RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Preliminary Environmental Information Report

Chapter 19 – Geology and Land Quality

26/04/2023

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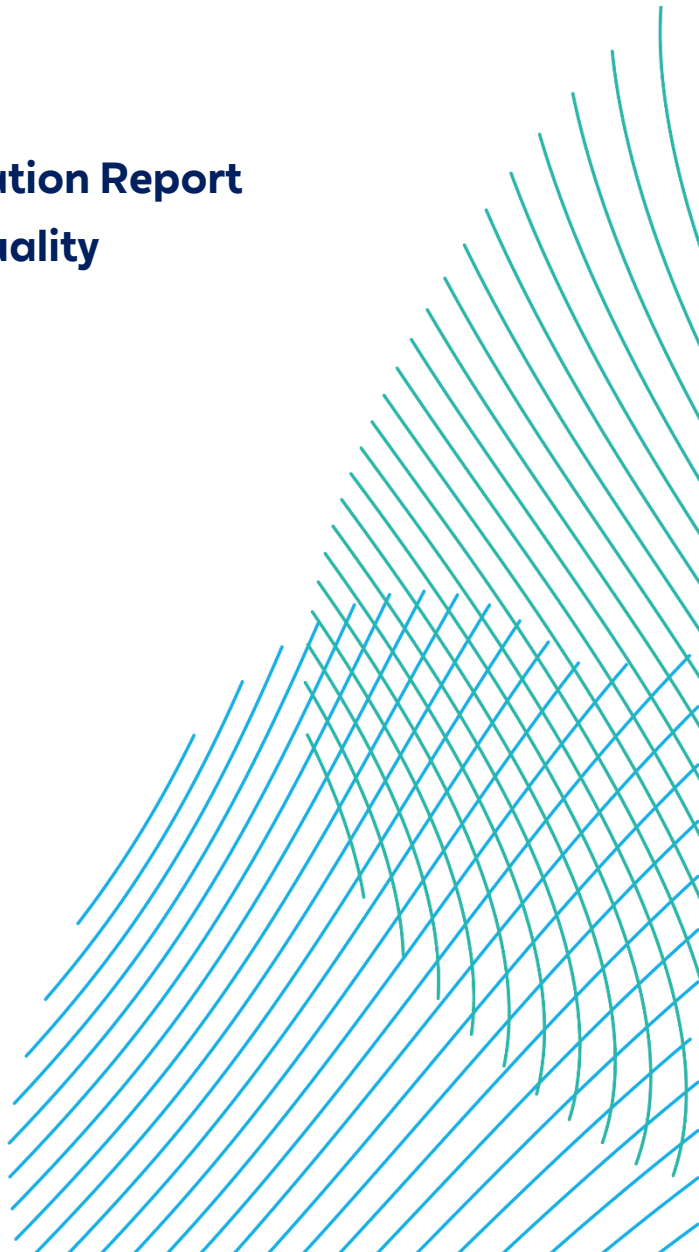

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Glossary

Term	Definition
Agricultural Land Classification	Agricultural Land Classification is a grading system used to assess and compare the quality of agricultural land in England and Wales. A combination of climate, topography and soil characteristics and their unique interaction determines the grade of the land. The grades range from 1 to 5. Grade 1 being excellent, Grade 2 very good, Grade 3a and 3b good to moderate (no subdivide), Grade 4 poor and Grade 5 very poor.
Cable construction compound	Area set aside to facilitate construction of the onshore export cables. These will be located adjacent to the onshore export cable corridor, with access to the highway.
Dogger Bank South (DBS) Offshore Wind Farms	The collective name for the two Projects, DBS East and DBS West.
Haul road	The track used by traffic to access different sections of the onshore export cable corridor for construction.
High groundwater vulnerability	High groundwater vulnerability areas can easily transmit pollution to groundwater. They are characterised by high-leaching soils and the absence of low-permeability superficial deposits.
Horizontal Directional Drilling (HDD)	HDD is a trenchless technique to bring the offshore cables ashore at the landfall and can be used for crossing other obstacles such as roads, railways and watercourses onshore.
Jointing bays	Underground structures constructed at regular intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	The point on the coastline at which the offshore export cables are brought onshore, connecting to the onshore export cables at the Transition Joint Bay.

Term	Definition
Link boxes	Below ground structures housing cable equipment, located along the onshore export cable corridor alongside the jointing bays.
Low groundwater vulnerability	Low groundwater vulnerability areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low-leaching soils and/or the presence of low-permeability superficial deposits.
Medium groundwater vulnerability	Medium groundwater vulnerability areas offer some groundwater protection from the transmission of pollution to groundwater.
Onshore Development Area	The Onshore Development Area for PEIR is the boundary within which all onshore infrastructure required for the Projects will be located including landfall, onshore export cable route, accesses, construction compounds and onshore substations. The Onshore Development Area is to be refined through the consultation and engineering review process.
Onshore export cable corridor	This is the area which includes cable trenches, haul roads, spoil storage areas, and limits of deviation for micro-siting. For assessment purposes, the cable corridor does not include the onshore substations, Transition Joint Bays or temporary access routes; but includes construction compounds (purely for the cable route).
Onshore export cables	Onshore export cables take the electricity from the Transition Joint Bay to the onshore substations.
Onshore Substations	A compound containing electrical equipment required to transform and stabilise electricity generated by the Projects so that it can be connected to the electricity transmission network. There will be one onshore substation for each Project.

Term	Definition
Onshore Substation Zones	Parcels of land within the Onshore Development Area where the onshore substation infrastructure (including the haul roads, temporary construction compounds and associated cable routeing) may be located.
Other trenchless techniques	Other techniques (aside from HDD) for installation of ducts or cables where trenching may not be suitable such as micro tunnelling or auger boring.
Principal Aquifer	These are layers of rock or drift deposits that have high intergranular and / or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifers.
Secondary A Aquifer	These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
Secondary B Aquifer	These are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Secondary Undifferentiated Aquifer	These are assigned in cases where it has not been possible to attribute either a Secondary A or B aquifer to the soil type due to the variable characteristics. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifers in different locations due to the variable characteristics of the rock type.
Source Protection Zone I	Inner protection zone - defined as the 50-day travel time from any point below the water table to the abstraction source. This zone has a minimum radius of 50 metres.

Term	Definition
Source Protection Zone II	Outer protection zone - defined by a 400-day travel time from a point below the water table. This zone has a minimum radius of 250 or 500 metres around the abstraction source, depending on the size of the abstraction.
Source Protection Zone III	Source catchment protection zone - defined as the area around an abstraction source within which all groundwater recharge is presumed to be discharged at the abstraction source.
The Applicant	RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited as the owners of DBS West and DBS East respectively are the named undertakers that will have the benefit of the Development Consent Order. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited.
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South offshore wind farms).
Transition Joint Bay (TJB)	The Transition Joint Bay (TJB) is an underground structure at the landfall that houses the joints between the offshore export cables and the onshore export cables.
Trenching	Open cut method for cable or duct installation

Acronyms

Term	Definition
ALC	Agricultural Land Classification
BGS	British Geological Survey
CDM	Construction Design Management
CEA	Cumulative Effects Assessment
CLR11	Contaminated Land Report 11
CoCP	Code of Construction Practice
COMAH	Control of Major Accident Sites
COSHH	Control of Substances Hazardous to Health
DCO	Development Consent Order
DECC	Department for Energy and Climate Change
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ERP	Emergency Response Plan
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
GPCL	Guiding Principles for Contaminated Land
HDD	Horizontal Directional Drilling
LNR	Local Nature Reserve
LoGS	Local Geological Site

Term	Definition
MCA	Mineral Consultation Area
MIIA	Mineral Infrastructure Impact Assessment
MPS	Minerals Policy Statement
MSA	Mineral Safeguarding Area
NNR	National Nature Reserve
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
NVZ	Nitrate Vulnerable Zone
PCOC	Potential Contaminant of Concern
PEIR	Preliminary Environmental Information Report
PPE	Personal Protective Equipment
PPG	Planning Practice Guidance
PRA	Preliminary Risk Assessment
RoFRaS	Risks of Flooding from Rivers and Sea
SAC	Special Area of Conservation
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TJB	Transition Joint Bay
UK	United Kingdom

Term	Definition
WFD	Water Framework Directive

19 Geology and Land Quality

19.1 Introduction

1. This chapter of the Preliminary Environmental Information Report (PEIR) considers the likely significant effects of the Projects on Geology and Land Quality. The chapter provides an overview of the existing environment for the proposed Onshore Development Area, followed by an assessment of likely significant effects for the construction, operation, and decommissioning phases of the Projects.
2. The assessment should be read in conjunction with the following linked chapters:
   - **Chapter 18 Terrestrial Ecology and Ornithology**;
   - **Chapter 20 Flood Risk and Hydrology**;
   - **Chapter 21 Land Use**; and
   - **Chapter 27 Human Health**.
3. Additional information to support the Geology and Land Quality assessment include:
   - **Appendix 19.1 Geo-Environmental Desk Study and Preliminary Risk Assessment Report**; and
   - **Appendix 19.2 Onshore Waste Assessment.**

19.2 Consultation

4. Consultation with regard to Geology and Land Quality has been undertaken in line with the general process described in **Chapter 6 EIA Methodology**. The key elements of consultation to date have included scoping and a meeting with key technical stakeholders. The feedback received has been considered in preparing the PEIR. **Table 19-1** provides a summary of how the consultation responses received to date have influenced the approach that has been taken.
5. This chapter will be updated following consultation on PEIR in order to produce the final assessment that will be submitted with the Development Consent Order (DCO) application. Full details of the consultation process will also be presented in the Consultation Report alongside the DCO application.

Table 19-1 Consultation Responses

Comment	Project Response
Planning Inspectorate / Scoping Responses 02/09/2022	
Reference is made within this paragraph to the vulnerability of aquifers (ranging from low to high), however this information is not presented within Table 3-5 (Aquifer Designation). The ES should ensure that all available information is utilised to assess the sensitivity of the identified receptors. The receptors and other relevant baseline information should also be indicated on an appropriate figure.	Groundwater vulnerability within each of the identified aquifer units is presented within **Table 19-10**. Information in relation to existing baseline for the Onshore Development Area can also be found in **Table 19-10** and **Appendix 19.1**. Figures illustrating baseline information, and potential receptors can be found as **Figures 19.2 – 19.9** within **Appendix 19.1**.
The Scoping Report refers to the potential for diffuse and point source pollution to be present across land that is currently in agricultural use within the onshore study area. Whilst land quality is addressed in Section 3.4, the Scoping Report does not address how the effects from mobilisation of existing contamination or introduction of pollution during construction, operation, or decommissioning, for example fuel spills, could impact on agricultural land quality.	Information in relation to potential sources of contamination within the Onshore Development Area are provided in **Table 19-10**. The potential contaminants associated with each of the sources, and which area of the Onshore Development Area may be impacted, are provided in **Table** 19-11 of this chapter and **Figures 19.4** and **19.5** of **Appendix 19.1**.

Comment	Project Response
The Inspectorate advises that the ES assess these impacts where significant effects are likely and describe any mitigation requirements.	Potential impacts , and mitigation measures, associated with the mobilisation of pre-existing sources of contamination, and the introduction of new sources, during construction and operation are discussed in section 19.6.1 and 19.6.2. Potential impacts to human health and controlled waters are discussed within section 19.6.1 and 19.6.2 and **Chapter 27 Human Health**. Impacts associated with contamination and impacts on agricultural land are discussed in sections 178 and 19.6.2.6 of this chapter. Additional discussions around potential impacts to agricultural land use outside of the risk posed by potential contamination are provided in **Chapter 21 Land Use.**
The Scoping Report does not refer to the potential for damage to new and existing infrastructure from potentially contaminated land, water, or ground gas. The ES should describe any design measures required to manage this issue.	Potential sources of ground gas and vapour generating materials on and within 250m of the Onshore Development Area are discussed in **Table 19-10** and **Table** 19-11 with further detail provided in **Appendix 19.1**. The potential impacts to existing and new infrastructure from potentially contaminated soils, groundwater and/or ground gases/vapours within and surrounding the Onshore Development Area are discussed in sections 19.6.1.5 and

Comment	Project Response
	19.6.2.4. These sections also discuss potential mitigation measures to lower the significance of effect to the built environment.
The Scoping Report states that the ES will assess the potential for temporary and permanent mineral sterilisation within the onshore study area. The ES should provide information on the geographic location of Mineral Safeguarding Areas (MSA) and the types of minerals or other resources that are protected, with reference to supporting figures as necessary.	A review of available data indicates that Mineral Safeguarding Areas are located within the Onshore Development Area. Details of their location and commodities present are discussed in **Table 19-10** with further detail provided in **Appendix 19.1.** Potential impacts relating to temporary and permanent sterilisation during construction and operation of the Projects are discussed in sections 19.6.1.4 and 19.6.2.3 respectively. Mitigation measures, including liaising with East Riding of Yorkshire Council, to reduce the significance of effect are also discussed in these sections.
The Scoping Report does not refer to the potential for the presence of Unexploded Ordnance (UXO) within the onshore study area. The ES should provide desk study information including a risk assessment to inform the ES.	Information in relation to the potential risks posed by UXO within the Onshore Development Area can be found in the Geo-Environmental Desk Study and Preliminary Risk Assessment (PRA) which accompanies this chapter (**Appendix 19.1**). This is a high level assessment of regional

Comment	Project Response
	bombing densities, a more detailed risk assessment will be provided post-consent (if required).

19.3 Scope

19.3.1 Study Area

6. The Geology and Land Quality study area has been defined on the basis of the distance over which impacts may occur and by the location of any receptors that may be affected by those potential impacts. This has been established using professional judgement and is supported by **Appendix 19.1**.

7. The Geology and Land Quality study area includes a 250m buffer around the Onshore Development Area as illustrated on **Figure 19.1**. A 100m buffer zone is also included on **Figure 19.1** to illustrate the spatial extent in relation to a review of historical mapping. Due to the agricultural nature of the surrounding area and based on professional judgement, a 100m buffer zone has been deemed appropriate for this review.

8. The buffer zone around the Onshore Development Area is extended to 1km for assessing the presence of Control of Major Accident Hazard (COMAH) sites, groundwater abstraction wells and Source Protection Zones (SPZ). This is due to the higher risk posed by COMAH sites and the sensitivity of groundwater abstraction wells and SPZs.

19.3.2 Realistic Worst Case Scenario

19.3.2.1 General Approach

9. The realistic worst case design parameters for likely significant effects scoped into the EIA for the Geology and Land Quality assessment are summarised in **Table 19-2**. These are based on the project parameters described in **Chapter 5 Project Description**, which provides further details regarding specific activities and their durations.

10. In addition to the design parameters set out in **Table 19-2**, consideration is also given to the different development scenarios still under consideration and the possible phasing of the construction as set out in sections 19.3.2.2 to 19.3.2.5.

Table 19-2 Realistic Worst Case Design Parameters

	Parameter		
	DBS East or DBS West in isolation	**DBS East and DBS West concurrently**	**DBS East and DBS West sequentially**
Construction			
Landfall	Landfall Horizontal Directional Drill (HDD) (temporary works) physical parameters: • HDD compound works area: 230 x 75m (for four HVAC) • Transition joint bay size: 5 x 20m • No. of transition joint bays: 4 (4x HVAC) • Construction land take for each transition joint bay: 10 x 30m • Maximum HDD depth: 20m • HHD horizontal length: 1,400m • Maximum number of HDD: 5 (4x power cables plus 1x spare) • Duration: 18 months	Landfall HDD (temporary works) physical parameters: • HDD compound works area: 310 x 75m (for four HVAC, two HVDC and one spare) • Transition joint bay size: 5 x 20m • No. of transition joint bays: 6 (4x HVAC, 2x HVDC) • Construction land take for each transition joint bay: 10 x 30m • Maximum HDD depth: 20m • HHD horizontal length: 1,400m • Maximum number of HDD: 9 (6 x power cables, 1 x fibre optic cable plus 2 spare) • Duration: 18 months	Landfall HDD (temporary works) physical parameters: • HDD compound works area: 310 x 75m (for four HVAC, two HVDC and one spare) • Transition joint bay size: 5 x 20m • No. of transition joint bays: 6 (4x HVAC, 2x HVDC) • Construction land take for each transition joint bay: 10 x 30m • Maximum HDD depth: 20m • HHD horizontal length: 1,400m • Maximum number of HDD: 9 (6 x power cables, 1 x fibre optic cable plus 2 spare) • Duration: 42 months
Onshore export cable corridor	Cable corridor construction physical parameters: • Working width: 50m (up to 125m at trenchless crossings) • Corridor length: 39km • Total onshore export cable corridor works area (est.): 4,504,535m^2 • Cable duct trench width: 10m based on 4xHVAC circuits • No. of trenches: Up to 5 • Maximum cable burial depth (where restrictions aren't present): 2m • Indicative cable burial depth: 1.6m • Haul road width: 7m (increasing to 11m at passing places) • Jointing bays: every 0.75 – 1.5km	Cable corridors construction physical parameters: • Working width: 100m (up to 250m at trenchless crossings) • Corridor length: 39km • Total onshore export cable corridor works area (est.): 8,228,754m^2 • Cable duct trench width: 10m for HVAC circuits, 5m for HVDC circuits • No. of trenches: 7 • Maximum cable burial depth (where restrictions aren't present): 2m • Indicative cable burial depth: 1.6m • Haul road width: 7m (increasing to 11m at passing places) • Jointing bays: every 0.75 – 1.5km	Cable corridors construction physical parameters: • Working width: 100m (up to 250m at trenchless crossings) • Corridor length: 39km • Total onshore export cable corridor works area (est.): 8,228,754m^2 • Cable duct trench width: 10m for HVAC circuits, 5m for HVDC circuits • No. of trenches: Up to 7 • Maximum cable burial depth (where restrictions aren't present): 2m • Indicative cable burial depth: 1.6m • Haul road width: 7m (increasing to 11m at passing places) • Jointing bays: every 0.75 – 1.5km

	Parameter		
	DBS East or DBS West in isolation	**DBS East and DBS West concurrently**	**DBS East and DBS West sequentially**

	• Jointing bay construction footprint (per bay): 10 x 25m
	• Jointing bay depth: 2.2m
	• Main construction compound: 100 x 100m
	• Secondary construction compounds:75 x 75m
	• No. of compounds (est.):
	  ○ Main compounds – 2
	  ○ Minor compounds – 15
	  ○ HDD compounds – 70
	  ○ Substation compound -1
	Trenchless crossings physical parameters:
	• Maximum width of buried cable: 60m
	• Maximum trenchless crossing depth: 20m
	• Trenchless crossing compound dimensions: 50 x 50m
	• No. of trenchless crossing: 35
	• Overall duration: 33 months
		• Jointing bay construction footprint (per bay): 10 x 25m
		• Jointing bay depth: 2.2m
		• Main construction compound: 100 x 100m
		• Secondary construction compounds: 75 x 75m
		• No. of compounds (est.):
		  ○ Main compounds – 4
		  ○ Minor compounds – 30
		  ○ HDD compounds – 140
		  ○ Substation compound - 1 per project
		Trenchless crossings physical parameters:
		• Maximum width of buried cable: 227m
		• Maximum trenchless crossing depth: 20m
		• Trenchless crossing compound dimensions: 50 x 50m
		• No. of trenchless crossing: 35
		• Overall duration: 33 months
			• Jointing bay construction footprint (per bay): 10 x 25m
			• Jointing bay depth: 2.2m
			• Main construction compound: 100 x 100m
			• Secondary construction compounds: 75 x 75m
			• No. of compounds (est.):
			  ○ Main compounds - 4
			  ○ Minor compounds – 30
			  ○ HDD compounds – 140
			  ○ Substation compound - 1 per project
			Trenchless crossings physical parameters:
			• Maximum width of buried cable: 227m
			• Maximum trenchless crossing depth: 20m
			• Trenchless crossing compound dimensions: 50 x 50m
			• No. of trenchless crossing: 35
			• Overall duration: 57 months

Onshore substations	Onshore substation (temporary works) physical parameters: • Total construction area: 180,000m^2 (based on one HVAC (AIS) substation + temporary construction compound) • Duration: 4 years	Onshore substation (temporary works) physical parameters: • Total construction area: 274,416m^2 (based on one HVAC (AIS) substation + temporary construction compound, and one HVDC substation + temporary construction compound) • Duration: 4 years	Onshore substation (temporary works) physical parameters: • Total construction area: 274,416m^2 (based on one HVAC (AIS) substation + temporary construction compound, and one HVDC substation + temporary construction compound) • Duration: 6 years

	Parameter		
	DBS East or DBS West in isolation	**DBS East and DBS West concurrently**	**DBS East and DBS West sequentially**
Operation			
Onshore export cable corridor	Cable corridors operational physical parameters: • No. of link boxes: 229 • Link box footprint (per box) = 3 x 8m	Cable corridors operational physical parameters: • No. of link boxes: 343 • Link box footprint (per box) = 3 x 8m	Cable corridors operational physical parameters: • No. of link boxes: 343 Link box footprint (per box) = 3 x 8m
Onshore substations	Onshore substation physical parameters: • Permanent substation area: 135,000m^2 (based on one HVAC substation) • Duration: 30 years	Onshore substation physical parameters: • Permanent substation footprint = 199,416m^2 (based on one HDAC and one HVDC substation) • Duration: 30 years	Onshore substation physical parameters: • Permanent substation footprint = 199,416m^2 (based on one HDAC and one HVDC substation) • Duration: 30 years
Decommissioning			
No final decision regarding the final decommissioning policy for the onshore project infrastructure including landfall, onshore cable route and onshore substation has yet been made. It is also recognised that legislation and industry best practice change over time. However, it is likely that the onshore project equipment, including the cable, will be removed, reused or recycled wherever possible and the transition bays and cable ducts being left in place. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator. It is anticipated that for the worst case scenario, the impacts will be no greater than those identified for the construction phase.			

19.3.2.2 Development Scenarios

11. There are currently two possible electrical solutions being considered for DBS West, HVAC or HVDC. Due to the distance of the array area offshore DBS East will be an HVDC project. Therefore, there are two possible electrical solutions for the Projects:

    - One HVDC project and one HVAC project; or
    - Two HVDC projects.

12. There are different parameters required for the onshore substations depending on which electrical solution is selected. Therefore, there are four possible development scenarios within the onshore substation zones that could be taken forward:

    - Two HVDC substations in Substation Zone 4;
    - One HVDC substation in Substation Zone 1 and one HVAC substation in Substation Zone 4;
    - One HVDC substation in Substation Zone 4 and one HVAC substation in Substation Zone 1; or
    - One HVDC substation in Substation Zone 1 and one HVDC substation in Substation Zone 4.

13. In order to ensure that a robust assessment has been undertaken, all development scenarios and options have been considered to ensure the realistic worst case scenario for each topic has been assessed. Further details are provided in **Chapter 5 Project Description**.

19.3.2.3 Construction Scenarios

14. The following principles set out the framework for how the Projects may be constructed (relating to both onshore and offshore works):

- DBS East and DBS West may be constructed at the same time, or at different times;
- If built concurrently, both Projects could be constructed in five years;
- If built non-concurrently, either Project could be built first;
- If built non-concurrently, each Project would require a five year period of construction;
- If built non-concurrently, it is anticipated that there would be up to a two year lag between the start of construction for the first project and the start of construction for the second project; and
- Assuming a maximum construction period per Project of five years, and taking the above into account, the maximum construction period over which the construction of both Projects could take place is seven years.

15. In order to determine which construction scenario presents the realistic worst case for each receptor and impact, the assessment considers both maximum duration effects and maximum peak effects, in addition to each Project being developed in isolation, drawing out any differences between each of the two Projects.

16. The three construction scenarios considered by the Geology and Land Quality assessment are therefore:

- Build DBS East or build DBS West in isolation;
- Build DBS East and DBS West concurrently – reflecting the maximum peak effects; and
- Build the Projects sequentially with a lag of up to two years – reflecting the maximum duration of effects.

17. The individual, concurrent and sequential construction scenarios all allow for flexibility to build out the Projects using a phased approach. This will allow the Projects to adapt to National Grid Electricity Transmission Operator's development plans for the onshore grid connection points. Under a phased approach the maximum timescales for individual elements of the construction have been assessed.

18. Any differences between the Projects, or differences that could result from the manner in which the first and the second Projects are built (concurrent or sequential and the length of any gap) are identified and discussed where relevant in section 19.6. For each potential impact, only the worst case construction scenario for two Projects is presented, i.e. either concurrent or sequential. The justification for what constitutes the worst case is provided, where necessary, in section 19.6.

19.3.2.4 Operation Scenarios

19. Operation scenarios are described in detail in **Chapter 5 Project Description**. The assessment considers the following scenarios:

- Only DBS East in operation;
- Only DBS West in operation; and
- The two Projects operating concurrently, with or without a lag of up to two years between each Project commencing operation.

20. If the Projects are built out using a phased approach, there would also be a phased approach to starting the operational stage. The worst case scenario for the operational phase for the Projects has been assessed. See section 5.1.1 of **Chapter 5 Project Description** for further information.

21. The operations lifetime of each Project is expected to be 30 years.

19.3.2.5 Decommissioning Scenarios

22. Decommissioning scenarios are described in **Chapter 5 Project Description**. Decommissioning arrangements will be agreed through the submission of a Decommissioning Programme prior to construction, however for the purpose of this assessment it is assumed that decommissioning of the Projects could be conducted separately, or at the same time.

19.3.3 Mitigation Embedded in the Design

23. This section outlines the embedded mitigation relevant to the Geology and Land Quality assessment, which has been incorporated into the design of the Projects (**Table 19-3**). Where other mitigation measures are proposed, these are detailed in the impact assessment (section 19.6).

Table 19-3 Embedded Mitigation Measures

Parameter	Mitigation Measures Embedded into the Project Design
Contaminated land	
Cable routing	The route of the onshore export cable corridor has been determined as part of a detailed site selection process (see **Chapter 4 Site Selection and Assessment of Alternatives**). The route of the onshore export cable corridor has been designed to avoid potential sources of contamination (e.g. landfills) where possible.
Groundwater quality	
Cable routing	Ground investigations and a hydrogeological risk assessment meeting the requirements of the Environment Agency's approach to groundwater protection (Environment Agency, 2018) would be undertaken at each HDD location.
Onshore substations	The use of oil water sumps within the onshore substations to reduce the potential for leaks and spills impacting groundwater quality.

19.4 Assessment Methodology

19.4.1 Policy, Legislation and Guidance

19.4.1.1 National Policy Statements

24. The assessment of potential impacts upon Geology and Land Quality has been made with specific reference to the relevant National Policy Statements (NPS). The specific assessment requirements for Geology and Land Quality, as detailed in the NPS, are summarised in **Table 19-4** together with an indication of the section of this chapter where each is addressed.

25. The UK Government announced a review of the existing NPS within its December 2020 Energy White Paper (HM Government, 2020) and issued a draft version of Overarching NPS for Energy EN-1, NPS for Renewable Energy Infrastructure EN-3 and NPS for Electricity Networks Infrastructure EN-5 for consultation in September 2021. At the time of writing this PEIR chapter, final versions of the revised NPSs are not available. A review of the draft versions has been undertaken in relation to specific assessment requirements for Geology and Land Quality. Applicable requirements are summarised in **Table 19-4**.

26. A review of the NPS identified that only NPS for Energy (EN-1) is relevant to Geology and Land Quality. Therefore, NPS for Renewable Energy Infrastructure (EN-3) and NPS for Electricity Networks Infrastructure (EN-5) have not been included in the below table as they are not deemed to be relevant to this chapter.

27. Following the consultation in 2021 on the draft energy NPS, a new consultation opened on the 30 March 2023 on revised drafts of the energy NPSs, including EN1, EN3 and EN5. Due to the timing of this consultation, and finalisation of this PEIR we have been unable to review and take these revised draft NPS into account within these documents. However, these will be reviewed and incorporated into the final ES where relevant.

Table 19-4 NPS Assessment Requirements

NPS Requirement	NPS Reference	PEIR Section Reference
EN-1 NPS for Energy		
Where the development is subject to EIA [Environmental Impact Assessment] the applicant should ensure that the ES [Environmental Statement] clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the [Secretary of State] consider thoroughly the potential effects of a proposed project.	Paragraph 5.3.3	A review of geologically designated sites, including Local Geological Sites (LoGS), within the Onshore Development Area has been undertaken as part of the preparation of this chapter (**Table 19-10**, see also **Figure 19.3** of **Appendix 19.1**). The review identified that there is one nationally designated geological site and one LoGS located within the landfall area and onshore export cable corridor. Potential impacts to these features, and mitigation measures, during the construction and operational phases are discussed in sections 19.6.1.6 and 19.6.2.5. Ecologically designated sites are also discussed in **Table 19-10**, with additional details in **Appendix 19.1**. Potential impacts, and mitigation measures, to ecologically designated sites are set out in sections 19.6.1.3 and 19.6.2.2. Further details on potential impacts to

NPS Requirement	NPS Reference	PEIR Section Reference
		ecologically designated sites are discussed in **Chapter 18 Terrestrial Ecology and Ornithology**.
The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.	Paragraph 5.3.4	The existing environment is discussed in section 19.5. Potential impacts, and proposed mitigation measures, during construction and operation are set out in sections 19.6.1 and 19.6.2 respectively. Potential impacts on ecological Sites of Special Scientific Interest (SSSI) are discussed in **Chapter 18 Terrestrial Ecology and Ornithology**.
In having regard to the aim of the Government's biodiversity strategy the [Secretary of State] should take account of the context of the challenge of climate change: failure to address this challenge will result in significant adverse impacts to biodiversity. The policy set out in the following sections recognises the need to protect the most important biodiversity and geological conservation interests. The benefits to nationally significant low carbon energy infrastructure development may include benefits may outweigh	Paragraph 5.3.6	Geological designated sites and impacts relating to climate change are discussed in **Table 19-10** and section 19.5.2 respectively. A review of geologically designated sites, including LoGS, within the Onshore Development Area has been undertaken as part of the preparation of this chapter (**Table 19-10**, see also **Figure 19.3** of **Appendix 19.1**). The review identified that there is one nationally designated geological site and one LoGS located within the landfall area and onshore export cable corridor.

NPS Requirement	NPS Reference	PEIR Section Reference
harm to these interests. The [Secretary of State] may take account of any such net benefit in cases where it can be demonstrated.		Potential impacts to these features, and mitigation measures, during the construction and operational phases are discussed in sections 19.6.1.6 and 19.6.2.5. Ecologically designated sites are also discussed in **Table 19-10**, with additional details in **Appendix 19.1**. Potential impacts, and mitigation measures, to ecologically designated sites are set out in sections 19.6.1.3 and 19.6.2.2. Further details on potential impacts to ecologically designated sites are discussed in **Chapter 18 Terrestrial Ecology and Ornithology**.
[The] development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives; where significant harm cannot be avoided, then appropriate compensation measures should be sought.	Paragraph 5.3.7	
In taking decisions, the [Secretary of State] should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; habitats and other species of principal importance for the conservation of biodiversity; and to biodiversity and geological interests within the wider environment.	Paragraph 5.3.8	

NPS Requirement	NPS Reference	PEIR Section Reference
Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.	Paragraph 5.10.8	The baseline environment in relation to agricultural land is discussed in **Table 19-10**. Potential impacts in relation to contamination that may occur during construction and operation are discussed in sections 19.6.1.6 and 19.6.2.6. Impacts associated with potential loss of agricultural land and disruption to farming practices are discussed in **Chapter 21 Land Use**.
Applicants should safeguard any mineral resources on the proposed site as far as possible, taking into account the long-term potential of the land use after any future decommissioning has taken place.	Paragraph 5.10.9	Mineral Safeguarding Areas are discussed in **Table 19-10**. Potential impacts to these areas during construction and operation are discussed in sections 19.6.1.4 and 19.6.2.3 respectively. Measures to mitigate the potential impacts during construction and operation are also discussed within these sections.

NPS Requirement	NPS Reference	PEIR Section Reference
Draft EN-1 NPS for Energy		
For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination, and where contamination is present, applicants should consider opportunities for remediation where possible. Applicants are encouraged to develop and implement a Soil Management Plan which could help minimise potential land contamination.	Paragraph 5.11.8	Risks posed by potential land contamination has been identified and assessed as part of a Preliminary Risk Assessment (PRA) (**Appendix 19.1**). Potential impacts associated with contamination on identified receptors are discussed in sections 19.6.1 and 19.6.2. Measures to mitigate the potential impacts during construction and operation are also discussed within these sections. A Soil Management Plan has also been committed to which will outline the mitigation measures and best practice techniques to be adhered to by contractors (see **Chapter 21 Land Use**).

19.4.1.2 Other Legislation, Policy and Guidance

28. In addition to the NPS, there are a number of pieces of legislation, policy and guidance applicable to the assessment of Geology and Land Quality. These include:

19.4.1.2.1 National Planning Policy Framework

29. The specific assessment requirements for Geology and Land Quality, as detailed in the National Planning Policy Framework Guidance (NPPF) (Ministry of Housing, Communities and Local Government, updated 2021) are detailed in **Table 19-5**.

Table 19-5 National Planning Policy Framework Guidance Relevant to Geology and Land Quality

NPPF Requirements	NPPF Reference	PEIR Reference
Planning policies and decisions should contribute to and enhance the natural local environment by: • protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan); • preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and • remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.	NPPF 15-174	In relation to Geology and Land Quality, the existing environment is discussed in section 19.5, with further details provided in **Appendix 19.1**. Potential impacts and mitigation measures aimed at minimising the potential impacts on identified receptors, including remediation are set out in **Table 19-3** and sections 19.6.1 and 19.6.2. Potential impacts in relation to air, water, biodiversity and noise are discussed in: • **Chapter 18 Terrestrial Ecology and Ornithology;** • **Chapter 20 Flood Risk and Hydrology;** • **Chapter 25 Noise;** and • **Chapter 26 Air Quality**.

NPPF Requirements	NPPF Reference	PEIR Reference
Planning policies and decisions should ensure that: • a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation); • after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and • adequate site investigation information, prepared by a competent person, is available to inform these assessments.	NPFF 15-183	The existing ground conditions and potential sources of contamination are discussed in section 19.5, with further details provided in **Appendix 19.1**. Potential impacts and mitigation measures (including ground investigation works) are set out in **Table 19-3** and sections 19.6.1 and 19.6.2. Pre-consent ground investigations are planned to be undertaken from spring/summer 2023. Following the completion of the targeted ground investigations, a generic quantitative risk assessment will be undertaken with recommendations included for further works should they be deemed necessary.

NPPF Requirements	NPPF Reference	PEIR Reference
Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and / or landowner. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.	NPFF 15-184 and NPPF 15-185	The existing ground conditions and potential sources of contamination are discussed in section 19.5, with further details provided in **Appendix 19.1**. An assessment of the potential impacts associated with the construction and operation of the Projects is provided in sections 19.6.1 and 19.6.2 respectively. Potential mitigation measures, for example targeted ground investigations in areas of concern, are also discussed within these sections. Potential interactions and inter-relationships between each of the identified impacts are discussed in sections 19.9 and 19.10 respectively.
The focus of planning policies and decisions should be whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues	NPPF 15-188	The existing environment is discussed in section 19.5, with further details provided in **Appendix 19.1**. Potential impacts, and mitigation measures to reduce the significance of effect are discussed in **Table 19-3** and sections 19.6.1 and 19.6.2.

NPPF Requirements	NPPF Reference	PEIR Reference
should not be revisited through the permitting regimes operated by pollution control authorities.		
It is essential that there is a sufficient supply of minerals to provide the infrastructure, buildings, energy and goods that the country needs. Since minerals are a finite natural resource, and can only be worked where they are found, best use needs to be made of them to secure their long-term conservation. Planning policies should: • safeguard mineral resources by defining Mineral Safeguarding Areas and Mineral Consultation Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked);	NPPF 17-209 and NPFF 17-210	Mineral Safeguarding Areas are discussed in section 19.5, with further details provided in **Appendix 19.1**. Potential impacts to these areas during the construction and operational phases of the Project are discussed in sections 19.6.1.4 and 19.6.2.3 respectively. Engagement with East Riding of Yorkshire Council will be undertaken to aid in identifying potential mitigation measures during the construction and operational phases of the Projects. Potential mitigation measures are discussed in sections 19.6.1.4 and 19.6.2.3.

NPPF Requirements	NPPF Reference	PEIR Reference
• set out policies to encourage the prior extraction of minerals, where practical and environmentally feasible, if it is necessary for non-mineral development to take place.		

19.4.1.2.2 East Riding of Yorkshire Council, East Riding Local Plan 2012 – 2029 (2016)

30. The East Riding Local Plan has been reviewed and the following policies and objectives are considered relevant to Geology and Land Quality.

31. Policy ENV4: Conserving and enhancing biodiversity and geodiversity states that:

"A. Proposals that are likely to have a significant effect on an International Site will be considered in the context of the statutory protection which is afforded to the site.

B. Proposals that are likely to have an adverse effect on a National Site (alone or in combination) will not normally be permitted, except where the benefits of development in that location clearly outweigh both the impact on the site and any broader impacts on the wider network of National Sites.

C. Development resulting in loss or significant harm to a Local Site, or habitats or species supported by Local Sites, whether directly or indirectly, will only be supported if it can be demonstrated there is a need for the development in that location and the benefit of the development outweighs the loss or harm.

D. Where loss or harm to a National or Local designated site, as set out in Table 9, cannot be prevented or adequately mitigated, as a last resort, compensation for the loss / harm must be agreed. Development will be refused if loss or significant harm cannot be prevented, adequately mitigated against or compensated for.

E. Proposals should further the aims of the East Riding of Yorkshire Biodiversity Action Plan (ERYBAP), designated Nature Improvement Areas (NIAs) and other landscape scale biodiversity initiatives. To optimise opportunities to enhance biodiversity, proposals should seek to achieve a net gain in biodiversity where possible and will be supported where they:

1. *Conserve, restore, enhance or recreate biodiversity and geological interests including the Priority Habitats and Species (identified in the ERYBAP) and Local Sites (identified in the Local Sites in the East Riding of Yorkshire).*
2. *Safeguard, enhance, create and connect habitat networks in order to:*
    - *i. protect, strengthen and reduce fragmentation of habitats;*
    - *ii. create a coherent ecological network that is resilient to current and future pressures;*
    - *iii. conserve and increase populations of species; and*
    - *iv. promote and enhance green infrastructure."*

32. Policy EC5: Supporting the energy sector states that:

"Proposals for the development of the energy sector, excluding wind energy but including the other types of development listed in Table 7, will be supported where any signific ant adverse impacts are addressed satisfactorily and the residual harm is outweighed by the wider benefits of the proposal. Developments and their associated infrastructure should be acceptable in terms of:

1. *The cumulative impact of the proposal with other existing and proposed energy sector developments;*
2. *The character and sensitivity of landscapes to accommodate energy development, with particular consideration to the identified Important Landscape Areas, as shown on Figure 11;*
3. *The effects of development on:*
    - i. *local amenity, including noise, air and water quality, traffic, vibration, dust and visual impact;*
    - ii. *biodiversity, geodiversity and nature, particularly in relation to designations, displacement, disturbance and collision and the impact emissions / contamination;*
    - iii. *the historic environment, including individual and groups of heritage assets above and below ground;*
    - iv. *telecommunications and other networks; including the need for additional cabling to connect to the National Grid, electromagnetic production and interference, and aeronautical impacts such as on radar systems;*
    - v. *transport, including the opportunity to use waterways and rail for transportation of materials and fuel, and the capacity of the road network to accommodate development;*
    - vi. *increasing the risk of flooding; and*
    - vii. *the land, including land stability, contamination and soil resources."*

33. Policy EC6: Protecting mineral resources states that:

"A. Mineral Safeguarding Areas for sand and gravel, crushed rock, limestone, industrial chalk, clay and silica sand are identified on the Policies Map.

B. Within or adjacent to Mineral Safeguarding Areas, non-mineral development, which would adversely affect the viability of exploiting the underlying or adjacent deposit in the future, will only be supported where it can be demonstrated that the:

1. *Underlying or adjacent mineral is of limited economic value;*
2. *Need for the development outweighs the need to safeguard the mineral deposit;*
3. *Non-mineral development can take place without preventing the mineral resource from being extracted in the future;*
4. *Non-mineral development is temporary in nature; or*
5. *Underlying or adjacent mineral deposit can be extracted prior to the non-mineral development proceeding, or prior extraction of the deposit is not possible."*

34. Policy ENV6: Managing environmental hazards states that:

"Environmental hazards, such as flood risk, coastal change, groundwater pollution and other forms of pollution, will be managed to ensure that development does not result in unacceptable consequences to its users, the wider community, and the environment."

And

"The risk of groundwater pollution will be managed by:

1. *Avoiding development that will increase the risk of pollution in Source Protection Zones (SPZ) and where this is not possible, ensuring that appropriate mitigation measures are employed;*
2. *Supporting developments which will decrease the risk of pollution in SPZs by cleaning up contaminated land and incorporating pollution-prevention measures;*
3. *Preventing inappropriate uses / activities in SPZ1 and SPZ2, unless adequate safeguards against possible contamination can be agreed;*
4. *Preventing non-mains drainage that would involve sewage, trade effluent or other contaminated discharges, as far as possible; and*
5. *Ensuring re-development of previously developed sites does not contaminate under-lying aquifers."*

19.4.1.2.3 East Riding of Yorkshire Council and Hull City Council, East Riding of Yorkshire and Kingston upon Hull Joint Minerals Local Plan 2016 – 2033 (2019)

35. The Joint Minerals Local Plan outlines the resources present within the East Riding of Yorkshire and Kingston upon Hull areas. In addition, the plan outlines the vision, approach, policies and allocations for both councils. The following Joint Minerals Local Plan Objective is relevant to this chapter:

    "Help prevent the unnecessary sterilisation of sand and gravel, chalk, limestone, clay, silica sand and building and roofing stone mineral resources by non-mineral forms of development by refining the extent of Mineral Safeguarding Areas."

36. With regards to polices protecting Mineral Safeguarding Areas, the plan refers back to Policy EC6 of the East Riding of Yorkshire Council, East Riding Local Plan 2012 – 2029 (2016) discussed above (see paragraph 0). No additional safeguarding policies relating to non-mineral developments in safeguarded areas are included within the Joint Minerals Local Plan.

19.4.1.2.4 Environmental Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance

37. The Environmental Protection Act 1990 makes provision for the improved control of pollution arising from certain industrial and other processes. Part 2A of the Act provides the statutory definition of contaminated land:

    "*Contaminated Land is any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under land that:*

    - *Significant harm is being caused or there is a significant possibility of such harm being caused; or*
    - *Significant pollution of controlled waters is being or is likely to be caused".*

38. The Act also provides the regulatory basis for the identification, designation and remediation of contaminated land. The Onshore Development Area could be located on land potentially affected by contamination. This requires assessment to ensure that the land is suitable for use following the construction of the Projects and that the land cannot be determined as contaminated land under Part 2A of the Act.

19.4.1.2.5 Environmental Permitting (England and Wales) Regulations 2016

39. The 2016 Regulations set out an environmental permitting and compliance regime that applies to various activities and industries. The environmental permitting regime is a common framework for applying for, receiving, varying or transferring and surrendering permits, along with compliance, enforcement and appeals arrangements. It rationalises the previous permitting and compliance regimes into a common framework that is easier to understand and simpler to use. The framework introduces different levels of control, based on risk:

- Exclusions (lower risk activities which may be undertaken without any permit);
- Standard rules permit (standard requirements and conditions for the relevant activities are set out so applicants can determine in advance where the permit is applicable to their proposals); and
- Bespoke permits (permits written specifically for activities which are unique or higher risk).

19.4.1.2.6 Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

40. The aim of the directive, which is informed by Directive 2000/60/EC, is for all waterbodies to achieve Good Status by 2027 (which is comprised of scoring of both Ecological and Chemical Status) and to ensure no deterioration from current status. This legislation is relevant to Geology and Land Quality as it will assist in determining the sensitivity of water bodies within the Onshore Development Area. Water quality is assessed in **Chapter 20 Flood Risk and Hydrology**.

19.4.1.2.7 Groundwater (Water Framework Directive) (England) Direction 2016

41. The aim of the direction, which is informed by Directive 2006/118/EC, is to set out instructions and obligations for the Environment Agency to protect groundwater, including monitoring and setting threshold values for both existing and new pollutants in groundwater. This legislation is relevant to Geology and Land Quality as it will assist in determining the sensitivity of groundwater resources within the Onshore Development Area.

19.4.1.2.8 The Water Resources Act 1991

42. The Act provides the definition of and regulatory controls for the protection of water resources including the quality standards expected for controlled waters. This legislation is relevant to Geology and Land Quality as it will assist in determining the sensitivity of controlled waters within the Onshore Development Area, particularly when assessing the effects during construction and operational phases.

19.4.1.2.9 Environment Act 1995

43. The Act established the Environment Agency and gave it responsibility for environmental protection of controlled waters. This legislation is relevant to Geology and Land Quality as it will help assess the sensitivity and potential effects of the construction and operational phases of the Projects. It will also aid in the identification of suitable mitigation measures to provide protection to the controlled waters present.

19.4.1.2.10 Environmental Damage (Prevention and Remediation) (England) Regulations 2015

44. The regulations transpose into domestic law the EU Directive 2004/35/EC on environmental liability with regards to the prevention and remedying of environmental damage. This legislation is relevant to Geology and Land Quality as it will aid in the identification of suitable preventative measures and mitigation techniques for the construction and operational phases of the Projects.

19.4.1.2.11 Construction (Design and Management) Regulations 2015

45. The regulations are the main set of regulations used to manage the health, safety and welfare of construction projects. The legislation is relevant to Geology and Land Quality as it ensures the safety of human receptors involved in the construction phase.

19.4.1.2.12 Land Contamination Risk Management Framework 2021

46. The Environment Agency guidance provides an update to the former Environment Agency Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR11). The guidance aims to help those assessing potentially contaminated sites to identify and assess the risks posed to sensitive receptors from potentially contaminated sites, make appropriate decisions in relation to the outcome of the assessment and identify the required actions necessary e.g., implement remediation if deemed necessary.

19.4.1.2.13 Guiding Principles for Contaminated Land

47. The Guiding Principles for Contaminated Land (GPCL) comprise three documents produced by the Environment Agency. The documents include GPCL 1 – Introduction, GPCL 2 – Frequently Asked Questions, technical information, detailed advice and references, and GPCL 3 – reporting checklist. The aims of these documents are to provide guidance to those who are involved with contaminated land, encourage good practice, promote compliance with regulatory requirements and to provide reference to applicable guidance.

19.4.1.2.14 The Environment Agency's Approach to Groundwater Protection Position Statements 2018

48. These position statements provide information relating to the Environment Agency's approach to managing and protecting groundwater. They detail how the Environment Agency delivers government policy for groundwater and adopts a risk-based approach where legislation allows. The primary aim of all of the position statements is the prevention of pollution of groundwater and protection of it as a resource.

19.4.1.2.15 Minerals Policy Statement 1: Planning and Minerals (MPS1)

49. MPS1 aims to secure adequate and steady supplies of the minerals needed by society and the economy. This publication has been withdrawn; however, it is still deemed relevant in the context of this assessment in the absence of any replacement guidance.

19.4.2 Data and Information Sources

19.4.2.1 Site Specific Surveys

50. In order to provide site specific and up to date information on which to base the impact assessment, a site characterisation study was conducted which consisted of reviewing available desk-based information related to Geology and Land Quality. The assessment is provided in the PRA (**Appendix 19.1**). The PRA provides an assessment of ground conditions for the Projects and follows a risk-based approach including consideration of potential sources, pathways and receptors to identify potential pollutant linkages that may result in unacceptable risks to receptors from ground contamination.

51. The data sources used to inform the PRA include:

- Environmental Database GIS data comprising environmental sensitivity data and permitting records within the Onshore Development Area, December 2022 (Order Reference GSIP-2022-13169-12044);
- British Geological Survey (BGS) Onshore Geoindex web portal (accessed November 2022);
- BGS Geological Map for Flamborough and Bridlington Solid and Drift (Sheet number 55 and 65), 1985, 1:50,000;
- BGS Geological Map for Beverley Solid and Drift (Sheet number 72), 1995, 1:50,000;
- BGS Geological Map for Hornsea Solid and Drift (Sheet number 73), 1998, 1:50,000;
- BGS Hydrogeological Map of East Yorkshire (Sheet number 10), 1980, 1:100,000;
- Google Earth, accessed November 2022;
- Multi Agency Government Information for the Countryside (MAGIC) map application (accessed November 2022);
- UK Health Security Agency UK maps of Radon; and
- Zetica UXO Unexploded Bomb (UXB) Risk Map accessed November 2022.

19.4.2.2 Impact Assessment Methodology

52. **Chapter 6 EIA Methodology** provides a summary of the general impact assessment methodology applied. The following sections describe the methods used to assess the likely significant effects on Geology and Land Quality.

19.4.2.3 Definitions

53. For each potential impact, the assessment identifies receptors sensitive to that impact and implements a systematic approach to understanding the impact pathways and the level of impacts (i.e. magnitude) on given receptors. The definitions of sensitivity and magnitude for the purpose of the Geology and Land Quality assessment are provided in **Table 19-6** and **Table 19-7**.

19.4.2.3.1 Sensitivity

54. Receptor sensitivity has been defined with reference to the adaptability, tolerance, recoverability and value of individual receptors. **Table 19-6** provides an example of the likely criteria for appraisal of sensitivity for identified Geology and Land Quality receptors based on professional judgement.

55. Receptor sensitivity considers, for example, whether the receptor:

- Is rare;
- Has protected or threatened status;
- Has importance at a local, regional or national scale; or
- Has a key role in ecosystem function (in the case of biological receptors).

56. Generic receptor sensitivity examples based on the above criteria are presented below in **Table 19-6**.

Table 19-6 Definition of Sensitivity for a Geology and Land Quality Receptor

Sensitivity	Definition
High – has very limited or no capacity to accommodate physical or chemical changes.	**General** • Receptor is internationally or nationally important / rare with limited potential.
	Land quality – human health • Construction workers involved in below ground construction works / ground breaking activities; • Public and local residents / children (on and offsite within 50m); and • Future end users (residential or allotment end use).
	Land quality – controlled waters and ecology • Groundwater source protection zones (SPZ) 1; • Public water supplies / licensed surface water and groundwater abstractions for potable use; • Private water supplies for potable use automatic 50m SPZ 1 applied (on and off-site within 50m); • Supports habitats or species that are highly sensitive to change in surface hydrology or water quality; and • Surface and groundwaters supporting internationally designated sites (e.g. Special Protection Areas (SPA) or Ramsar sites).
	Land quality – geological sites and mineral resources • Mineral Safeguarding Area (MSA) or Mineral Consultation Areas (MCA) – nationally important resource; and • Designated geological sites of international importance.
	Built environment • Sites of international importance, World Heritage Sites and Scheduled Monuments.
	Agricultural land • Land at Agricultural Land Classification (ALC) Grade 1 or 2.

Sensitivity	Definition
Medium – has limited capacity to accommodate physical or chemical changes.	**General** • Receptor is regionally important / rare with limited potential for offsetting / compensation.
	Land quality – human health • Future end users (commercial / industrial end use / open space / farmers and workers on agricultural land); • Public and local residents / children (off-site at distances >50m but <250m); • Commercial / industrial workers (off-site within 50m); and • Construction workers (above ground).
	Land quality – controlled waters and ecology • Groundwater SPZ 2 and SPZ 3; • Principal Aquifers; • Secondary A and B Aquifers with private potable groundwater abstractions; • Private water supplies for potable groundwater abstraction (off-site within 250m); and • Surface and groundwaters supporting nationally designated sites (SSSI).
	Land quality – geological sites and mineral resources • MSA or MCA – regionally important resources; and • Designated geological site of national importance e.g. SSSI.
	Built environment • Commercial or residential buildings.
	Agricultural land • Land at ALC Grade 3.
Low – has moderate capacity	**General** • Receptor is locally important / rare.

Sensitivity	Definition
to accommodate physical or chemical changes.	**Land quality – human health** • Future end users (transport end use such as car parks or highways); • Public and local residents / children (off-site >250m); and • Commercial / industrial workers (off-site at distances >50m but <250m).
	Land quality – controlled waters and ecology • Secondary A and B Aquifers without groundwater abstractions; and • Groundwater or surface waters supporting locally important sites (e.g. Local Nature Reserves LNR).
	Land quality – geological sites and mineral resources • Adjacent to a MSA or MCA; and • Low economically viable mineral resource.
	Built environment • Car parks, highways, transport infrastructure and utilities.
	Agricultural land • Land at ALC Grade 4.
Negligible – is generally tolerant of physical or chemical changes.	**General** • Receptor is not considered to be particularly important / rare.
	Land quality – human health • Commercial / industrial workers (off-site >250m).
	Land quality – controlled waters and ecology • Unproductive strata; and • Supports or contributes to habitats that are not sensitive to changes in surface hydrology or water quality.
	Land quality – geological sites and mineral resources • No economically viable minerals.

Sensitivity	Definition
	Built environment • Locally important roads and footpaths.
	Agricultural land • Land at ALC Grade 5

19.4.2.3.2 Magnitude

57. The magnitude of potential impacts are assessed qualitatively, according to the criteria set out in **Table 19-7**.

58. For impacts related to human health, magnitude reflects the likely increase of decrease in exposure risk for a receptor. For controlled waters, magnitude represents the likely impact an activity would have on resource availability or value, at the receptor. Magnitude is therefore affected by the distance connectivity between an impact source and the receptor.

Table 19-7 Definition of Magnitude of Impacts

Magnitude	Definition
High – permanent or large-scale change affecting usability, risk or value over a wide area, or certain to affect regulatory compliance.	**Land quality – human health** • Permanent or major change to existing risk exposure (adverse / beneficial); • Unacceptable risks / severe harm to one or more receptors with a long-term or permanent effect (adverse); or • Remediation and complete source removal (beneficial).
	Land quality – controlled waters • Permanent, long-term or wide scale effects on water quality or availability (adverse / beneficial); • Permanent loss or long-term derogation of a water supply source resulting in prosecution (adverse); • Change in Water Framework Directive (WFD) water body status / potential or its ability to achieve WFD objectives in the future (adverse / beneficial); • Permanent habitat creation or complete loss (adverse / beneficial); or • Measurable habitat changes that are sustainable / recoverable over the long-term (adverse / beneficial).
	Land quality – geological sites and mineral resources • Complete loss of designated sites; or • Complete sterilisation of mineral resources.
	Built environment • Catastrophic damage to buildings or structures.
	Agricultural land • Permanent or major change to existing ALC grade.

Magnitude	Definition
Medium reversible change affecting usability, value, or risk over the medium-term or local area: possibly affecting regulatory compliance.	**Land quality – human health** • Medium-term or moderate change to existing risk of exposure (adverse / beneficial); or • Unacceptable risks to one or more of the receptors with a medium-term effect (adverse).
	Land quality – controlled waters • Medium-term or local scale effects on water quality or availability (adverse / beneficial); • Medium-term derogation of a water supply source, possibly resulting in prosecution (adverse); • Observable habitat changes that are sustainable / recoverable over the medium-term (adverse / beneficial); or • Temporary change in status / potential of a WFD water body or its ability to meet objectives (adverse / beneficial).
	Land quality – geological sites and mineral resources • Partial loss of designated geological sites; or • Medium-term or local scale loss of mineral resources.
	Built environment • Damage to buildings or structures.
	Agricultural land • Medium-term or local scale effects on ALC grade.
Low – temporary change affecting usability, risk, or value over the short-term or within the study area; measurable permanent change with minimal effect, usability, risk, or value; no effect on	**Land quality – human health** • Short-term temporary or minor change to existing risk exposure (adverse / beneficial); or • Unacceptable risks to one or more receptors with a shirt-term effect (adverse).
	Land quality – controlled waters • Short-term or very localised effects on water quality or availability (adverse / beneficial); • Short-term derogation of a water supply source (adverse);

Magnitude	Definition
regulatory compliance.	• Measurable permanent effects on a water supply source that does not impact on its operations (adverse); • Observable habitat changes that are sustainable / recoverable over the short-term (adverse / beneficial); or • No change in status / potential of a WFD water body or its ability to meet objectives (neutral).
	Land quality – geological sites and mineral resources • Temporary change in status of designated geological sites; or • Short-term or very localised effects on mineral resources.
	Built environment • Easily repairable damage to buildings or structures.
	Agricultural land • Short-term or very localised effects on ALC grade.
Negligible – minor permanent or temporary change, indiscernible over the medium to long-term. Short-term, with no effect on usability	**Land quality – human health** • Negligible change to existing risk exposure; or • Activity is unlikely to result in unacceptable risks to receptors (neutral).
	Land quality – controlled waters • Very minor or intermittent impact on local water quality or availability (adverse / beneficial); • Usability of a water supply source will be unaffected (neutral); • Very slight local changes that have no observable impact on dependent receptors (neutral); or • No change in status / potential of a WFD water body or its ability to meet objectives (neutral).
	Land quality – geological sites and mineral resources • No change in status of designated geological site; or • Very minor impact on mineral resources.

Magnitude	Definition
	Built environment • Very slight, non-structural damage or cosmetic harm to buildings or structures.
	Agricultural land • Very minor effect on ALC grade.

19.4.2.4 Significance of Effect

59. The assessment of significance of an effect is informed by the sensitivity of the receptor and the magnitude of the impact (see **Chapter 6 EIA Methodology** for further detail). The determination of significance is guided by the use of a Geology and Land Quality significance of effect matrix, as shown in **Table 19-8**. Definitions of each level of significance are provided in **Table 19-9**. For the purposes of this assessment, any effect that is of major or moderate significance is considered to be significant in EIA terms, whether this be adverse or beneficial. Any effect that has a significance of minor or negligible is not significant.

Table 19-8 Geology and Land Quality Significance of Effect Matrix

		Adverse Magnitude				Beneficial Magnitude			
		High	**Medium**	**Low**	**Negligible**	**Negligible**	**Low**	**Medium**	**High**
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Table 19-9 Definition of Effect Significance

Significance	Definition
Major	Very large or large change in receptor condition, which is likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which is likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore, no change in receptor condition.

19.4.3 Cumulative Effect Assessment Methodology

60. The cumulative effect assessment (CEA) considers other plans and projects that may result in cumulation of effects with the Projects. **Chapter 6 EIA Methodology** provides details of the general framework and approach to the CEA that will be undertaken for the Projects.

61. The final assessment of cumulative effects will be undertaken during the later stages of the EIA, once further information is available on a number of projects such as the Outer Dowsing Offshore Wind Farm, Hornsea Project Four decision and the Sheringham Shoal and Dudgeon Extension Projects examination. However, for the purposes of the PEIR, it is possible to identify a number of projects and plans which are likely to feature in that assessment and consider the extent to which cumulative effects might arise. Section 19.7 presents the following preliminary information regarding cumulative effects:

- Screening for cumulative effects; and
- A preliminary short list of plans and projects considered for CEA, including a brief description as to how projects have been screened in and the initial tier level they have been assigned.

19.4.4 Assumptions and Limitations

62. This preliminary assessment is considered to be an interim stage in the EIA process. The results presented in the following sections are based on early design assumptions and initial assessments which will be refined and presented in the final Environmental Statement (ES) to be submitted as part of the DCO application.

63. The desk-based PRA (**Appendix 19.1**) is based on a range of publicly available information. No ground investigation data from within the Onshore Development Area has been used to inform the PRA or the impact assessment presented in this chapter. The assessments therefore adopt a precautionary approach i.e., if a potential pollutant linkage has been identified it is assumed to be present until further site-specific information is available to clarify whether the linkage exists.

64. The impact assessment presented in this chapter is therefore limited by the finite data on which it is based. There is a level of uncertainty associated with the extrapolation of site-specific data or non-site data to other locations within the Onshore Development Area.

19.5 Existing Environment

19.5.1 Baseline Environment

65. A summary of the baseline environment for the Onshore Development Area is provided in **Table 19-10**, with potential sources of contamination set out in **Table 19-10**. Full details are provided within **Appendix 19.1.**

Table 19-10 Summary of Baseline Environment

Parameter	Landfall	Onshore export cable corridor	Onshore substation zones
Geology	Although not identified on British Geological Survey (BGS) mapping, localised areas of Made Ground associated with historical land uses may be present within the Onshore Development Area. Superficial deposits are present throughout the Onshore Development Area, with the exception of a small area (approximately 0.7ha) in the western part of Onshore Substation Zone 4.		
	Lacustrine Deposits: isolated pockets		Lacustrine Deposits: not present
	Alluvium: isolated pockets		
	Head Deposits: not present	Head Deposits: located to the southern end	
	Glaciofluvial Deposits: isolated pockets		Glaciofluvial Deposits: not present
	Glacial Till Deposits: present throughout the Onshore Development Area		
	Sand and Gravel Deposits: not present	Sand and Gravel Deposits: isolated pockets	
	Rowe Chalk Formation: present	Rowe Chalk Formation: present from boundary with landfall to the settlement of Dunnington	Rowe Chalk Formation: not present
	Flamborough Chalk Recorded on BGS geological cross sections as underlying the Rowe Chalk Formation	Flamborough Chalk Formation: present - recorded on BGS geological cross sections as underlying the Rowe Chalk Formation (where present)	Flamborough Chalk Formation: present
	Burnham Chalk Formation: Recorded on BGS geological cross sections as underlying the Flamborough Chalk Formation	Burnham Chalk Formation: Recorded on BGS geological cross sections as underlying the Flamborough Chalk Formation	Burnham Chalk Formation : present – recorded on BGS geological cross sections as underlying the Flamborough Chalk Formation
	No recorded linear features or faults within the possible landfall locations	Landform – back feature marking former coastline (Ipswichian age) located between Ings Road and Driffield Road within the onshore export cable corridor running in a north south orientation. Also located between Minister Way and the A1079 within Onshore Substation Zone 1. Fault - a fault with an east west orientation bisects the southern reaches of the onshore export cable corridor and Onshore Substation Zone 4. The fault appears to correlate with the boundary between the Flamborough Chalk Formation and Burnham Chalk Formation.	

Parameter	Landfall	Onshore export cable corridor	Onshore substation zones
Hydrogeology	Secondary A Aquifers: Alluvium, Glaciofluvial Deposits (both high vulnerability) and Sand and Gravel (medium vulnerability). Secondary B Aquifer (high vulnerability): Lacustrine Deposits Secondary Undifferentiated Aquifers (medium vulnerability): Head and Glacial Till Principal Aquifers (low to high vulnerability): Rowe Chalk Formation, Flamborough Chalk Formation and Burnham Chalk Formation. The onshore export cable corridor to the west of Whitecross Road (A165) through to Newbald Road is located within an SPZ 3 Total Catchment. The onshore export cable corridor to the south of Newbald Road, and the Onshore Substation Zones 1 and 4 (up to the area surrounding Park Lane) are located within an SPZ 2 Outer Catchment. The area of the onshore export cable corridor 200m southwards of the intersection of Park Lane and the A1079 is designated as an SPZ 1 Inner Catchment (see **Figure 19.8** of **Appendix 19.1**). The Hull and East Riding Chalk WFD groundwater body is present beneath the entirety of the Onshore Development Area. There are no recorded licensed groundwater abstractions located within the Onshore Development Area. There are however, nine active licensed abstractions located within 1km of the Onshore Development Area, three of which are potable abstractions (see **Figure 19.8** of **Appendix 19.1**). All records indicate that the groundwater is abstracted from within the bedrock geology. Information in relation to active private groundwater abstractions, including potable abstractions, will be gathered as part of the ongoing consultation with East Riding of Yorkshire Council. The information will be provided within the ES following refinement of the DCO boundary.		

Parameter	Landfall	Onshore export cable corridor	Onshore substation zones
Hydrology and surface drainage (additional details on the hydrology of the Onshore Development Area are provided in **Chapter 20 Flood Risk and Hydrology**).	Streams and ditches associated with agriculture are present within the possible landfall locations, however, there are no named features that have been identified. Additional surface water features are located within 250m of possible landfall locations. The following WFD surface water body catchments are present within the possible landfall locations: • Coastal Catchment (name not recorded); and • Barmston Sea Drain / Skipsea Drain to Conf. The following WFD surface water bodies are located at possible landfall locations: • Yorkshire South.	Streams and ditches associated with agriculture are present throughout the onshore export cable corridor. Named features include: • Stream Dike; • Dunnington Sewer; • Arnold and Riston Drain; • Monk Dike; • Meaux and Routh East Drain; • South Bullock Dike; and • Sisterbeck Drain. Additional surface water features are located within 250m of the onshore export cable corridor. The following WFD surface water body catchments are present within the onshore export cable corridor: • Barmston Sea Drain / Skipsea Drain to Conf*; • Old Howe / Frodingham Beck to R Hull; • Mickley Dike Catchment; • Catchwater Drain; • Foredyke Stream Upper*; • Foredyke Stream Lower to Holderness Dr*; • Holderness Drain Source to Foredyke Stream; • Beverley and Barmston Drain*; • High Hunsley to Arram Area*; and • High Hunsley to Woodmansey Area*. Hull from Arram Beck to Humber, a WFD surface water body, is also located within the onshore export cable corridor. *also WFD surface water body.	Streams and ditches associated with agriculture are present throughout the onshore substation zones. Named features include: • Autherd Drain. Additional surface water features are located within 250m of the onshore substation zones. The following WFD surface water body catchments are present within the onshore substation zones: • High Hunsley to Woodmansey Area (also WFD surface water body).

Parameter	Landfall	Onshore export cable corridor	Onshore substation zones
Sensitive land uses	The following sensitive land uses are located within the possible landfall locations: • Withow Gap, Skipsea – SSSI, SSSI Unit and SSSI impact risk zone designated due to its geological properties (exposed at the cliff face); • Greater Wash – SPA designated due to its habitat features and species of interest; • Holderness Inshore – Marine Conservation Zone designated due to intertidal and subtidal sediment properties; • Barmston Sea Drain from Skipsea Drain to N Sea Nitrate Vulnerable Zone (NVZ); • Priority habitat inventory – marine cliff and slope habitat; • Habitat networks – Primary habitat and Network Enhancement Zones 1 and 2; and • Skipsea Drain LoGS.	The following sensitive land uses are located within the onshore export cable corridor: • Barmston Sea Drain from Skipsea Drain to N Sea NVZ; • River Hull from Arram Beck to Humber NVZ; • Holderness Drain from Fordyke Stream to Humber NVZ; • Yorkshire Chalk NVZ; • SSSI impact risk zones; • Priority habitat inventory – deciduous woodland, traditional orchard, coastal and floodplain grazing marsh; • Habitat networks - Restorable habitat and Network Enhancement Zones 1 and 2; and • Skipsea Drain LoGS.	The following sensitive land uses are located within the onshore substation zones: • Designated ancient woodland (unnamed); • River Hull from Arram Beck to Humber NVZ; • Yorkshire Chalk NVZ; • SSSI impact risk zones; and • Priority habitat inventory – deciduous woodland and traditional orchard.
Mineral Safeguarding Areas	Land within the Onshore Development Area is designated as being located within a MSA. The minerals associated with the designations are sands and gravels (throughout the Onshore Development Area) and chalk (western area onshore substation zones only). The safeguarded areas are not present as continuous features, but as localised areas throughout the possible landfall locations, onshore export cable corridor and onshore substation zones (see **Figure 19.7** of **Appendix 19.1**). Sand and gravel preferred areas are located within the onshore export cable corridor between Riston Road and A165, Catwick. Sand and gravel areas of search are also located within the onshore export cable corridor to the north of Sigglesthorne and to the east and west of Whitecross Road.		

Parameter	Landfall	Onshore export cable corridor	Onshore substation zones
Human health (additional information in relation to human health, outside of the potential risks associated with contamination, is provided in **Chapter 27 Human Health**)	The Projects' onshore infrastructure comprises landfall works, onshore export cables and onshore substations as set out in **Chapter 5 Project Description**. Haul and access roads will also be required during the construction period as will construction compounds. During the installation of the onshore infrastructure, the critical human health receptors would be those involved with construction activities, adjacent offsite residents, nearby workers (e.g. agricultural workers) and visitors (e.g. where Public Rights of Way (PRoW) might be in use). During the operational phase, the human health receptors would be site users and workers at the onshore substations.		
Agricultural land (additional information in relation to the agricultural land baseline environment is provided in **Chapter 21 Land Use**)	Agricultural Land Classification (ALC) Grades 2 and 3 are present within the possible landfall areas.	ALC Grades 2 and 3 are present throughout the onshore export cable corridor. An area of non-agricultural land is located between the settlements of Tickton and Arram.	The onshore substation zones are located entirely within land designated as ALC Grade 2.
Potentially contaminative land uses	Potentially contaminative land uses within the possible landfall locations include: • Agricultural land; and • Former pits and ponds.	Potentially contaminative land uses within the onshore export cable corridor include: • Agricultural land; • Former pits and ponds; • Railway land; • Historical landfills; • Pumping station; and • Sewage works.	Potentially contaminative land uses within the onshore substation zones include: • Agricultural land; • Former pits and ponds; and • Historical landfills.

Table 19-11 Potential Sources of Contamination (✓present, X absent)

Parameter	Potential Contaminant of Concern	Landfall	Onshore export cable corridor	Onshore substation zones
Onsite				
Agricultural land / practices for fertilisers, pesticides and herbicides	Herbicides and pesticides, in addition it is not uncommon for discarded material to be buried on farmland which could potentially contain a range of contaminants including asbestos. Although not recorded on historical mapping, there is the potential for sheep dips to be present within the Onshore Development Area. Contaminants associated with sheep dipping include, but are not limited to, metals, organophosphorus and synthetic pyrethroids.	✓	✓	✓
Potentially infilled pits / ponds	Localised Made Ground may be present in areas associated with the backfilling of former pits and / or ponds should this have been undertaken within the Onshore Development Area. Potential contaminants include, but are not limited to, asbestos, metals and metalloids, polycyclic aromatic hydrocarbons (PAHs), fuel and oil hydrocarbons, volatile and semi-volatile organic compounds (VOCs and SVOCs), inorganic and organic contaminants, herbicides, polychlorinated biphenyls (PCBs) and ground gas.	✓	✓	✓
Made Ground (including potentially demolished infrastructure)	Asbestos containing materials and associated fibres are commonly identified in Made Ground deposits, particularly localised to where building demolition has occurred, and material has been buried / used. Other contaminants of concern that may be present are dependent on the nature of the Made Ground materials present within the Onshore Development Area.	✓	✓	✓
Railway land	Railway land (both current and historical) is a potential source of contamination and Made Ground. Contaminants associated with railway land includes herbicides, metals and metalloids, fuel and oil hydrocarbons, PAHs, PCBs, glycols and sulphates. Asbestos can also be associated with the materials used within the track bedding material, fill used in the formation of embankments and within the trains themselves.	X	✓	X
Historical landfills (Environment Agency records) / unspecified heaps	The contaminants of concern are dependent on the materials deposited in areas of landfilling. Potential contaminants include, but are not limited to, asbestos, metals and metalloids, PAHs, fuel and oil hydrocarbons, VOCs and SVOCs, inorganic and organic contaminants, PCBs, polyfluoroalkyl substances (PFAS), landfill leachate and ground gas.	X	✓	✓
Electricity substation	Asbestos, metals and metalloids, PAHs, fuel and oil hydrocarbons and PCBs.	X	X	X
Pumping station	Lubricants and greases, PAHs and metals.	X	✓	X
Sewage works	The processing of sewage could release contaminants into the environment depending on the site's full operational history and usage. Potential contaminants could include, but are limited to, metals, cyanides, nitrates, sulphates, asbestos, fuel and oil hydrocarbons, VOCs and SVOCs, PCBs and PFAS. Biological contaminants, such as pathogens, may also be associated with the sewage works.	X	✓	X

Parameter	Potential Contaminant of Concern	Landfall	Onshore export cable corridor	Onshore substation zones
Offsite (within 100m)				
Agricultural land and historical practices (including sheep dipping)	Herbicides and pesticides, in addition it is not uncommon for discarded material to be buried on farmland which could potentially contain a range of contaminants. Contaminants associated with sheep dipping include, but are not limited to, metals, organophosphorus and synthetic pyrethroids.	✓	✓	✓
Landfill	Potential contaminants include, but are not limited to, asbestos, metals and metalloids, PAHs, fuel and oil hydrocarbons, VOCs and SVOCs, inorganic and organic contaminants, PCBs, polyfluoroalkyl substances (PFAS), landfill leachate and ground gas.	X	✓	✓
Potentially infilled pits / ponds Made Ground (including potentially demolished infrastructure)	Asbestos, metals and metalloids, PAHs, fuel and oil hydrocarbons, VOCs and SVOCs, inorganic and organic contaminants, PCBs vapours and ground gas.	✓	✓	✓
Railway land	Contaminants associated with railway land includes herbicides, metals and metalloids, fuel and oil hydrocarbons, PAHs, PCBs, glycols and sulphates. Asbestos can also be associated with the materials used within the track bedding material, fill used in the formation of embankments and within the trains themselves.	X	✓	X
Travelling cranes	Potential contaminants may include fuel and oil hydrocarbons, metals and metalloids, PAHs, asbestos, sulphates and sulphides.	✓	X	X
Airfield	Potential contaminants may include metals, VOCs and SVOCs, glycols, fuel / oil hydrocarbons, phenols, PFAS and PCBs.	X	✓	X
Unspecified tanks	A number of unspecified tanks have been recorded within 250m of the Onshore Development Area, therefore a range of potential contaminants of concern may be associated with these areas. These may include, but are not limited to, fuel and oil hydrocarbons, PAHs, VOCs and SVOCs. Vapour risks may also be present.	✓	✓	✓
Superphosphate works / fertiliser works	Potential contaminants may include metals and metalloids, ammonium salts, phosphates and superphosphates, organic and inorganic contaminants, fuels and oil hydrocarbons, lubricating oils, PCBs and asbestos.	X	✓	X

Parameter	Potential Contaminant of Concern	Landfall	Onshore export cable corridor	Onshore substation zones
Gas valve compound / gasometer / gas works / gas governor	Contaminants of concern include, but are not limited to, asbestos, metals and metalloids, inorganic and organic compounds, fuels, and oil hydrocarbons, PAHs and phenols.	X	✓	X
Smithy	Metals and metalloids, cyanides, sulphates, phosphates, PAHs, fuel and oil hydrocarbons, solvents, and asbestos. There is the potential for vapours to be generated within the area of the former smithy which have the potential to migrate into the Onshore Development Area.	X	✓	X
Sewage works	Potential contaminants could include, but are limited to, metals, cyanides, nitrates, sulphates, asbestos, fuel and oil hydrocarbons, VOCs and SVOCs, PCBs and PFAS. Biological contaminants, such as pathogens, may also be associated with the sewage works.	X	X	✓
Brickworks	Potential contaminants could include, but are limited to, metals and metalloids, fuel and oil hydrocarbons, VOCs, SVOCs, organic and inorganic contaminants, PCBs, PAHs, PFAS and asbestos.	✓	✓	X
Whiting works		X	✓	X
Water works	Potential contaminants could include, but are limited to, metals and metalloids, nitrates, sulphates, fuel and oil hydrocarbons, VOCs, SVOCs, organic and inorganic contaminants, PCBs, PAHs and PFAS.	✓	✓	X
Garages	Metals and metalloids, PAHs, fuel and oil hydrocarbons, glycols, VOCs and SVOCs, asbestos, inorganic and organic contaminants.	✓	✓	X
Electricity substation	Asbestos, metals and metalloids, PAHs, fuel and oil hydrocarbons and PCBs.	✓	✓	X
Pumping station	Lubricants and greases, PAHs and metals.	✓	✓	✓

19.5.2 Future Trends

66. A description of future conditions for Geology and Land Quality has been carried out and is described within this section.

67. Sections of the Onshore Development Area are located within areas identified as containing mineral resources. Should extraction of these materials take place, the baseline conditions for those areas would be altered. The potential changes not only relate to the geology of the area, but also the hydrogeology and hydrology. Removal of superficial deposits has the potential to impact on groundwater flow patterns, for example by removing more permeable strata, and discharges into surface water bodies. The removal of deposits also has the potential to expose pre-existing contamination which then may be mobilised.

68. Climate change is causing more extreme weather in the UK resulting in wetter winters and drier summers. This change in climate conditions has the potential to mobilise pre-existing contamination through, for example, increased rates of infiltration due to heavier rainfalls, increased surface run off due to heavy rainfall following a period of drought / dry weather, dust generation through drier summers and the creation of fissures (either via drier summers or periods of cold weather) within soils allowing infiltration into deeper layers where contamination may be present (Society of Brownfield Risk Assessment, 2022).

69. It should also be noted that natural degradation / attenuation of contaminants over time may result in a general improvement in ground conditions.

70. There is also the potential for groundwater levels to rise as a result of increased rainfall. A rise in groundwater levels into the unsaturated zone has the potential to mobilise pre-existing contaminants resulting in potential migration and adversely impacting controlled waters.

71. Climate change has the potential to impact on the hydrology of surface drainage networks, with higher winter flows, lower summer flows and a greater number of storm related flood flows. The risk of flooding would also be amplified as a result of the predicted increase in rainfall which may result in an increase in peak river flows and an increase in the magnitude of surface water flooding.

72. The changes in weather patterns as a result of climate change also has the potential to increase the rate of erosion observed along the UK coastline. Future trends associated with coastal erosion are covered in more detail in **Chapter 8 Marine Physical Environment**.

73. An increase in population, increasing urbanisation and improvement in living standards may lead to a reduction in land available for agriculture. For land that is retained for agricultural use, pressures for more productive practices may increase to feed the increased population. As such, there may be an increase in the use of agricultural chemicals and industrial fertiliser to ensure continued high crop yields at a high quality.

74. Although there is the potential for increased usage of agricultural chemicals to maintain crop yields, ongoing measures, such as the regulation of agricultural chemicals and catchment wide initiatives, as part of the implementation of the WFD are likely to improve the baseline environment by reducing the existing pressures on groundwater bodies. Also, as the degradation of contaminants within soils, the baseline for groundwater quality is likely to improve over time through the natural breakdown of chemicals that may currently be present within the baseline environment.

75. Increasing demand from population growth may also drive the expansion of urban areas into new areas, including land that been previously developed (i.e. brownfield land). This expansion could result in an increase in the number of potential receptors to pre-existing sources of contamination. The expansion could also result in the introduction of new sources of contamination (e.g. fuel spills) and new pathways (e.g. piled foundations).

19.6 Assessment of Significance

19.6.1 Potential Effects During Construction

19.6.1.1 Impact 1 Exposure of Workforce, Landowners, Land Users and Neighbouring Land Users to Contaminated Soils and Groundwater and Associated Health Impacts

76. The excavation of cable trenches, earthworks and piling (if required for the onshore substations and installation of anchors for HDD rigs) as well as the movement and stockpiling of soils have the potential to mobilise existing ground contamination (where present). This could result in impacts to human health through dermal contact, inhalation and ingestion of contaminants.

77. A PRA (**Appendix 19.1**) has been undertaken for the Onshore Development Area to identify plausible contaminant linkages as a result of the potential presence of contaminants within the soils and groundwater. The PRA identified that the majority of land within the Onshore Development Area has an agricultural use where unacceptable risks from contamination are not anticipated.

78. The PRA also identified localised areas within the Onshore Development Area with a history of potentially contaminative uses. The areas identified include mineral extraction sites and ponds which may have been infilled, historical landfill, railway land, pumping station, sewage works and electricity substation (see **Table 19-10**).

79. The PRA identified potential contaminants of concern (PCOC) that could be present within the Onshore Development Area and could represent a risk to construction workers, land owners, land users and neighbouring land users if exposed during construction activities. Construction activities, particularly earthworks could disturb and expose construction workers and other site users to localised Made Ground soils and potential soil and / or groundwater contamination associated with historical and current land uses within the Onshore Development Area. Construction activities could create pollutant linkages through ingestion, inhalation and direct dermal contact pathways.

80. In the event of exposing soils and stockpiling construction waste (including excavated soils), dust could be generated during dry and windy conditions. Under these conditions, construction workers and land owners, land users and neighbouring land uses could temporarily be exposed to contamination via the inhalation of potentially contaminated dusts.

81. Additionally, the risks associated with soil contamination sources to human health could be altered by a change in the migration pathways by construction activities. A specific risk of concern is ground gases. Excavation of the onshore export cable corridor and piling work (if required for the onshore substations and installation of anchors for HDD rigs) has the potential to create a preferential pathway for any gases or vapours to migrate and accumulate in confined spaces. The ground gas and vapour risk for the proposed Onshore Development Area is unknown. The potential risk from ground gas could represent a risk to human health through asphyxiation and explosion.

82. Construction workers are considered to be the most sensitive receptors as the activities they are engaged in constitute more direct exposure routes over longer periods of time.

19.6.1.1.1 Magnitude of Impact – DBS East or DBS West in Isolation

83. During the construction phase of DBS East or DBS West, there would be the requirement for materials to be excavated to construct the onshore export cable corridor, temporary haul road, joint bays, link boxes and temporary construction compounds. Excavation and movement of material would also be required at landfall and the onshore substation.

84. The maximum construction period for DBS East or DBS West in isolation is anticipated to be five years (as reported within section 19.3.2). At the time of writing, the anticipated onshore export cable construction rate and extent of open cut trenches per work front are yet to be determined. Earthworks, however, would not be operating continuously or at the same location during the whole construction phase.

85. Potential impacts are therefore predicted to be of local spatial extent (localised to the work areas and areas where contamination may be present). Potential impacts are also anticipated to be of short-term duration, of intermittent occurrence and high reversibility (occurring only during the works). The magnitude of impact is therefore considered to be low for DBS East or DBS West in isolation.

86. In relation to risks associated with the migration of ground gases and / or vapours along the onshore export cable corridor, the impacts could be present over the length of the onshore export cable corridor for the duration of the works. This could represent acute or chronic health effects to workers. The magnitude of impact is therefore considered to be high for DBS East or DBS West in isolation with regards to ground gas and vapours. It should, however, be noted that this is subject to the plausibility of a ground gas / vapour source of contamination and receptor linkage.

19.6.1.1.2 Magnitude of Impact – DBS East and DBS West Together

87. The total volume of material that will require excavation for DBS East and DBS West together (concurrently or sequentially) is yet to be confirmed. It is, however, anticipated that the volumes will be greater than that of DBS East or DBS West in isolation.

88. Sequential construction of DBS East and DBS West is considered to be the worst case scenario due to the longer period of time to which human health receptors could be exposed to potential contamination. It is assumed that the maximum construction period for the sequential DBS East and DBS West scenario would be five years per project with a two year lag between the start of construction for the first project and the start of construction for the second project. Therefore, the maximum construction for both Projects is seven years (section 19.3.2).

89. Although stretching over a period of seven years, any earthworks are not anticipated to be continuous or at the same location throughout the entire construction period. As such, the impacts to human health associated with excavation are predicted to be of short-term duration, of local spatial extent (localised to the work areas and areas where contamination may be present) , of intermittent occurrence and high reversibility (occurring only during the works). The magnitude of impact is therefore considered to be low.

90. In relation to risks associated with the migration of ground gas and / or vapours along the onshore export cable corridor, the impacts could be present over the length of the corridors for the duration of the works. Therefore, there is the potential for acute or chronic health impacts to workers from exposure to ground gas / vapours. The magnitude of impact is considered to be high in relation to ground gas / vapours. It should, however, be noted that this is subject to the plausibility of a ground gas / vapour source of contamination and receptor linkage.

19.6.1.1.3 Sensitivity of Receptor

91. The sensitivity of construction workers, land owners, land users and neighbouring land users is considered to be high.

19.6.1.1.4 Significance of Effect for all Scenarios

92. For all scenarios, the potential impact to human health associated with the excavation works for DBS East and / or DBS West is low on a high sensitivity receptor. This therefore results in a **moderate** adverse significance of effect in the absence of mitigation.

93. In relation to potential impacts associated with the migration of ground gases and / or vapours to human health, the magnitude of impact is high and a high sensitivity receptor. This therefore results in a **major** adverse significance of effect in the absence of mitigation.

19.6.1.1.5 Mitigation and Residual Significance of Effect for all Scenarios

94. Where areas of potential contamination cannot be avoided, such as the areas that cross the entire width of the onshore export cable corridor (e.g., historical and active railway lines) targeted ground investigations may be required prior to construction to determine the extent and source of any contamination. The ground investigation may include, but is not limited to, the collection of soil, soil-leachate, groundwater and surface water samples for laboratory analysis. The range of contaminants tested for may vary between locations and sample type, examples of contaminants that may be test for include, but are not limited to, metals, PAHs, PCBs and PFAS. Ground gas monitoring wells will be installed in areas identified as potentially containing ground gas generating materials. Groundwater monitoring wells would also be required as part of the ground investigation in order to establish the groundwater regime and to identify, for example, whether contamination is from onsite or offsite sources.

95. This would characterise the conditions within the Onshore Development Area, identify unacceptable risks and determine whether remediation is required. If areas of potential concern are identified, then a remediation strategy would be developed and agreed with the relevant bodies prior to the commencement of remedial works and construction activities. The ground investigation, risk assessment and remediation would follow guidance provided within the 2021 Environment Agency Land Contamination Risk Management Framework.

96. A Code of Construction Practice (CoCP) is being developed which will be adhered throughout construction. An Outline CoCP is available to review as part of the consultation documents. The CoCP will be regularly reviewed and updated post consent, prior to and during the construction period. The CoCP will be informed by the findings of pre-construction site investigation and will include an assessment of the potential risks to human health and controlled waters receptors from DBS East and / or DBS West. Based on that risk assessment appropriate working methods would be developed to avoid, minimise or mitigate impacts relating to construction. The risk mitigation strategies incorporated into the Outline CoCP include:

- Appropriate Personal Protective Equipment (PPE);
- Provision of welfare facilities;
- Monitoring of works including air quality and odour; and
- Implementation of relevant good working practices applied including stockpile management and dust suppression activities to reduce the risk relating to the creation and inhalation of wind-blown dusts.

97. The Outline CoCP incorporates legislation requirements including the Construction Design Management Regulations 2015 (CDM), Health and Safety at Work Act 1974, CoCP and Control of Substances Hazardous to Health Regulations 2002 (COSHH).

98. In addition, a plan for dealing with unexpected contamination will be developed as part of the CoCP. This plan would also incorporate the Environment Agency best practice guidelines for pollution prevention which have been withdrawn from use but still provide a useful best practice guide and include:

- Environment Agency Pollution Prevention Guidance (PPG) 01 – Understanding your environmental responsibilities;
- Environment Agency PPG 05 – Works and maintenance near water;
- Environment Agency PPG 06 – Working at construction and demolition: preventing pollution guidance;
- Environment Agency PPG 08 – Safe storage and disposal of used oils;
- Environment Agency PPG 21 – Pollution incident response planning; and
- Environment Agency PPG 22 –Dealing with spills.

99. Adoption of a CL:AIRE Industry Code of Practice to manage the re-use and disposal of excavated soils on site would also be incorporated as an additional mitigation measure to protect human health, this would aid in maximising sustainability and providing an audit trail to demonstrate the appropriate use of materials.

100. A Materials Management Plan (MMP) would be drafted in advance of any construction works, this would include chemical screening criteria in order to ensure that imported and / or reused materials are chemically suitable for use. If materials identified as containing asbestos are identified, then a specialist contractor should be employed to aid in its removal from site, in line with current legislation.

101. The MMP would form part of the final CoCP to be submitted for approval with the relevant bodies in advance of implementation.

102. Risks associated with the creation of a preferential pathway for ground gas and vapours via the onshore export cable corridor can be mitigated via re-instating excavated materials following the installation of the onshore export cables. If however, a different source of material is required to backfill excavations (i.e. because the excavated material was deemed to pose an unacceptable risk), the risks associated with the creation of preferential pathways can be mitigated via ensuring that the material has the same porosity as that of the excavated material. This would help reduce the risks posed to human health receptors as it would provide continuity with the surrounding environment and not introduce areas of lower porosity soils which could act as preferential pathways.

103. If a significant source of ground gas / vapour generating material is encountered during construction further consideration will be required.

104. Risks to construction workers in relation to ground gas and vapours would be mitigated by the use of appropriate working methods incorporated within the CoCP and use of PPE.

105. These measures will reduce the magnitude of impact from high to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

19.6.1.2 Impact 2 Direct Impacts on Groundwater Quality and Groundwater Resources

106. Direct impacts to the Secondary A, B and Undifferentiated Aquifers within the superficial deposits may occur due to the intrusive nature of trenching. The significance of the disturbance will be dependent on the depth of the aquifer unit in relation to the proposed depth of the excavation, with superficial aquifers present at the surface at greater risk of direct impacts.

107. During construction it may be necessary to excavate areas within the Onshore Development Area to create storage pits. It is proposed that these storage pits will be used to hold the drilling fluids associated with HDD operations. As with the potential impacts to superficial aquifers from trenching, the significance of disturbance will be dependent on the depth of the proposed storage pit and aquifer units, with those located at the surface at greater risk of direct impacts.

108. During construction, surface layers would be excavated, which could allow increased infiltration of rainwater and surface run-off to the subsurface. This could potentially mobilise any residual contamination already present in the overlying unsaturated strata which could potentially migrate into the underlying shallow superficial aquifers impacting groundwater quality and associated groundwater abstractions. Whilst significant areas of contamination are not expected across the majority of the Onshore Development Area, there are areas where crossing potentially contaminated land may be unavoidable.

109. Direct impacts to the Principal Aquifers and SPZs may occur from deep ground workings related to trenchless crossing (e.g. HDD) operations for cable installation beneath surface infrastructure (e.g. railways) and watercourses. HDD will also be required at landfall as part of the works to connect onshore and offshore export cables, this may result in direct impacts to the Principal Aquifers associated with the chalk in this area.

110. Trenchless crossings and the HDD required at landfall have the potential to create preferential pathways and for drilling mud / other contaminants to leak along the drill path, which could cause contamination of groundwater. The volume of drilling fluid that could be released during HDD works is dependent on a number of factors, including the size of the fracture, the permeability of the geological material, the viscosity of the drilling fluid and the pressure of the hydraulic drilling system.

111. Piling may be required to allow for the installation of anchors for HDD rigs as well as for the foundations of the onshore substations. Should piling be required, there is the potential to create preferential pathways through a low permeability layer.

112. Although the locations of any potential piling activities associated with the HDD rigs are yet to be determined, there is the potential for them to be located within areas designated as a SPZ. In relation to the onshore substation foundations, should piling be required it would be located within an area designated as a SPZ II.

113. Piling activities undertaken within an area designated as a SPZ may allow potential contamination to migrate into underlying Principal Aquifers and SPZ, impacting water quality and associated offsite groundwater abstractions.

114. If required, dewatering of perched water or groundwater within excavations could also affect groundwater flow and water quality. This may result in impacts to base flow of local watercourses or impacts to groundwater abstractions.

115. In addition, during construction there is the potential for the accidental release of lubricants, fuels and oils from construction machinery. This can occur as a result of spillages, leakage or storage. These can enter into the ground and subsequently into groundwater impacting groundwater quality and associated groundwater abstractions.

19.6.1.2.1 Magnitude of Impact – DBS East or DBS West in Isolation

116. During the construction phase of either DBS East or DBS West in isolation there would be the requirement for materials to be excavated to construct the onshore export cable corridor, temporary haul and access roads, joint bays and temporary compounds. Excavation of material would also be required at landfall and within the onshore substation zones. Although the total volume of materials required to be excavated is not yet determined, the works would be required along the 39km length of the onshore export cable corridor. The anticipated construction area for the onshore substation for this scenario is predicted to be 180,000m^2 (worst case), although excavation may not be required across the entirety of the construction area.

117. A maximum construction period for the onshore elements of DBS East or DBS West in isolation is four years (as set out within section 19.3.2). Earthworks, however, would not be operating continuously or at the same location during the whole of the construction period.

118. Any changes to infiltration rates, surface runoff or dewatering occurring as a direct result of earthworks activities and direct impacts to the underlying superficial aquifers are predicted to be of local spatial extent within each aquifer unit. Impacts are predicted to be of short-term duration (related to the working areas only), of intermittent occurrence and high reversibility (occurring only during the works and returning to baseline conditions following completion of the works). The magnitude of effect associated with earthworks is therefore considered to be low.

119. Trenchless crossings (e.g. HDD) will be required as part of the construction works associated with either DBS East or DBS West in isolation e.g., at landfall and where the onshore export cable corridor intersects a Main River. The foundation design of the onshore substation, i.e. whether piling is required, and the total number of piles is yet to be determined. The total number of piles required to install the anchors for HDD rigs is also yet to be determined.

120. The Principal Chalk Aquifers present within the landfall area are not designated as SPZs, this is likely due to the saline intrusion from the sea interacting with the groundwater making it unsuitable for use as potable water. The magnitude of impact associated with HDD works at landfall is therefore considered to be low.

121. The impacts of either trenchless crossings or piling on the underlying Principal Aquifers and SPZs are predicted to be of local spatial extent (occurring only at trenchless crossing locations and at the substation if piling is required) and of intermittent occurrence. The magnitude of impact associated with trenchless crossings and piling activities is therefore considered to be low.

19.6.1.2.2 Magnitude of Impact – DBS East and DBS West Together

122. The construction of DBS East and DBS West together would require excavation of materials to construct the onshore export cable corridor, temporary haul and access roads, joint bays and temporary compounds. Excavation of material would also be required at landfall and within the onshore substation zones. The volumes of material required to be excavated are yet to be determined but would be required along the 39km of the onshore export cable corridor. The anticipated construction area for the onshore substations is predicted (as a worst case) to be 274,416m^2. Excavation, however, may not be required across the entirety of the construction area.

123. Both of the two-project scenario (sequential or concurrent) are expected to require an increased number of piles (if piling is required) for the installation of anchors for HDD rigs and the construction of the onshore substations. The two-project scenario will also lead to an increased number of drills at landfall and trenchless crossings when compared to DBS East or DBS West in isolation. Sequential construction of DBS East and DBS West is considered to be the worst case scenario due to the longer period of time period over which impacts could be experienced.

124. As with DBS East or DBS West in isolation, the potential impacts to the Secondary Aquifers, Principal Aquifers and SPZs are predicted to be of local spatial extent within each aquifer unit. Impacts are predicted to be of short-term duration (related to the working areas only) of intermittent occurrence and high reversibility. The magnitude of impact is therefore considered to be low.

125. The magnitude of impact to the Principal Aquifers as a result of HDD works at landfall is also considered to be low.

19.6.1.2.3 Sensitivity of Receptor

126. There are no recorded groundwater abstractions from the Secondary A, B or Undifferentiated Aquifers of the Onshore Development Area, or within 1km. Therefore, the sensitivity of these aquifers is considered to be low.

127. There are no licensed potable groundwater abstractions extracting more than 20m^3 of water per day from the Principal Aquifers within the Onshore Development Area. There are however two licensed potable groundwater abstractions extracting more than 20m^3 of water per day recorded within 250m of the Onshore Development Area. **Table 19-6** indicates that the sensitivity of Principal Aquifers, SPZs II and III as well as private potable abstractions within 250m is medium.

128. Information in relation to active private groundwater abstractions, including potable abstractions, will be gathered as part of the ongoing consultation with East Riding of Yorkshire Council and individuals. This will allow for the sensitivity of Principal and Secondary Aquifers to be refined and identification of mitigation measures that are bespoke to each location should they be required. The information will be provided within the ES following refinement of the DCO boundary.

129. The area of the Onshore Development Area located within the SPZ I is considered to be of high sensitivity. Following receipt of private potable groundwater abstraction data, should any be present within the Onshore Development Area and automatic 50m SPZ I would be applied around the abstraction. There is the potential for private potable abstractions to be located throughout landfall, the onshore export cable corridor or onshore substation zones. Therefore, there is the potential for additional SPZ I to be present.

19.6.1.2.4 Significance of Effect – All Scenarios

130. For all scenarios, prior to mitigation, the overall significance of disturbance causing impacts to groundwater quality or the resource potential of the Secondary Aquifers during construction is low magnitude on a low sensitivity receptor. The resultant significance of effect is considered **minor** adverse.

131. The overall significance on groundwater quality within the Principal Aquifers, as a result of HDD works at landfall, trenchless crossings and piling, is low magnitude on a medium to high sensitivity receptor, representing a **minor** to **moderate** adverse significance of effect.

19.6.1.2.5 Mitigation and Residual Significance of Effect – All Scenarios

132. As discussed in section 19.6.1.1.5, mitigation includes measures such as investigations to characterise ground conditions. Should contamination be encountered that is considered to pose an unacceptable risk to groundwater and groundwater resources, a remediation strategy proportionate to the level of risk would be developed and agreed with the relevant bodies. Once agreed, any required remediation works, which will be dependent on the type and level of contamination encountered, would be undertaken to mitigate the potential risks posed.

133. In addition, the CoCP will include specific measures relevant to the storage of fuels, oils, lubricants, waste water and other chemicals during the works. This will include:

- Storing all fuels, oils, lubricants, waste water and other chemicals in impermeable bunds with at least 110% of the stored capacity, with any damaged containers being removed from site;
- Refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils to be used where possible; and
- Ensuring that spill kits are available on site at all times as well as sand bags and stop logs for deployment in case of emergency spillages.

134. In addition, mitigation measures relating specifically to impacts to groundwater may include the development of a hydrogeological risk assessment where earthworks / excavations are within 50m (or 250m dependent upon volume abstracted) of private potable groundwater abstractions if they are unavoidable through micro-siting. The risk assessment would be desk-based and follow a tiered approach with more detailed assessments carried out in areas considered to be a potentially greater risk to groundwater. Hydrogeological risk assessments would also be developed in areas where trenchless crossing techniques are utilised to assess the potential impacts to groundwater from bentonite breakout during drilling.

135. The production of the hydrogeological risk assessment would be undertaken prior to the commencement of construction works (should one be deemed necessary) and meet the requirements of Environment Agency's Approach to Groundwater Protection 2018 Framework.

136. Furthermore, a piling risk assessment would be undertaken if piles are to be used (e.g. the onshore substation zones and installation of an anchor for the HDD rigs) in areas of potential contamination, in line with the Environment Agency's Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (Environment Agency, 2001). The mitigation measures and monitoring requirements recommended by these assessments, would be implemented during construction works.

137. For all scenarios, aquifer units and SPZs, these measures will reduce the magnitude of impact from low to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

19.6.1.3 Impact 3 Impacts on Surface Water Quality and the Ecological Habitats they Support from Contamination

138. As described in **Table 19-11** and the PRA (**Appendix 19.1**), potential sources of contamination have been identified within the Onshore Development Area. Installation of the onshore export cables and construction of the onshore substations would require substantial earthworks, as well as the potential for piling. These activities have the potential to disturb potential contamination which could migrate and be released into surface water via the following pathways:

- Mobilisation and migration of free phase hydrocarbons, soil contaminants or dissolved phase contaminants in groundwater by construction activities with subsequent release into surface waters;
- Surface water runoff from contaminated Made Ground soils brought to surface during construction;
- Runoff from stockpiles of potentially contaminated soils;
- Migration of soil or groundwater contaminants into surface water drains during construction activities which then enter surface water;
- Accidental spillage whilst handling, storage or treatment of contaminated water or fuels or other chemicals used during construction; and
- The hydraulic regime of the local area could also be affected by the construction of DBS East and / or DBS West for example backfilling excavated areas with less compacted soil / material could potentially create preferential flow paths into surface water receptors.

19.6.1.3.1 Magnitude of Impact – All Scenarios

139. It is possible that there would be multiple sources of contamination within a river catchment for both DBS East or DBS West in isolation and together. As such, the magnitude of impact is assessed as medium for both scenarios.

19.6.1.3.2 Sensitivity of Receptor

140. Any migration and discharge of contamination into surface waters could lead to a reduction in surface water quality and impact on the ecological habitats they support. The Onshore Development Area crosses Greater Wash and Holderness Inshore which are statutory designated sites (SPA and MCZ respectively). Although both protected areas are located within the landfall area, surface water features from other areas of the Onshore Development Area may flow and discharge into the protected area. Therefore, the sensitivity of surface waters is considered to be high.

141. Additional impacts relating to surface water quality and ecological habitats are provided in **Chapter 18 Terrestrial Ecology and Ornithology** and **Chapter 20 Flood Risk and Hydrology**.

19.6.1.3.3 Significance of Effect – All Scenarios

142. Prior to mitigation, the overall significance of effect on surface water quality from contamination during the construction of DBS East and / or DBS West in isolation or together is considered **major** adverse.

19.6.1.3.4 Mitigation and Residual Significance of Effect – All Scenarios

143. The mitigation measures set out in sections 19.6.1.1.5 and 19.6.1.2.5 would also serve to prevent the migration of contamination into surface water bodies.

144. In addition, in areas that have been identified as potential areas of contamination within the PRA or encountered during construction works, perched waters within Made Ground or groundwater from dewatering activities would be collected within a tank or lagoon prior to any treatment or discharge. This waste water shall either be:

- Discharged to foul sewer under a trade effluent consent agreed with the local water company / supplier; and / or
- Discharged to surface water under an environmental permit issued from the Environment Agency.

145. On site treatment plant may be required to treat the waste water prior to disposal in order to meet discharge limits set by either the Environment Agency or local water company.

146. These measures will reduce the magnitude of impact from medium to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

19.6.1.4 Impact 4 Sterilisation of Future Mineral Resources

147. As described in **Table 19-10**, there are a number of MSAs, Areas of Search and Preferred Area are located as localised features throughout the Onshore Development Area. Construction activities and installation of cables within these areas would prevent the extraction of the identified resources.

19.6.1.4.1 Magnitude of Impact – DBS East or DBS West in Isolation

148. The installation of up to five trenches for DBS East or DBS West in isolation within the onshore export cable corridor, which runs a length of 39km and a width of 50m (increasing in width to 125m at trenchless crossings) has the potential to sterilise the resources present within the narrow linear route. In all cases, where the onshore export cable corridor intersects a MSA, Areas of Search or Preferred Area only part of each area is impacted and not the whole protected area.

149. The onshore substation construction area will be 180,000m^2 and has the potential to temporarily sterilise mineral resources within its footprint during construction works. The total area of MSAs impacted during the construction of DBS East or DBS West will be quantified following route refinement and included within the Environmental Statement.

150. The footprint required for construction works will be greater than that required for permanent infrastructure during the operational phase. Therefore, the potential impacts during the construction phase will temporarily sterilise a larger area than that which would be permanently sterilised during operation (see section 19.6.2.3).

151. Following completion of construction works, infrastructure associated with haul roads, construction compounds etc., that have effectively sterilised mineral resources present within the Onshore Development Area will be removed. This would then allow for the mineral resources to be available for extraction. Therefore, the magnitude of impact during construction of DBS East or DBS West is considered to be low.

19.6.1.4.2 Magnitude of Impact – DBS East and DBS West Together

152. The construction of DBS East and DBS West sequentially is considered to be the worst case scenario as it has the potential to temporarily impact a greater proportion of any MSA, Areas of Search or Preferred Area present over the longest period of time. As such, there is the potential to temporarily sterilise a larger volume of mineral resources when compared to DBS East or DBS West in isolation.

153. However, as mentioned in section 19.6.1.4.1, the footprint required for construction works will be greater than that required for permanent infrastructure during the operational phase and therefore has the potential to temporarily sterilise a greater area (see section 19.6.2.3.2 for permanent impacts associated with the operational phase of DBS East and DBS West together).

154. As the potential impacts of sterilisation are considered to be temporary during the construction phase, the magnitude of impact is considered to be low.

19.6.1.4.3 Sensitivity of Receptor

155. Mineral Safeguarding Areas are considered to be of regional importance and therefore the sensitivity of the receptor is considered to be medium.

19.6.1.4.4 Significance of Effect – All Scenarios

156. Without mitigation, the potential impact on mineral resources associated with the construction of DBS East or DBS West in isolation or together is low magnitude on a medium sensitivity receptor. Therefore, the potential significance of effect is **minor** adverse.

19.6.1.4.5 Mitigation and Residual Significance of Effect – All Scenarios

157. Mitigation will include consultation with East Riding of Yorkshire Council regarding the practicality and viability of extraction of the mineral resource. Supporting information may include a post consent ground investigation undertaken prior to construction to help better determine the depth, accessibility and quality of the mineral resource and enable a quantification of the amount of the mineral that may be sterilised, should it be required by East Riding of Yorkshire Council. If it is determined that extraction of the resource was reasonably practical, it may be extracted prior to the commencement of construction works and therefore reduce the area that may be potentially sterilised.

158. A Mineral Resource Assessment (MRA) will be undertaken (if required) post consent, and prior to the commencement of construction works, to provide an indication of the likely quality and extent of the mineral resource, the commercial viability of extraction and environmental impact. This may also aid in determining whether it is reasonably practical for the resource to extracted prior to the commencement of construction works and therefore, reduce the area that may be potentially sterilised.

159. In addition to the MRA, a Mineral Infrastructure Impact Assessment (MIIA) may be required to identify and discuss the potential impacts associated with the construction of the Projects on mineral infrastructure already present. This would be undertaken in consultation with East Riding of Yorkshire Council. As with the MRA, this would be undertaken post consent and prior to the commencement of construction works.

160. Following the mitigation described above, it is considered that the magnitude of impact from DBS East or DBS West in isolation or together to mineral resources during construction would remain low. Therefore the residual significance of effect would remain **minor** adverse which is deemed to be not significant.

19.6.1.5 Impact 5 Built Environment

161. The construction phase has the potential to impact the existing built environment. This may be through creating new preferential pathways for contaminants or gases to migrate that may lead to degradation of utilities (potable water supply pipes) and concrete from aggressive attack. This could potentially compromise the integrity of buildings or utilities, or the migration of ground gases into buildings could cause explosion.

162. Potential impacts associated with the Onshore Development Area on existing utilities, in relation to electricity cables, telecommunications and high pressure gas pipelines, are discussed in **Chapter 21 Land Use**.

19.6.1.5.1 Magnitude of Impact – DBS East or DBS West in Isolation

163. Commercial, residential and holiday properties, a school and hospital are located within 250m of the construction works. These features are not present along the entirety of the Onshore Development Area boundary but as isolated areas. The greatest concentration of buildings within 250m of the Onshore Development Area is around the settlement of Beverly.

164. Potential impacts to the built environment are considered to be localised to work areas and areas of contamination. The magnitude of impact is therefore considered to be medium.

19.6.1.5.2 Magnitude of Impact – DBS East and DBS West Together

165. Whilst the concurrent and sequential construction scenarios have the potential to impact a larger area of the built environment compared to DBS East or DBS West in isolation, the magnitude of impact is still considered to be medium.

19.6.1.5.3 Sensitivity of Receptor

166. Although there are no buildings present within the Onshore Development Area, there are commercial, residential / holiday properties, a school and hospital within 250m. Therefore, the sensitivity of the built environment is considered to be medium.

19.6.1.5.4 Significance of Effect – All Scenarios

167. Without mitigation, the potential significance of effect on the built environment for all scenarios is considered **moderate** adverse.

19.6.1.5.5 Mitigation and Residual Significance of Effect – All Scenarios

168. Mitigation includes the reduction of construction activities in proximity to commercial and residential properties where possible, for example locating construction compounds away from residential properties. However, where this isn't possible pre-construction site characterisation works in areas identified as potential sources of contamination (see **Table 19-11** and **Appendix 19.1**) may be required. This would allow for the identification of potential contamination and the risks these may present to the built environment during construction works. Should it be determined that risks to the built environment are present, appropriate remediation works would be undertaken to mitigate the potential impacts.

169. These measures will reduce the magnitude of impact from medium to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

19.6.1.6 Impact 6 Impacts to Designated Geological Sites

170. Within the Onshore Development Area one nationally designated geological site and one LoGS have been identified. Withow Gap, Skipsea SSSI is located within one of the possible landfall locations and Skipsea Drain LoGS located within one of the possible landfall locations extending into the onshore export cable corridor (see **Figure 19-9** of **Appendix 19.1**).

171. Where overlaps occur between the possible landfall locations or onshore export cable corridor and the SSSI / LoGS, construction activities such as excavations or HDD drilling could physically damage the protected geological features.

19.6.1.6.1 Magnitude of Impact – DBS East or DBS West in Isolation

172. The construction phase of DBS East or DBS West in isolation would require up to five HDD locations at landfall which has the potential to physically impact Withow Gap Skipsea SSSI and Skipsea Drain LoGS leading to permanent loss of the protected geological features. It is however noted that HDD would have to be below the Withow Gap Skipsea SSSI as it is in a cliff face. The excavation of the onshore export cable corridor through the Skipsea Drain LoGS could also lead to permanent loss of the geological feature. The magnitude of impact is therefore considered to be high.

19.6.1.6.2 Magnitude of Impact – DBS East and DBS West Together

173. The construction of DBS East and DBS West together (either sequentially or concurrently) would require up to seven HDD locations at landfall which has the potential to physically impact Withow Gap Skipsea SSSI and Skipsea Drain LoGS leading to the potential for a greater proportion of the features to be permanently lost compared to the one of the Projects in isolation. In addition, the excavation of seven trenches for the onshore export cable corridor through the designated features also has the potential to lead to a greater area being permanently lost. Therefore, the magnitude of impact is considered to be high.

19.6.1.6.3 Sensitivity of Receptor

174. Due to the designation of geological features within the Onshore Development Area, the sensitivity is considered to be medium.

19.6.1.6.4 Significance of Effect – All Scenarios

175. The significance of effect on designated geological sites during the construction phase for all scenarios is considered **major** adverse.

19.6.1.6.5 Mitigation and Residual Significance of Effect – All Scenarios

176. Possible mitigation measures which could be applied to reduce the significance of effect on the Withow Gap Skipsea SSSI include employing trenchless crossing techniques below the designated feature or avoidance. Further engineering investigations are currently being undertaken to assess the feasibility of applying these mitigation measures for the Withow Gap Skipsea SSSI.

177. Assuming these measures can be applied to Withow Gap Skipsea SSSI they will reduce the magnitude of impact from high to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

178. In relation to the Skipsea Drain LoGS, avoidance or trenchless crossings as a mitigation measure may not be applicable and there may be a requirement for open trenching through the LoGS to be undertaken as part of the construction works. Therefore, at this stage the magnitude of impact would remain high with a **major** adverse significance of effect. Further assessment of both potential impacts to the LoGS and mitigation measures will be undertaken as part of the EIA process and presented within the ES.

19.6.1.7 Impact 7 Impacts on Agricultural Land

179. The majority of the construction footprint is located within areas currently associated with agricultural production, with ALC Grades 2 and 3 present throughout the Onshore Development Area.

180. Due to the nature of the land use within the Onshore Development Area, it would not be possible to avoid agricultural land. As mentioned in section 19.6.1.1, the PRA identified localised areas within the Onshore Development Area with a history of potentially contaminative uses which could represent a contamination risk to agricultural land.

181. Construction activities therefore have the potential to mobilise pre-existing sources of contamination in identified areas or due to the invasive nature of construction actives, create new preferential pathways. There is also the potential for new sources of contamination to be introduced to the area which may have adverse impacts on agricultural land.

182. Discussions in relation to potential impacts associated with construction on agricultural land beyond the impacts related to contamination land can be found in **Chapter 21 Land Use**.

19.6.1.7.1 Magnitude of Impact – DBS East or DBS West in Isolation

183. During the construction phase of DBS East or DBS West, there will be the requirement for materials to be excavated to construct the onshore elements of the Projects, inclusive of temporary haul roads and temporary construction compounds.

184. Potential impacts to agricultural land during the construction phase are predicted to be of local spatial extent (localised to the work areas and areas where contamination may be present). Potential impacts are also anticipated to be of short-term duration, of intermittent occurrence and high reversibility (occurring only during the works).

185. The magnitude of impact is therefore considered to be low for DBS East or DBS West in isolation.

19.6.1.7.2 Magnitude of Impact – DBS East and DBS West Together

186. Whilst the sequential and concurrent construction scenarios have the potential to impact a larger area of agricultural land over a longer period of time, the magnitude of impact is still considered to be low for DBS East and DBS West together.

19.6.1.7.3 Sensitivity of Receptor

187. Due to the presence of ALC Grade 2 land, the sensitivity of the receptor is considered to be high (worst-case).

19.6.1.7.4 Significance of Effect – All Scenarios

188. The significance of effect on agricultural land during construction for all scenarios is considered to be **moderate** adverse in the absence of mitigation.

19.6.1.7.5 Mitigation and Residual Significance of Effect – All Scenarios

189. Mitigation measures discussed in sections 19.6.1.1.5, 19.6.1.2.5 and 19.6.1.3.4 would also serve to reduce the magnitude of impact on agricultural land as a result of construction activities. Implementation of the measures previously discussed would reduce the magnitude of impact to negligible, and therefore reduced the significance of effect to **minor** adverse, which is deemed to be not significant.

19.6.2 Potential Effects During Operation

19.6.2.1 Impact 8 Exposure of Workforce, Landowners, Land Users and Neighbouring Land Users to Contaminated Soils and Groundwater and Associated Health Impacts

190. During the operation of DBS East and / or DBS West there would be no planned maintenance along the onshore export cable corridor which would require the excavation of soils. In the unlikely event of a cable failure then that stretch of cable between two joint bays may need to be replaced. This would require excavation at the two joint locations to expose the joint bays and allow the cable to be pulled out and replaced. Maintenance works associated with the onshore substations are anticipated to be undertaken during the operational life of the Projects, this may include the need for soils to be excavated.

191. If contaminated materials are brought to the surface through excavation during the operational phase and no mitigation measures are implemented, these materials would permanently be exposed at surface. This creates the potential for maintenance workers, land owners, land users and neighbouring land users to come in to direct contact with contaminated soils left in-situ via direct contact pathways.

192. Materials excavated during the installation of the onshore export cables and construction of the onshore substations would be re-instated following completion where possible. If however, a different source of material is used to backfill excavations onshore export cable corridor that is not of a similar porosity as the surrounding environment (e.g. a more porous material such as coarse hardcore is used), there is the potential for ground gases and / or vapours to migrate along the length of the corridor or from beneath the onshore substations. This may lead to the accumulation of ground gas and vapours within the onshore substation accessed by maintenance workers during the operational phase. Therefore, risks associated with asphyxia and explosion may be present.

193. If however, during site characterisation works areas considered to represent an unacceptable risk to human health be identified, remedial works proportionate the level of risk would be undertaken. In addition, should areas of unexpected contamination be encountered during construction works, appropriate mitigation measures (including potential remediation) would also be undertaken to reduce the significance of effect to human health receptors.

194. In relation to risks posed by ground gases and vapours, should potential sources of ground gas / vapour generating materials be identified as part of site characterisation works or encountered unexpectedly during construction appropriate mitigation measures, including the removal of the source material would be implemented prior to construction. Impacts associated with ground gas / vapours to the built environment are discussed in section 19.6.2.4.

19.6.2.1.1 Magnitude of Impact – All Scenarios

195. There may be a need for ground excavations to be undertaken at joint bay locations or at the onshore substations as part of the maintenance for both DBS East or DBS West in isolation or together. The impacts are predicted to be of local spatial extent (localised to areas where contamination may be present and to areas where excavation works are required), of short-term duration, of intermittent occurrence and high reversibility (occurring only during the maintenance works). The magnitude of impact is therefore considered to be low for the operational phase of DBS East or DBS West in isolation or together.

196. In areas where there is the potential for ground gases and / or vapours to accumulate (e.g. within the onshore substation buildings) mitigation measures implemented during the construction phase would form the embedded mitigation measures during operation. The incorporation of the embedded mitigation measures would reduce the magnitude of impact during operation. Therefore, the magnitude of impact is considered to be low.

19.6.2.1.2 Sensitivity of Receptor

197. The sensitivity of maintenance workers, land owners, land users and neighbouring land users located within 50m of DBS East or DBS West in isolation or together is considered to be high (see **Table 19-6**).

19.6.2.1.3 Significance of Effect – All Scenarios

198. Without the implementation of additional mitigation measures outlined below, the potential impact on human health associated with the operation of DBS East or DBS West in isolation or together is low magnitude on a high sensitivity receptor, representing a **moderate** adverse significance.

19.6.2.1.4 Mitigation and Residual Significance of Effect – All Scenarios

199. Following the completion of construction works, the health and safety folder for the Projects will be handed to the Applicant by the Principal Contractor. The folder will include information in relation to the residual risks present within the Onshore Development Area, including the potential risks associated with ground gas (should materials of a differing porosity be used to backfill excavations).

200. Maintenance workers that are required to undertake ground excavations during the operational phase would be provided with the information contained within the health and safety folder regarding the nature of ground conditions within each area so that they can develop site and task specific risk assessments and method statements with the recommendations implemented prior to the commencement of the task.

201. These measures will reduce the magnitude of impact from low to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

19.6.2.2 Impact 9 Impact on Controlled Waters (Groundwater and Surface Waters)

202. Maintenance activities at landfall, along the onshore export cable corridor and at the onshore substations have the potential to mobilise pre-existing contamination or create new contamination through the leakage or spillage of fuels, oils or other chemicals from machinery, vehicles or operational equipment. This could affect water quality within the aquifers underlying the site, surface water receptors and the water abstractions they support.

19.6.2.2.1 Magnitude of Impact – All Scenarios

203. Although excavation works will not form part of planned maintenance activities during the operational phase of DBS East or DBS West in isolation or together, there is the potential for excavations to be undertaken to conduct unplanned repairs. Should excavation works be required as part of unplanned works, these would be at joint bay locations for cable repairs or at the onshore substations and not involve the entirety of the Projects infrastructure.

204. The impacts are predicated to be of local spatial extent (localised to areas of excavation / maintenance and where contamination may be present). The magnitude of impact is therefore considered to be low during the operational phase.

19.6.2.2.2 Sensitivity of Receptor

205. Any migration and discharge of contamination into surface waters through direct or indirect pathways (e.g. surface run-off, discharge of groundwater into surface water bodies) could lead to a reduction in surface water quality and impact on the ecological habitat they support. The Onshore Development Area crosses Greater Wash SPA and Holderness Inshore MCZ. Although both protected areas are located within the landfall area, surface water features from other areas of the Onshore Development Area may flow and discharge into the protected areas. Therefore, the sensitivity of surface waters is considered to be high.

19.6.2.2.3 Significance of Effect – All Scenarios

206. Without mitigation, the potential impacts to controlled waters resulting from the operation of DBS East or DBS West in isolation or together is low magnitude on a high sensitivity receptor. Therefore, the significance of effect is considered **moderate** adverse.

19.6.2.2.4 Mitigation and Residual Significance of Effect – All Scenarios

207. Maintenance workers that are required to undertake ground excavations or maintenance works during the operation of DBS East or DBS West in isolation or together will be provided with the information contained within the health and safety folder regarding the nature of ground conditions within each area so that they can develop site and task specific risk and method statements and implement their recommendations to protect controlled waters.

208. During cable repair / maintenance works and at the onshore substations, all fuels, oils, lubricants and other chemicals will be stored in an impermeable bund with at least 110% of stored capacity. Spill kits will be available on site at all times and an Emergency Response Plan (ERP) (or similar) will be developed and recorded within the health and safety folder. The ERP will outline mitigation measures to undertaken in the event of an uncontrolled release of hazardous materials.

209. These measures will reduce the magnitude of impact from low to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

19.6.2.3 Impact 10 Sterilisation of Future Mineral Resources

210. Future extraction of resources from within MSAs, Areas of Search or Preferred Areas would be prevented within the permanent easement for the onshore export cables, onshore substations and permanent access roads. This would prevent extraction within these areas for the duration of the operational period (30 years).

211. The impacts are predicted to be permanent and could affect the receptor directly, however, the proportion of the total MSAs, Areas of Search or Preferred Areas that would be effectively sterilised is considered to be small. The total area of MSAs, Areas of Search or Preferred Areas impacted during the operational phase of the Projects will be quantified following route refinement and included within the ES.

19.6.2.3.1 Magnitude of Impact – DBS East or DBS West in Isolation

212. If DBS East or DBS West were to be constructed in isolation, the realistic worst case scenario would result in the prevention of future extraction along a 39km cable corridor plus easement and the onshore substation.

213. Although the operational footprint of DBS East or DBS West will be smaller than that of the construction footprint, the impacts would be permanent during the operational lifetime rather than temporary. Following the decommissioning of DBS East or DBS West, these areas may become available for mineral extraction once more and so the impacts are considered reversible. Therefore, the magnitude of impact is considered to be medium.

19.6.2.3.2 Magnitude of Impact – DBS East and DBS West Together

214. If DBS East and DBS West were be constructed together (either sequentially or concurrently), the realistic worst case scenario would involve the sterilisation of mineral resources along 39km cable corridors plus easements and the onshore substations.

215. As with the operation of DBS East or DBS West in isolation, the operational footprint for DBS East and DBS West together would be smaller than that of construction, with the impacts during the operational phase considered permanent but reversible following decommissioning. Therefore, the magnitude of impact is considered to be medium.

19.6.2.3.3 Sensitivity of Receptor

216. MSAs are considered to be of regional importance and therefore, the sensitivity of future mineral resources is considered to be medium.

19.6.2.3.4 Significance of Effect – All Scenarios

217. Without mitigation, the potential impact to mineral resources resulting from the operation of DBS East or DBS West in isolation or together is of medium magnitude on a medium sensitivity receptor, representing a **moderate** adverse significance of effect.

19.6.2.3.5 Mitigation and Residual Significance of Effect – All Scenarios

218. As discussed in section 19.6.1.4.5, prior to construction and operation consultation with East Riding of Yorkshire Council will be undertaken to determine potential mitigation measures, including for example, the feasibility of mineral extraction within the area that would be sterilised. It may be necessary for a MRA to be undertaken to determine the amount of mineral at risk from sterilisation and the viability of extraction. Where viable, consideration will be given to the extraction of the mineral resource during construction which would reduce the potential area at risk from sterilisation and so reduce the significance of effect.

219. These measures will reduce the magnitude of impact from medium to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

19.6.2.4 Impact 11 Built Environment

220. Materials such as concrete used in the infrastructure associated with DBS East and / or DBS West have the potential to undergo degradation, such as chemical attack, from aggressive ground conditions due to the presence of acids or sulphates. This has the potential to compromise the integrity of structures associated with the substation.

221. In addition, the presence of contaminants in soils could also result in a risk of corrosion and permeation of utilities such as plastic water supply pipes that may be installed at the onshore substation.

222. Buildings built on or near sources of ground gas (such as infilled land) could also be at risk from the accumulation of gases potentially causing explosion.

19.6.2.4.1 Magnitude of Impact – All Scenarios

223. Desk based information indicates that the onshore substation zones are located in and near to potential sources of ground gases, such as landfills. Depending on the location of jointing bays and link boxes in relation to potential sources of ground gas generating contamination, there is the potential for the gases to migrate and accumulate in these underground structures at landfall and along the onshore export cable corridor.

224. There is also the potential to encounter unexpected sources of ground gas during construction works. Therefore, the potential magnitude of impact on the surrounding built environment during the operation of all scenarios is medium.

19.6.2.4.2 Sensitivity of Receptor

225. Due to the presence of the onshore substations and ancillary structures as well as the neighbouring commercial, residential and holiday properties, a school and hospital within 250m of the Onshore Development Area, the sensitivity of the built environment is considered to be high.

19.6.2.4.3 Significance of Effect – All Scenarios

226. Without mitigation, the potential impacts to the built environment resulting from the operation of DBS East or DBS West in isolation or together is medium magnitude on a high sensitivity receptor. Therefore, the significance of effect is considered **major** adverse.

19.6.2.4.4 Mitigation and Residual Significance of Effect – All Scenarios

227. Should unexpected sources of ground gas be identified prior to or during construction works, a ground investigation will be undertaken to characterise ground conditions and assess the potential risks. Depending on the outcome of the assessment, mitigation measures such as the use of gas protection measures within the design of the onshore substations will be implemented.

228. If utilities corridors are within land affected by contamination, construction of clean or lined service corridors will be installed to protect land users and utilities. This would include, for example, the use of soils deemed not to contain contamination above human health generic assessment criteria appropriate for the end use within the Onshore Development Area.

229. The above measures would be implemented during the construction phase of all scenarios and form part of the embedded mitigation measures for the operational phase of all scenarios.

230. These mitigation measures will reduce the magnitude of impact to negligible, resulting in a **minor** adverse residual significance of effect.

19.6.2.5 Impact 12 Impacts to Designated Geological Sites

231. During the operation of DBS East and DBS West there would be no planned maintenance at landfall or along the onshore export cable corridor which would require excavation.

232. In the unlikely event of a cable failure then that stretch of cable between two joint bays may need to be replaced. This would require excavation at the two joint locations to expose the joint bays and allow the cable to be pulled out and replaced. Therefore there is the potential for excavation works to be required within the designated geological areas.

19.6.2.5.1 Magnitude of Impact – All Scenarios

233. There may be a need for ground excavations to be undertaken at joint bays as part of the maintenance for both DBS East or DBS West in isolation or together. The impacts are predicted to be localised to the areas of work and result in the permanent loss of the designated features within the works area. Therefore the magnitude of impact for all scenarios is considered to be high.

19.6.2.5.2 Sensitivity of Receptor

234. Due to the designation of geological features within the Onshore Development Area, the sensitivity is considered to be medium.

19.6.2.5.3 Significance of Effect – All Scenarios

235. The significance of effect on designated geological sites during the operational phase for all scenarios is considered **major** adverse.

19.6.2.5.4 Mitigation and Residual Significance of Effect – All Scenarios

236. The only mitigation measures available to reduce the significance of effect on the designated geological features is avoidance as part of the design process. Avoidance of the designated geological features would result in no physical disturbance. It may be possible to avoid the Withow Gap Skipsea SSSI, however it is yet to be determined whether it would also be applicable to the Skipsea Drain LoGS.

237. Assuming these measures can be applied they will reduce the magnitude of impact from high to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant. However, if these measures cannot be applied to the Skipsea Drain LoGS, the magnitude of impact would remain high with a **major** adverse significance of effect. For this area of the Onshore Development Area.

19.6.2.6 Impact 13 Impacts on Agricultural Land

238. As mentioned previously, maintenance activities within the Onshore Development Area have the potential to mobilise pre-existing contamination or create new contamination through the leakage or spillage of fuels, oils or other chemicals from machinery, vehicles or operational equipment. This could impact on agricultural land quality.

19.6.2.6.1 Magnitude of Impact – All Scenarios

239. Although excavation works will not form part of planned maintenance activities during the operational phase of DBS East or DBS West in isolation or together, there is the potential for excavations to be undertaken to conduct unplanned repairs. Should excavation works be required as part of unplanned works, these would be at joint bay locations for cable repairs or at the onshore substations and not involve the entity of the Projects infrastructure.

240. The impacts are predicted to be of local spatial extent (localised to areas of excavation / maintenance and where contamination may be present). The magnitude of impact is therefore considered to be low during the operational phase.

19.6.2.6.2 Sensitivity of Receptor

241. Due to the presence of ALC Grade 2 land, the sensitivity of the receptor is considered to be high.

19.6.2.6.3 Significance of Effect – All Scenarios

242. The significance of effect on agricultural land during resulting from the operation of DBS East or DBS West in isolation or together is considered **moderate** adverse in the absence of mitigation.

19.6.2.6.4 Mitigation and Residual Significance of Effect – All Scenarios

243. As mentioned in sections 19.6.2.1.4 and 19.6.2.2.4 maintenance works will be undertaken in accordance with site and task specific risk assessments based on information regarding the nature of the ground conditions within the area.

244. All fuels, oils, lubricants and other chemicals will be stored in an impermeable bund with at least 110% of stored capacity. Spill kits will be available on site at all times and an ERP (or similar) will be developed and recorded within the health and safety folder. The ERP will outline mitigation measures to undertaken in the event of an uncontrolled release of hazardous materials.

245. These measures will reduce the magnitude of impact from low to negligible therefore the residual effect is **minor** adverse, which is deemed to be not significant.

19.6.3 Potential Effects During Decommissioning

246. No decision has been made regarding the final decommissioning policy for the onshore export cables, as it is recognised that industry best practice, rules and legislation change over time. It is likely that the cables would be pulled through the ducts and removed, with the ducts themselves left in situ.

247. In relation to the substation, the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology would be determined later within the lifetime of DBS East and / or DBS West, but are expected to include:

- Dismantling and removal of outside electrical equipment from site located outside of the substation(s) buildings;
- Removal of cabling from site;
- Dismantling and removal of electrical equipment from within the substation(s) buildings;
- Removal of main substation(s) building and minor services equipment;
- Demolition of support buildings and removal of fencing;
- Landscaping and reinstatement of the site (including land drainage); and
- Removal of areas of hard standing.

248. Whilst details regarding the decommissioning of the substation are currently unknown, considering a worst case scenario, which would be the removal and reinstatement of the current land use, it is anticipated that the impacts would be similar or less than those during construction. This is because areas of identified contamination would have been remediated during the construction phase.

249. The decommissioning methodology would need to be finalised nearer to the end of the lifetime of DBS East and / or DBS West so as to be in line with current guidance, policy and legalisation at that point. Any such methodology would be agreed with the relevant authorities and statutory consultees. However, there will be a DCO Requirement to ensure that DBS East or DBS West in isolation or together are decommissioned in accordance with an approved methodology.

19.7 Preliminary Assessment of Cumulative Effects

250. As detailed in section 19.4.3, this section presents a preliminary assessment of cumulative effects in relation to geology and land quality. The final CEA will be undertaken within the ES chapter.

19.7.1 Initial Screening for Cumulative Effects

251. **Table 19-12** details the potential cumulative effects that may occur between the Projects and other plans, projects and activities. Only potential impacts assessed in section 19.6 where the potential for cumulative effects has been identified (minor, moderate or major) will be taken forward to the final CEA (i.e. those assessed as 'no impact' are not taken forward as there is no potential for them to contribute to a cumulative impact).

Table 19-12 Potential Cumulative Effects

Impact	Potential for Cumulative Effects	Data Confidence	Impact
Construction			
Impact 1 Exposure to contaminated soils (human health)	Yes	High	The residual effects to construction workers would be confined to the Onshore Development Area. Effects on landowners, land users and neighbouring land users may be exacerbated by other projects.
Impact 2 Impacts on groundwater	Yes	High	Residual effects on Secondary and Principal Aquifers may be exacerbated by other projects which are located within the same aquifer and / or SPZ.
Impact 3 Impacts on surface waters	Yes	High	Residual effects on surface water and the ecological habitats they support may be exacerbated by other projects that are located within the same river catchment.
Impact 4 Sterilisation of future mineral resources	Yes	High	Residual effects on MSAs may be exacerbated by other projects if located within the same safeguarding area.
Impact 5 Built environment	Yes	High	Residual effects on the built environment may be exacerbated by other projects if located near to the same structures.

Impact	Potential for Cumulative Effects	Data Confidence	Impact
Impact 6 Impacts to Designated geological sites	Yes	High	Residual effects to designated geological sites may be exacerbated by other projects if located within the same designated site.
Impact 7 Impacts on agricultural land	Yes	High	Residual effects on agricultural land may be exacerbated by other projects.
Operation			
Impact 8 Exposure to contaminated soils (human health)	Yes	High	The residual effects to maintenance workers would be confined to the Onshore Development Area. Residual effects on landowners, land users and neighbouring land users may be exacerbated by other projects.
Impact 9 Impact on groundwater and surface water	Yes	High	Residual effects on Secondary and Principal Aquifers may be exacerbated by other projects which are located within the same aquifer and /or SPZ.
Impact 10 Sterilisation of mineral resources	Yes	High	Residual effects on MSAs may be exacerbated by other projects if they are located within the same safeguarding area.

Impact	Potential for Cumulative Effects	Data Confidence	Impact
Impact 11 Built environment (users of existing buildings)	Yes	High	Residual effects on the built environment may be exacerbated by other projects if located near the same buildings.
Impact 12 Impacts to designated geological sites	Yes	High	Residual effects on designated geological sites may be exacerbated by other projects if located in the same designated site.
Impact 13 Impacts on agricultural land	Yes	High	Residual effects on agricultural land may be exacerbated by other projects if located near the same parcel of agricultural land.

19.7.2 Plans/Projects Considered for Cumulative Impacts

252. A high-level list of plans/projects that may result in cumulative effects with the Projects is detailed in **Table 19-13**. For geology and land quality, a search distance of 1km from the Onshore Development Area has been used to determine the initial list of projects considered for the CEA.

253. Plans / projects have been assigned a tier level between 1 and 7, based on the most recent guidance (see **Chapter 6 EIA Methodology**). For the final CEA at ES, this high-level list will be reviewed and screened to ensure all relevant plans / projects are considered in the final assessment. All listed plans / projects will be re-examined at ES to ensure each assigned tier remains accurate at the time of writing.

254. In addition to other offshore wind farms, the classes of projects that could potentially be considered for the cumulative assessment of geology and land quality includes:

- Construction projects (commercial, residential and transport developments); and
- Remediation projects.

255. With respect to these activities, the cumulative assessment considers them to be part of the baseline conditions for the surrounding area. As such, it is not expected that the Projects will contribute to cumulative effects with the existing activities in the above list, and therefore these have not been the subject of further assessment.

Table 19-13 High-Level List of Plans/Projects Screened For Further Assessment in the Final CEA

Tier	Plan / Project	Distance to Onshore Development Area (km)
2	Dogger Bank A & B Offshore Wind Farm	Crosses onshore export cable corridor
3	A164 and Jock Lodge Junction Improvement Scheme	Crosses onshore export cable corridor
3	Solar Farm – Land south of Creyke Beck Substation, 4875 Park Lane, Cottingham	Within Onshore Development Area
3	Solar Farm – Land east and west of West of Tickton Bridge Plantation, Main Road, Routh	Adjacent to the Onshore Development Area
4	Hornsea Project Four Offshore Wind Farm	Adjacent to onshore export cable corridor
4	Household Recycling Centre – Land north west of Ings Road Picnic Site, Molescroft	Within Onshore Development Area
6	Solar Farm – Robson & Co, White Hall, Shepard Lane, Woodmansey	Within Onshore Development Area
7	New National Grid Substation (Birkill Wood)	Within Onshore Development Area
7	North Humber to High Marnham	Within Onshore Development Area
7	Creyke Beck Substation Extension	400m from Onshore Development Area

19.8 Potential Monitoring Requirements

256. Monitoring requirements will be described in the In-Principal Monitoring Plan (IPMP) submitted alongside the DCO application and further developed and agreed with stakeholders prior to construction based on the IPMP and taking account of the final detailed design of the Projects.

257. Groundwater and ground gas monitoring may be required as part of any targeted ground investigations that may be required to determine site characteristics. The monitoring will aid in the identification of potential risks to human health, groundwater and surface water receptors identified within this chapter.

19.9 Interactions

258. The effects identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between effects are presented in **Table 19-14**. This provides a screening tool for which effects have the potential to interact. **Table 19-15** provides an assessment for each receptor (or receptor group) as related to these impacts.

259. Within **Table 19-15** the effects are assessed relative to each development phase to see if multiple effects could increase the significance of the effect upon a receptor. Following this a lifetime assessment is undertaken which considers the potential for effect to affect receptors across all development phases.

Table 19-14 Interactions Between Impacts - Screening

Potential Interactions between Impacts							
Construction							
	Impact 1 Exposure to contaminated soils (human health)	Impact 2 Impacts on groundwater	Impact 3 Impacts on surface waters	Impact 4 Sterilisation of mineral resources	Impact 5 Built environment (users of existing buildings)	Impact 6 Impacts to designated geological sites	Impact 7 Impacts on agricultural land
Impact 1 Exposure to contaminated soils (human health)		Yes	No	No	No	No	Yes
Impact 2 Impacts on groundwater	Yes		Yes	No	No	No	Yes
Impact 3 Impacts on surface waters	No	Yes		No	No	No	Yes
Impact 4 Sterilisation of future mineral resources	No	No	No		No	No	No
Impact 5 Built environment	No	No	No	No		No	No
Impact 6 Impacts to Designated geological sites	No	No	No	No	No		No
Impact 7 Impacts on agricultural land	Yes	Yes	Yes	No	No	No	
Operation							
	Impact 8 Exposure to contaminated soils (human health)	Impact 9 Impact on groundwater and surface water		Impact 10 Sterilisation of mineral resources	Impact 11 Built environment (users of existing buildings)	Impact 12 Impacts to designated geological sites	Impact 13 Impacts on agricultural land
Impact 8 Exposure to contaminated soils (human health)		Yes		No	No	No	Yes

Potential Interactions between Impacts						
Impact 9 Impact on groundwater and surface water	Yes		No	No	No	Yes
Impact 10 Sterilisation of mineral resources	No	No		No	No	No
Impact 11 Built environment (users of existing buildings)	No	No	No		No	No
Impact 12 Impacts to designated geological sites	No	No	No	No		No
Impact 13 Impacts on agricultural land	Yes	Yes	No	No	No	

Table 19-15 Interaction Between Impacts - Phase and Lifetime Assessment

Receptor	Highest Significance Level				
	Construction	Operation	Decommissioning	Phase Assessment	Lifetime Assessment
Human health	Minor adverse	Minor adverse	Minor adverse	**No greater than individually assessed impact** The potential impacts to human health are assessed as **minor** adverse on receptors deemed to be of high sensitivity, with the most sensitive receptors deidentified as construction workers. Impacts to human health during construction, operation and decommissioning phases will be managed through standard and best practice methodologies. Given the proposed mitigation measures, and the **minor** adverse significance, it is considered that there would either by no interactions between impacts during each phase or that interactions would be no greater than when assessed individually.	**No greater than individually assessed impact** The impacts to human health are considered a potential risk during the construction, operation and decommissioning phases. Risks associated with each of the phases of DBS East and DBS West will be managed through best practice and adoption of appropriate mitigation measures discussed within this chapter. Therefore, no lifetime effects for receptors are anticipated.
Groundwater	Minor adverse	Minor adverse	Minor adverse	**No greater than individually assessed impact** The impacts to groundwater are assessed as **minor** adverse significance on receptors of low to high sensitivity. Impacts to groundwater during construction, operation and decommissioning phases will be managed through standard and best practice methodologies. Given the proposed mitigation measures, and the **minor** adverse significance of effect, it is considered that there would either be no interactions during each of the phases, or that interactions would be no greater than individually assessed.	**No greater than individually assessed impact** The impacts to groundwater quality in the superficial aquifers during earthworks are only considered a potential risk during the construction and decommissioning phases. It is considered unlikely that earthwork activities would be required during the operational phase of DBS East and DBS West. If earthworks are required during the operational phase, they are anticipated to be managed in line with best practice with appropriate risk assessments conducted and submitted to the relevant agency. The impacts to groundwater quality in the bedrock aquifers, and by extension SPZs, during trenchless crossing activities or piling (if required) are only considered a potential risk during the construction and decommissioning phases. Risks associated with the decommissioning phase are associated with the complete or partial removal of piles (if present) associated with the onshore substations. If these works are required, they are anticipated to be managed in line with best practice with appropriate risk assessments conducted and submitted to the relevant agency.

Receptor	Highest Significance Level				
	Construction	Operation	Decommissioning	Phase Assessment	Lifetime Assessment
					Therefore, no lifetime effects for receptors are anticipated.
Surface water	Minor adverse	Minor adverse	Minor adverse	**No greater than individually assessed impact** The impacts to surface waters are assessed as **minor** adverse significance on receptors of high sensitivity. Impacts to surface waters during construction, operation and decommissioning phases will be managed through standard and best practice methodologies. Given the proposed mitigation measures and **minor** adverse significance, it is considered that there would either be no interactions between impacts during each of the phases or that interactions would be no greater than when individually assessed.	**No greater than individually assessed impact** The impacts to surface water quality from contamination of groundwater are only considered a potential risk during the construction and decommissioning phases. Risks associated with the operational phase of DBS East and DBS West will be managed through best practice. Therefore, no lifetime effects are anticipated for surface water receptors.
Mineral resources	Minor adverse	Minor adverse	Minor adverse	**No greater than individually assessed impact** The impacts to mineral resources are assessed as **minor** adverse on receptors of medium sensitivity. Loss of mineral resources during construction, operation and decommissioning phases will be managed by undertaking an assessment of the feasibility of extraction prior to development and, where viable, undertaking extraction prior to development. Given the proposed mitigation measures, and the **minor** adverse significance, it is considered that there would either be no interactions between impacts during each of the phases or that interactions would be no greater than when individually assessed.	**No greater than individually assessed impact** Impacts to mineral resources are considered a potential risk during construction, operation or decommissioning phases of DBS East and DBS West. Risks associated with each of the phases of DBS East and DBS West will be managed through feasibility assessments, and extraction of mineral resources prior to development. Therefore, no lifetime effects for receptors are anticipated should feasible resources be absent or extracted prior to development.

Receptor	Highest Significance Level				
	Construction	Operation	Decommissioning	Phase Assessment	Lifetime Assessment
Built environment	Minor adverse	Minor adverse	Minor adverse	**No greater than individually assessed impact** The impacts to the built environment are assessed as **minor** adverse on receptors of medium sensitivity. Impacts to the built environment during construction, operation and decommissioning phases will be managed through standard and best practice methodologies. Given the proposed mitigation measures and **minor** adverse significance, it is considered that there would either be no interactions between impacts during each of the phases or that interactions would be no greater than when individually assessed.	**No greater than individually assessed impact** The impacts to the built environment are considered a potential risk during the construction, operation and decommissioning phases. Risks associated with each of the phases of DBS East and DBS West will be managed through best practice and adoption of appropriate mitigation measures discussed within this chapter. Therefore, no lifetime effects for receptors are anticipated.
Designated Geological sites	Minor to major adverse	Minor to major adverse	Minor to major adverse	**No greater than individually assessed impact** The impacts to the designated geological sites are assessed as **minor** adverse (Withow Gap Skipsea SSSI) and **major** adverse (Skipsea Drain LoGS) on receptors of medium sensitivity. Impacts to designated geological sites can be managed through the avoidance of the features as part of the design process. It is also possible to mitigate potential impacts via employing trenchless crossing techniques below the features. However, as mentioned in sections 19.6.1.6 and 19.6.2.5 these mitigation measures may not be applicable in relation to the Skipsea Drain LoGS, hence the **major** adverse significance.	**No greater than individually assessed impact** The impacts to the designated geological sites are considered a potential risk during the construction, operation and decommissioning phases. Risks can be managed through employing trenchless crossing techniques or the avoidance of these features. Avoidance would result in no physical impacts or permanent loss of the feature.

Receptor	Highest Significance Level				
	Construction	Operation	Decommissioning	Phase Assessment	Lifetime Assessment
Agricultural land	Minor adverse	Minor adverse	Minor adverse	**No greater than individually assessed impact** The potential impacts to agricultural land are assessed as **minor** adverse on receptors deemed to be of high sensitivity, with the most sensitive receptor deidentified as ALC Grade 2 land. Impacts to agricultural land during construction, operation and decommissioning phases will be managed through standard and best practice methodologies. Given the proposed mitigation measures, and the **minor** adverse significance of effect, it is considered that there would either be no interactions during each of the phases, or that interactions would be no greater than individually assessed.	**No greater than individually assessed impact** The impacts to agricultural land are considered a potential risk during the construction, operation and decommissioning phases. Risks associated with each of the phases of DBS East and DBS West will be managed through best practice and adoption of appropriate mitigation measures discussed within this chapter. Therefore, no lifetime effects for receptors are anticipated.

19.10 Inter-relationships

260. For Geology and Land Quality potential inter-relationships between other topics assessed within this PEIR including Flood Risk and Hydrology, Terrestrial Ecology and Ornithology, Land Use and Human Health. A summary of the potential inter-relationships between human health, controlled waters, the built environment, mineral resources and ecological habitats is provided in **Table 19-16**.

Table 19-16 Geology and Land Quality Inter-relationships

Topic and Description	Related Chapter	Where Addressed in this Chapter	Rationale
Construction			
Impact 1: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts	N/A	Section 19.6.1.1	No additional inter-related impacts to human health have been identified for these receptors during construction which would increase the standalone assessment from **minor** adverse (and not significant in EIA terms).
Impact 2: Direct impacts on groundwater quality and groundwater resources	**Chapter 20 Flood Risk and Hydrology**	Section 19.6.1.2	Any project-related changes to Geology and Land Quality (both physically and chemically) during construction could impact on the quantity and quality of groundwater resources and hydrologically connected surface water receptors. This is

Topic and Description	Related Chapter	Where Addressed in this Chapter	Rationale
			assessed in section 19.6.1.2.
Impact 3: Impacts on surface water quality and the ecological habitats they support from contamination	**Chapter 18 Terrestrial Ecology and Ornithology**	Section 19.6.1.3	Potential changes to the quantity and quality of groundwater resources and any hydrologically connected surface water during construction could impact upon water dependent biological features, inclusive of designated sites. This is assessed in section 19.6.1.3.
Impact 4: Sterilisation of future mineral resources	N/A	Section 19.6.1.4	No additional inter-related impacts on mineral resources have been identified.
Impact 5: Built environment	N/A	Section 19.6.1.5	No additional inter-related impacts on the existing built environment have been identified.
Impact 6: Impacts to designated geological sites	N/A	Section 19.6.1.6	No additional inter-related impacts on designated geological sites have been identified.
Impact 7: Impacts on agricultural land	**Chapter 21 Land Use**	Section 19.6.1.6178	Potential contamination of agricultural land during the construction phase could impact on the ALC grade and productivity of

Topic and Description	Related Chapter	Where Addressed in this Chapter	Rationale
			agricultural land. This is assessed in section 19.6.1.6.
Operation			
Impact 8: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts	N/A	Section 19.6.2.1	No additional inter-related impacts on human health have been identified for these receptors during operation which would increase the standalone assessment from **minor** adverse (and not significant in EIA terms).
Impact 9: Impact on controlled waters (groundwater and surface waters)	**Chapter 18 Terrestrial Ecology and Ornithology** **Chapter 20 Flood Risk and Hydrology**	Section 19.6.2.2	Potential changes to the quality of groundwater or hydraulically connected surface water bodies have the potential to also impact on water dependent biological features. However, no additional inter-related impacts on controlled waters have been identified.
Impact 10: Sterilisation of future mineral resources	N/A	Section 19.6.2.3	No additional inter-related impacts on mineral resources have been identified.

Topic and Description	Related Chapter	Where Addressed in this Chapter	Rationale
Impact 11: Built environment	N/A	Section 19.6.2.4	No additional inter-related impacts on the built environment have been identified.
Impact 12: Impacts to designated geological sites	N/A	Section 19.6.2.5	No additional inter-related impacts on designated geological sites have been identified.
Impact 13: Impacts on agricultural land	**Chapter 21 Land Use**	Section 19.6.2.6	Potential contamination of agricultural land during the operational phase could impact on the ALC grade and productivity of agricultural land.
Decommissioning			
Effects associated with the decommissioning phase would be no greater than those identified for the construction phase.			

19.11 Summary

261. This chapter has provided a characterisation of the existing environment for Geology and Land Quality based on existing data which has established that, with the exception of impacts to designated geological sites, there will be some **minor** adverse residual effects on the receptors associated with Geology and Land Quality during the construction, operation and decommissioning phases of DBS East and DBS West.

262. The assessment has established that the receptors relating to Geology and Land Quality could be impacted as a result of direct disturbance and mobilisation of existing contamination, introduction of new sources of contamination and sterilisation of mineral resources during each of the phases of DBS East and DBS West. The residual effects on the receptors following implementation of mitigation measures are however, considered not to be significant in EIA terms.

263. The assessment has demonstrated that although the scenarios involving DBS East and DBS West together (sequentially or concurrently) have a larger land area and would lead to greater ground disturbance when compared to DBS East or DBS West in isolation, there is no difference in the residual impacts on the receptors for each of the scenarios assessed.

Table 19-17 Summary of Potential Likely Significant Effects on Geology and Land Quality

Potential Impact	Receptor	Sensitivity	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect
Construction						
Impact 1: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts	Human health	High	Low to high	Moderate to major adverse	Targeted pre-construction ground investigations in areas of potential sources of contamination; implementation of a CoCP; adoption of a CL:AIRE Industry Code of Practice; use of materials of a similar porosity as the surrounding environment.	Minor adverse
Impact 2: Direct impacts on groundwater quality and groundwater resources	Secondary A, Secondary B, Secondary Undifferentiated and Principal Aquifers; SPZs	Low to high	Low	Minor to moderate adverse	Targeted pre-construction ground investigations in areas of potential sources of contamination; implementation of a CoCP; hydrogeological risk assessment at each HDD crossing and piling risk assessment (if required for the installation of anchors for HDD rigs and onshore substations).	Minor adverse
Impact 3: Impacts on surface water quality and the ecological habitats they support from contamination	Controlled waters	High	Medium	Major adverse	Targeted pre-construction ground investigations in areas of potential sources of contamination; implementation of a CoCP; perched waters or groundwater from dewatering activities collected within a tank or lagoon prior to any treatment or discharge.	Minor adverse
Impact 4: Sterilisation of future mineral resources	Mineral Safeguarding Areas	Medium	Low	Minor adverse	Consultation with East Riding of Yorkshire Council with regards to feasibility of mineral extraction prior to commencement of works; production of a Mineral Resources Assessment.	Minor adverse
Impact 5: Built environment	Buildings and utilities	Medium	Medium	Moderate adverse	Reduction of construction activities in proximity to existing buildings; targeted pre-construction ground investigations in areas of potential sources of contamination.	Minor adverse
Impact 6: Impacts to designated geological sites	Designated geological sites	Medium	High	Major adverse	Employing trenchless crossing techniques below or avoidance of the designated areas would reduce the significance of effect.	Minor to major adverse
Impact 7: Impacts on agricultural land	Agricultural land	High	Low	Moderate adverse	Targeted pre-construction ground investigations in areas of potential sources of contamination and implementation of a CoCP.	Minor adverse

Potential Impact	Receptor	Sensitivity	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect
Operation						
Impact 8: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts	Human health	High	Low	Moderate adverse	Undertaking remedial activities if areas of contamination are identified during pre-construction ground investigations; implementation of task and site specific risk assessment prior to commencement of maintenance works.	Minor adverse
Impact 9: Impact on controlled waters (groundwater and surface waters)	Controlled waters	High	Low	Moderate adverse	Implementation of task and site specific risk assessment prior to commencement of maintenance works to protect controlled waters; storage of fuels, oils, lubricants and other chemicals in an impermeable bund with at least 110% storage capacity; development of a ERP within the CoCP.	Minor adverse
Impact 10: Sterilisation of future mineral resources	Mineral Safeguarding Areas	Medium	Medium	Moderate adverse	Extraction of feasible mineral resources and development of a Minerals Resources Assessment prior to commencement of construction works.	Minor adverse
Impact 11: Built environment	Buildings and utilities	High	Medium	Major adverse	Design of built elements in accordance with BRE Special Digest 1; incorporation of ground gas protection measures (if required); clean or lined service corridors.	Minor adverse
Impact 12: Impacts to designated geological sites	Designated geological sites	Medium	High	Major adverse	Avoidance of the designated areas is the only available mitigation measure to reduce the significance of effect.	Minor to major adverse
Impact 13: Impacts on agricultural land	Agricultural land	High	Low	Moderate adverse	Implementation of task and site specific risk assessment prior to commencement of maintenance works to protect agricultural land; storage of fuels, oils, lubricants and other chemicals in an impermeable bund with at least 110% storage capacity; development of a ERP within the CoCP; information in relation to the nature of ground conditions included within the health and safety folder for development of task and site specific risk assessments.	Minor adverse

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