing for two failures, which will be located below Mean Low Water Springs (MLWS). They will likely be up to 2000m from the TJBs with exit pits positioned 500m below MHWS. The HDD exit pits will be excavated or dredged to the required depth (up to 5m). The material will be retained and used to backfill the pits post cable installation.
25. The jack up vessel (JUV) or cable lay vessel (CLV) will be located behind the HDD punch out location and the exit pit will be excavated using a long reach excavator located on the JUV or CLV. There will be up to three exit pits open at one time, remaining open for a duration of up to 12 months and then backfilled on completion. Material will either be taken away to a designated disposal site or stored adjacent to the exit pit prior to backfilling.

2.2 Volumes of Spoil for Disposals

26. The Maximum Design Scenario (MDS) for the volumes of material from activities including foundation works, pile drilling and cable installation preparation that will require disposal are summarised in Table 2.1. Importantly, there will be no introduction of sources of contamination, with all sediments being disposed near to the dredge location.
27. It is important to note that it is possible that pin piled foundations may require seabed preparation works in addition to drilling. In this case, the total volume for disposal for this foundation will not be greater than the MDS of the seabed preparation for non-piled foundations.

Table 2.1: The Maximum Design Scenario of the drilling for piled and seabed preparation for non-piled foundations.

Source	Volume (m^3)	
	Drilling for piled foundations	Seabed preparation for non-piled foundations
Foundations Within Array Area		
WTG Foundations (m^3)	780,000m^3 (Pin piled jacket)	2,020,000m^3 (50% GBS and 50% Suction bucket foundations)
OSS Foundations (Four small OSS) (m^3)	109,600m^3 (Pin piled jacket)	194,000m^3 (GBS foundations)
Offshore Accommodation Platform (m^3)	27,400m^3 (Pin piled jacket)	48,500m^3 (GBS foundations)
Foundation subtotal (m^3)	917,000m^3	2,262,500m^3
Foundations Within Offshore ECC		
ORCP Foundations (within nearshore ECC disposal site)	54,800m^3 (Pin piled jacket)	97,000m^3 (GBS foundations)
Cables (Sandwave Clearance)		
Array Cables (within the array) (m^3)	7,819,671m^3	
Interlink Cables (within the array) (m^3)	2,563,945m^3	
Export Cables (within the array) (m^3)	1,232,000m^3	
Export Cables (within offshore ECC disposal site) (m^3)	1,703,565m^3	
Export Cables (within IDRBNR SAC disposal site) (m^3)	2,063,652m^3	
Export Cables (within nearshore ECC disposal site) (m^3)	751,296m^3	
Cables subtotal (m^3)	16,134,075m^3	
HDD Exit Pits		
HDD Exit Pits (six) (within nearshore ECC disposal site) (m^3)	30,000m^3 (5,000m^3 per exit pit)	

28. The worst-case scenario for the total volume of material that would require disposal is up to 18,523,575m^3, if non-piled foundation were to be used for all the foundations. The breakdown of total volume of material per site is as follows:

- Array area: 13,878,062m^3
- Offshore ECC: 1,703,565m^3

- IDRBNR SAC: 2,063,652m³
- Nearshore ECC: 878,296m³

2.3 Alternative Options for Disposal

29. Once drilled or dredged material is produced, it is classified as a waste material. When waste materials enter the waste stream it is strictly controlled.
30. The disposal of dredged and drilled material is controlled under the London Convention 1972 and the Oslo-Paris Commission (OSPAR) Convention 1992, and The Waste (England and Wales) Regulations 2011 (as amended) . The Waste Hierarchy (Department for Environment, Food and Rural Affairs (DEFRA) 2011) is at the core of the Waste Framework Directive, which comprises:
    - Prevention;
    - Re-use;
    - Recycle;
    - Other recovery; and
    - Disposal.
31. Where it is not possible for prevention or minimisation, alternative options must be considered in the order of priority indicated above (i.e. re-use, recycle, other recovery and then disposal). Therefore, the considerations of alternative options for the disposal of dredged and/or drilled materials within the array and offshore ECC is an important part of the characterisation process and is required in order to inform the decision-making process required of the relevant authority. The following sections of this document present information on the potential alternative to disposal of drilled and dredged material from the Project.

2.3.1 Prevention

32. The Waste Hierarchy assigns a strong emphasis on waste prevention or minimisation. The Project is seeking consent for the potential use of a range of foundation options and cable installation methodologies. The final design will be determined post consent so it is possible that more than one foundation type will be required across the Project.
33. For piled foundations, hard ground conditions may be present, and the piles may require drilling out before the pile can be driven to the full depth. If drilling is required, the generation of spoil arising from the drilling will be unavoidable. For piled foundations, the MDS is that up to 10% of the foundations may require drilling to assist with installation or up to 10% of pile depths across the array area may require drilling.
34. For non-piled foundation, seabed preparation works where they are required are unavoidable since they are needed to achieve the stable and flat seabed required for installation of the foundations. The volume of spoil generated would be dependent on the size of the foundations and the seabed conditions at each installation location.
35. Sandwave clearance is expected to be required in areas where sandwave gradients are in excess of the working limits for standard cable installation equipment. This avoids unnecessary strain

on the cables through bending, maximises the ploughing efficiency and reduces the chances of burial failure. The cables are required to be buried to a depth where they can be expected to remain buried for the lifetime of the Project. Additionally, sandwaves are typically mobile in nature therefore the cable must be buried beneath the level where natural sandwave movement would uncover it. In some cases, this can only be done through the removal of the mobile sediment prior to installation occurring. Therefore, sandwave clearance and the associated dredging and disposal works, where they are required, would be unavoidable. Similarly, the cable installation will need to achieve burial to target depth such that spoil generated from cable installation will also be unavoidable.

36. As a result, the installation of the Project infrastructure is highly likely to involve techniques that give rise to spoil. Whilst the volumes of spoil will be minimised to that necessary for safe and effective installation, it is not possible to prevent spoil generation.

2.3.2 Re-use

37. Where prevention is not possible, the re-use of dredged and drilled material is the preferred method.
38. In this case, the material for disposal from the array and offshore ECC could potentially have alternative uses. Examples of these are schemes such as beach renourishment, land reclamation and habitat enhancement. Transfer of the volume of spoil to another location where it may be used would require the movement of up to 33,582,895m^3 (see Table 2.1 for a breakdown). The alternative uses are likely to be on land, which would require up to approximately 833 dredging cycles (assuming a hopper capacity of 22,000m^3, when allowing for overspill). Each cycle would form a round trip to the nearest port or point of discharge.
39. The collection and retention of drill arisings from foundation drilling operations would require suction dredging vessels in addition to the drilling vessels and is therefore not considered to be a viable option. There would also be environmental impacts due to, for example, increased vessel emissions from the vessels used for transporting material, which may also require an anchoring system at each loading point.
40. At the time of writing there are no projects identified that could accept the spoil material due to the volume and type. Therefore, the re-use of the material cannot be facilitated even if it were technically and economically feasible.
41. Therefore, whilst the potential to re-use the material may exist in theory, and noting that EIA process set out in the ES has not identified any significant adverse effects (in EIA terms) on receptors as a result of the proposed disposal activity, at this stage, re-use is considered not possible and disposal *in situ* remains the preferred option.

2.3.3 Recycle

42. A further alternative is the recycling of the dredged or drilled material. This would involve transforming the material into a different form, such as, for example, bricks or aggregate materials. Referring to MMO guidance, recycling of material is typically a land-based solution, with any material produced being used in onshore construction projects (MMO, 2011). Therefore, the same issues arise with respect to the amount of vessel movements required to transport the material to land as discussed in the section above are relevant considerations here. The disposal of drilled and dredged spoil material in situ would preclude the additional environmental impacts that would arise from such an approach, even if a market opportunity for recycling were to be identified.

2.3.4 Other Recovery

43. To date, there are very few examples of recovery from dredged and drilled material (MMO, 2011), and no such options have been identified for the spoil material from the Project.

2.3.5 Disposal

44. With regards to the potential to dispose of the produced spoil at existing licensed areas in close proximity to the Project (as described within Section 18.4.3.10 of Chapter 18: Infrastructure and Other Marine Users (APP-073)), there are only two existing disposal sites. The only site stated as being open is associated with another windfarm, Race Bank OWF (HU126). This was used for the construction of the windfarm and, as this is now operational, it is presumed that this site is no longer in use. The other site is Sheringham Shoal Drillings site (HU123) which is closed.
45. Therefore, there are no suitable, existing licensed sites in close proximity to the Project. In addition, disposal sites are generally licensed to enable a specific activity and with a limit on disposal volumes linked to that activity, so additional volumes beyond the scope of the licence are not permitted.
46. Considering existing disposal sites within an area of greater distance from the Project array or offshore ECC (e.g. offshore of the Humber estuary) would result in additional vessel movements. Furthermore, the disposal material may be moved to an area that is characterised by different sediment composition or requires hydrodynamic and sediment transport modelling studies to determine the capacity of the site to accommodate the additional spoil type and volumes. Therefore, disposing of the material in situ ensures the spoil will return to the same sedimentary environment and ensures that the spread of material away from the point of production is minimised. This is particularly relevant for the IDRBNR SAC disposal site, where the retention of sediment within the system is a key mitigation measure supported by Natural England (Table 1.1).
47. Therefore, disposal at an existing marine disposal site is not considered a feasible option and additionally would not offer the most efficient or environmentally favourable disposal approach.

2.3.6 Summary

48. The sections above have considered the options available for managing the material produced as part of the construction of the Project. In conclusion, it is determined that disposal within the areas defined within this document is the only viable option available to the Project, and additionally would be the option that does not give rise to additional environmental impacts.

3 Characteristics of the Project Disposal Sites

3.1.1 Physical Characteristics

49. This section provides a summary of the physical characteristics of the Project array area and offshore ECC, sufficient to inform this site characterisation report. As such, this information adequately characterises the proposed disposal sites. Further details on the physical environment are set out in Volume 1, Chapter 7: Marine Physical Processes (document reference 6.1.7) (APP-062), Volume 3, Appendix 7.1: Marine Physical Processes Technical Baseline (document reference 6.3.7.1) (APP-150), Volume 1, Chapter 8: Marine Water and Sediment Quality (document reference 6.1.8) (AS1-038) and Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9) (APP-064).

3.1.1.1 Tidal and Wave Regime

Array Area Disposal Site

50. The array area is exposed predominantly to waves originating in the north and north-northwest, with annual mean significant wave heights in the centre of the array area of 1.3m. Wave heights and peak wave periods increase throughout the array area with distance offshore.
51. Tidal flows across the array area are generally to the southeast on the flood tide and to the northwest on the ebb tide. Peak spring tidal flows occur at modelled velocities of approximately 1.0m/s to 1.2m/s whilst data recorded within the array area between 2022 and 2023 recorded mean depth-average tidal current speeds of 0.83m/s and 0.41m/s for springs and neaps, respectively.
52. Tidal range across the array area increases from the northeast to the southwest, transitioning from a meso-tidal regime in the east, with mean spring and neap ranges of 3.28m and 1.58m, to a macro-tidal regime in the west, with mean spring and neap ranges of 4.14m and 2.00m, respectively.

Offshore ECC Disposal Site

53. Waves within the offshore ECC disposal site originate primarily from the north with smaller components from the southeast and southwest. Significant wave height can reach over 2m with mean spring tidal ranges of approximately 3.6m. Tidal flows are generally oriented to the southeast on the flood tide and northwest on the ebb, with current speeds similar to the array area.

Within IDRBNR SAC ECC Disposal Site

54. The wave climate within the within IDRBNR SAC disposal site is complex with refraction and sheltering effects occurring due to the presence of sandbanks such as Inner Dowsing. Prevailing waves originate from the north and northeast, with smaller components from the southwest and east. Records show that the largest waves are observed in more offshore waters, decreasing in a landwards direction. Wave periods are typically between 3 and 4 seconds, generally indicative of locally generated wind waves, corresponding to a significant wave height between 0.5 and 1.0m.

Inshore ECC Disposal Site

55. The wave regime within the Inshore ECC disposal site as characterised by the Chapel Point Directional Waverider Buoy indicates that waves occur most frequently from the north-northeast and northeast. The annual mean wave height recorded is approximately 0.8m, with wave heights highest during the winter. The most common peak wave periods are between 4 and 6 seconds and significant wave heights have been calculated as 3.3m, 3.9m, and 4.2m for return periods of 1, 10, and 100 years, respectively.
56. Waves arrive on the Lincolnshire coast from the northeast, with an annual significant wave height less than 1.0m. The landfall area within the Inshore disposal site is located within a macro-tidal environment. Peak flow speeds are greater than 0.8m/s generally and can exceed 1.0m/s in parts, with tidal currents following the orientation of the coastline with a flood tide to the south and an ebb tide to the north.

3.1.1.2 Seabed Geology

Array Area Disposal Site

57. Geophysical and regional BGS data indicates that the western half of the array area is underlain by Cretaceous Chalk with mudstones, limestones and sandstones present in the east. Chalk bedrock is located approximately between 5 and 30m below the seabed and overlain by stiff Pleistocene sediments, primarily the Bolders Bank and Swarte Bank Formation. This in turn is overlain by a layer of Holocene sediments approximately between 0 and 5m thick, with thicker deposits in the east.
58. Surficial seabed sediments within the array area are characterised generally by a mix of sand and gravel, with a greater proportion of sand at shallower depths associated with sandbank features. The proportion of fines is generally minimal, with a slightly higher content observed at deeper sample points.
59. Water depths across the array area range from 5 to 47m, with over 90% between 15 and 25m (Lowest Astronomical Tide (LAT)).

Offshore ECC Disposal Site

60. The offshore ECC disposal site is characterised by Pleistocene deposits above Cretaceous Chalk bedrock, overlain in turn by a veneer of Holocene sediments. Surficial sediments within the offshore ECC disposal site are characterised mainly by sandy gravel, with some mud component. Water depths range from between 10 to 30m (LAT).

Within IDRBNR SAC ECC Disposal Site

61. Water depths in the within IDRBNR SAC ECC disposal site are highly variable, ranging between 10 to 30m (LAT). The thickness of sediments overlying the bedrock is highly dependent on morphology, with some parts crossing sandbank features with Holocene sediments over 10m thick, and other parts characterised by an area of chalk bedrock close to the surface, with a very thin Holocene sediment layer. Surficial sediments within the IDRBNR SAC ECC disposal site are variable ranging from areas of gravelly mud and muddy sandy gravel in the east of the IDRBNR SAC and gravelly sand and sandy gravel to the west of the IDRBNR SAC.

Inshore ECC Disposal Site

62. Within the Inshore ECC disposal site and closer to the shore, the proportion of sand generally decreases, with a corresponding increase in gravel and fines content. The coastal bedrock geology of the Inshore ECC disposal site is composed of Burnham Chalk and overlain with marine sand deposits. The present form of the beaches is directly influenced by the 'Lincshore' annual beach nourishment scheme, with nourishment material best described as poorly sorted gravelly sand.

3.1.1.3 Bedforms and Sediment Transport

Array Area Disposal Site

63. The general seabed profile across the array area is bound to the eastern edge by Sole Pit, and on the western boundary by the Outer Dowsing Channel. To the north of the array are several non-designated sandbanks with heights between 10 and 12m. Areas of northwest-facing sand waves are also present with wave heights generally between 2 and 3m, reaching up to 8m in some areas.
64. The tidal regime exerts primary control on the sediment transport regime in the offshore environment. Regional-scale assessments identify a net north-westerly direction of bedload transport in the Project array area, which is located seaward of the bedload parting zone. This is supported by analysis of bedform migration, identifying transport to the north-northwest in the western half of the array area, although features in the east of the array area were observed to migrate towards the southeast.

Offshore ECC Disposal Site

65. Similar to the array area, bedload sediment transport within the offshore ECC disposal site is towards the northwest. Where the flow is diverted, such as around the margins of sandbanks, localised changes to the broad scale sediment transport path occurs. Potential sediment mobility for the Triton Knoll Electrical System found that silt and sand is expected to be mobile during both spring and neap tides, except for very coarse sand (~1,500µm), which is only expected to be mobile during spring tides. Gravel sized material is predicted to be immobile or only mobilised during the highest spring tides.

Within IDRBNR SAC ECC Disposal Site

66. The Race Bank – North Ridge – Dudgeon Shoal and Inner Dowsing Annex I sandbank systems are located within the IDRBNR SAC ECC disposal site. Sediment transport modelling undertaken as part of the Race Bank OWF ES indicates predominantly north-westerly sediment transport pathways across the majority of the site, although geomorphological analysis indicates the anticlockwise migration of bedforms on the North Ridge sandbank. The Inner Dowsing sandbank is considered to be a relict feature, although it has experienced some changes in crest level, and is maintained by tidal currents.
67. Inner Silver Pit is located on the northern boundary of the IDRBNR SAC ECC disposal site. This elongated, over-deepened and enclosed paleo-valley is partly filled with unconsolidated sediments, with changes in water depth in excess of 60m over 0.5km. Due to erosional processes, bedrock is exposed at the seabed within the Inner Silver Pit, with chalk bedrock exposed at the seabed within the feature as well as in the fan to the south.

Inshore ECC Disposal Site

68. Within the Inshore ECC disposal site, wave direction is from the northeast, which produces a net southerly drift of beach material along the Lincolnshire coast and into the Wash. This area has experienced long-term erosion, with an estimated erosion rate of approximately 1.3m/year. Much of the surficial beach layer has been removed by contemporary hydrodynamic processes, and an annual beach nourishment scheme has been in operation since 1994, with an average of 500,000m^3 of sediment deposited along the Lincolnshire coast each year.

3.1.1.4 Suspended Sediments

Array Area Disposal Site

69. Suspended sediment in the region is mainly sourced from the eroding Holderness cliffs, which primarily consists of mud. Due to the distance of terrestrial sources, low surface concentrations of up to 5mg/l were recorded in the array area between the period 1998 to 2015 (Cefas, 2016). Higher suspended sediment concentrations will occur during spring tides and storm conditions. Project-specific turbidity data indicated mean near-surface (around 5m below surface) and near-bed summer concentrations of circa 2.4mg/l and 9.2mg/l, respectively, between April and August 2022 within the array area, and winter concentrations of 2.3mg/l and 8.9mg/l, respectively, between November 2022 and May 2023.

Offshore ECC Disposal Site

70. There is an east to west gradient in surface Suspended Particulate Matter (SPM) throughout the year, although this is most pronounced in winter. Concentrations in the Offshore ECC Disposal Site are generally similar to those identified within the array area, as indicated by data recorded between 1998 and 2015 (Cefas, 2016).

Within IDRBNR SAC ECC Disposal Site

71. Suspended sediment within the ECC described above, is generally representative of the whole area and the IDRBNR SAC ECC disposal site, although in areas closest to the coast these levels are likely to be higher, particularly during winter months.

Inshore ECC Disposal Site

72. Within the Inshore ECC disposal site, Surface SPM levels are directly under the influence of terrestrial sources from the Humber Estuary and Holderness Cliffs, such that concentrations reach around 60mg/l (measured between 1998 to 2015) (Cefas, 2016).

3.1.1.5 Sediment Quality

73. There are two commonly used guidelines applied to assessing the contamination levels within sediment samples: Cefas Guideline Action Levels and the Canadian Marine Sediment Quality Guidelines. Project-specific surveys have analysed sediment for contaminant levels both within the array and ECC, with analysis undertaken by SOCOTEC, an MMO-accredited laboratory. Full details are provided in Chapter 8 (document reference 6.1.8).

Array Area Disposal Site

74. Sediments with larger particle sizes (e.g. sands) are not typically associated with elevated concentrations of anthropogenic contaminants, with hydrocarbons, in particular, closely correlated to the spatial distribution of sediment types. As noted above and described in further detail in Appendix 7.1 (document reference 6.3.7.1), the sediments within the array have been characterised as predominantly sands and gravels, which are not typically associated with elevated concentrations of anthropogenic contaminants.
75. Out of 30 stations analysed within the array area, concentrations of arsenic exceeded Cefas Guideline Action Level 1 (AL1)[1] at four stations, and concentrations of lead exceeded AL1 at three stations. No heavy metal concentrations exceeded Cefas Guideline Action Level 2 (AL2).

[1] In general, contaminant levels in material below Action Level 1 (AL1) are of no concern and are unlikely to influence the licensing decision. However, material with contaminant levels above Action Level 2 (AL2) is generally considered unsuitable for disposal at sea. Material with contaminant levels between AL1 and AL2 may require further consideration before a decision can be made.

76. All stations within the array area recorded PAH concentrations below the Threshold Effect Level[2] (TEL) apart from one, exceeded for acenapthene and phenanthrene. The concentrations recorded did not exceed the Probable Effect Level[3] (PEL). This sample station is in close proximity to Pickerill-B, a decommissioned gas platform previously operated by Perenco.
77. At all 30 stations within the array area, the full suite of remaining contaminants analysed (including organotins, polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCBs)) analysed were at concentrations below AL1.

Offshore ECC Disposal Site

78. Of the stations analysed for metals within the Offshore ECC Disposal Site, concentrations of arsenic exceeded AL1 at one station. No heavy metal concentrations exceeded AL2. No stations within the Offshore ECC Disposal Site exceeded the TEL threshold for PAHs. At all stations, the full suite of remaining contaminants analysed (including organotins, PCBs and OCPs) analysed were at concentrations below AL1.

Within IDRNBR SAC ECC Disposal Site

79. Of the stations analysed for metals within the Within IDRNBR SAC ECC Disposal Site, concentrations of arsenic exceeded AL1 at two stations, and concentrations of nickel exceeded AL1 at one station. No heavy metal concentrations exceeded AL2. No stations within the Within IDRNBR SAC ECC Disposal Site exceeded the TEL threshold for PAHs. At all stations, the full suite of remaining contaminants analysed (including organotins, PCBs and OCPs) analysed were at concentrations below AL1.

Inshore ECC Disposal Site

80. Metal concentrations in sediments are generally higher in the coastal zone and around estuaries, reducing offshore, indicating that river input and run-off from land are significant sources. Of the stations analysed for metals within the Inshore ECC Disposal Site, concentrations of arsenic exceeded AL1 at two stations, concentrations of nickel exceeded AL1 at one station, and concentrations of chromium exceeded AL1 at one station. No heavy metal concentrations exceeded AL2.
81. One station within the Inshore ECC Disposal Site exceeded recorded PAH concentrations above the TEL threshold, although none exceeded the PEL threshold. TEL thresholds were exceeded at these stations for dibenzo(a,h)anthracene, naphthalene, and phenanthrene.
82. At all stations, the full suite of remaining contaminants analysed (including organotins, PCBs and OCBs) analysed were at concentrations below AL1.

[2] Threshold Effect Levels (TEL): the minimal effect range within which adverse effects rarely occur.
[3] Probable Effect Levels (PEL): the possible effect range within which adverse effects occasionally occur.

3.1.2 Biological Characteristics

83. This section provides a summary of the biological characteristics of the disposal sites. Full details are provided in the ES chapters, alongside their technical appendices;

- Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9) (APP-064);
- Volume 3, Appendix 9.1: Benthic Ecology Technical Report (Array) (document reference 6.3.9.1) (APP-154);
- Volume 3, Appendix 9.2: Benthic Ecology Technical Report (ECC) (document reference 6.3.9.2) (APP-155);
- Volume 1, Chapter 10: Fish and Shellfish Ecology (document reference 6.1.10) (APP-065);
- Volume 1, Chapter 11: Marine Mammals (document reference 6.1.11) (APP-066); and
- Volume 1, Chapter 12: Offshore and Intertidal Ornithology (document reference 6.1.12) (AS1-040).

84. Additional information can be found in their associated Technical Report appendices.

3.1.2.1 Benthic and Intertidal Ecology

Array Area Disposal Site

85. A total of 4,429 individuals representing 265 taxa were recorded from the 71 macrofaunal grab samples collected from across the Project array area during a site-specific survey conducted in April 2022 (Volume 3, Appendix 9.1 Benthic Ecology Technical Report (Array) (document reference 6.3.9.1 and Volume 3, Appendix 9.2 Benthic Ecology Technical Report (ECC)(document reference 6.3.9.2))). The macrofaunal communities were found to be highly variable across the project array, a pattern related to the varying coarseness of seabed sediment present in this high energy environment. Communities were generally dominated by Annelida and Mollusca, which together contributed to approximately 60% of the fauna identified.

86. Epibenthic taxa identified from seven epibenthic trawls undertaken across the Project array area included a total of 4,866 individuals recorded across 91 taxa which mirrored those identified in the grab samples and reflected sand and gravel dominated sediments. Further analysis revealed epifaunal community differences between sand dominated sandbank crest habitats and coarse sediment habitats, with much of the observed dissimilarity being related to the presence/absence of the tubicolous Ross worm *Sabellaria spinulosa*.

87. The dataset derived from benthic sediment eDNA samples collected across the benthic subtidal and intertidal study area included a total of 340 taxa which, with the addition of Arthropoda, indicated a dominance of Annelida and Mollusca.

88. A total of seven biotope complexes and four impoverished biotopes were identified within the array area. The predominant biotope complex was ‘Atlantic circalittoral coarse sediment’ (MC32) with patches of ‘Atlantic circalittoral mixed sediment’ (MC42). MC32 characterised the western region of the array, whilst MC42 formed intermediate habitats prevalent to the east,

centre and west of the survey area. Other biotopes identified within the array area included Atlantic circalittoral sand (MC52), Atlantic infralittoral sand (MB52), Atlantic offshore circalittoral coarse sediment (MD32), Infralittoral coarse sediment (MB32), *Spirobranchus triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles (Impoverished) (MC3211), Infralittoral mobile clean sand with sparse fauna (Impoverished) (MB5231), *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (Intermediate) (MC4214) and S. *spinulosa* on stable circalittoral mixed sediment (MC2211).

89. A single location within the southern extent of the array area was identified as cobble habitat. However, the habitat scored 'low' resemblance to Annex I habitat 'reef', as per the qualifying criteria set out in regulatory guidance (Irving, 2009 and Golding *et al*., 2020). Additionally, although the station had epifauna present at sufficient densities to be considered 'possible reef with sand veneer', the mean reef species count did not meet Annex I stony reef criteria.
90. *S. spinulosa* aggregations were present at two stations in the southeast of the array area where the community conformed to the biotope '*S. spinulosa* on stable circalittoral mixed sediment' (MC2211). However, the aggregations of S. spinulosa were not reef forming and unlikely to constitute 'reef' (Gubbay, 2007).
91. No evidence of any other Annex I habitats or Annex II species, OSPAR threatened and/or declining species and habitats (OSPAR, 2021; and ICUN, 2022), or habitats and species listed under Section 41 of the NERC Act (2006), was observed within the Project array.

Offshore ECC Disposal Site

92. Across the offshore ECC site specific benthic surveys recorded 366 taxa and 6,352 individuals with communities dominated by Annelida, (comprising 21% of identified fauna), followed by Arthropoda (17.7%), Mollusca (9%) and Echinodermata (1.8%). Other phyla (Cnidaria, Nematoda, Nemertea, Platyhelminthes and Phoronida) comprised 2.2% of the faunal complement. As detailed within Volume 3, Appendix 9.2 (document reference 6.3.9.2), benthic sediment eDNA samples acquired from three sites along the offshore ECC identified the highest number of taxa (102) at the furthest offshore station at a site within the offshore disposal site; the central station, located within the IDRBNR SAC, was observed to have had the lowest taxa across the ECC.
93. An average of 33 species were recorded in site specific grab samples across the ECC, while the average abundance was 266 individuals per 0.1m^2. When looking three sections of the ECC in relation to disposal the average number of species per site varied between 32 and 34 while the average abundance ranged between 202 and 301 individuals per 0.1m^2.
94. Epibenthic taxa identified from seven epibenthic trawls undertaken across the ECC included a total of 4,484 individuals recorded across 92 taxa. Arthropods were the most common and abundant group recorded with Pisces, Annelida and Echinodermata also common. The species complement identified reflected the typically coarse sandy sediments characterising the ECC.
95. One habitat complex, three biotope complexes and four biotopes were identified within the offshore ECC. The predominant biotope complex was 'Circalittoral coarse sediment' (MD321) which was recorded throughout the ECC in areas of circalittoral coarse sediment; this complex

was associated with the biotope '*P. kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand' (MC3213). 'Circalittoral mixed sediments' (MC42) were also widespread, although less common in offshore areas and showed strong conformity to the biotope '*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment' (MC4214). The 'Infralittoral muddy sand' (MB5) habitat was associated with sandbanks in the eastern region of the offshore ECC adjacent to the array. The biotope '*S. spinulosa* on stable circalittoral mixed sediment' (MC2211) was recorded form the inshore to the central section of the offshore ECC. The deeper habitats were dominated by rippled fine to coarse sands and silty sands and identified as the habitat 'Circalittoral muddy sand' (MC52) with examples of the biotope '*Ophiura ophiura* on circalittoral muddy sand' (A5.262TMP), however in an impoverished form, thus confidence in the classification is limited.

96. During the site-specific surveys *S. spinulosa* was identified throughout the offshore ECC with the highest abundance recorded within the Within IDRBNR SAC ECC disposal site. *S. spinulosa* aggregations were assessed in relation to their 'reefiness' potential, although all were classified as 'Not a reef' (further details of the assessment are presented in Appendix 9.2: Benthic Ecology Technical Report (ECC) and subsequent analysis undertaken by Envision (document reference 6.9.3.3)).
97. The main sandbank features occur within the Wash Approaches, the Race Bank-North Ridge-Dudgeon Shoal system and at Inner Dowsing and are located primarily within the IDRBNR SAC Disposal Site. The tops of the sandbanks are characterised by communities of polychaetes and amphipods. The trough areas between these sandbank features are composed of mixed and gravelly sands.

Within IDRBNR SAC ECC Disposal Site

98. Encompassing the IDRBNR SAC ECC disposal site are designated sandbank features, the SAC is also designated for biogenic reef although reef was not recorded in the site-specific evidence (as detailed in paragraph 94 below). Biogenic reef created by the Ross worm, *S. spinulosa*, have consistently been recorded within the site. These reefs are known to support a variety of species including hydroids, sponges, bryozoans, anemones, as well as the commercial species European lobster *Homarus gammarus* and pink shrimp *Pandalus montagui.* Biogenic reefs formed by *S. spinulosa* allow colonisation by species not otherwise associated with the adjacent, looser sediment habitats.
99. During the site-specific surveys *S. spinulosa* was identified throughout the offshore ECC with the highest abundance recorded within the Within IDRBNR SAC ECC disposal site. *S. spinulosa* aggregations were assessed in relation to their 'reefiness' potential, although all were classified as 'Not a reef' (further details of the assessment are presented in Appendix 9.2: Benthic Ecology Technical Report (ECC) and subsequent analysis undertaken by Envision (document reference 6.9.3.3)).

100. The main sandbank features occur within the Wash Approaches, the Race Bank-North Ridge-Dudgeon Shoal system and at Inner Dowsing. The tops of the sandbanks are characterised by communities of polychaetes and amphipods. The trough areas between these sandbank features are composed of mixed and gravelly sands.

Inshore ECC Disposal Site

101. The mosaic of habitats and characterising species across the inshore ECC disposal site are similar to those within the other two ECC disposal sites.

3.1.2.2 Fish and Shellfish Ecology

Array Area Disposal Site

102. Site-specific epibenthic trawls conducted within the array area recorded a total of 25 fish species and revealed a fish community characterised by demersal species including dab *Limanda limanda*, plaice Pleuronectes platessa, goby species, bull-rout *Myoxocephalus scorpius*, grey gurnard *Eutrigla gurnardus*, Mediterranean scaldfish *Arnoglossa laterna*, solenette *Buglossidium luteum*, pogge *Agonus cataphractus* and dragonet *Callionymus lyra* as well as the inshore species lesser weever *Echiichthys vipera* and long-spined bullhead *Taurulus bubalis*. In addition to the characterising species mentioned above, several commercially important species were also recorded at low abundances within the array area including whiting *Merlangius merlangus*, ling *Molva molva* and common sole *Solea solea.*

103. In addition to the characterising species mentioned above, greater sandeel *Hyperoplus lanceolatus*, lesser sandeel *Ammodytes tobianus*, smooth sandeel *Gymnammodytes semisquamatus* and Raitt's sandeel *Ammodytes marinus* were all recorded in epibenthic trawls. These species were also recorded within site-specific grab samples.

104. The shellfish community identified from epibenthic trawls included brown crab *Cancer pagurus*, spider crab Inachus spp., harbour crab Liocarcinus spp, velvet swimming crab Necora puber, hermit crab *Pagurus bernhardus,* brown shrimp *Crangon crangon*, pink shrimp *Pandalus montagui,* queen scallop *Aequipecten opercularis* and blue mussel *Mytilus edulis*. Spider crab, harbour crab and brown crab were also recorded within grab samples.

105. eDNA samples collected across the array area and ECC recorded the presence of 28 fish species, 24 bony fish species and 4 elasmobranch species. Bony fish species of note in the array area, that were not recorded in the epibenthic trawls, include: northern rockling *Ciliata septentrionalis*, brown trout *Salmo trutta*, European sardine *Sardina pilchardus*, Atlantic mackerel *Scomber scombrus* and sprat *Sprattus sprattus*. Elasmobranch species of note include: tope shark *Galeorhinus galeus*, starry smoothhound *Mustelus asterias*, spotted ray *Raja montagui*, and small-spotted catshark *Scyliorhinus canicula*.

106. Spawning grounds for several fish species have been identified which either overlap or are in close proximity to the array area. For instance, the array area overlaps with high intensity spawning grounds for plaice, whilst low intensity spawning grounds are present for whiting, cod *Gadus morhua*, sandeel and sole (Coull *et al*. 1998; Ellis *et al*. 2010; Ellis *et al*. 2012). Other spawning grounds are also present for herring *Clupea harengus*, lemon sole *Microstomus kitt*, mackerel *Scomber scombrus* and sprat *Sprattus sprattus* (Coull *et al*. 1998). The array area also coincides with low intensity nursery grounds for anglerfish Lophius piscatorius, cod *Gadus morhua*, herring *Clupea harengus,* mackerel *Scomber scombrus*, plaice , sandeel and spurdog *Squalus acanthias* (Coull *et al*. 1998).

107. There are also 'high intensity' nursery grounds for cod, herring and whiting (Coull *et al*., 1998). 'Low intensity' nursery grounds are present across the study area for anglerfish *Lophius piscatorius,* blue whiting *Micromesistius poutassou*, cod, European hake *Merluccius merluccius,* herring, ling, mackerel *Scomber scombrus*, plaice, sandeel, sole, spurdog *Squalus acanthias*, thornback ray *Raja clavata*, tope shark *Galeorhinus galeus* and whiting (Ellis *et al*., 2010). There are also nursery grounds present across the study area for lemon sole, Nephrops and sprat (Coull *et al*. 1998). Nursery grounds are also present for lemon sole and sprat (Coull *et al*. 1998).

Offshore ECC Disposal Site

108. Site-specific epibenthic trawls conducted within the offshore ECC revealed a similar fish community to that within the array area. In addition to much of the fish species found in the array area, thornback ray *Raja clavata* and common seasnail *Liparis liparis* were recorded within the ECC. The shellfish community was also similar between the array area and the ECC, with the addition of king scallop Pecten maximus and common whelk *Buccinum undatum* within the ECC.

109. eDNA samples collected across the array area and ECC recorded the presence of 28 fish species, 24 bony fish species and 4 elasmobranch species. Bony fish species of note in the ECC, that were not recorded in the epibenthic trawls, include: European bass *Dicentrarchus labrax,* European anchovy *Engaulis encrasicolus,* European perch *Perca fluviatilis,* Atlantic salmon, European sardine, Atlantic mackerel, sprat and whiting pout *Trisopterus luscus.* Elasmobranch species of note recorded in the ECC include: tope shark, starry smoothhound, spotted ray, and small-spotted catshark.

110. Spawning grounds for several fish species have been identified which either overlap or are in close proximity to the offshore ECC disposal site. For instance, lower sensitivity spawning grounds are present for sandeel, sole and whiting (Ellis *et al*. 2010; Ellis *et al*. 2012). Spawning grounds are also present for lemon sole (Coull *et al*. 1998).

111. There are also 'low intensity' nursery grounds for cod, herring, mackerel, plaice, sandeel and whiting within the offshore ECC disposal site (Ellis *et al*. 2010; Ellis *et al*. 2012).

Within IDRBNR SAC ECC Disposal Site

112. As mentioned above, site-specific epibenthic trawls conducted within the offshore ECC revealed a similar fish and shellfish community to that of the array area with some additional species including thornback ray, common seasnail, king scallop and common whelk.

113. Spawning grounds for several fish species have been identified which either overlap or are in close proximity to the IDRBNR SAC ECC disposal site. For instance, low intensity spawning grounds are present for sandeel, sole and cod. Undetermined spawning grounds are also present for herring and lemon sole.

114. High intensity nursery grounds for herring are present within the IDRBNR SAC disposal site as well as low intensity nursery grounds for plaice, sole, thornback ray and whiting within the IDRBNR SAC ECC disposal site.

Inshore ECC Disposal Site

115. As mentioned above, site-specific epibenthic trawls conducted within the offshore ECC revealed a similar fish and shellfish community to that of the array area with some additional species including thornback ray, common seasnail, king scallop and common whelk.

116. Spawning grounds for several fish species have been identified which either overlap or are in close proximity to the inshore ECC disposal site. For instance, low intensity spawning grounds are present for sandeel and sole, whilst undetermined spawning grounds are also present for herring and lemon sole.

117. High intensity nursery grounds for herring are present within the IDRBNR SAC disposal site as well as low intensity nursery grounds for plaice, sole, thornback ray and whiting within the inshore ECC disposal site.

3.1.2.3 Marine Mammals

Array Area Disposal Site

118. The Project site specific surveys and baseline data sources have confirmed the presence of six marine mammal species which are most likely to be present within the Project marine mammal study area. These include harbour porpoise *Phocoena phocoena*, minke whale *Balaenoptera acutorostrata*, white beaked dolphin *Lagenorhynchus albirostris*, bottlenose dolphin *Tursiops truncatus*, grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina*.

119. The Project array area is partly located within the summer area of the Southern North Sea SAC for harbour porpoise and is in close proximity to the Wash and North Norfolk Coast SAC for harbour seals and the Humber Estuary SAC for grey seals. Other marine mammal protected areas which are located further from the project include: the Berwickshire and North Northumberland Coast SAC (grey seals), the Southern Trench MPA and Sea of Hebrides MPA (minke whale), and the Moray Firth SAC (bottlenose dolphins).

Offshore ECC Disposal Site

120. As mentioned above, site specific surveys and baseline data sources have confirmed the presence of six marine mammal species which are most likely to be present within the Project marine mammal study area and Offshore ECC Disposal Site. As such it is likely that these marine mammal species may be present within the Offshore ECC disposal site.

Within IDRBNR SAC ECC Disposal Site

121. As mentioned above, site specific surveys and baseline data sources have confirmed the presence of six marine mammal species which are most likely to be present within the Project marine mammal study area. As such it is likely that these marine mammal species may be present within the IDRBNR SAC ECC disposal site.

Inshore ECC Disposal Site

122. As mentioned above, site specific surveys and baseline data sources have confirmed the presence of six marine mammal species which are most likely to be present within the Project marine mammal study area. As such it is likely that these marine mammal species may be present within the Inshore ECC Disposal Site.

3.1.2.4 Offshore and Intertidal Ornithology

Array Area Disposal Site

123. The Project site specific surveys and baseline data sources have confirmed the presence of 27 species within the Project study area. These include species actively using the site or passing through, and include birds breeding relatively locally and those that use the site during the non-breeding season. Key species present include kittiwake *Rissa tridactyla* guillemot *Uria aalge,* razorbill *Alca torda and* gannet *Morus bassanus.*

The project *array area does not extend over any designated sites for birds. However, the ECC does cover 151.2 km2 of the Greater Wash SPA, which is designated for non-breeding populations of common scoter Melanitta nigra, red-throated diver Gavia stellata and little gull Hydrocoloeus minutus, and for breeding Sandwich tern Thalasseus sandvicensis, common tern Sterna hirundo and little tern Sternula albifrons*. The project lies within *mean maximum foraging range of several SPA's; Flamborough and Filey Coast SPA, North Norfolk Coast SPA, Farne Islands SPA, Coquet Island SPA and the Alde-Ore Estuary SPA. Offshore ECC Disposal Site*

124. As presented above, site specific surveys and baseline data sources have confirmed the presence of 27 bird species within the Project study area and Offshore ECC Disposal Site. As such it is likely that these species may be present within the Offshore ECC disposal site.

125.

Within IDRBNR SAC ECC Disposal Site

126. As presented above, site specific surveys and baseline data sources have confirmed the presence of 27 bird species within the Project study area and Offshore ECC Disposal Site. As such it is likely that these species may be present within the IDRBNR SAC ECC disposal site.

127.

Inshore ECC Disposal Site

128. As presented above, site specific surveys and baseline data sources have confirmed the presence of 27 bird species within the Project study area and Offshore ECC Disposal Site. As such it is likely that these species may be present within the Inshore ECC disposal site.

3.1.2.5 Designated Sites

Array Area Disposal Site

129. The array area disposal site does not overlap with any sites designated for nature conservation and water quality. The closest designated site to the array area is the North Norfolk Sandbanks and Saturn Reef SAC which is 5.8km from the Project array.

Offshore ECC Disposal Site

130. The offshore ECC disposal site does not overlap with any sites designated for nature conservation and water quality, but lies immediately offshore of the IDRBNR SAC.

Within SAC ECC Disposal Site

131. The IDRBNR SAC ECC disposal site is located within the Inner Dowsing, Race Bank and North Ridge SAC which is designated for Annex I reef and sandbank habitat. The disposal site also overlaps with the Greater Wash SPA.

Inshore ECC Disposal Site

132. The Inshore ECC disposal site overlaps with the Greater Wash SPA, and lies immediately inshore of the IDRBNR SAC. It overlaps with the Lincolnshire Coastal Waterbody and lies within the Anderby Bathing Water. There are no shellfish waters which overlap with the proposed disposal site.

3.1.3 Human Environment Characteristics

133. This section summarises the human environment of the Project array area and offshore ECC. Further detail can be found in;

- Volume 1, Chapter 14: Commercial Fisheries (APP-069);
- Volume 1, Chapter 15: Shipping and Navigation (APP-070);
- Volume 1, Chapter 13: Marine Archaeology (APP-068); and
- Volume 1, Chapter 18: Infrastructure and Other Users (APP-073).

134. Further detail can be found in their associated appendices.

3.1.3.1 Commercial Fisheries

135. The Project array area and offshore ECC overlaps International Council for the Exploration of the Sea (ICES) rectangles 35F0, 35F1, 36F0 and 36F1. The average annual value of landings from ICES rectangle 36F0 from 2017 to 2021 was £11.6 million whilst equivalent values across the other three rectangles ranged between £1.9 million and £2.5 million (MMO, 2023). Landings are dominated by shellfish species and key fisheries include cockles *Cerastoderma edule*, brown crabs *Cancer pagurus*, whelks *Buccinum undatum*, brown shrimps Crangon crangon and lobsters *Homarus gammarus*.

136. For non-UK vessels, the commercial fisheries study area is dominated by landings of plaice *Pleuronectes platessa,* sole *Solea solea* and other demersal species, with evidence of sporadic pelagic trawl activity, targeting mackerel *Scomber scombrus* and herring *Clupea harengus*. Additionally, a Danish sandeel *Ammodytes marinus* fishery was active in the study area, which has declined substantially since its peak in 2004.

137. ICES rectangle 36F1 which is located within the array area, UK potting vessels target brown crab, whelk and lobster with an average annual landed value of £820,000 between the 2017 to 2021 period. Whelks dominate landings in ICES rectangles 35F0 and 35F1 which are located within the offshore ECC and had an average annual landed value of £1.8 million across the 2017 to 2021 period.

138. Dredging, which is operated by larger UK vessels targeting king scallop, occurs within the study area but is primarily focused on ICES rectangle 36F0, to the north of, and outside of, the offshore ECC. Although occasional scallop dredging does occur within ICES rectangle 36F1 located within the north-western extent of the array area, annual average landings by UK dredge vessels are low, with £50,000 over the 2017 to 2021 period.

139. UK beam trawl activity within the study area is focused in ICES rectangle 35F0 located within the inshore portion of the offshore ECC, with limited activity in other parts of the study area. The UK beam trawl fleet primarily target the brown shrimp fishery in The Wash, which has shown an overall over the 2017 to 2021 period declining from over 280 tonnes in 2018 to approximately 50,000 tonnes in 2021 (valued at £145,000).

140. UK otter trawl activity is limited within the study area and is conducted primarily by EU vessels. French otter trawlers which primarily target whiting, are active in the study area with the majority of their landings being made from ICES rectangle 35F0 located within the offshore ECC. Some potential French otter trawl activity also occurs across the central portion of the offshore ECC. As mentioned above, there has been a historical fishery for sandeel and sprat by Danish vessels in the North Sea, with previously targeted sandeel grounds understood to overlap with the north-eastern extent of the study area.

141. Fishing activity using several other gear types are also known to occur within the study area. For instance, demersal seine netting is increasing within the southern North Sea and landing have been valued at £13,500 from ICES rectangles 35F1 and 36F1. Fixed nets used by small English-registered inshore vessels are recorded in ICES rectangle 35F1 and averaged 0.7 tonnes across the 2017 to 2021 period, with an average annual value of £1,000. Pelagic or mid-water trawl landings data indicates that there may be occasional, highly sporadic activity by large Danish and French pelagic trawlers. However, landings from the study area by have declined substantially since 2010, averaging 60 tonnes per year between 2010 and 2016.

3.1.3.2 Shipping and Navigation

142. The Project array area disposal site is located within the North Sea, approximately 54km east of the Lincolnshire coast and is near to a number of major shipping routes. During the summer, the main vessel types recorded within the shipping and navigation study area during the summer survey period were cargo vessels (43% of all traffic), tankers (17%) and oil and gas vessels (14%). During winter, the main vessel types were also cargo vessels (46%), tankers (21%), and oil and gas vessels (15%). The main vessel types recorded within the Offshore ECC study area during the survey period were cargo vessels (50%), tankers (16%), and wind farm vessels (14%).

143. A total of 13 main routes were identified within the shipping and navigation study area, with the highest traffic volume between Humber Ports and Rotterdam, with an average of 16 vessels per day. This was followed by Tees to Rotterdam with an average of 12 vessels per day. All other routes ranged between an average of <1 to 4 vessels per day.

144. The principal activity near to Project are those vessels engaged in the oil and gas industry. Oil and gas fields in the area which had high levels of fishing activity include Clipper, Barque, Galleon, Amethyst, and West Sole. Fishing vessels were mainly recorded to the north and within the array area included both vessels engaged in fishing (i.e., gear may have been deployed) and in transit.

145. Vessel activity within the ECC is dominated by cargo vessels (50% of the vessels recorded during summer and 58% during winter) followed by tankers (16% in summer and 18% in winter). During summer, wind farm vessel activity in the inshore disposal site is higher and represented 14% of total vessel activity.

3.1.3.3 Marine Archaeology

146. Within the array disposal site there are 15 records for wrecks and obstructions. Of these three wrecks and five obstructions have been identified in the site specific geophysical data and one additional wreck not previously recorded has been identified. Further eight paleochannel features were identified from the sub-bottom profiler data. Within the offshore ECC disposal, SAC ECC disposal and Inshore ECC disposal sites there are three, nine and five records for wrecks, aircraft, obstructions, foul ground and sites respectively.

147. Of the recorded wrecks, archaeological assessment of geophysical data combined with the baseline conditions identified 17 LIVE (wreck considered to exist as a result of detection through survey) wrecks, four DEAD (not detected over repeated surveys, therefore not considered to exist in that location) wrecks, nine UNKNOWN (the state of the wreck is unknown) or unconfirmed, along with one previously unrecorded wreck within the marine archaeology study area.

148. In terms of geophysical data, the following contacts of archaeological potential have been identified: 1,696 features of low potential, 148 features of medium potential, and 21 features of high potential.

149. There are currently no marine archaeological and cultural heritage receptors within the disposal sites that are designated under the Protection of Wrecks Act 1973, or any other site designation or statutory protection.

3.1.3.4 Infrastructure and Other Marine Users

150. There is no spatial overlap of any other OWFs within the disposal sites. However, there are currently four OWFs (proposed or operational) which have been identified adjacent to the ECC disposal sites which include Triton Knoll export cable adjacent to the inshore ECC and SAC disposal sites, Race Bank array area adjacent to the IDRBNR SAC disposal site, Lincs array area adjacent to the inshore ECC disposal site and the proposed Dudgeon Extension array area adjacent to the offshore ECC disposal site.

151. Four oil and gas platforms are present within the array disposal site, of which one is active, and none are manned. No oil and gas platforms are present within any of the ECC disposal sites.

152. There are a total of three oil and gas associated pipelines located within the array disposal site; with licences held by Perenco and Shell PLC. Of these, two are active (Galahad Tee to Lancelot Tee and 34 Inch Gas Shearwater – Bacton Seal Line). The Galahad Tee to Lancelot Tee pipeline also crosses the offshore ECC disposal site. Other oil and gas associated pipelines include the Loggs PP to Theddlethorpe, Viking AR to Theddlethorpe MEOH Line which cross the offshore ECC disposal site.

153. There are no pipelines which cross the IDRBNR SAC disposal site or inshore disposal site.

4 Characteristics of the Material for Disposal

4.1 Physical Characteristics

4.1.1 Drilled Material

4.1.1.1 Array Area

154. The spoil material derived from drilling activities will be different in nature to that disposed of via seabed preparation/dredging as these drilled materials will include predominantly sediment/rock from deeper in the soil profile.

155. The western half of the array area is underlain by Cretaceous Chalk with mudstones, limestones and sandstones present in the east. Chalk bedrock is located approximately between 5 and 30m below the seabed and overlain by stiff Pleistocene sediments, primarily the Bolders Bank and Swarte Bank Formation. This is in turn overlain by a layer of Holocene sediments approximately between 0 and 5m thick, with thicker deposits in the east.

156. The exact proportions of these deposits that will form the basis of the drill arisings deposited on the seabed will vary according to the drilling locations and the depth to which drilling occurs.

4.1.1.2 Offshore ECC

157. As with the array area, sub-surface geology of the offshore ECC disposal site is characterised mainly by Pleistocene deposits present above Cretaceous Chalk bedrock, overlain in turn by a veneer of Holocene sediments. In contrast, parts of the IDRBNR SAC ECC disposal site cross an area of chalk bedrock close to the surface, with a very thin Holocene sediment layer, while other parts are characterised by sandbank features. The Inshore ECC disposal site is composed of Burnham Chalk, overlain by marine sand deposits.

158. As with the array, the exact proportions of these deposits that will form the basis of the drill arisings deposited on the seabed will vary according to the location of drilling and the depth to which drilling occurs.

4.1.2 Dredged Material

4.1.2.1 Array Area

159. The dominant sediment types identified in the array area that will be dredged are characterised generally by a mix of sand and gravel, with a greater proportion of sand at shallower depths associated with sandbank features (Figure 4.1).

160. Although the actual process of disposal may result in a slight change to the existing particle size composition of seabed sediments, the material disposed *in situ* via seabed preparation and cable trenching would be similar to the existing material as the spoil disposal will occur close to the site of production.

4.1.2.2 Offshore ECC

161. Surficial sediments within the offshore ECC disposal site are characterised mainly by sandy gravel. This is similar for sediments within the eastern area of the SAC disposal site, but with areas of gravelly muddy sand and muddy sandy gravel in the west. Closer to the coast and within the Inshore ECC disposal site, the proportion of sand generally decreases, with a corresponding increase in gravel and fines content (Figure 4.2).

162. Although the actual process of disposal may result in a slight change to the existing particle size composition of seabed sediments, the material disposed *in situ* via seabed preparation and cable trenching would be similar to the existing material as the spoil disposal will occur close to the site of production.

350000

400000

5950000

5900000

N

0 5 10 km

Legend

- Array Area
- Offshore Export Cable Corridor
- ORCP Area

Seabed Sediments (FOLK)

- 1.2.1 sandy Mud
- 1.3.1 muddy Sand
- 1.3.2 (gravelly) muddy Sand
- 2.1.1 Sand
- 2.1.2 (gravelly) Sand
- 3.1.1 gravelly Sand
- 3.2.1 sandy Gravel
- 3.3.1 Gravel
- 4.1.1 gravelly Mud
- 4.3.1 gravelly muddy Sand
- 4.4.1 muddy sandy Gravel
- 5. Rock and Boulders

Benthic Samples - Folk Class (GEOxyz, August / November 2022)

- Sand
- Slightly Gravelly Sand
- Slightly Gravelly Muddy Sand
- Gravelly Sand
- Sandy Gravel
- Muddy Sandy Gravel
- Gravelly Muddy Sand
- Gravel

Sediment composition (%)

- Fines
- Sand
- Gravel

Seabed Sediments 1:250 000 – Europe
© EMODnet Geology,
European Commission, 2016

Coordinate System: WGS 1984 UTM Zone 31N

0 10 20 km

Scale: 1:350,000

A3 Page Size

Disposal Site Characterisation Report

Sediment Distributions across the Array Area based on Descriptive Classifications by Folk (1954)

Figure 4.1

OUTER DOWSING OFFSHORE WIND

Date: 12/09/2024
Produced By: BPHB
Revision: 0.1

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325000 350000 375000 400000

5950000 5925000 5900000 5875000

N

Legend

- Offshore Export Cable Corridor
- ORCP Area
- Inshore ECC Disposal Site
- Within IDRBNR SAC ECC Disposal Site
- Offshore ECC Disposal Site

Seabed Sediments (FOLK)

- 1.2.1 sandy Mud
- 1.3.1 muddy Sand
- 1.3.2 (gravelly) muddy Sand
- 2.1.1 Sand
- 2.1.2 (gravelly) Sand
- 3.1.1 gravelly Sand
- 3.2.1 sandy Gravel
- 3.3.1 Gravel
- 4.3.1 gravelly muddy Sand
- 4.4.1 muddy sandy Gravel

Benthic Samples - Folk Class (GEOxyz, August / November 2022)

- Sand
- Slightly Gravelly Sand
- Slightly Gravelly Muddy Sand
- Gravelly Sand
- Sandy Gravel
- Muddy Sandy Gravel
- Gravelly Muddy Sand
- Gravel

Sediment composition (%)

- Fines
- Sand
- Gravel

Seabed Sediments 1:250 000 – Europe
© EMODnet Geology, European Commission, 2016

Coordinate System: WGS 1984 UTM Zone 31N

0 10 20 km

Scale: 1:300,000

A3 Page Size

Disposal Site Characterisation Report

Sediment Distributions across the ECC based on Descriptive Classifications by Folk (1954)

Figure 4.2

OUTER DOWSING OFFSHORE WIND

Date: 12/09/2024
Produced By: BPHB
Revision: 0.1

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Contains ESRI Basemapping; EMDOnet Geology 2016

Document Path: Z:\GIS\GIS_Projects\0152 Outer Dowsing EIA\GIS\Figures\Examination\Disposal Characterisation Report\ODOW_0152_DCR_Fig4.2_Seabed_Sediments_ECC_v3.mxd

4.2 Chemical Characteristics

163. This section summarises the chemical characteristics of sediments in the Project array area and offshore ECC. Further detail can be found in ES Volume 1, Chapter 8: Marine Water and Sediment Quality (document reference 6.1.8) (AS1-038), Volume 1, Chapter 9: Benthic and Intertidal Ecology (APP-064), Volume 3, Appendix 9.2: Benthic and Intertidal Ecology Technical Report (APP-155) (document reference 6.1.9 and 6.3.9.2).

4.2.1 Array Area Disposal Site

164. The results of the sediment contamination analyses revealed that polycyclic aromatic hydrocarbon concentrations recorded from sediments within the array area occurred within threshold values at the majority of stations. The only exception to this was at a single station which exceed the TEL[4] for Acenaphthene and Phenanthrene. However, concentrations did not exceed the PEL[5]. This sample station is in close proximity to Pickerill-B, a decommissioned gas platform previously operated by Perenco.

165. Metals were generally present at low concentrations but varied across the array area, with concentrations below AL1 at 23 of the 30 stations sampled. Of the remaining seven stations, AL1 was exceeded for arsenic at four stations and nickel at three stations. No metals exceeded the AL2 threshold.

166. At all 30 stations within the Array area, the full suite of remaining contaminants (organotins, PCBs and OCPs) analysed were at concentrations below AL1.

167. Cefas Action Levels (ALs) are used to assess the suitability of dredged material for disposal at sea. They are part of a "weight of evidence" approach that determines the contaminant loading of material and its potential impact on the environment. The Cefas Action Levels are used as part of a 'weight of evidence' approach to assessing the suitability of material for disposal at sea but are not themselves statutory standards. For dredging projects, contaminants below the Action Level 1 are not considered to be of concern and are approved for disposal at sea. Contaminant levels above Action Level 2 are not considered suitable for disposal at sea without further consideration. It is noted that the Project is not a proposed dredging scheme but, given the project proposal to dredge, drill and dispose of seabed material within the RLB, and in keeping with common practice, contaminants will be contextualised against the Cefas Action Levels to provide an indicative risk to the environment.

168.

[4] Threshold Effect Level - concentration below which adverse effects are expected to occur only rarely

[5] Probable Effect Level - the concentration above which adverse effects are expected to occur frequently

4.2.2 Offshore ECC Area Disposal Site

169. The results of the sediment contamination analyses revealed that of the polycyclic aromatic hydrocarbon concentrations recorded from sediments within the offshore and SAC ECC disposal sites did not exceed TEL thresholds. However, of the stations sampled within the Inshore ECC disposal site, TEL thresholds were exceeded at two stations for Dibenzo(a,h)anthracene, Naphthalene and Phenanthrene. No stations across the three ECC disposal sites exceeded PEL thresholds.

170. As with the array area, metal concentrations were generally low across the ECC. Within the offshore ECC disposal site, AL1 was exceeded at only one station for arsenic. Within the SAC disposal site, AL1 was exceeded at two stations for arsenic and a single station for nickel. Within the Inshore disposal site, AL1 was exceeded at two stations for arsenic, one station for nickel and a single station for chromium. No stations exceeded the AL2 threshold for any metals.

171. At all 28 stations within the ECC, the full suite of remaining contaminants analysed were at concentrations below AL1.

4.3 Biological Characteristics

172. Biological characteristics can be found in further detail in Section 3.1.2 and in the sources stated in Table 4.1 below

Table 4.1: Locations of further information for specific data categories.

Data	ES Document
Contamination analysis	Volume 1, Chapter 8: Marine Water and Sediment Quality (document reference 6.1.8) (AS1-038) Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9) (APP-064) Volume 3, Appendix 9.1 Benthic Ecology Technical Report (Array) (document reference 6.3.9.1) (APP-154) Volume 3, Appendix 6.3.9.2 Benthic Ecology Technical Report (ECC) (document reference 6.3.9.2) (APP-155) Volume 3, Appendix 9.3: Benthic Subtidal and Intertidal Ecology Technical Report (document reference 6.3.9.3) (APP-156)
Seabed geology	Volume 1, Chapter 7: Marine Physical Processes (document reference 6.1.7) (APP-062(Volume 3, Appendix 7.1: Marine Physical Processes Technical Report (document reference 6.3.7.1) (APP-150)
Biotopes and benthic fauna	Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9) (APP-064) Volume 3, Appendix 9.1 Benthic Ecology Technical Report (Array) (document reference 6.3.9.1) (APP-154) Volume 3, Appendix 6.3.9.2 Benthic Ecology Technical Report (ECC) (document reference 6.3.9.2) (APP-155) Volume 3, Appendix 9.3: Benthic Subtidal and Intertidal Ecology Technical Report (document reference 6.3.9.3) (APP-156)

Data	ES Document
Fish and shellfish spawning and nursery areas	Volume 1, Chapter 10: Fish and Shellfish Ecology (document reference 6.1.10) (APP-065) Volume 3, Appendix 10.1: Fish and Shellfish Ecology Technical Baseline (document reference 6.3.10.1) (APP-159)

5 Summary of the Potential Adverse Effects of In Situ Spoil Disposal

5.1 Physical Environmental

173. Gravels and sands will settle relatively rapidly towards the seabed. From the maximum expected height of initial suspension (primarily between approximately 10 – 30m throughout the disposal sites), sediment of these grain sizes is likely to resettle to the seabed (no longer contributing to an increase in SSC) within approximately one to 60 minutes.

174. Although the actual process of disposal may result in a slight change to the existing particle size composition of seabed sediments, the material disposed in situ via seabed preparation and cable trenching would be similar to the existing material as the spoil disposal will occur close to the site of production.

175. Whist the IDRBNR SAC disposal site and the Inshore disposal site overlap with nationally important designated sites, the seabed in these areas is highly dynamic and is assessed to have some capacity to recover from disturbance. However, any reductions in bed level in response to dredging will be within the range of that occurring naturally in response to migration of the bedform features that may be dredged. Any increases in bed level in response to spoil disposal are expected to be of short-term duration and modest in relation to total water depth at any given location.

176. Marine processes are not themselves receptors in the majority of cases. However, changes to these processes may have an impact on other sensitive receptors.

5.2 Biological and Human Environment

177. The ES for the Project provides a detailed assessment of likely significant effects relating to disposal activities on a number of sensitive biological and human environment receptors, including (amongst others) benthic habitats, fish and shellfish spawning and nursery habitats, marine mammals, birds, and commercial fisheries.

178. For all of these assessments, the effects defined within Chapter 7 have been interpreted with regard to their subsequent impact on various receptors. The sensitivity of various receptors to these effects (increased suspended sediment concentrations, sediment deposition and potential loss of seabed habitats) has been determined based on relevant literature and an assessment of the significance of any effects undertaken.

179. The relevant chapters/documents of the ES are referenced where further detail of those assessments of effects can be found. It is important to note that only impacts related to the disposal of sediment (increased suspended sediment concentrations, sediment deposition and potential loss of seabed habitats) and considered in Table 5.1.

Table 5.1: Summary of Impacts from the disposal of material from seabed preparation, sandwave clearance, pile driving and cable trenching within the Project Order Limits

Potential Impact	Relevant ES Section	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
Marine Physical Processes				
Increases in SSC resulting in elevated turbidity and consequential changes to seabed levels	Volume 1, Chapter 7: Marine Physical Processes (document reference 6.1.7)	(Pathway)	(Pathway)	(Pathway)
Potential Impacts to Seabed Morphology (Sandbanks, Sandwave Areas and Notable Bathymetric Depressions)		Low	Negligible	Minor
Modifications to Littoral Transport and Coastal Behaviour (Erosion), Including at Landfall, including Coastal Processes and Geomorphology above MHWS		Medium	Low	Minor
Marine Water and Sediment Quality				
Deterioration in water quality due to suspension of sediments	Volume 1, Chapter 8: Marine Water and Sediment Quality	Negligible	Bathing Waters: Medium Lincolnshire Coastal Waterbody: Low Non-designated waterbodies: Negligible	Minor Negligible Negligible
Release of sediment-bound contaminants from disturbed sediments.		Low	Negligible	Negligible
Deterioration in water clarity due to the release of drilling mud		Low	Bathing Waters: Medium Lincolnshire Coastal Waterbody: Low	Minor Negligible

Potential Impact	Relevant ES Section	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
			Non-designated waterbodies: Negligible	Negligible
Benthic and Intertidal Ecology				
Temporary increase in SSC and associated sediment deposition (in the offshore ECC and array)	Volume 1, Chapter 9: Benthic and Intertidal Ecology (document ref. 6.1.9)	Medium	Medium	Minor
Temporary increase in SSC and associated deposition (in the intertidal).		Low	Low	Minor
Direct and indirect seabed disturbances leading to the release of sediment contaminants.		Negligible	Low	Negligible
Fish and Shellfish Ecology				
Direct and indirect seabed disturbances leading to the release of sediment contaminants.	Volume 1, Chapter 10: Fish and Shellfish Ecology (document reference 6.1.10)	Low	Negligible	Minor
Marine Mammals				
Change in fish abundance/ distribution	Volume 1, Chapter 11: Marine Mammals (document reference 6.1.11)	Low	Negligible	Minor
Offshore and Intertidal Ornithology				
Indirect impacts through effects on habitats and prey.	Volume 1, Chapter 12: Offshore and Intertidal Ornithology (d	Low	Negligible	Minor
Commercial Fisheries				
Increase in SSC and sediment deposition	Volume 1, Chapter 14: Commercial Fisheries	Low	Low to Medium	Minor
Temporary seabed habitat loss/disturbance		Low	Negligible to Medium	Minor

Potential Impact	Relevant ES Section	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect
Direct and indirect seabed disturbances leading to the release of sediment contaminants		Negligible	Low to Medium	Minor

6 Monitoring

180. Based on the findings of the impact assessments presented in the ES, and summarised within this document, there are no predicted significant effects across physical processes, benthic or water quality that would necessitate monitoring for disposal and no monitoring is proposed by the specialists for those topics.

7 Conclusions

181. This document represents the site characterisation for the disposal sites for the Project. It forms the proposal for a licensed disposal site within the array area and three disposal sites within the offshore ECC for drill arisings, and material from foundation seabed preparation, cable installation preparation, and in relation to the ECC, excavation of HDD exits pits. This is required by the MMO to allow them to consider the potential impacts of disposal within these sites.

182. Noting that all the information required for a site characterisation to support a disposal licence application is contained within the wider ES, this document takes the form of a 'framework' document that provides a summary of the key points of relevance to site characterisation and refers to more detailed information and data presented within the relevant sections of the ES.

183. The source of material to be disposed of within the array and ECC will be sediment removed from the upper layer of the existing seabed as part of foundation seabed preparation works and cable installation preparation, and/or materials from the deeper soil profile and upper sediments derived from drilling activities for piled foundations.

184. Where drilling is required to facilitate the installation of piles to target depth, the drill arisings will be disposed of at sea, adjacent to the foundation location.

185. As a worst case scenario, the total volume of natural material that may require disposal would be up to 18,427,229m^3.

186. Following the Waste Hierarchy, the Project have analysed relevant alternatives and concluded that disposal within the proposed disposal sites is the preferred and only feasible option. Dredging and disposal are unavoidable in order to provide the stable seabed required for foundation types and cable installation. The technologies required for reuse and recycling would have additional environmental impacts and would be inefficient; consequently, in situ disposal remains the most feasible option, with the added benefit of maintaining sediment within the local sedimentary system. However, disposal material volumes will be kept to a minimum in order to ensure safe and successful installation.

187. As outlined above, no significant effects arising from the impacts associated with dredge and disposal have been identified within the ES, when considering the inclusion of the mitigation measure for impacts to the IDRBNR SAC of the retention of all material dredged from the SAC within the SAC system, with the specific inclusion of a dedicated disposal site for this area. For all the disposal sites, the dredge and disposal of the native sediments will not lead to any change in the sediment characteristics and habitats of the disposal sites and any impacts from changes in SSC and associated sediment deposition will be temporary and not lead to any significant effects in EIA terms. Importantly, there will be no introduction of sources of contamination, with all sediments being disposed near to the dredge location.

188. As the assessment has not identified any significant adverse effects on receptors for this proposed disposal activity, it is concluded that disposal *in situ* remains the most viable and appropriate option.

8 References

Joint Nature Conservation Committee (JNCC) (2013). Response to East Anglia One Wind Farm Order Application; Annex J: Disposal Site Characterisation.

Marine Management Organisation (MMO), (2023). IFISH database with landing statistics data for UK registered vessels for 2018 to 2022 with attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; species; live weight (tonnes); and value; and landing year; landing month; vessel length category; country code; vessel/gear type; port of landing; species; live weight (tonnes); and value.