



DOGGER BANK D WIND FARM

Preliminary Environmental Information Report

Volume 1
Chapter 19 Geology and Ground Conditions

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Appendix 19.2	Preliminary Risk Assessment
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Glossary

Term	Definition
Additional Mitigation	<p>Measures identified through the EIA process that are required as further action to avoid, prevent, reduce or, if possible, offset likely significant adverse effects to acceptable levels (also known as secondary (foreseeable) mitigation).</p> <p>All additional mitigation measures adopted by the Project are provided in the Commitments Register.</p>
Agricultural Land Classification	<p>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, Grade 4 poor and Grade 5 very poor.</p>
Birkhill Wood Substation	<p>The onshore grid connection point for DBD identified through the Holistic Network Design process. Birkhill Wood Substation which is being developed by National Grid Electricity Transmission and does not form part of the Project.</p>
Commitment	<p>Refers to any embedded mitigation and additional mitigation, enhancement or monitoring measures identified through the EIA process and those identified outside the EIA process such as through stakeholder engagement and design evolution.</p> <p>All commitments adopted by the Project are provided in the Commitments Register.</p>
Design	<p>All of the decisions that shape a development throughout its design and pre-construction, construction / commissioning, operation and, where relevant, decommissioning phases.</p>
Development Consent Order (DCO)	<p>A consent required under Section 37 of the Planning Act 2008 to authorise the development of a Nationally Significant Infrastructure Project, which is granted by the relevant Secretary of State following an application to the Planning Inspectorate.</p>
Effect	<p>An effect is the consequence of an impact when considered in combination with the receptor’s sensitivity / value / importance, defined in terms of significance.</p>

Term	Definition
Embedded Mitigation	<p>Embedded mitigation includes:</p> <ul style="list-style-type: none">Measures that form an inherent part of the project design evolution such as modifications to the location or design of the development made during the pre-application phase (also known as primary (inherent) mitigation); andMeasures that will occur regardless of the EIA process as they are imposed by other existing legislative requirements or are considered as standard or best practice to manage commonly occurring environmental impacts (also known as tertiary (inexorable) mitigation). <p>All embedded mitigation measures adopted by the Project are provided in the Commitments Register.</p>
Energy Storage and Balancing Infrastructure (ESBI)	<p>A range of technologies such as battery banks to be co-located with the Onshore Converter Station, which provide valuable services to the electrical grid such as storing energy to meet periods of peak demand and improving overall reliability.</p>
Enhancement	<p>Measures committed to by the Project to create or enhance positive benefits to the environment or communities, as a result of the Project.</p> <p>All enhancement measures adopted by the Project are provided in the Commitments Register.</p>
Environmental Impact Assessment (EIA)	<p>A process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information and includes the publication of an Environmental Statement.</p>
Environmental Statement (ES)	<p>A document reporting the findings of the EIA which describes the measures proposed to mitigate any likely significant effects.</p>
Evidence Plan Process (EPP)	<p>A voluntary consultation process with technical stakeholders which includes a Steering Group and Expert Topic Group (ETG) meetings to encourage upfront agreement on the nature, volume and range of supporting evidence required to inform the EIA and HRA process.</p>
Expert Topic Group (ETG)	<p>A forum for targeted technical engagement with relevant stakeholders through the EPP.</p>
Grid Connection	<p>The offshore and onshore electricity transmission network connection to Birkhill Wood Substation.</p>
Haul Roads	<p>Temporary tracks set aside to facilitate transport access during onshore construction works.</p>
Impact	<p>A change resulting from an activity associated with the Project, defined in terms of magnitude.</p>

Term	Definition
Jointing Bays	Underground structures constructed at regular intervals along the onshore export cable corridor to facilitate the joining of discrete lengths of the installation of cables.
Landfall	The area on the coastline, south-east of Skipsea, at which the offshore export cables are brought ashore, connecting to the onshore export cables at the transition joint bay above Mean High Water Springs.
Link Boxes	Structures housing electrical equipment located alongside the jointing bays in the onshore export cable corridor and the transition joint bay at the landfall, which could be located above or below ground.
Mitigation	<p>Any action or process designed to avoid, prevent, reduce or, if possible, offset potentially significant adverse effects of a development.</p> <p>All mitigation measures adopted by the Project are provided in the Commitments Register.</p>
Mitigation Hierarchy	A systematic approach to guide decision-making and prioritise mitigation design. The hierarchy comprises four stages in order of preference and effectiveness: avoid, prevent, reduce and offset.
Monitoring	<p>Measures to ensure the systematic and ongoing collection, analysis and evaluation of data related to the implementation and performance of a development. Monitoring can be undertaken to monitor conditions in the future to verify any environmental effects identified by the EIA, the effectiveness of mitigation or enhancement measures or ensure remedial action are taken should adverse effects above a set threshold occur.</p> <p>All monitoring measures adopted by the Project are provided in the Commitments Register.</p>
Onshore Converter Station (OCS) Zone	The area within which the Onshore Converter Station and Energy Storage and Balancing Infrastructure will be located in vicinity of Birkhill Wood Substation.
Onshore Converter Station - OCS	A compound containing electrical equipment required to stabilise and convert electricity generated by the wind turbines and transmitted by the export cables into a more suitable voltage for grid connection into Birkhill Wood Substation.
Onshore Development Area	The area in which all onshore infrastructure associated with the Project will be located, including any temporary works area required during construction and permanent land required for mitigation and enhancement areas, which extends landward of Mean Low Water Springs. There is an overlap with the Offshore Development Area in the intertidal zone.
Onshore Export Cable Corridor (ECC)	The area within which the onshore export cables will be located, extending from the landfall to the Onshore Converter Station zone and onwards to Birkhill Wood Substation.

Term	Definition
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.
Project Design Envelope	<p>A range of design parameters defined where appropriate to enable the identification and assessment of likely significant effects arising from a project's worst-case scenario.</p> <p>The Project Design Envelope incorporates flexibility and addresses uncertainty in the DCO application and will be further refined during the EIA process.</p>
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.
Scoping Opinion	<p>A written opinion issued by the Planning Inspectorate on behalf of the Secretary of State regarding the scope and level of detail of the information to be provided in the Applicant's Environmental Statement.</p> <p>The Scoping Opinion for the Project was adopted by the Secretary of State on 02 August 2024.</p>
Scoping Report	<p>A request by the Applicant made to the Planning Inspectorate for a Scoping Opinion on behalf of the Secretary of State.</p> <p>The Scoping Report for the Project was submitted to the Secretary of State on 24 June 2024.</p>
Source Protection Zone 1	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.
Source Protection Zone 2	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 3	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.

Term	Definition
Study Areas	A geographical area and / or temporal limit defined for each EIA topic to identify sensitive receptors and assess the relevant likely significant effects.
Temporary Construction Compounds	Areas set aside to facilitate the construction works for the onshore infrastructure, which include the landfall construction compound, main and intermediate construction compounds for onshore export cable works and OCS and ESBI construction compounds.
The Applicant	SSE Renewables and Equinor acting through 'Doggerbank Offshore Wind Farm Project 4 Projco Limited'.
The Project	Dogger Bank D Offshore Wind Farm Project, also referred to as DBD in this PEIR.
Trenching	Open cut method for cable or duct installation.
Trenchless Techniques	<p>Trenchless cable or duct installation methods used to bring offshore export cables ashore at landfall, facilitate crossing major onshore obstacles such as roads, railways and watercourses and where trenching may not be suitable.</p> <p>Trenchless techniques included in the Project Design Envelope include Horizontal Directional Drilling (HDD), auger boring, micro-tunnelling, pipe jacking / ramming and Direct Pipe.</p>

19 Geology and Ground Conditions

19.1 Introduction

1. This chapter of the Preliminary Environmental Information Report (PEIR) presents the preliminary results of the Environmental Impact Assessment (EIA) of the Dogger Bank D Offshore Wind Farm (hereafter ‘the Project’ or ‘DBD’) on geology and ground conditions.
2. **Chapter 4 Project Description** provides a description of the key infrastructure components which form part of the Project and the associated construction, operation and maintenance (O&M) and decommissioning activities.
3. The primary purpose of the PEIR is to support the statutory consultation activities required for a Development Consent Order (DCO) application under the Planning Act 2008. The information presented in this PEIR chapter is based on the baseline characterisation and assessment work undertaken to date. The feedback from the statutory consultation will be used to inform the final design where appropriate and presented in an Environmental Statement (ES), which will be submitted with the DCO application.
4. This PEIR chapter:
 - Describes the baseline environment relating to geology and ground conditions;
 - Presents an assessment of the likely significant effects on geology and ground conditions during the construction, O&M, and decommissioning phases of the Project;
 - Identifies any assumptions and limitations encountered in compiling the environmental information; and
 - Sets out proposed mitigation measures to avoid, prevent, reduce or, if possible, offset potential significant adverse environmental effects identified during the EIA process and, where relevant, monitoring measures or enhancement measures to create or enhance positive effects.
5. This chapter should be read in conjunction with the following related chapters. Inter-relationships are discussed further in **Section 19.9.1**:
 - **Chapter 20 Air Quality and Dust;**
 - **Chapter 21 Water Resources and Flood Risk;**
 - **Chapter 22 Soils and Land Use;**
 - **Chapter 23 Onshore Ecology and Ornithology;**

- **Chapter 24 Onshore Archaeology and Cultural Heritage;**
- **Chapter 28 Major Accidents and Disasters;** and
- **Chapter 31 Climate Change.**

6. Additional information to support the geology and ground conditions assessment includes:

- **Volume 2, Appendix 19.1 Consultation Responses for Geology and Ground Conditions;**
- **Volume 2, Appendix 19.2 Preliminary Risk Assessment;** and,
- **Volume 2, Appendix 19.3 Onshore Waste and Resources Technical Report.**

19.2 Policy and Legislation

19.2.1 National Policy Statements

7. Planning policy on energy Nationally Significant Infrastructure Projects (NSIP) is set out in the National Policy Statements (NPS). The following NPS is relevant to the geology and ground conditions assessment:
 - Overarching NPS for Energy (EN-1) (DESNZ, 2023a).
8. The geology and ground conditions chapter has been prepared with reference to specific requirements in the above NPS. The relevant parts of the NPS are summarised in **Table 19-1**, along with how and where they have been considered in this PEIR chapter.

CHAPTER 19 GEOLOGY AND GROUND CONDITIONS

Table 19-1 Summary of Relevant National Policy Statement Requirements for Geology and Ground Conditions

NPS Reference and Requirement	How and Where Considered in the PEIR
NPS for Energy (EN-1)	
<p>Paragraph 5.4.17:</p> <p>“Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance (including those outside of England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats.”</p>	<p>A review of geologically designated sites, including Local Geological Sites (LGS), within the Onshore Development Area has been undertaken as part of the preparation of this chapter (see Table 19-13 and Volume 2, Appendix 19.2 Preliminary Risk Assessment).</p> <p>Ecologically designated sites are also discussed in Table 19-13, with additional details presented in Volume 2, Appendix 19.2 Preliminary Risk Assessment. Further details on potential impacts to ecologically designated sites are discussed in Chapter 23 Onshore Ecology and Ornithology.</p>
<p>Paragraph 5.4.18:</p> <p>“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.”</p>	
<p>Paragraph 5.4.19:</p> <p>“The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.”</p>	<p>The baseline environment is summarised in Table 19-13. Potential impacts, and proposed mitigation measures, during the construction and O&M phases on geologically designated sites are set out in Sections 19.7.1 and 19.7.2 respectively. Potential impacts on ecologically designated sites such as Sites of Special Scientific Interest (SSSI) are discussed in Chapter 23 Onshore Ecology and Ornithology.</p>
<p>Paragraph 5.4.42:</p> <p>“As a general principle, and subject to the specific policies below, development should, in line with the mitigation hierarchy, aim to avoid significant harm to biodiversity and geological conservation interests, including through consideration of reasonable alternatives (as set out in Section 4.3 above). Where significant harm cannot be avoided, impacts should be mitigated and as a last resort, appropriate compensation measures should be sought.”</p>	<p>A review of geologically designated sites, including LGS, within the Onshore Development Area has been undertaken as part of the preparation of this chapter (see Table 19-13 and Volume 2, Appendix 19.2 Preliminary Risk Assessment).</p> <p>Potential impacts to these features, and mitigation measures, during the construction and O&M phases are discussed in Sections 19.7.1 and 19.7.2.</p> <p>Ecologically designated sites are also discussed in Table 19-13, with additional details presented in Volume 2, Appendix 19.2 Preliminary Risk Assessment. Further details on potential impacts to ecologically designated sites are discussed in Chapter 23 Onshore Ecology and Ornithology.</p>
<p>Paragraph 5.4.46:</p> <p>“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.”</p>	
<p>Paragraph 5.11.12:</p> <p>“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).”</p>	<p>The baseline environment in relation to agricultural land is discussed in Table 19-13. Potential impacts in relation to contamination that may occur during the construction and O&M phases are discussed in Sections 19.7.1 and 19.7.2. Impacts associated with potential loss of agricultural land and disruption to farming practices are discussed in Chapter 22 Soils and Land Use.</p>
<p>Paragraph 5.11.19:</p> <p>“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.”</p>	<p>Mineral Safeguarding Areas (MSA) are in Table 19-13. Potential impacts to these areas during the construction and O&M phases are discussed in Sections 19.7.1 and 19.7.2. Measures to mitigate the potential impacts during the construction and O&M phases are also discussed within these sections.</p>

19.2.2 Other Policy and Legislation

9. Other policy and legislation relevant to the geology and ground conditions assessment is summarised in the following sections.

19.2.2.1 National

19.2.2.1.1 Environmental Protection Act 1990 (Part 2A) Contaminated Land

10. The Environmental Protection Act 1990 makes provision for the improved control of pollution arising from certain industrial and other processes. Section 78A 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 caused, or there is significant possibility of such pollution being caused”.*

11. 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 prior to and following the construction of the Project and that the land cannot be determined as contaminated land under Part 2A of the act.

19.2.2.1.2 Water Resources Act 1991 (as amended by the Water Act 2003)

12. 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 ground conditions as it will assist in determining the sensitivity of controlled waters within the Onshore Development Area, particularly when assessing the effects during the construction and O&M phases.

19.2.2.1.3 Environment Act 1995

13. The act established the Environment Agency and gave it responsibility for environmental protection of controlled waters. This legislation is relevant to geology and ground conditions as it provides the principles to assess the sensitivity and potential effects of the construction and O&M phases of the Project. It will also aid in the identification of suitable mitigation measures to provide protection to the controlled waters present.

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

14. The regulations transpose for England 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 ground conditions as it will aid in the identification of suitable preventative measures and mitigation techniques for the construction and O&M phases of the Project.

19.2.2.1.5 Construction (Design and Management) Regulations 2015

15. 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 ground conditions as it ensures the safety of human receptors involved in the construction phase.

19.2.2.1.6 Environmental Permitting (England and Wales) Regulations 2016

16. The 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).

17. These regulations are relevant to geology and ground conditions as there may be the need to apply for environmental permits for activities such as discharging groundwater from dewatering activities during construction works.

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

18. 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 ground conditions as it will assist in determining the sensitivity of groundwater resources within the Onshore Development Area.

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

19. 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 ground conditions as it will assist in determining the sensitivity of water bodies within the Onshore Development Area. Water quality is assessed in **Chapter 21 Water Resources and Flood Risk**.
20. Following the UK's withdrawal from the European Union, the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 remain in force under the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

19.2.2.1.9 Environment Act 2021

21. The aim of this act is to improve air and water quality, protect wildlife and reduce waste. This act is relevant to geology and ground conditions due to its governance on both waste and groundwater quality.

19.2.2.1.10 Minerals Policy Statement 1: Planning and Minerals

22. This policy statement 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.

19.2.2.1.11 National Planning Policy Framework

23. The specific assessment requirements for geology and ground conditions, as detailed in the National Planning Policy Framework (NPPF) Guidance (Ministry of Housing, Communities and Local Government, 2024) are set out in **Table 19-2**.

Table 19-2 National Planning Policy Framework Guidance Relevant to Geology and Ground Conditions

NPPF Requirements	How and Where Considered in the PEIR
<p>NPPF 15-187:</p> <p>“Planning policies and decisions should contribute to and enhance the natural local environment by:</p> <ul style="list-style-type: none"> 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); recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland; maintaining the character of the undeveloped coast, while improving public access to it where appropriate; minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures and incorporating features which support priority or threatened species such as swifts, bats and hedgehogs; 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.” 	<p>In relation to geology and ground conditions, the baseline environment is discussed in Table 19-13, with further details provided in Volume 2, Appendix 19.2 Preliminary Risk Assessment.</p> <p>Potential impacts and mitigation measures aimed at minimising the potential impacts on identified receptors, including remediation, are set out in Sections 19.7.1 and 19.7.2.</p> <p>Potential impacts in relation to air, water, biodiversity and noise are discussed in:</p> <ul style="list-style-type: none"> Chapter 20 Air Quality and Dust; Chapter 21 Water Resources and Flood Risk; Chapter 22 Onshore Ecology and Ornithology; and Chapter 25 Noise and Vibration.
<p>NPPF 15-196:</p> <p>“Planning policies and decisions should ensure that:</p> <ul style="list-style-type: none"> 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.” 	<p>The existing ground conditions and potential sources of contamination are discussed in Table 19-13, with further details provided in Volume 2, Appendix 19.2 Preliminary Risk Assessment.</p> <p>Potential impacts and mitigation measures (including ground investigation works) are set out in Sections 19.7.1 and 19.7.2.</p>
<p>NPPF 15-197 and NPPF 15-198:</p> <p>“Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and / or landowner.</p> <p>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. In doing so they should:</p> <ul style="list-style-type: none"> mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and 	<p>The existing ground conditions and potential sources of contamination are discussed in Table 19-13, with further details provided in Volume 2, Appendix 19.2 Preliminary Risk Assessment.</p> <p>An assessment of the potential impacts associated with the construction and O&M of the Project is set out in Sections 19.7.1 and 19.7.2. Potential mitigation measures, such as targeted ground investigations in areas of concern, are also discussed within these sections.</p> <p>Potential interactions and inter-relationships between each of the identified impacts are discussed in Sections 19.8 and 19.9.</p>

NPPF Requirements	How and Where Considered in the PEIR
<ul style="list-style-type: none"> limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.” 	
<p>NPPF 15- 201:</p> <p>“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 should not be revisited through the permitting regimes operated by pollution control authorities”</p>	<p>The baseline environment is discussed in Table 19-13, with further details provided in Volume 2, Appendix 19.2 Preliminary Risk Assessment. Potential impacts, and mitigation measures to reduce the significance of effect are discussed in Sections 19.7.1 and 19.7.2.</p>
<p>NPPF 17- 222 and NPPF 17- 223:</p> <p>“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.</p> <p>Planning policies should:</p> <ul style="list-style-type: none"> provide for the extraction of mineral resources of local and national importance, but not identify new sites or extensions to existing sites for peat extraction; so far as practicable, take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously; safeguard mineral resources by defining MSA and Mineral Consultation Areas (MCA); 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); 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; safeguard existing, planned and potential sites for: the bulk transport, handling and processing of minerals; the manufacture of concrete and concrete products; and the handling, processing and distribution of substitute, recycled and secondary aggregate material; set out criteria or requirements to ensure that permitted and proposed operations do not have unacceptable adverse impacts on the natural and historic environment or human health, taking into account the cumulative effects of multiple impacts from individual sites and / or a number of sites in a locality; when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction; and ensure that worked land is reclaimed at the earliest opportunity, taking account of aviation safety, and that high quality restoration and aftercare of mineral sites takes place.” 	<p>MSA are discussed in Table 19-13, with further details provided in Volume 2, Appendix 19.2 Preliminary Risk Assessment. Potential impacts to these areas during the construction and O&M phases of the Project are discussed in Sections 19.7.1 and 19.7.2.</p> <p>Engagement with East Riding of Yorkshire Council (ERYC) will be undertaken to aid in identifying potential mitigation measures during the construction and O&M phases of the Project. Potential mitigation measures are discussed in Sections 19.7.1 and 19.7.2.</p>

19.2.2.2 Local

24. EN-1 states that the Planning Inspectorate will also consider Development Plan Documents or other documents in the Local Plan Framework to be relevant to its decision making. The local plans relevant to geology and ground conditions are summarised in the following sections.

19.2.2.2.1 East Riding Local Plan Update 2025-2039 Strategy Document Update (Adopted April 2025)

25. The East Riding Local Plan Update 2025 – 2039, adopted 2025 (ERYC, 2025) details the direction that ERYC wish to take their planning decisions, up to 2039. Key policies of relevance to the geology and ground conditions assessment are noted below.

26. Policy ENV4: International, National and Local Sites of importance for biodiversity states that:

“A. Proposals that are likely to have a significant adverse effect on statutory designated sites listed in Table 16 (alone or in combination) will be considered in the context of the statutory protection afforded to the site.”

“F. 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. This should consider adverse impacts such as recreational pressure, functionally linked land, air quality, and water quality.”

“G. 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 that there is a need for the development in that location and the benefit of the development outweighs the loss or harm.”

27. Policy ENV5: Enhancing biodiversity and geodiversity states that:

“A. Proposals will be supported where they:

- 1. Conserve, restore, enhance or recreate biodiversity and geological interests including the priority habitats and species, irreplicable habitats and Local Sites (identified in Table 16)*
- 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.”

28. Policy EC5: Supporting the renewable and low carbon energy sector states that

“A. Proposals for the development of the energy sector, excluding mineral extraction, but including all other types of development listed in Table 13, will be supported where any significant 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 13, and for onshore wind energy developments, the Wind Energy Landscape Sensitivity Strategy shown in Figure 11.*
- 3. The effects of development on:*
 - i. local amenity, including noise, air and water quality, traffic, vibration, dust, light (including reflection, glint, glare and shadow flicker), and visual impact;*
 - ii. biodiversity, geodiversity and nature, particularly in relation to designations, displacement, disturbance and collision and the impact of 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, best and most versatile agricultural land and soil resources.*

B. Where appropriate, proposals should include provision for decommissioning at the end of their operational life. Where decommissioning is necessary, the site should be restored, with minimal adverse impact on amenity, landscape and biodiversity, and opportunities taken for enhancement of these features”

29. Policy EC6: Protecting mineral resources states:

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

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.”*

30. Policy ENV6: Managing environmental hazards states that:

“A. Environmental hazards, such as flood risk, coastal change, nutrient deposition, aerial pollution, 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.”

“H. The risk of groundwater pollution will be managed by:

- 1. Avoiding development that has potential to increase the risk of groundwater pollution in source protection zones and where an alternative site outside an SPZ is not available, ensuring that appropriate mitigation measures are employed;*
- 2. Preventing inappropriate uses / activities in SPZ1 and SPZ2, unless adequate safeguards against possible contamination can be agreed;*
- 3. Supporting developments which will decrease the risk of pollution in SPZs by cleaning up contaminated land and incorporating pollution-prevention measures;*
- 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.”*

19.2.2.2.2 East Riding of Yorkshire Joint Minerals Local Plan (Adopted 2019)

31. 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.”

32. With regards to policies protecting Mineral Safeguarding Areas (MSA), the plan refers back to Policy EC6 in the adopted East Riding Local Plan. No additional safeguarding policies relating to non-mineral developments in safeguarded areas are included within the Joint Minerals Local Plan.

19.3 Consultation

33. Topic-specific consultation in relation to geology and ground conditions has been undertaken in line with the process set out in **Chapter 7 Consultation**. A Scoping Opinion from the Planning Inspectorate was received on 2nd August 2024, which has informed the scope of the assessment presented within this chapter (as outlined in **Section 19.4.2**).

34. Feedback received through the ongoing Evidence Plan Process (EPP) in Expert Topic Group (ETG) meetings and wider technical consultation meetings with relevant stakeholders has also been considered in the preparation of this chapter. Details of technical consultation undertaken to date on geology and ground conditions are provided in **Table 19-3**.

Table 19-3 Technical Consultation Undertaken to Date on Geology and Ground Conditions

Meeting	Stakeholder(s)	Date(s) of Meeting / Frequency	Purpose of Meeting
ETG Meetings			
ETG10 (Water Resources, Flood Risk and Geology and Ground Conditions) Meeting 02	Environment Agency Beverley and North Holderness Internal Drainage Board (IDB) ERYC	24 th September 2024	To set out the approach to the assessment methodology and baseline characterisation and to summarise responses made in the Scoping Opinion.

35. **Volume 2, Appendix 19.1 Consultation Responses for Geology and Ground Conditions** summarises how consultation responses received to date are addressed in this chapter.
36. This chapter will be updated based on refinements made to the Project Design Envelope and to consider, where appropriate, stakeholder feedback on the PEIR. The updated chapter will form part of the Environmental Statement to be submitted with the DCO Application.

19.4 Basis of the Assessment

37. The following sections establish the basis of the assessment of likely significant effects, which is defined by the Study Area, assessment scope, realistic worst-case scenarios and development scenarios.
38. This section should be read in conjunction with **Volume 2, Appendix 1.2 Guide to PEIR**, **Volume 2, Appendix 6.2 Impacts Register** and **Volume 2, Appendix 6.3 Commitments Register**, which will be submitted alongside the PEIR.

19.4.1 Study Area

39. The Geology and Ground Conditions 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 **Volume 2, Appendix 19.2 Preliminary Risk Assessment**.
40. The Geology and Ground Conditions Study Area includes a 250m buffer around the Onshore Development Area as illustrated on **Figure 19-1**. The buffer zone around the Onshore Development Area is extended to 1km for assessing the presence of Control of Major Accident Hazard (COMAH) sites and groundwater abstraction wells. This is due to the higher risk posed by COMAH sites and the sensitivity of groundwater abstraction wells.
41. The Geology and Ground Conditions Study Area was agreed with stakeholders at the second meeting of ETG10 held on the 24th September 2024. Further details are provided in **Volume 2, Appendix 19.2 Preliminary Risk Assessment**.

19.4.2 Scope of the Assessment

42. No impacts have been scoped out of the geology and ground conditions assessment. All impacts have been scoped into the assessment, as outlined in **Table 19-4** and discussed further in **Section 19.7**.

43. The impacts scoped into the geology and ground conditions assessment are also summarised in **Volume 2, Appendix 6.2 Impacts Register**. A description of how the Impacts Register should be used alongside the PEIR chapter is provided in **Volume 2, Appendix 1.2 Guide to PEIR** and **Chapter 6 Environmental Impact Assessment Methodology**.

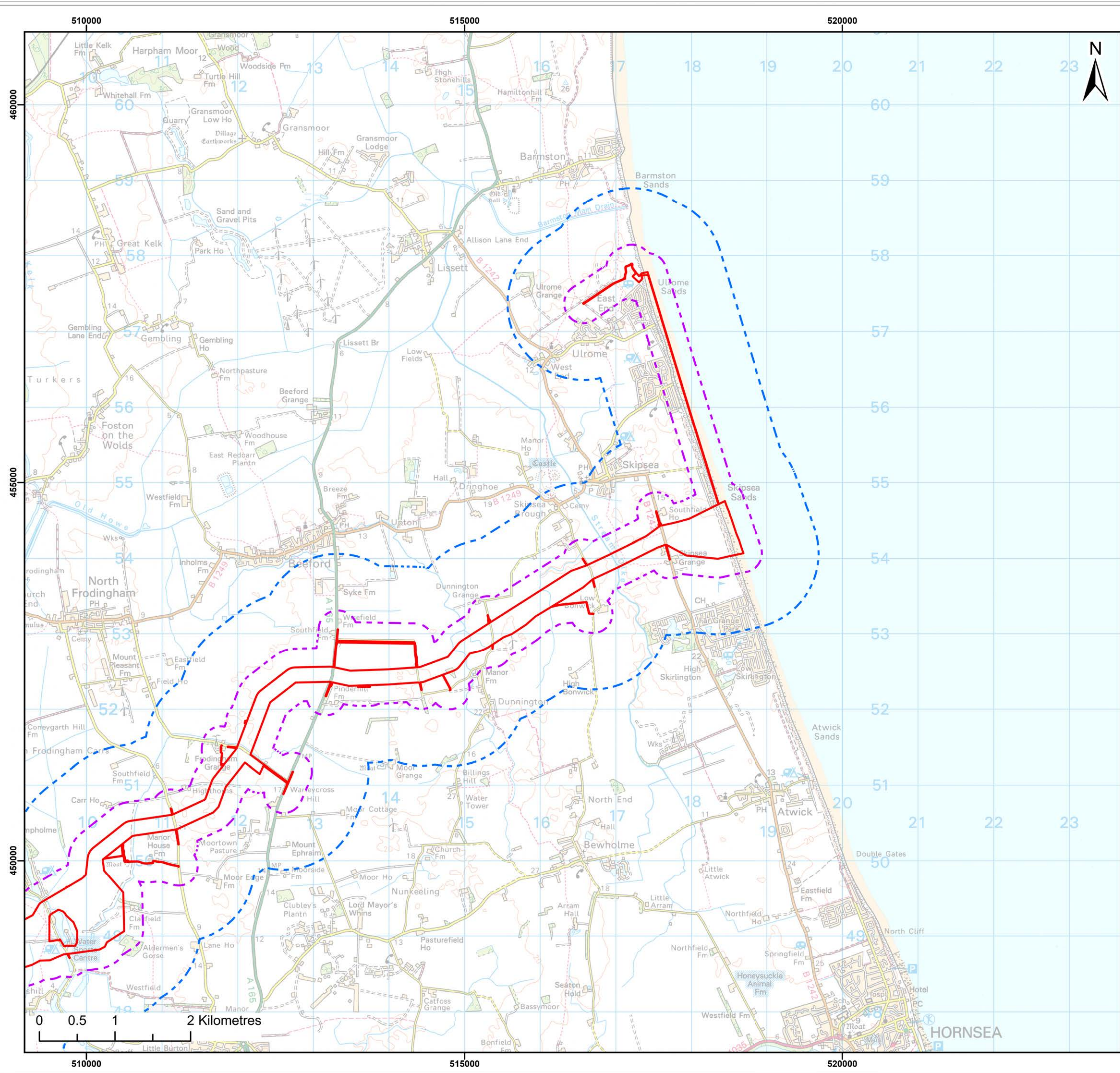
Table 19-4 Geology and Ground Conditions – Impacts Scoped into the Assessment

Impact ID	Impact and Project Activity	Rationale
Construction		
GGC-C-01	Impacts to human health from on-site and off-site contamination– construction activities with potential to mobilise pre-existing ground contaminants where present	Construction works have the potential to either generate or mobilise soil and groundwater contamination and create pathways for them to interact with human health receptors.
GGC-C-02	Impacts on groundwater quality and groundwater resources – construction activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources, such as trenchless crossings and piling	Construction works have the potential to either generate or mobilise soil and groundwater contamination and create pathways for them to interact with human health receptors.
GGC-C-03	Impacts on surface water quality and associated ecological habitats from contamination – construction activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution	Construction works have the potential to either generate or mobilise soil and groundwater contamination and create pathways for them to interact with surface water and ecological habitat receptors.
GGC-C-04	Impacts to designated geological sites – ground breaking activities that directly overlap designated geological sites, such as trenching, excavation, piling	Construction works have the potential to damage designated geological features or cause their destruction.
GGC-C-05	Sterilisation of future mineral resources - ground breaking activities that directly overlap mineral resources, such as trenching, excavation, piling	Construction works have the potential to damage or sterilise mineral resources.
GGC-C-06	Impacts to the built environment – construction activities with potential to mobilise pre-existing ground contaminants where present, such as trenching,	Construction works have the potential to damage existing buildings and utilities.

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Impact ID	Impact and Project Activity	Rationale
	excavation, piling and movement and stockpiling of soil	
GGC-C-07	Impacts to agricultural land – construction, maintenance and decommissioning activities with potential to mobilise pre-existing ground contaminants where present, such as trenching, excavation, piling and movement and stockpiling of soil	Construction works have the potential to destroy or lesson the quality of agricultural land.
Operation and Maintenance		
GGC-O-01	Impacts to human health from on-site and off-site contamination –O&M activities with potential to mobilise pre-existing ground contaminants where present	O&M works have the potential to either generate or mobilise soil and groundwater contamination and create pathways for them to interact with human health receptors.
GGC-O-02	Impacts on groundwater quality and groundwater resources – O&M activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources	O&M works have the potential to either generate or mobilise soil and groundwater contamination and create pathways for them to interact with human health receptors.
GGC-O-03	Impacts on surface water quality and associated ecological habitats from contamination – O&M activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution	O&M works have the potential to either generate or mobilise soil and groundwater contamination and create pathways for them to interact with surface water and ecological habitat receptors.
GGC-O-04	Impacts to designated geological sites – ground breaking activities and presence of permanent infrastructure that directly overlap designated geological sites	O&M works and presence of permanent infrastructure have the potential to damage designated geological features or cause their destruction.
GGC-O-05	Sterilisation of future mineral resources - ground breaking activities and presence of permanent infrastructure that directly overlap mineral resources	O&M works and presence of permanent infrastructure have the potential to damage or sterilise mineral resources.

Impact ID	Impact and Project Activity	Rationale
GGC-O-06	Impacts to the built environment – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure	O&M works and presence of permanent infrastructure have the potential to damage existing buildings and utilities.
GGC-O-07	Impacts to agricultural land – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure	O&M works and presence of permanent infrastructure have the potential to destroy or lesson the quality of agricultural land.
Decommissioning		
GGC-D-01	Impacts to human health from on-site and off-site contamination – decommissioning activities not yet defined	Decommissioning impacts are scoped in; however, details of onshore decommissioning activities are not known at this stage. As discussed in Section 19.7.3 , decommissioning impacts will be assessed in detail through the Onshore Decommissioning Plan (see Table 19-5 , Commitment ID CO56) where relevant, which will be developed prior to the commencement of onshore decommissioning works. In this assessment, it is assumed that most decommissioning activities would be the reverse of their construction counterparts, and that their impacts would be of similar nature to, and no worse than, those identified during the construction phase.
GGC-D-02	Impacts on groundwater quality and groundwater resources – decommissioning activities not yet defined	
GGC-D-03	Impacts on surface water quality and associated ecological habitats from contamination – decommissioning activities not yet defined	
GGC-D-04	Impacts to designated geological sites – decommissioning activities not yet defined	
GGC-D-05	Sterilisation of future mineral resources – decommissioning activities not yet defined	
GGC-D-06	Impacts to the built environment – decommissioning activities not yet defined	
GGC-D-07	Impacts to agricultural land – decommissioning activities not yet defined	



Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer
- Onshore Development Area 1km Buffer

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Project:

Dogger Bank D
Offshore Wind Farm

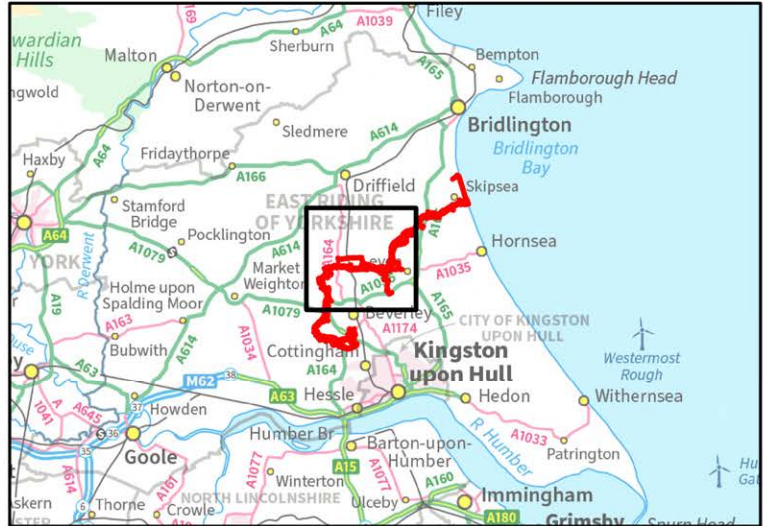
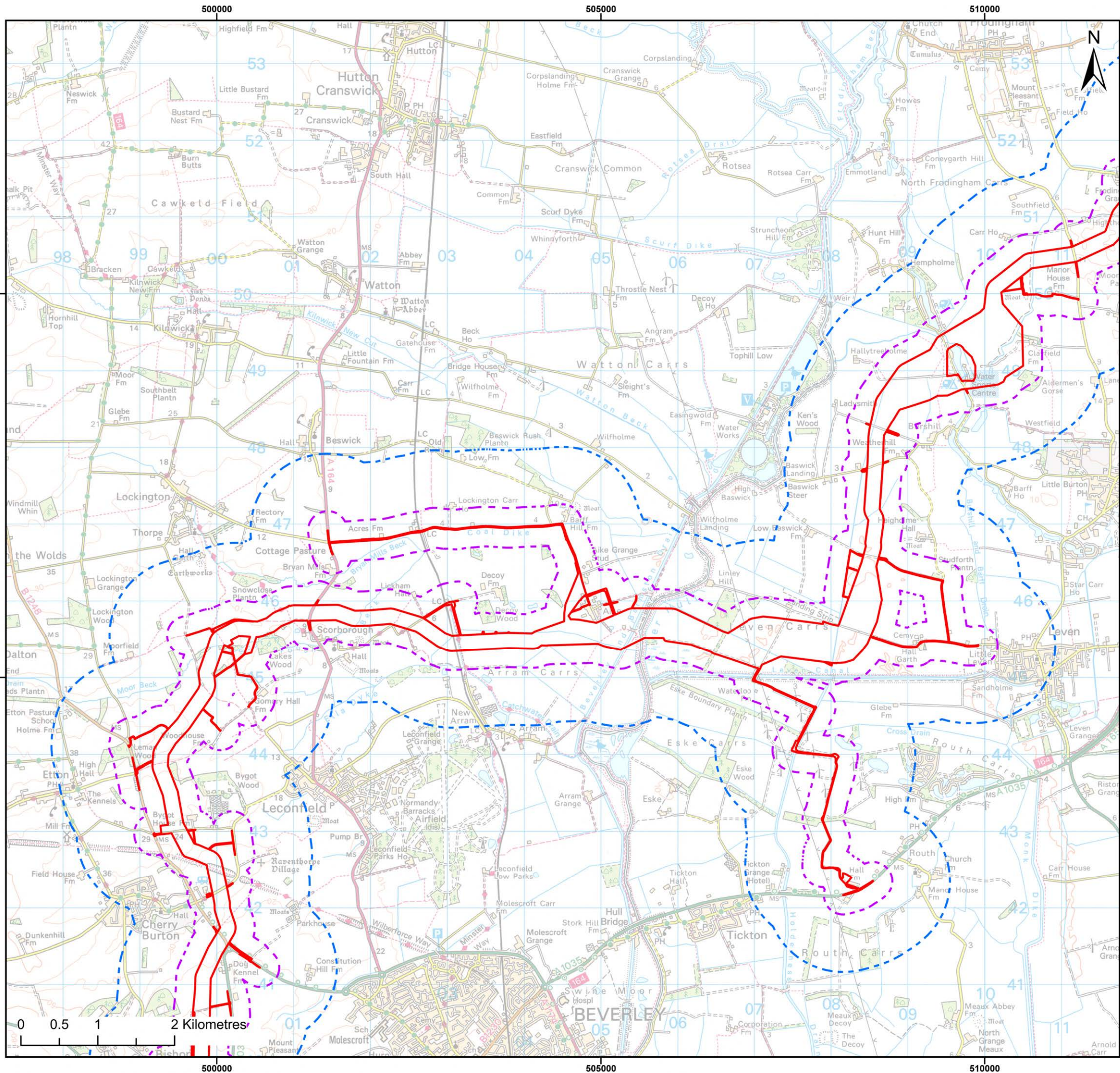
DOGGER BANK
WIND FARM

Title:

Geology and Ground Conditions Study Area
- Sheet 1 of 3

Figure:	19-1	Drawing No:	PC6250-RHD-XX-OF-DR-GS-0378			
Revision:	Date:	Drawn:	Checked:	Size:	Scale:	
02	20/03/2025	JH	AB	A3	1:50,000	
01	10/01/2025	MW	AB	A3	1:50,000	

Co-ordinate system: British National Grid



- Legend:
- Onshore Development Area
 - Onshore Development Area 250m Buffer
 - Onshore Development Area 1km Buffer

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Project:

Dogger Bank D
Offshore Wind Farm

**DOGGER BANK
WIND FARM**

Title:

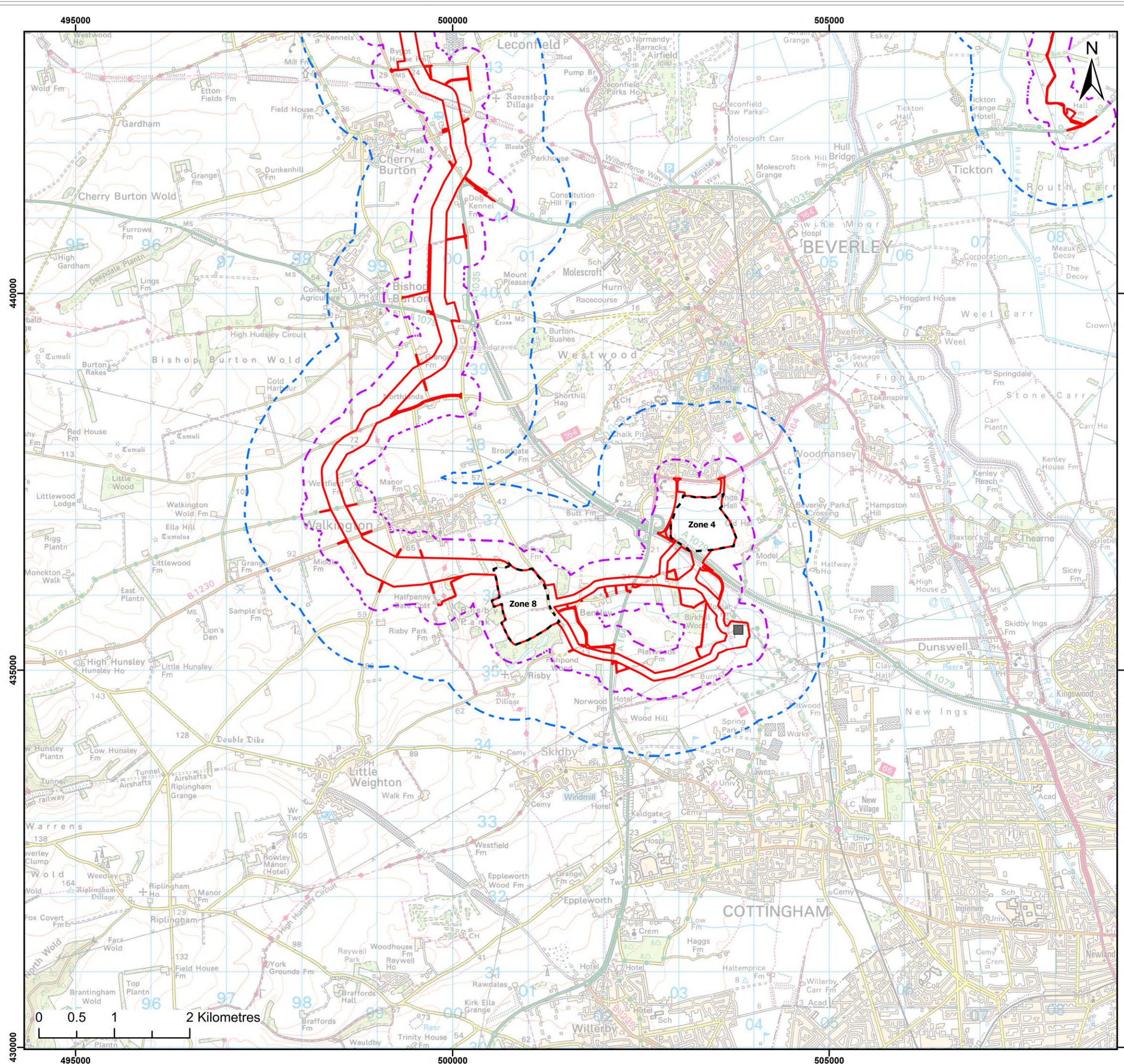
Geology and Ground Conditions Study Area
- Sheet 2 of 3

Figure: 19-1 Drawing No: PC6250-RHD-XX-OF-DR-GS-0378

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
02	20/03/2025	JH	AB	A3	1:50,000
01	10/01/2025	MW	AB	A3	1:50,000

Co-ordinate system: British National Grid





Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer
- Onshore Development Area 1km Buffer
- Onshore Converter Station Zone Options
- Indicative Birkhill Wood Substation Location

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Project:

Dogger Bank D
Offshore Wind Farm

**DOGGER BANK
WIND FARM**

Title:

Geology and Ground Conditions Study Area
- Sheet 3 of 3

Figure:	19-1	Drawing No:	PC6250-RHD-XX-OF-DR-GS-0378			
Revision:	Date:	Drawn:	Checked:	Size:	Scale:	
02	20/03/2025	JH	AB	A3	1:50,000	
01	10/01/2025	MW	AB	A3	1:50,000	

Co-ordinate system: British National Grid

19.4.3 Embedded Mitigation Measures

44. The Project has made several steps to avoid, prevent, reduce or, if possible, offset potential adverse environmental effects through mitigation measures embedded into the evolution of the Project Design Envelope. These embedded mitigation measures include actions that will be undertaken to meet other existing legislative requirements and those considered to be standard or best practice to manage commonly occurring environmental effects.
45. The assessment of likely significant effects has therefore been undertaken on the assumption that these measures are adopted during the construction, O&M and decommissioning phases. **Table 19-5** identifies proposed embedded mitigation measures that are relevant to the geology and ground conditions assessment.
46. Full details of all commitments made by the Project are provided in **Volume 2, Appendix 6.3 Commitments Register**. A description of how the Commitments Register should be used alongside the PEIR chapter is provided in **Volume 2, Appendix 1.2 Guide to PEIR** and **Chapter 6 Environmental Impact Assessment Methodology**. In addition, a list of draft outline management plans which are submitted with the PEIR for consultation is provided in **Section 1.10** of **Chapter 1 Introduction**. These documents will be further refined and submitted along with the DCO application. See **Volume 2, Appendix 1.2 Guide to PEIR** for a list of all PEIR documents.
47. The Commitments Register is provided at PEIR stage to provide stakeholders with an early opportunity to review and comment on the proposed commitments. Proposed commitments may evolve during the pre-application phase as the EIA progresses and in response to refinements to the Project Design Envelope and stakeholder feedback. The final commitments will be confirmed in the Commitments Register submitted along with the DCO application.

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Table 19-5 Embedded Mitigation Measures Relevant to Geology and Ground Conditions

Commitment ID	Proposed Embedded Mitigation	How the Embedded Mitigation will be Secured	Relevance to Geology and Ground Conditions Assessment	Relevance to Impact ID
CO23	At the landfall, trenchless installation techniques will be implemented and exit pits will be located beyond Mean Low Water Springs (MLWS). Installation will be at a suitable depth below the base of the cliff to avoid potential impacts to the Withow Gap Site of Special Scientific Interest (SSSI).	DCO Works DCO Requirement - Code of Construction Practice	Limits the potential impacts of landfall construction activities on protected geological features.	GGC-C-04
CO32	Installation of cable ducts at crossings of Environment Agency Main Rivers will be undertaken using trenchless installation techniques. Installation of cable ducts at crossings of Beverley and North Holderness Internal Drainage Board (IDB) maintained drains will be undertaken using trenchless installation techniques unless agreed otherwise.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to surface waters as a result of construction activities and subsequent O&M.	GGC-C-03 GGC-O-03
CO33	At trenchless crossings of Environment Agency Main Rivers, crossing entry and exit points will be located at least 20m from the bank of the Main River or the nearest landward toe of any associated flood defence structure. At trenchless crossings of Internal Drainage Board maintained drains and where trenchless techniques are proposed for other ordinary watercourses, crossing entry and exit points will be located at least 9m from the bank of the drain or watercourse.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to surface waters as a result of construction activities and subsequent O&M.	GGC-C-03 GGC-O-03
CO35	A Watercourse Crossing Method Statement (WCMS) will be provided as part of the Code of Construction Practice (CoCP). The WCMS will be developed in accordance with the Outline CoCP and will include details of the crossing technique and construction methodology to be undertaken at each crossing and associated environmental mitigation measures. Where open cut trenching is proposed for ordinary watercourses, temporary measures to maintain the flow of water and mitigate adverse effects on the watercourse and flood risk will be implemented during construction. Where the Environment Agency's Main Rivers are to be crossed by temporary haul roads, bailey or similar clear span bridges will be used. For other watercourses, temporary culverts with an overlying haul road will be used where existing access is not available and where temporary bridges are not practicable. Temporary culverts will be adequately sized to avoid impounding flows (including appropriate climate change allowances), and the invert set below the bed level to allow bedload transport.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to surface waters as a result of construction activities.	GGC-C-03
CO36	Onshore export cables will be installed at a minimum depth of 2m (to the top of the duct / cable or otherwise) below the channel bed of watercourses, including the landward toe of any associated flood defences. The final depth at each watercourse crossing will be dependent on local geology and geomorphology risks and will take into consideration anticipated climate change-related changes in fluvial flows and erosion that may occur over time. Crossing-specific vertical clearance depth will be agreed with the relevant authorities through the Watercourse Crossing Method Statement (WCMS).	DCO Requirement - Code of Construction Practice	Limits the potential impacts to surface waters as a result of construction activities and subsequent O&M.	GGC-C-03 GGC-O-03
CO38	A Drilling Fluid Breakout Management Plan will be provided as part of the Code of Construction Practice (CoCP). The Drilling Fluid Breakout Management Plan will be developed in accordance with the Outline CoCP and will detail mitigation measures to reduce the risk of fluid breakouts during trenchless installation works and a response plan should a fluid breakout occur.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to groundwater and surface waters as a result of construction.	GGC-C-02 GGC-C-03

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Commitment ID	Proposed Embedded Mitigation	How the Embedded Mitigation will be Secured	Relevance to Geology and Ground Conditions Assessment	Relevance to Impact ID
CO39	A Code of Construction Practice (CoCP) will be provided in accordance with the Outline CoCP. The CoCP will enable effective planning, monitoring and management of onshore construction works to mitigate potential impacts on the environment and communities and ensure compliance with the latest relevant regulatory requirements and best practice.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to all geology and ground conditions receptors as a result of construction activities.	GGC-C-01 GGC-C-02 GGC-C-03 GGC-C-04 GGC-C-05 GGC-C-06 GGC-C-07
CO40	A Pollution Prevention Plan (PPP) will be provided as part of the Code of Construction Practice (CoCP). The PPP will incorporate the latest relevant Environment Agency best practice guidelines for pollution prevention and detail how ground and surface waters will be protected from construction-related pollution. The PPP will include appropriate control measures for the use and storage of any fuels, oils and other chemicals during construction works.	DCO Requirement - Code of Construction Practice		
CO41	To protect groundwater bodies, the depth of excavation works will be kept as shallow as possible in line with construction and operational requirements. The target burial depth of onshore export cables will be approximately 1.2m to the top of the installed cable ducts, except where trenchless installation techniques are used or where deeper burial depth would be required due to other restrictions such as interactions with surface and buried infrastructure and landowner requirements.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to groundwater as a result of construction activities and subsequent O&M.	GGC-C-02 GGC-O-02
CO42	A hydrogeological risk assessment, informed by ground investigations, will be undertaken at each trenchless crossing location, where earthworks / excavations are within 50m (or 250m dependent upon volume abstracted) of private potable groundwater abstractions and / or where construction works have potential to interact with Source Protection Zone (SPZ) 1 or 2 areas. A hydrogeological risk assessment will also be required for earthworks / excavations within influencing distance of abstractions whereby construction works may interrupt flow pathways due to activities such as dewatering. The hydrogeological risk assessment will be undertaken in accordance with the Environment Agency's Approach to Groundwater Protection.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to surface waters as a result of construction activities.	GGC-C-02 GGC-C-03
CO44	An Operational Drainage Strategy will be provided for permanent infrastructure in the Onshore Converter Station (OCS) zone in accordance with the Outline Operational Drainage Strategy. The Operational Drainage Strategy will include measures to ensure that existing land drainage is reinstated and / or maintained, discharge rates are limited and flows are attenuated to maintain greenfield run-off rates.	DCO Requirement - Operational Drainage Strategy	Limits the potential impacts to surface waters from the presence of infrastructure during O&M.	GGC-O-03
CO46	A Soil Management Plan (SMP) will be provided as part of the Code of Construction Practice (CoCP). The SMP will be developed in accordance with the Outline CoCP and will detail the soil stripping, excavation, storage, reinstatement, cropping and aftercare measures to safeguard soil resources and drainage during the construction works. The SMP will be informed by Agricultural Land Classification (ALC) and soil condition surveys which will be undertaken post-consent and prior to construction.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to agricultural land as a result of construction activities. Appropriate implementation during construction will also limit potential impacts during O&M activities.	GGC-C-07 GGC-O-07

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Commitment ID	Proposed Embedded Mitigation	How the Embedded Mitigation will be Secured	Relevance to Geology and Ground Conditions Assessment	Relevance to Impact ID
CO47	Made ground, topsoil and subsoil will be stored in separate stockpiles, and any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required). The stockpile area will be cordoned off, if required, with secure fencing to prevent any disturbance or contamination by other construction activities. The stockpiled material will be sealed to prevent water ingress and erosion / wash out of the material into the surrounding environment. Where the soil is to be stockpiled for more than six months, the surface of the stockpiles will be seeded with grass / clover mix or covered to minimise erosion. This will be done in accordance with the Soil Management Plan (SMP).	DCO Requirement - Code of Construction Practice		GGC-C-01 GGC-C-02 GGC-C-03
CO48	A Contaminated Land and Groundwater Scheme will be provided as part of the Code of Construction Practice (CoCP). The Contaminated Land and Groundwater Scheme will be developed in accordance with the Outline CoCP and will identify any areas of known or potential contamination and provide a protocol for the discovery of unexpected contamination. Where potentially unacceptable ground contamination risks to receptors are identified, targeted ground investigations and generic quantitative risk assessment will be undertaken to determine the presence, magnitude and extent of contaminants and to inform the development of appropriate mitigation measures. Where unacceptable risks are identified, the Contaminated Land and Groundwater Scheme will include a Remediation Strategy.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to all geology and ground conditions receptors as a result of construction activities.	GGC-C-04 GGC-C-05 GGC-C-06 GGC-C-07
CO49	Details of residual contamination risks identified during construction will be included in the Onshore Operation and Maintenance (O&M) Plan or similar. O&M workers required to undertake ground excavations during the O&M phase will be provided with the Onshore O&M Plan to allow them to determine the nature of ground conditions in each area and develop appropriate risk assessments and method statements. Appropriate pollution prevention measures and emergency response measures in the event of an uncontrolled release of hazardous materials and other pollutants will be included in the Onshore O&M Plan.	DCO Requirement - Onshore Operations and Maintenance Plan	Limits the potential impacts to all geology and ground conditions receptors as a result of O&M activities.	GGC-O-01 GGC-O-02 GGC-O-03 GGC-O-04 GGC-O-05 GGC-O-06 GGC-O-07
CO50	Health, safety and environmental risks will be identified and managed in accordance with the latest relevant regulatory requirements and best practice methods and construction activities will be informed by appropriate risk assessments and undertaken with appropriate personal protective equipment.	DCO Requirement - Code of Construction Practice DML Condition – Project Environmental Management Plan	Limits the potential impacts to workers health as a result of activities.	GGC-C-01
CO51	A Materials Management Plan (MMP) will be provided as part of the Code of Construction Practice (CoCP). The MMP will be developed in accordance with the Outline CoCP and will set out measures to ensure the sourcing, handling, re-use and disposal of soils (in particular and may be limited to Made Ground soils) are undertaken in a sustainable manner and in line with the latest relevant guidance.	DCO Requirement - Code of Construction Practice		GGC-C-01 GGC-C-02 GGC-C-03
CO53	In areas identified as potential areas of contamination in the Contaminated Land and Groundwater Scheme or encountered during the construction works, perched waters within Made Ground or groundwater from dewatering activities will be collected in a tank or lagoon prior to any treatment of discharge. The wastewater will 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 by the Environment Agency.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to all geology and ground conditions receptors as a result of construction activities.	GGC-C-04 GGC-C-05 GGC-C-06 GGC-C-07

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Commitment ID	Proposed Embedded Mitigation	How the Embedded Mitigation will be Secured	Relevance to Geology and Ground Conditions Assessment	Relevance to Impact ID
CO54	A piling risk assessment will be undertaken if piles are to be used for the construction of infrastructure within the Onshore Converter Station (OCS) zone and where piling is required for the entry pits of trenchless installation works. The piling risk assessment will be undertaken in line with the Environment Agency's Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (2001) or latest relevant guidance.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to human health, controlled waters and built environment receptors as a result of construction. Appropriate implementation during construction will also limit potential impacts during O&M activities.	GGC-C-01 GGC-O-01 GGC-C-02 GGC-O-02 GGC-C-03 GGC-O-03 GGC-C-06 GGC-O-06
CO56	An Onshore Decommissioning Plan will be developed prior to commencement of onshore decommissioning works based on the relevant available guidance and legislative requirements. The scope and methodology of onshore decommissioning works and appropriate mitigation measures will be detailed in the plan.	DCO Requirement - Onshore Decommissioning Plan	Limits the potential impacts to all identified geology and ground conditions receptors as a result of decommissioning activities.	GGC-D-01 GGC-D-02 GGC-D-03 GGC-D-04 GGC-D-05 GGC-D-06 GGC-D-07
CO94	An appropriate Project Emergency Response Plan or similar will be provided as part of the Project Environmental Management Plan (PEMP) and Emergency Response and Contingency Plan (ERCoP) for offshore construction works and the Code of Construction Practice (CoCP) for onshore construction works. The PEMP and CoCP will be developed in accordance with the Outline PEMP and Outline CoCP respectively. The Project Emergency Response Plan will detail protocols that would be undertaken in the event of an emergency, including occupational health and safety and environmental incidents, and set out clear roles and responsibilities, emergency contacts and reporting and escalation pathways. Protocols for extreme weather events will also be included.	DCO Requirement - Code of Construction Practice DML Condition - Project Environmental Management Plan	Limits the potential impacts to all geology and ground conditions receptors as a result of construction activities.	GGC-C-01 GGC-C-02 GGC-C-03 GGC-C-04 GGC-C-05 GGC-C-06 GGC-C-07
CO97	Regular and periodic inspections and maintenance of all infrastructure will be undertaken over the operational lifetime of the Project to identify and remediate any damage and deterioration and where necessary to maintain good working condition. Monitoring of site-specific weather metocean conditions, recent extreme weather events and up-to-date climate change projection data will be undertaken to provide a dynamic risk assessment of climate change impacts and inform operation and maintenance (O&M) planning.	DML Condition – Offshore Operations and Maintenance Plan DCO Requirement– Onshore Operations and Maintenance Plan	Limits the potential impacts to all geology and ground conditions receptors as a result of O&M activities.	GGC-O-01 GGC-O-02 GGC-O-03 GGC-O-04 GGC-O-05 GGC-O-06 GGC-O-07

Commitment ID	Proposed Embedded Mitigation	How the Embedded Mitigation will be Secured	Relevance to Geology and Ground Conditions Assessment	Relevance to Impact ID
CO106	Where construction works overlap with Mineral Safeguarding Areas (for chalk or sand and gravel), consultation will be undertaken with East Riding of Yorkshire Council (ERYC) prior to the commencement of the relevant stage of construction works. If required, a Mineral Resource Assessment supported by targeted ground investigations will be undertaken to determine the likely quantity, quality and accessibility of the mineral resource and the amount that may be sterilised by the construction works and inform appropriate mitigation measures.	DCO Requirement - Code of Construction Practice	Limits the potential impacts to mineral resources as a result of construction activities and subsequent O&M.	GGC-C-05 GGC-O-05

48. A draft version of the **Outline Code of Construction Practice** (CoCP) (document reference 8.9) is provided with the PEIR for consultation, which will be updated post-PEIR and submitted with the DCO application. The Outline CoCP will detail measures relevant to geology and ground conditions that will be secured in the plan. Indicative embedded mitigation measures which are included in the Outline CoCP are set out in **Table 19-6**.

Table 19-6 Indicative Embedded Mitigation Measures Included in the Outline Code of Construction Practice

Outline CoCP: Embedded Mitigation Measures for Geology and Ground Conditions

Contaminated Land and Groundwater Scheme (part of CoCP developed post-consent)

A Contaminated Land and Groundwater Scheme for the specific stage of construction works will be included in the CoCP. The scheme will be developed in line with the Environment Agency’s Land Contamination: Risk Management Framework (2021) or the latest available guidance, which sets out the framework for assessing and managing risks from contaminated land.

The Contaminated Land and Groundwater Scheme will include an investigation and assessment report prepared by a suitably qualified geoenvironmental expert to identify any areas of known or potential contamination within the specific works area, and should an unacceptable risk be identified, a Remediation Strategy will be provided to render the land fit for its intended purpose, including long-term measures to manage any residual contaminants on site. The scheme will also include considerations of the potential creation of a contaminant linkage from the works area to an off-site location which was not previously at risk.

Areas of known or potential contamination should be avoided where possible. Where these areas must undergo excavation, targeted ground investigations and a generic quantitative risk assessment must be undertaken prior to the commencement of the relevant stage of construction works, and the findings will inform the site-specific measures in the Contaminated Land and Groundwater Scheme.

Potential management measures to avoid and minimise risks from contaminated land during construction include but are not limited to the following:

- Provision of appropriate PPE (e.g. nitrile gloves or another suitable specification, protective overalls, face masks and safety goggles) and welfare facilities for construction staff designed to account for potential presence of contamination (e.g. cleaning facilities for washing or disposal of contaminated PPE, supply of new PPE);
- Collection of soil, soil leachate, groundwater and / or surface water samples as required by a suitably qualified geoenvironmental engineer / consultant for laboratory analysis to inform the risk assessment, and if required, Remediation Strategy;
- Excavated Made Ground, topsoil and subsoil will be stored separately and cordoned off with secure fencing to prevent disturbance or contamination by other construction activities. Any suspected or confirmed contaminated soils will be stored separately and appropriately labelled and covered to prevent creation and inhalation of wind-blown debris;
- Site monitoring for visual and / or olfactory evidence of contamination as required;
- Ground gas monitoring may be required as part of targeted ground investigations for areas identified as potentially containing ground gas / vapour generating materials; and
- An emergency protocol for incidents involving exposure to contaminated soils by construction staff will be included in the Project Emergency Response Plan.

Outline CoCP: Embedded Mitigation Measures for Geology and Ground Conditions

In the event that unexpected contamination is encountered during construction, the following measures will be included in the Contaminated Land and Groundwater Scheme and implemented by the Principal Contractor(s) as appropriate:

- Where visual and / or olfactory evidence of contamination (e.g. significant source of ground gas / vapour generating material) is encountered during construction, works will cease and be reported to the Principal Contractor(s). The area of suspected contamination will be contained and made as safe as reasonably possible, pending an investigation by a suitably qualified geoenvironmental expert;
- The locations of the suspected contamination will be annotated on site drawings and photographed;
- Soil, soil leachate, groundwater and / or surface water samples may be required to be collected by a suitably qualified geoenvironmental expert for laboratory analysis to verify the contamination and determine whether and what actions would be required prior to the recommencement of works;
- Re-assessment of the suitability of PPE and welfare facilities provided on site;
- Construction staff will be trained to identify potential contamination (e.g. asbestos awareness) and the protocol for the discovery of unexpected contamination during construction will form part of the site induction; and
- Consultation with the relevant local authorities (e.g. ERYC and Environment Agency) will be undertaken where required to agree plans for further site investigations and remediation.

In addition, the Contaminated Land and Groundwater Scheme will include site-specific mitigation and monitoring measures to protect groundwater resources, which will be informed by hydrogeological and piling risk assessments (where required) undertaken in advance of the commencement of the relevant stage of construction works. Groundwater monitoring wells may be required as part of targeted ground investigations to establish the groundwater regime and identify the presence of on-site / off-site contamination sources.

Hydrogeological Risk Assessment (part of CoCP developed post-consent)

A hydrogeological risk assessment, informed by ground investigations, will be undertaken at each trenchless crossing location, where earthworks / excavations are within 50m (or 250m dependent upon volume abstracted) of private potable groundwater abstractions and / or where construction works have potential to interact with Source Protection Zone (SPZ) 1 or 2 areas. A hydrogeological risk assessment will also be required for earthworks / excavations within influencing distance of abstractions whereby construction works may interrupt flow pathways due to activities such as dewatering. The hydrogeological risk assessment will be undertaken in accordance with the Environment Agency’s Approach to Groundwater Protection Framework (2018) or the latest available guidance.

Piling Risk Assessment (part of CoCP developed post-consent)

A piling risk assessment, informed by ground investigations, will be undertaken if piles are to be used during the construction of foundations for the OCS and ESBI and where piles are required for the construction of entry pits for trenchless installation works. The piling risk assessment will be undertaken in accordance with the Environment Agency’s Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (2001) or the latest available guidance.

Outline CoCP: Embedded Mitigation Measures for Geology and Ground Conditions

Mineral Resource Assessment (MRA) (part of CoCP developed post-consent)

Where construction works overlap with Mineral Safeguarding Areas (for chalk or sand and gravel) and areas of search and preferred areas in the Joint Minerals Local Plan (ERYC and Hull City Council, 2023), the following measures may be required to be included in the CoCP:

- Targeted ground investigations and a Mineral Resource Assessment (MRA) undertaken prior to the commencement of the relevant stage of construction works to determine the likely quantity, quality and accessibility of the mineral resource and the amount that may be sterilised by the construction works;
- If practicable, pre-construction extraction and storage of mineral resources to prevent sterilisation risks; and
- Mineral Infrastructure Impact Assessment (MIIA) undertaken prior to the commencement of the relevant stage of construction works to identify and manage potential impacts on existing mineral infrastructure.

Materials Management Plan (MMP) (part of CoCP developed post-consent)

An MMP for the specific stage of construction works will be included in the CoCP. The MMP will be developed in accordance with the Contaminated Land: Application in Real Environments (CL:AIRE) Definition of Waste Code of Practice (2011) or the latest available guidance.

The MMP will provide measures which seek to maximise the reuse of site-won materials during construction where the materials are deemed to be suitable and therefore minimise the volume of materials classified as waste for off-site disposal. The MMP will contain the following information:

- Roles and responsibilities for the implementation of the MMP;
- Estimated volumes and types of site-won materials arising from the works and their estimated reuse / disposal routes;
- Criteria against which site-won / imported materials will be assessed to determine their suitability for reuse;
- Record keeping measures to provide an audit trail of the movement of site-won / imported materials from the point of origin (e.g. excavation, material import) through to their final destination; and
- Details of how the MMP will be verified by a Qualified Person registered with CL:AIRE.

Pollution Prevention Plan (PPP) (part of CoCP developed post-consent)

A PPP for the specific stage of construction works will be included in the CoCP. The PPP will be developed in accordance with the Environment Agency’s Pollution Prevention Guidance (PPG) notes (including PPG01, PPG05, PPG06, PPG08, PPG21, PPG22) (although these have been revoked in England, they still provide a useful guide for best practice measures), CIRIA’s C532 Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors (2001), Defra’s Pollution Prevention for Businesses (2016), CIRIA’s C648 Control of Water Pollution from Linear Construction Projects (2006) and other latest available guidance.

The PPP will include the following measures to minimise the risk of on-site pollution incidents on ground and surface waters during construction. The PPP should be implemented in conjunction with the pollution incident reporting and containment measures in the Project Emergency Response Plan:

Outline CoCP: Embedded Mitigation Measures for Geology and Ground Conditions

- Concrete and cement mixing and washing areas will be located at least 10m away from the nearest watercourse. These areas will incorporate settlement and recirculation systems to allow water to be re-used. All washing out of equipment will take place in a contained area, and the water collected for disposal off-site;
- Storing all fuels, oils, lubricants and other chemicals in impermeable bunds with capacity of 110% of the capacity if the largest storage vessel located within the bund or 25% of the total capacity of the tanks in the bund (whichever is greatest), with any damaged containers being removed from site;
- Siting of storage bunds within the working area will take into consideration site security, location of sensitive receptors such as boreholes, wells, drains and watercourses and potential pollution pathways and flood risk;
- The walls for the storage bunds will be of sufficient height and structural soundness to withstand flood water ingress;
- Storage bunds will be locked and made secure when not in use;
- Refuelling will take place in a dedicated impermeable area, using a bunded bowser, located at least 10m away from the nearest water body;
- Biodegradable oils are to be used where practicable;
- Ensuring that spill kits are available on site at all times as well as sandbags and stop logs for deployment on the outlets from the site drainage system in case of emergency spillages;
- Potential contaminants will be stored under cover to prevent rainwater carrying pollutants away;
- Temporary construction compounds will comprise hardstanding areas of permeable material, such as gravel aggregates, matting / timber, or similar, underlain by geotextile or another suitable material to a minimum of 50% of the exposed area;
- Potential contaminants will be stored in a safe place away from vehicles to prevent collisions;
- Fuels, oils, lubricants and other chemicals will be clearly labelled, and the site should retain an up-to-date Control of Substances Hazardous to Health (COSHH) inventory;
- All reasonable steps will be undertaken to ensure that mud, silty water and other loose sediments do not enter the local road network and surface water drains. Should these materials encroach onto the local road network, steps will be undertaken to ensure its clean-up;
- Wheel washing facilities will be cleaned frequently;
- Plant and equipment not in use will be placed away from watercourses and surface water drains with suitable interceptor drip tray protection or plant nappies utilised;
- Activities involving the handling of large quantities of hazardous materials (e.g. deliveries and refuelling activities) will be undertaken by designated and trained construction staff;
- Measures to intercept sediment run-off at source in the drainage system using suitable filters will be implemented to remove sediment from water discharged to the surface drainage network;
- Dewatering from cable trenches and excavations and surface water run-offs will be collected in lagoons / settlement tanks to allow suspended solids to settle before discharge;
- Storage bunds and drainage systems will be inspected regularly (e.g. weekly) for signs of spillage, leaks and damage and silt depositions;

Outline CoCP: Embedded Mitigation Measures for Geology and Ground Conditions

- Inspection of all construction plant and equipment for fuel leaks to be undertaken before being mobilised to the working area;
 - Buffer strips of vegetation adjacent to water bodies will be retained where practicable to intercept any contaminated run-off;
 - The soil stockpiles will be set back at least 10m from watercourses; and
 - Geotextile silt fencing will be used, where required, at the toe of stockpile slopes, to reduce the movement of silt – this should be installed before soil stripping has begun and vehicles start tracking over the site.
-

19.4.4 Realistic Worst-Case Scenarios

49. To provide a precautionary, but robust, assessment at this stage of the Project's development process, a realistic worst-case scenario has been defined for each impact scoped into the assessment (as outlined in **Section 19.4.2**). The realistic worst-case scenarios are derived from the range of parameters included in the Project Design Envelope. They ensure that the assessment of likely significant effects is based on the maximum potential impact on the environment. Should an alternative development scenario be taken forward in the final design of the Project, the resulting effects would not be greater in effect significance. Further details on the Project Design Envelope are provided in **Chapter 6 Environmental Impact Assessment Methodology**.
50. The realistic worst-case scenarios used to assess impacts on geology and ground conditions are defined in **Table 19-7**. Following the PEIR publication, further design refinements will be made based on ongoing engineering studies and stakeholder feedback. Therefore, realistic worst-case scenarios presented in the PEIR may be updated in the ES. The Project Design Envelope will be refined where possible to retain design flexibility only where it is needed.

19.4.5 Development Scenarios

51. Consideration is also given to the different development scenarios with respect to the Onshore Converter Station (OCS) zones. At this stage, two OCS zone options remain within the Project Design Envelope (see **Chapter 4 Project Description** for further details) noting that only one option will be developed. The two development scenarios are:
- Infrastructure located in OCS Zone 4; or
 - Infrastructure located in OCS Zone 8.

52. With respect to the geology and ground conditions assessment, it is noted that the assessment of likely significant effects is not materially affected by the two development scenarios, as the same broad receptors, realistic worst-case scenarios and potential effects are applicable to both OCS zone options. Therefore, the assessment outcomes presented in **Section 19.7** remain the same for both development scenarios.

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Table 19-7 Realistic Worst-Case Scenarios for Impacts on Geology and Ground Conditions

Impact ID	Impact and Project Activity	Realistic Worst-Case Scenario	Rationale
Construction			
GGC-C-01	Impacts to human health from on-site and off-site contamination– construction activities with potential to mobilise pre-existing ground contaminants where present	Landfall <ul style="list-style-type: none"> Maximum number of Transition Joint Bay (TJB) at landfall: 1 Maximum number of underground link box at landfall: 1 Maximum TJB and underground link box burial depth: 3m Maximum number of landfall cable ducts: 3 (including 1 spare) Indicative temporary landfall construction compound area: 12,500m² (including construction footprint of TJB and underground link box) Maximum number of landfall construction compound: 1 Maximum horizontal length of trenchless installation: 2,000m Indicative haul road width at landfall: 7m Anticipated duration of landfall construction works: approximately three years (including one year of trenchless installation works) Onshore ECC <ul style="list-style-type: none"> Maximum length of High Voltage Direct Current (HVDC) export cable corridor: 50km Maximum length of High Voltage Alternating Current (HVAC) export cable corridor: 5km Maximum number of trenches of HVDC onshore export cables: 2 Maximum number of trenches of HVAC onshore export cables: 4 Indicative width of cable trench at surface: 3m Target minimum cable burial depth using open cut trenching: 1.2m Target minimum cable burial depth using trenchless installation techniques: 3.5m Target maximum cable burial depth using trenchless installation techniques: 20m Indicative temporary construction corridor width for HVDC onshore export cables: 32m (50m at trenchless crossing locations) Indicative temporary construction corridor width for HVAC onshore export cables: 55m (60m at trenchless crossing locations) Indicative number of jointing bay locations along onshore ECC: 62 Indicative number of link box locations along onshore ECC: 56 (for the purposes of the PEIR assessment, it is assumed that at approximately 20 link box locations for the HVDC export cables and all link box locations for the HVAC export cables will involve the use of above-ground link boxes) Maximum jointing bay burial depth: 2.5m Maximum underground link box burial depth / above-ground link box height: 2m 	<p>These parameters represent the maximum footprint and duration of disturbance of works within the Onshore Development Area.</p> <p>Duration includes site preparation works, temporary construction compounds, accesses and haul roads establishment, trenchless installation works, open cut trenching for cable duct installation, cable pull-in and jointing operations, construction of jointing bays, the TJB and associated link boxes, OCS and ESBI construction and reinstatement works.</p>
GGC-C-02	Impacts on groundwater quality and groundwater resources – construction activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources, such as trenchless crossings and piling		
GGC-C-03	Impacts on surface water quality and associated ecological habitats from contamination – construction activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution		
GGC-C-04	Impacts to designated geological sites – ground breaking activities that directly overlap designated geological sites, such as trenching, excavation, piling		
GGC-C-05	Sterilisation of future mineral resources - ground breaking activities that directly overlap mineral resources, such as trenching, excavation, piling		
GGC-C-06	Impacts to the built environment – construction activities with potential to mobilise pre-existing ground contaminants where present, such as trenching, excavation, piling and movement and stockpiling of soil		
GGC-C-07	Impacts to agricultural land – construction, maintenance and decommissioning activities with potential to mobilise pre-existing ground contaminants where present, such as trenching, excavation, piling and movement and stockpiling of soil		

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Impact ID	Impact and Project Activity	Realistic Worst-Case Scenario	Rationale
		<ul style="list-style-type: none"> Maximum jointing bay and link box temporary construction area for HVDC export cables: 660m² (per location) Maximum jointing bay and link box temporary construction area for HVAC export cables: 1,040m² (per location) Indicative number of main construction compounds for onshore export cable works: 4 Indicative number of intermediate construction compounds for onshore export cable works: 8 Indicative number of trenchless crossing locations: 70 Indicative main construction compound area: 20,000m² (per compound) Indicative intermediate construction compound area: 5,625m² (per compound) Indicative trenchless installation compound area for HVDC export cables: 300m² (5,625m² for non-HDD techniques) (per compound) Indicative trenchless installation compound area for HVAC export cables: 800m² (5,625m² for non-HDD techniques) (per compound) Trenchless installation techniques under consideration include HDD, auger boring, micro-tunnelling, pipe jacking / ramming and Direct Pipe Anticipated duration of onshore export cable construction works: approximately four years Maximum land area temporarily disturbed during construction: 1,700,000m² <p>OCS Zone (OCS and ESBI)</p> <ul style="list-style-type: none"> Indicative quantity of topsoil excavated within OCS zone: 100,000m³ (assumed 50% of topsoil to be removed off-site – 50,000m³) Indicative access road width (including site access road from the public highway and internal tracks within the site): 7.3m Maximum developable area for OCS and ESBI: 25ha (including but not limited to platform footprint, landscaping, access, drainage and attenuation but exclude areas for ecological mitigation / enhancement) Total permanent area: 20.5ha (including but not limited to platform footprint, landscaping, access, drainage and attenuation but exclude areas for ecological mitigation / enhancement) Total temporary area: 4.5ha (including 2 temporary construction compounds for the OCS and ESBI) Anticipated duration of OCS and ESBI construction works: approximately five years 	

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Impact ID	Impact and Project Activity	Realistic Worst-Case Scenario	Rationale
Operation and Maintenance			
GGC-O-01	Impacts to human health from on-site and off-site contamination – O&M activities with potential to mobilise pre-existing ground contaminants where present	<p>Anticipated duration of O&M phase: approximately 35 years</p> <p>Landfall</p> <ul style="list-style-type: none"> Maximum permanent underground link box area: 10m² Underground link box will be installed with a manhole cover for O&M access at ground level and typically marked / protected by bollards, fences or similar of approximately 1.2m to 2m in height (where required and agreed with the relevant landowners) Maximum permanent TJB area: 30m² Maximum TJB and underground link box burial depth: 3m <p>Onshore ECC</p> <ul style="list-style-type: none"> Indicative width of operational easement for HVDC export cables: 20m Indicative width of operational easement for HVAC export cables: 25m Maximum number of trenches of HVDC onshore export cables: 2 Maximum number of trenches of HVAC onshore export cables: 4 Target minimum cable burial depth using open cut trenching: 1.2m Target minimum cable burial depth using trenchless installation techniques: 3.5m Target maximum cable burial depth using trenchless installation techniques: 20m Indicative number of jointing bay locations along onshore ECC: 62 Indicative number of link box locations along onshore ECC: 56 (for the purposes of the PEIR assessment, it is assumed that at approximately 20 link box locations for the HVDC export cables and all link box locations for the HVAC export cables will involve the use of above-ground link boxes) Maximum jointing bay burial depth: 2.5m Maximum underground link box burial depth / above-ground link box height: 2m Maximum permanent jointing bay area: 30m² (per jointing bay) Maximum permanent underground link box area: 4m² (per link box) Maximum permanent above-ground link box area: 3m² (per link box) Underground link boxes will be installed with a manhole cover for O&M access at ground level. Above-ground link boxes will be installed as kiosks on concrete pads. Link boxes are typically marked / protected by bollards, fences or similar of approximately 1.2 to 2m in height (where required and agreed with the relevant landowners). Small marker posts of approximately 1 to 1.2m height will be installed along the operational easement to demark the location of the installed onshore export cables. Marker posts will, at a minimum, be required at field boundaries, on either side of obstacle crossings such as roads and watercourses and where there are significant directional changes in the cable route. 	<p>These parameters represent the maximum footprint of the Project that would interact with the baseline environment.</p>
GGC-O-02	Impacts on groundwater quality and groundwater resources – O&M activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources		
GGC-O-03	Impacts on surface water quality and associated ecological habitats from contamination – O&M activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution		
GGC-O-04	Impacts to designated geological sites – ground breaking activities and presence of permanent infrastructure that directly overlap designated geological sites		
GGC-O-05	Sterilisation of future mineral resources - ground breaking activities and presence of permanent infrastructure that directly overlap mineral resources		
GGC-O-06	Impacts to the built environment – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure		
GGC-O-07	Impacts to agricultural land – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure		

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Impact ID	Impact and Project Activity	Realistic Worst-Case Scenario	Rationale
		OCS Zone (OCS and ESBI) <ul style="list-style-type: none"> Maximum developable area for OCS and ESBI: 25ha (including but not limited to platform footprint, landscaping, access, drainage and attenuation but exclude areas for ecological mitigation / enhancement) Total permanent area: 20.5ha (including but not limited to platform footprint, landscaping, access, drainage and attenuation but exclude areas for ecological mitigation / enhancement) 	
Decommissioning			
GGC-D-01	Impacts to human health from on-site and off-site contamination – decommissioning activities not yet defined	<p>The final decommissioning strategy of the Project’s onshore infrastructure has not yet been decided. For a description of potential onshore decommissioning works, refer to Chapter 4 Project Description.</p> <p>It is recognised that regulatory requirements and industry best practice change over time. Therefore, the details and scope of onshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning. Specific arrangements will be detailed in an Onshore Decommissioning Plan (see Table 19-5, Commitment ID CO56), which will be submitted and agreed with the relevant authorities prior to the commencement of onshore decommissioning works.</p> <p>For this assessment, it is assumed that decommissioning is likely to operate within the parameters identified for construction (i.e. any activities are likely to occur within the temporary construction working areas and require no greater amount or duration of activity than assessed for construction). The decommissioning sequence will generally be the reverse of the construction sequence. It is therefore assumed that decommissioning impacts would likely be of similar nature to, and no worse than, those identified during the construction phase.</p>	
GGC-D-02	Impacts on groundwater quality and groundwater resources – decommissioning activities not yet defined		
GGC-D-03	Impacts on surface water quality and associated ecological habitats from contamination – decommissioning activities not yet defined		
GGC-D-04	Impacts to designated geological sites – decommissioning activities not yet defined		
GGC-D-05	Sterilisation of future mineral resources – decommissioning activities not yet defined		
GGC-D-06	Impacts to the built environment – decommissioning activities not yet defined		
GGC-D-07	Impacts to agricultural land – decommissioning activities not yet defined		

Table 19-8 with further information in **Volume 2, Appendix 19.2 Preliminary Risk Assessment**.

19.5 Assessment Methodology

19.5.1 Guidance Documents

53. The following guidance documents have been used to inform the baseline characterisation, assessment methodology and mitigation design for geology and ground conditions.

19.5.1.1 Land Contamination Risk Management Framework 2023

54. The Environment Agency guidance aims to help those assessing potentially contaminated sites to identify and assess the risks posed to sensitive receptors, make appropriate decisions in relation to the outcome of the assessment and identify the required actions necessary (e.g. implement remediation if deemed necessary).

19.5.1.2 The Environment Agency's Approach to Groundwater Protection Position Statements 2018 (Under Review)

55. 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 the position statements is the prevention of pollution of groundwater and protection of it as a resource.

19.5.2 Data and Information Sources

19.5.2.1 Desk Study

56. A desk study has been undertaken to compile baseline information in the previously defined Study Area(s) (see **Section 19.4.1**) using the sources of information set out in

Table 19-8 Desk-Based Sources for Geology and Ground Conditions Data

Data Source	Spatial Coverage	Year(s)	Summary of Data Contents
Envirocheck GIS data	Geology and Ground Conditions Study Area	2024	Environmental Database comprising environmental sensitivity data and permitting records. (Order reference SR00339234). (Envirocheck data is updated in cycles and was retrieved in September 2024).
British Geological Society (BGS) Onshore Geoindex web portal	Geology and Ground Conditions Study Area	2024	Online geological mapping, accessed October 2024.
BGS Geological Map for Flamborough and Bridlington Solid and Drift (Sheet number 55 and 65), 1:50,000	Geology and Ground Conditions Study Area	1985	Geological Map
BGS Geological Map for Great Driffeld Solid and Drift (sheet number 64) 1:50,000	Geology and Ground Conditions Study Area	1993	Geological Map
BGS Geological Map for Beverley Solid and Drift (Sheet number 72), 1:50,000	Geology and Ground Conditions Study Area	1995	Geological Map
BGS Geological Map for Hornsea Solid and Drift (Sheet number 73), 1:50,000	Geology and Ground Conditions Study Area	1998	Geological Map
BGS Hydrogeological Map of East Yorkshire (Sheet number 10), 1:100,000	Geology and Ground Conditions Study Area	1980	Hydrogeological Map
Google Earth	Geology and Ground Conditions Study Area	2024	Online map viewing platform, accessed October 2024.

Data Source	Spatial Coverage	Year(s)	Summary of Data Contents
Multi Agency Government Information for the Countryside map.	Geology and Ground Conditions Study Area	2024	Online map viewing platform displaying geographical and government information. Accessed October 2024.
UK Health Security Agency UK maps of Radon	Geology and Ground Conditions Study Area	2024	Online map viewer displaying radon concentrations. Accessed October 2024.
Zetica UXO Unexploded Bomb (UXB) Risk Map	Geology and Ground Conditions Study Area	2024	Online map viewer displaying unexploded ordnance risk levels. Accessed October 2024.
ERYC	Geology and Ground Conditions Study Area	2024	Information provided from ERYC with respect to private domestic and commercial potable groundwater abstractions which are registered with them.
			The adopted East Riding of Yorkshire Local Plan (2016) was consulted for information on LGS and contaminated land.
			The East Riding of Yorkshire Joint Minerals Plan (2019) was consulted for information on MSA.
Environment Agency	Geology and Ground Conditions Study Area	2024	Information provided from Environment Agency with respect to private domestic potable groundwater abstractions which are registered with them.
Hull and East Riding of Yorkshire RIGS Group	Geology and Ground Conditions Study Area	2024	Website listing RIGS sites, accessed October 2024.

19.5.2.2 Site-Specific Surveys

57. In addition to desk-based sources, a site walkover survey was undertaken to provide detailed baseline information on geology and ground conditions. The survey took place between 21st and 23rd October 2024 consisting of a visual assessment of publicly accessible areas identified as potential sources of contamination. Further details are provided in **Volume 2, Appendix 19.2 Preliminary Risk Assessment**.

19.5.3 Impact Assessment Methodology

58. **Chapter 6 Environmental Impact Assessment Methodology** sets out the overarching approach to the impact assessment methodology. The topic-specific methodology for the geology and ground conditions assessment is described further in this section.

19.5.3.1 Impact Assessment Criteria

19.5.3.1.1 Receptor Sensitivity

59. Receptor sensitivity has been defined with reference to the adaptability, tolerance, recoverability and value of individual receptors. 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).
60. Receptor sensitivity has been defined with reference to the adaptability, tolerance, recoverability and value of individual receptors. Generic receptor sensitivity examples are presented in **Table 19-9** and demonstrate likely criteria for appraisal of sensitivity for identified geology and ground conditions receptors based on professional judgement.

Table 19-9 Definition of Receptor Sensitivity

Sensitivity	Definition
High – has very limited or no capacity to accommodate physical or chemical changes.	General <ul style="list-style-type: none"> • Receptor is internationally or nationally important / rare with limited potential.
	Human health <ul style="list-style-type: none"> • 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).
	Controlled waters and ecology <ul style="list-style-type: none"> • Groundwater source protection zones (SPZ) 1; • Public water supplies / licensed surface water and groundwater abstractions for potable use;

Sensitivity	Definition
	<ul style="list-style-type: none"> • Private water supplies for potable use an automatic minimum of 50m SPZ1 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. SPA or Ramsar sites).
	Geological sites and mineral resources <ul style="list-style-type: none"> • MSA or MCA – nationally important resource; and • Designated geological sites of international importance.
	Built environment <ul style="list-style-type: none"> • Sites of international importance, World Heritage Sites and Scheduled Monuments.
	Agricultural land <ul style="list-style-type: none"> • Land at Agricultural Land Classification (ALC) Grade 1 or 2.
Medium – has limited capacity to accommodate physical or chemical changes.	General <ul style="list-style-type: none"> • Receptor is regionally important / rare with limited potential for offsetting / compensation.
	Human health <ul style="list-style-type: none"> • 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).
	Controlled waters and ecology <ul style="list-style-type: none"> • Groundwater SPZ2 and SPZ3; • 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).

Sensitivity	Definition
Low – has moderate capacity to accommodate physical or chemical changes	Geological sites and mineral resources <ul style="list-style-type: none"> MSA or MCA – regionally important resources; and Designated geological site of national importance (e.g. SSSI).
	Built environment <ul style="list-style-type: none"> Commercial or residential buildings.
	Agricultural land <ul style="list-style-type: none"> Land at ALC Grade 3.
	General <ul style="list-style-type: none"> Receptor is locally important / rare.
	Human health <ul style="list-style-type: none"> 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).
	Controlled waters and ecology <ul style="list-style-type: none"> Secondary A and B Aquifers without groundwater abstractions; and Groundwater or surface waters supporting locally important sites (e.g. LNR).
	Geological sites and mineral resources <ul style="list-style-type: none"> Adjacent to a MSA or MCA; Low economically viable mineral resource; and Geological site of local importance (e.g. LGS).
Negligible – is generally tolerant of physical or chemical changes.	Built environment <ul style="list-style-type: none"> Car parks, highways, transport infrastructure and utilities.
	Agricultural land <ul style="list-style-type: none"> Land at ALC Grade 4.
	General <ul style="list-style-type: none"> Receptor is not considered to be particularly important / rare.
	Human health

Sensitivity	Definition
	<ul style="list-style-type: none"> Commercial / industrial workers (off-site >250m).
	Controlled waters and ecology <ul style="list-style-type: none"> Unproductive strata; and Supports or contributes to habitats that are not sensitive to changes in surface hydrology or water quality.
	Geological sites and mineral resources <ul style="list-style-type: none"> No economically viable minerals.
	Built environment <ul style="list-style-type: none"> Locally important roads and footpaths.
	Agricultural land <ul style="list-style-type: none"> Land at ALC Grade 5.

19.5.3.1.2 Impact Magnitude

61. The magnitude of potential impacts is assessed qualitatively, according to the criteria set out in **Table 19-10**.
62. For impacts related to human health, magnitude reflects the likely increase or 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 19-10 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.	Human health <ul style="list-style-type: none"> 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).
	Controlled waters <ul style="list-style-type: none"> Permanent, long-term or wide scale effects on water quality or availability (adverse / beneficial);

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Magnitude	Definition
Medium - reversible change affecting usability, value or risk over the medium-term or local area: possibly affecting regulatory compliance.	<ul style="list-style-type: none"> Permanent loss or long-term derogation of a water supply source resulting in prosecution (adverse); Change in Water Environment (England and Wales) Regulations 2017 (WER) water body status / potential or its ability to achieve WER 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).
	Geological sites and mineral resources <ul style="list-style-type: none"> Complete loss of designated sites; or Complete sterilisation of mineral resources.
	Built environment <ul style="list-style-type: none"> Catastrophic damage to buildings or structures.
	Agricultural land <ul style="list-style-type: none"> Permanent or major change to existing ALC grade.
	Human health <ul style="list-style-type: none"> 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).
	Controlled waters <ul style="list-style-type: none"> 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 WER water body or its ability to meet objectives (adverse / beneficial).
	Geological sites and mineral resources <ul style="list-style-type: none"> Partial loss of designated geological sites; or Medium-term or local scale loss of mineral resources.
	Built environment

Magnitude	Definition
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 regulatory compliance.	<ul style="list-style-type: none"> Damage to buildings or structures.
	Agricultural land <ul style="list-style-type: none"> Medium-term or local scale effects on ALC grade.
	Human health <ul style="list-style-type: none"> Short-term temporary or minor change to existing risk exposure (adverse / beneficial); or Unacceptable risks to one or more receptors with a short-term effect (adverse).
	Controlled waters <ul style="list-style-type: none"> Short-term or very localised effects on water quality or availability (adverse / beneficial); Short-term derogation of a water supply source (adverse); 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 WER water body or its ability to meet objectives (neutral).
	Geological sites and mineral resources <ul style="list-style-type: none"> Temporary change in status of designated geological sites; or Short-term or very localised effects on mineral resources.
Negligible – minor permanent or temporary change, indiscernible over the medium to long-term. Short-term with no effect on usability.	Built environment <ul style="list-style-type: none"> Easily repairable damage to buildings or structures.
	Agricultural land <ul style="list-style-type: none"> Short-term or very localised effects on ALC grade.
	Human health <ul style="list-style-type: none"> Negligible change to existing risk exposure; or Activity is unlikely to result in unacceptable risks to receptors (neutral).
	Controlled waters <ul style="list-style-type: none"> Very minor or intermittent impact on local water quality or availability (adverse / beneficial); Usability of a water supply source will be unaffected (neutral);

Magnitude	Definition
	<ul style="list-style-type: none"> Very slight local changes that have no observable impact on dependent receptors (neutral); or No change in status / potential of a WER water body or its ability to meet objectives (neutral).
	Geological sites and mineral resources <ul style="list-style-type: none"> No change in status of designated geological site; or Very minor impact on mineral resources.
	Built environment <ul style="list-style-type: none"> Very slight, non-structural damage or cosmetic harm to buildings or structures.
	Agricultural land <ul style="list-style-type: none"> Very minor effect on ALC grade.

19.5.3.1.3 Effect Significance

63. The assessment of significance of an effect is informed by the sensitivity of the receptor and the magnitude of the impact (see **Chapter 6 Environmental Impact Assessment Methodology** for further detail). The determination of significance is guided by the use of a geology and ground conditions significance of effect matrix, as shown in **Table 19-11**. Definitions of each level of significance are provided in **Table 19-12**. 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 19-11 Geology and Ground Conditions Effect Significance Matrix

		Adverse Effect				Beneficial Effect			
		Impact Magnitude							
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Receptor Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Negligible	Negligible	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Table 19-12 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.

19.5.4 Cumulative Effects Assessment Methodology

64. The cumulative effect assessment (CEA) considers other plans and projects that may act collectively with the Project to give rise to cumulative effects on geology and ground conditions receptors. The general approach to the CEA for geology and ground conditions involves screening for potential cumulative effects, identifying a short list of plans and projects for consideration and evaluating the significance of cumulative effects. **Chapter 6 Environmental Impact Assessment Methodology** and **Volume 2, Appendix 6.5 Cumulative Effects Screening Report – Onshore** provides further details on the general framework and approach to the CEA.
65. The final assessment of cumulative effects will be undertaken during the later stages of the EIA. 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 in the CEA, including a brief description as to how projects have been screened in and the initial tier level that they have been assigned.

19.5.5 Assumptions and Limitations

66. This chapter provides a preliminary assessment of the likely significant effects of the Project in relation to geology and ground conditions using information available at the time of drafting as described in **Chapter 6 Environmental Impact Assessment Methodology**. This assessment will be refined and presented in the ES to be submitted with the DCO application.
67. The desk-based PRA (see **Volume 2, Appendix 19.2 Preliminary Risk Assessment**) 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).
68. 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.

19.6 Baseline Environment

19.6.1 Existing Baseline

69. A summary of the baseline environment for the Onshore Development Area is provided in **Table 19-13** with potential sources of contamination set out in **Table 19-14**. Full details are provided within **Volume 2, Appendix 19.2 Preliminary Risk Assessment**.
70. Further information is displayed on **Figures 19-5** and **19-6**.

Table 19-13 Summary of Baseline Environment

Parameter	Landfall	Onshore ECC	OCS Zones
Geology (see Figures 19-2 and 19-3)	Made Ground: Although not identified on BGS mapping, localised areas of Made Ground associated with historical land uses are likely to be present within the Onshore Development Area.		
	Lacustrine Deposits: Present in isolated areas.		Lacustrine Deposits: Not present.
	Alluvium: Present in isolated areas.		

Parameter	Landfall	Onshore ECC	OCS Zones
Hydrogeology (see Figure 19-4)	Head Deposits: Not present.	Head Deposits: Present in isolated areas.	
	Glaciofluvial Deposits: Not present.	Glaciofluvial Deposits: Present in isolated areas.	Glaciofluvial Deposits: Not present.
	Glacial Till: Located throughout the Onshore Development Area.		
	Sand and Gravel (of uncertain age and origin): Not present.	Sand and Gravel (of uncertain age and origin): Present in isolated areas.	
	Rowe Chalk Formation: Located throughout the landfall.	Rowe Chalk Formation: Present in north-east of the onshore ECC.	Rowe Chalk Formation: Not present.
	Flamborough Chalk Formation: Underlying Rowe Chalk Formation.	Flamborough Chalk Formation: Located throughout the onshore ECC.	Flamborough Chalk Formation: Located throughout OCS Zone 4.
	Burnham Chalk Formation: Underlying Flamborough Chalk Formation.	Burnham Chalk Formation: Underlying Flamborough Chalk Formation.	Burnham Chalk Formation: Present in OCS Zone 8 and underlying Flamborough Chalk Formation.
Hydrogeology (see Figure 19-4)	There is one recorded licensed groundwater abstraction located within the Onshore Development Area (Hotham Family Trust Borehole No2, located within the onshore ECC, adjacent to a proposed temporary construction access). There are 29 recorded groundwater abstraction wells within 1km of the Onshore Development Area (12 EA licensed and 17 Local Authority registered), 14 of which are recorded as potable supplies. Six of the abstractions are recorded abstracting from the chalk principal aquifer, although for the remaining 23 locations, it is not noted what groundwater body is being abstracted from.		
	The Environment Agency position statements on groundwater within section B3 indicates that an SPZ1 should be applied for a minimum of 50m should be applied around private potable supplies and depending on the abstraction type an SPZ2 of up to 250m should be applied. There has been no overlap identified between the private potable abstractions (see Figure 19-4) and potential sources of contamination identified on (Figures 19-5 and 19-6) whereby the potential mobilisation of existing ground contamination may pose a risk to private potable supplies.		

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Parameter	Landfall	Onshore ECC	OCS Zones
		<p>Secondary A Aquifers: Alluvium, Glaciofluvial Deposits (both high vulnerability).</p> <p>Secondary B Aquifer (high vulnerability): Lacustrine Deposits.</p> <p>Secondary Undifferentiated Aquifers (medium vulnerability): Head Deposits and Glacial Till.</p>	
Secondary A Aquifers: Alluvium (high vulnerability).			Secondary A Aquifers: Alluvium (high vulnerability), Sand and Gravel (medium vulnerability).
Secondary B Aquifer (high vulnerability): Lacustrine Deposits.		Principal Aquifers (low to high vulnerability): White Chalk Subgroup.	Secondary Undifferentiated Aquifers (medium vulnerability): Head Deposits and Glacial Till.
Secondary Undifferentiated Aquifers (medium vulnerability): Glacial Till.		The Hull and East Riding Chalk WER groundwater body is present beneath the entirety of the Onshore Development Area.	Principal Aquifers (low to high vulnerability): White Chalk Subgroup.
Principal Aquifers (low to high vulnerability): White Chalk Subgroup.		The onshore ECC section along Scarborough Lane is in SPZ1 and SPZ2.	The Hull and East Riding Chalk WER groundwater body is present beneath the entirety of the Onshore Development Area.
The Hull and East Riding Chalk WER groundwater body is present beneath the entirety of the Onshore Development Area.		The onshore ECC section south of Hall Farm Wind Farm is in SPZ3.	Both OCS zones are in SPZ2.
		The onshore ECC to the west of Bealey's is located within SPZ3.	
		The onshore ECC to the south of Cross Drain is in SPZ2.	
		The onshore ECC from the areas south-east of Little Weighton Road up to the north-west of Birkhill Wood are in SPZ2.	

Parameter	Landfall	Onshore ECC	OCS Zones
		<p>The area of the onshore ECC to the south of Scarborough Lane and from the east of Beverley Road (A164) to the north of Popular Farm is in SPZ1.</p> <p>The area around Birkhill Wood Substation, south of A164 and Jillywood Farm, is located within SPZ1.</p>	
Hydrology and surface drainage (additional details in Chapter 21 Water Resources and Flood Risk)		<p>Streams and ditches associated with agriculture are present within the Onshore Development Area. Named features include:</p> <ul style="list-style-type: none"> • Skipsea Drain; • Dunnington Sewer; • Catchmoor Gutter; • Towns Drain; • Mickley Dike; • Weedland Drain; • Hull River; • North Side Drain; • Beverley and Bramston Drain; • Aike Beck Diversion; • Scarborough Beck; • Bealey's Beck; • Autherd Drain; • Dunnington Sewer; • Harrison's Drain; • Roam Drain; • Halls Drain; • Holt's Drain • Hallytreeholme Farm; • Holderness Drain; • Heigholme Drain; • Leven South Carr Drain; 	

Parameter	Landfall	Onshore ECC	OCS Zones
	<ul style="list-style-type: none"> Hall Farm Drain; Coal Dike; Boundary Drain; and Whitewater Drain. <p>The following WER surface water body catchments are located within the Onshore Development area:</p> <ul style="list-style-type: none"> Coastal Catchment; Bramston Sea Drain to Skipsea Drain to Confluence; Old Howe to Frodingham Beck to R Hull; Mickley Dike Catchment; Holderness Drain Source to Foredyke Stream; Foredyke Stream Lower to Holderness Drain; Hull from west Beck to Arram Beck; Beverley and Barmston Drain; Bryan Mills Beck Source to Bryan Mills Farm; Ella Dyke; Scorborough Beck; High Hunsley to Arram Area; and High Hunsley to Woodmansey Area. 		
Sensitive Land Uses (see Figure 19.2-4 of Volume 2 Appendix 19.2 Preliminary Risk Assessment)	<p>The following sensitive land uses are located within the landfall:</p> <ul style="list-style-type: none"> Withow Gap – SSSI and SSSI impact risk zone designated due to its geological properties; Greater Wash – SPA designated due to its habitat features and species of interest; Holderness Inshore – Marine Conservation Zone; 	<p>The following sensitive land uses are located within the onshore ECC:</p> <ul style="list-style-type: none"> Leven Canal – SSSI and SSSI impact risk zone designated as a site of biological interest; Barmston Sea Drain from Skipsea Drain to the North Sea Nitrate Vulnerable Zone (NVZ); Holderness Drain from Fordyke Stream to Humber NVZ; 	<p>The following sensitive land uses are located within the OCS zones:</p> <ul style="list-style-type: none"> SSSI impact risk zone (Leven Canal and Skipsea Bail Mere); River Hull from Arram Beck to Humber NVZ; Yorkshire Chalk NVZ; and, Habitat networks – Primary habitat and Network Enhancement Zone 1.

Parameter	Landfall	Onshore ECC	OCS Zones
	<ul style="list-style-type: none"> Barmston Sea Drain from Skipsea Drain to the North Sea NVZ; Priority habitat inventory – marine cliff and slope habitat; Habitat networks – Primary habitat and Network Enhancement Zones 1 and 2; and Skipsea Drain LGS. <p>The following sensitive land uses are located within 250m of the landfall:</p> <ul style="list-style-type: none"> Underground monitoring post – Scheduled ancient monument. 	<ul style="list-style-type: none"> River Hull from Arram Beck to Humber NVZ; Yorkshire Chalk NVZ; Priority habitat inventory – coastal and floodplain grazing marsh, deciduous woodland and traditional orchard; Habitat networks – Primary habitat and Network Enhancement Zones 1 and 2; and Skipsea Drain LGS. Local Wildlife Sites – Beeford, Bealey’s Lane, Leman Road Corner, Raventhorpe Embankment and Bealey’s Beck. 	<p>The following sensitive land uses are located within 250m of the OCS zones:</p> <ul style="list-style-type: none"> One Grade II Listed Building (OCS Zone 8); Two Scheduled Ancient Monuments (OCS Zone 8); and, Risby Hall – Registered Park and Garden (OCS Zone 8)
		<p>The following sensitive land uses are located within 250m of the onshore ECC:</p> <ul style="list-style-type: none"> Seven Grade II listed buildings; Bryan Mills Field – SSSI; Skipsea Bail Mere – SSSI and RIGS; Bygot Wood, Leman Wood and Birkhill Wood – Designated Ancient Woodlands; 	

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Parameter	Landfall	Onshore ECC	OCS Zones
		<ul style="list-style-type: none"> Dunnington, Leven, Cherry Burton and Bishop Burton - Conservation Areas; and Two scheduled ancient monuments. 	
Mineral Safeguarding Areas (MSA) (see Figure 19.2-10 of Volume 2 Appendix 19.2 Preliminary Risk Assessment)	Localised areas within the landfall are designated as MSA relating to Sand and Gravel.	Localised areas within the onshore ECC are designated as MSA with areas in the northeast mainly relating to Sand and Gravel and areas in the southwest mainly relating to Chalk.	Localised areas within the OCS zones are designated as MSA with the area in the south of OCS Zone 4 relating to Sand and Gravel and the area within OCS Zone 8 relating to Chalk.
Human health (additional information in relation to human health, outside of the potential risks associated with contamination, is provided in Chapter 29 Human Health)	During the installation of the onshore infrastructure, the critical human health receptors would be those involved with construction activities, adjacent off-site residents, nearby workers (e.g. agricultural workers) and visitors (e.g. where Public Rights of Way (PRoW) might be in use). During the O&M phase, the human health receptors would be site users and workers at the OCS zones.		
Agricultural land (additional information is provided in Chapter 22 Soils and Land Use)	Agricultural Land Classification (ALC) Grades 2 and 3 are present at the landfall. No non-agricultural land is recorded at landfall.	ALC Grades 2, 3 and 4 are present throughout the onshore ECC. No non-agricultural land is recorded in the onshore ECC.	The OCS zones are located entirely within land designated as ALC Grade 2, based on provisional ALC data. No non-agricultural land is recorded in the OCS zones.
Built Environment	No buildings are located within the Onshore Development Area. Residential, commercial and holiday properties are located within 250m of the landfall.	No buildings are located within the Onshore Development Area. Residential, commercial and holiday properties are located within 250m of the onshore ECC.	No buildings are located within the Onshore Development Area. Residential, commercial and holiday properties are located within 250m of the OCS zones.
Potentially contaminative land uses (see Figures 19-5 and 19-6)	Potentially contaminative land uses within the landfall include: <ul style="list-style-type: none"> Agricultural land; 	Potentially contaminative land uses within the onshore ECC include: <ul style="list-style-type: none"> Agricultural land; 	Potentially contaminative land uses within the OCS zones include: <ul style="list-style-type: none"> Agricultural land;

Parameter	Landfall	Onshore ECC	OCS Zones
	<ul style="list-style-type: none"> Historic brick & tiles manufacturer; and Infilled pits and ponds. 	<ul style="list-style-type: none"> Historical landfills; Railways; Pumping station; and Infilled pits and ponds. 	<ul style="list-style-type: none"> Historical landfills; and Infilled pits and ponds.
Walkover (further details provided in Volume 2, Appendix 19.2, Preliminary Risk Assessment).	The walkover identified potential signs of contamination within the landfall area comprising a sheen on water within a surface water drain north-east of Withow Gap.	The walkover identified above ground fuel tanks within 250m of the onshore ECC. The walkover identified potential signs of contamination within the onshore ECC comprising a sheen and sludge-like material within Holderness Drain. Localised fly tipping was observed within 250m	No signs of contamination were noted within the OCS zones.

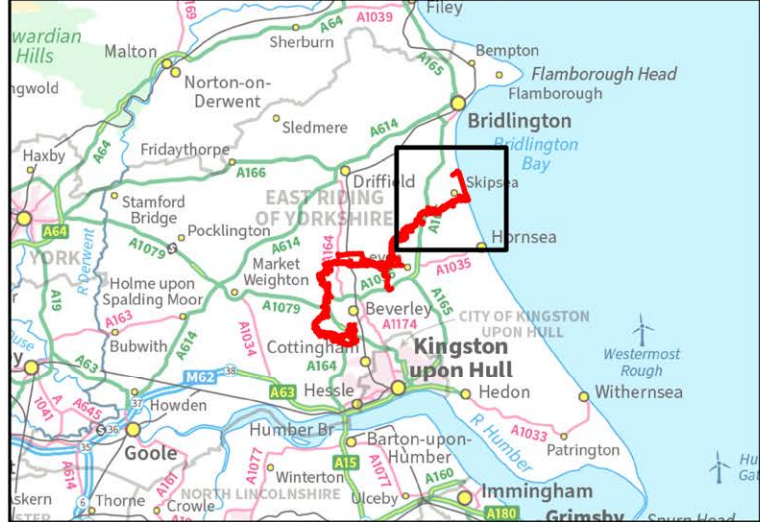
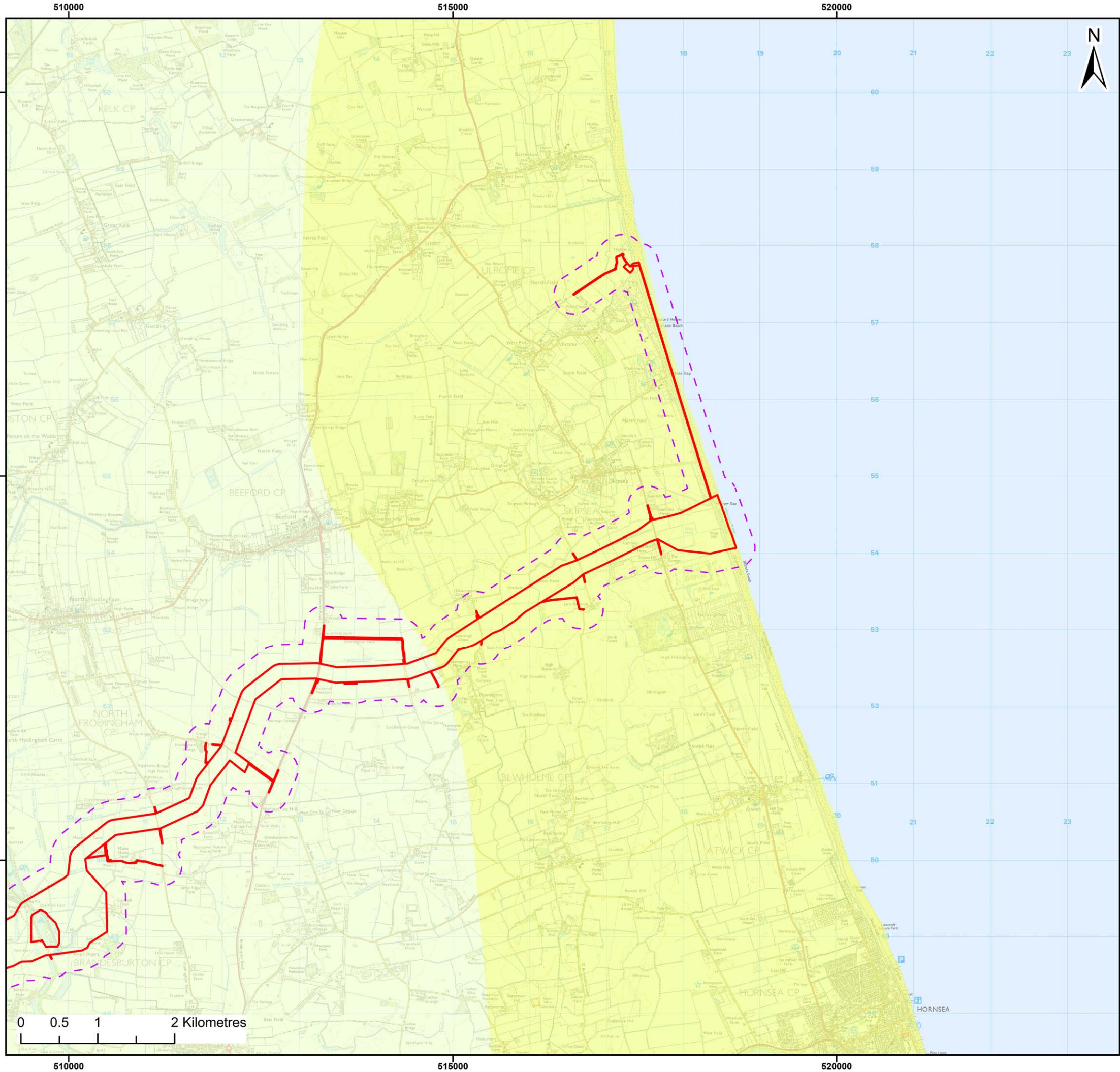
Table 19-14 Potential Sources of Contamination (✓ present, X absent)

Parameter	Potential Contaminant of Concern	Landfall	Onshore ECC	OCS Zones
On-Site				
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 and nitrates. 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.	✓	✓	✓

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Parameter	Potential Contaminant of Concern	Landfall	Onshore ECC	OCS Zones
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 (PAH), fuel and oil hydrocarbons, volatile and semi-volatile organic compounds (VOC and SVOC), inorganic and organic contaminants, herbicides, polychlorinated biphenyls (PCB) 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 and, or 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, PAH, PCB, 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
Hempholme Pumping station	Lubricants, greases, PAH, metals.	X	✓	X
Historical Landfill	Inorganic and organic contaminants, PCB, polyfluoroalkyl substances (PFAS), landfill leachate and ground gas.	X	✓	✓
Off-Site (within 250m)				
Agricultural land and historical practices (including intensive poultry farming).	Herbicides, pesticides and fertilisers, 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. In addition to the above, potential contaminants associated with intensive poultry farming includes nitrates.	✓	✓	✓

Parameter	Potential Contaminant of Concern	Landfall	Onshore ECC	OCS Zones
Potentially infilled pits, ponds. Made Ground.	Asbestos, metals and metalloids, PAH, fuel and oil hydrocarbons, VOC and SVOC, inorganic and organic contaminants, PCB vapours and ground gas	✓	✓	✓
Pumping Station	Lubricants and greases, PAH and metals.	X	✓	X
Airfield	Potential contaminants may include metals, VOC and SVOC, glycols, fuel and, or oil hydrocarbons, phenols, Lubricants and greases, PFAS and PCB.	X	✓	X
Historic Electrical Substation	Asbestos, metals and metalloids, PAH, fuel and oil hydrocarbons and PCB.	✓	X	X
Gas valve compound or Gas monitoring facility	Contaminants of concern include, but are not limited to, asbestos, metals and metalloids, inorganic and organic compounds, fuels, and oil hydrocarbons, PAH and phenols.	X	✓	X
Dismantled railway	Contaminants associated with railway land includes herbicides, metals and metalloids, fuel and oil hydrocarbons, PAH, PCB, 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



- Legend:
- Onshore Development Area
 - Onshore Development Area 250m Buffer

50k Bedrock Geology

- Rowe Chalk Formation
- Flamborough Chalk Formation
- Burnham Chalk Formation

Note: Only bedrock geology formations that intersect the Onshore Development Area are shown in the legend

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Project:

Dogger Bank D
Offshore Wind Farm

**DOGGER BANK
WIND FARM**

Title:

Bedrock Geology
- Sheet 1 of 3

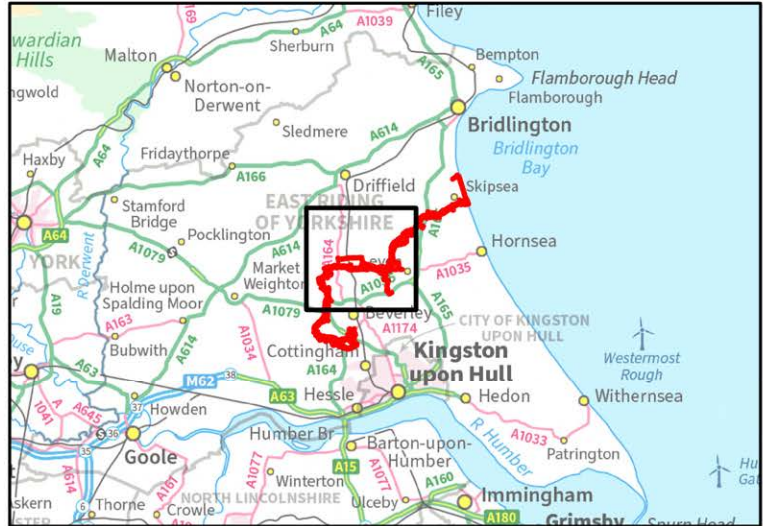
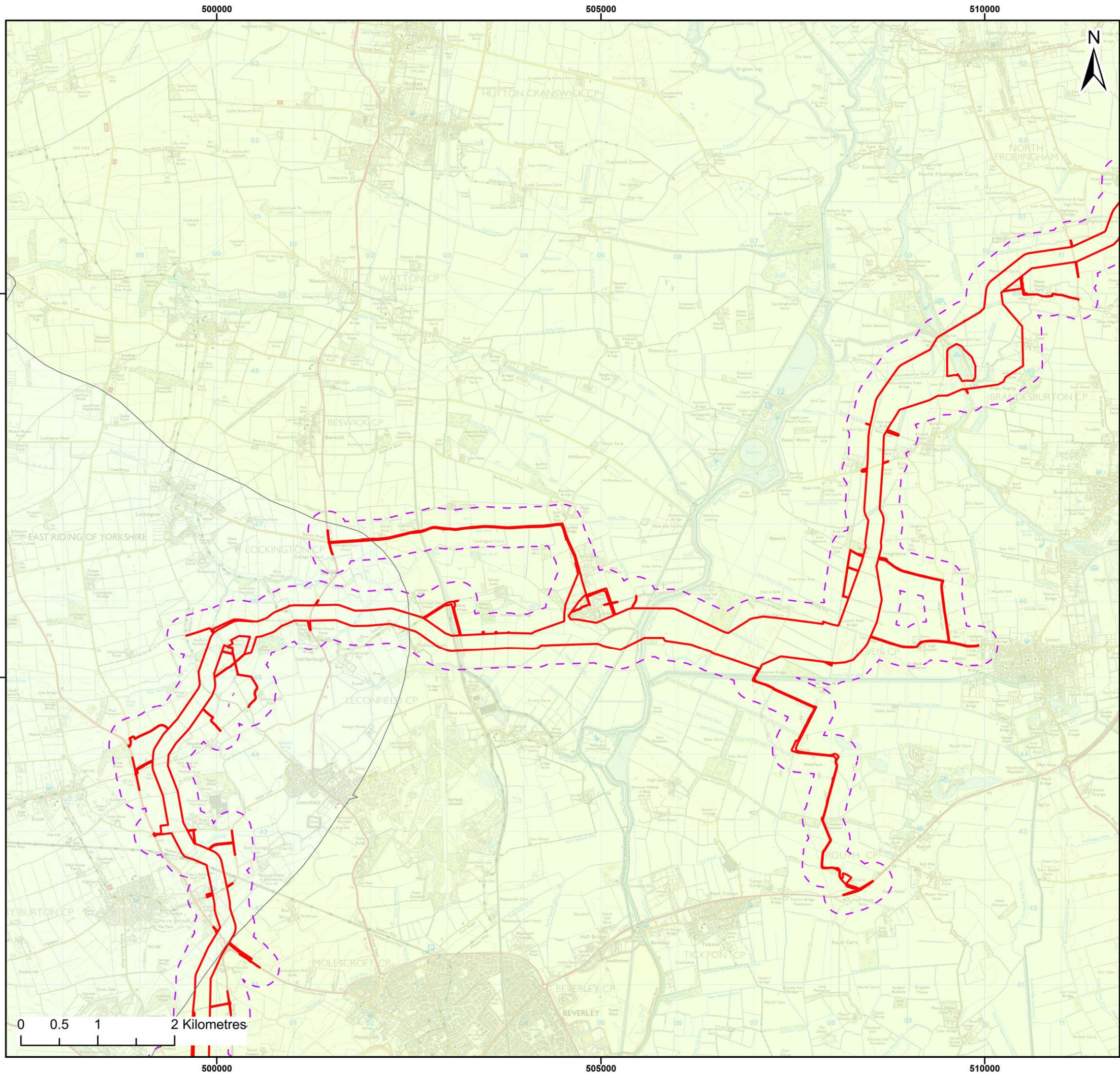
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Drawing No: PC6250-RHD-XX-OF-DR-GS-0379

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Co-ordinate system: British National Grid





- Legend:
- Onshore Development Area
 - Onshore Development Area 250m Buffer

50k Bedrock Geology

- Rowe Chalk Formation
- Flamborough Chalk Formation
- Burnham Chalk Formation

Note: Only bedrock geology formations that intersect the Onshore Development Area are shown in the legend

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Project:	DOGGER BANK WIND FARM
Dogger Bank D Offshore Wind Farm	

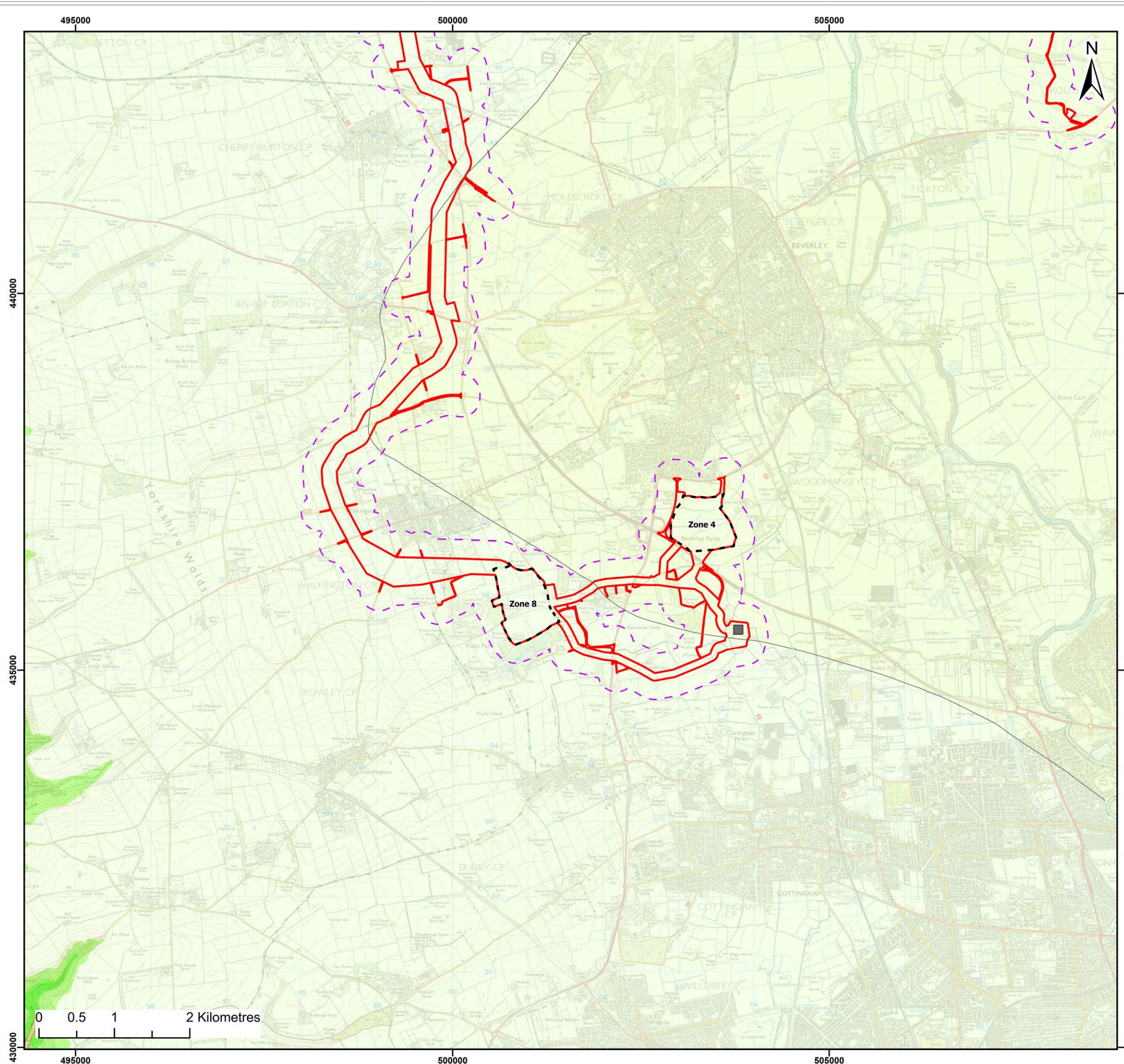
Title:

Bedrock Geology
- Sheet 2 of 3

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Co-ordinate system: British National Grid





Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer
- Onshore Converter Station Zone Options
- Indicative Birkhill Wood Substation Location

50k Bedrock Geology

- Rowe Chalk Formation
- Flamborough Chalk Formation
- Burnham Chalk Formation

Note: Only bedrock geology formations that intersect the Onshore Development Area are shown in the legend

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Project:

Dogger Bank D
Offshore Wind Farm

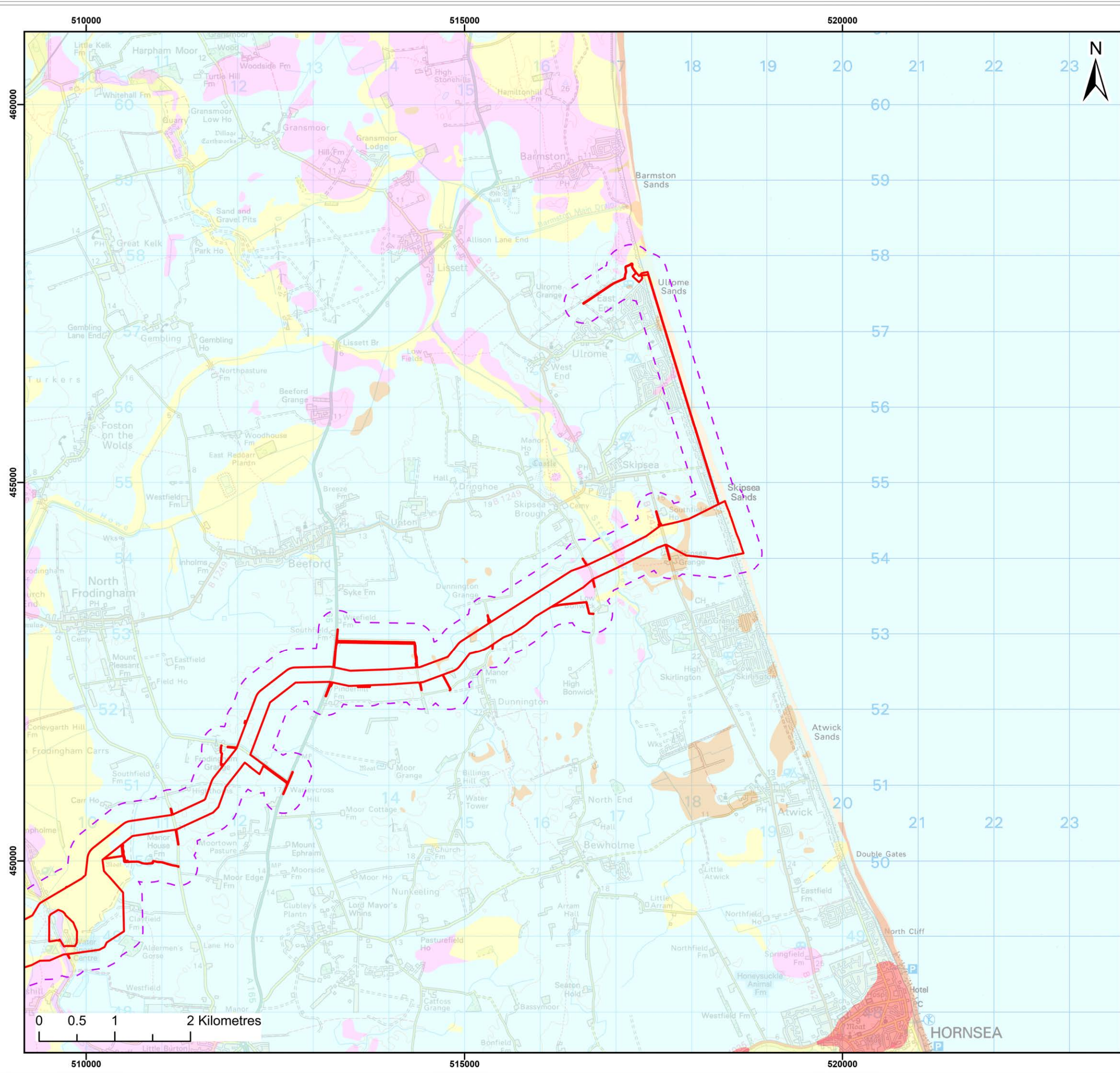
**DOGGER BANK
WIND FARM**

Title:

Bedrock Geology
- Sheet 3 of 3

Figure:	19-2	Drawing No:	PC6250-RHD-XX-OF-DR-GS-0379			
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Co-ordinate system: British National Grid



Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer

50k Superficial Geology

- Till
- Glaciofluvial Deposits
- Alluvium
- Storm Beach Deposits
- Lacustrine Deposits
- Head
- Sand and Gravel

Note: Only superficial geology formations that intersect the Onshore Development Area are shown in the legend

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Offshore Wind Farm

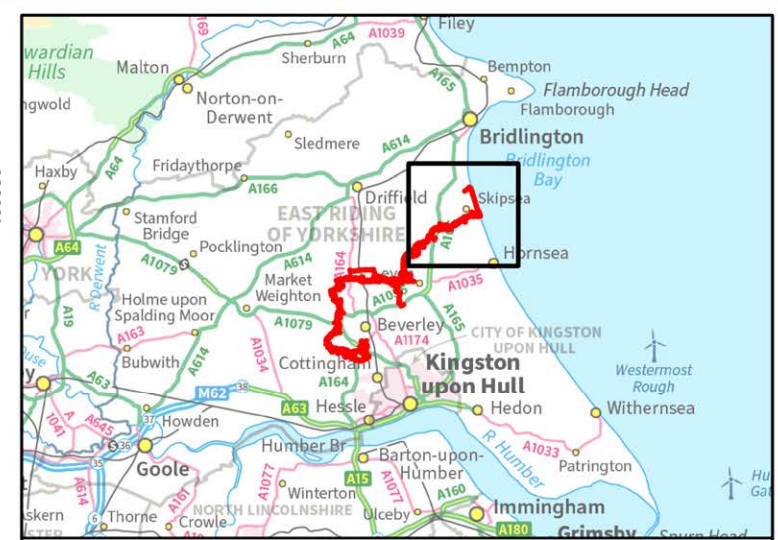
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WIND FARM**

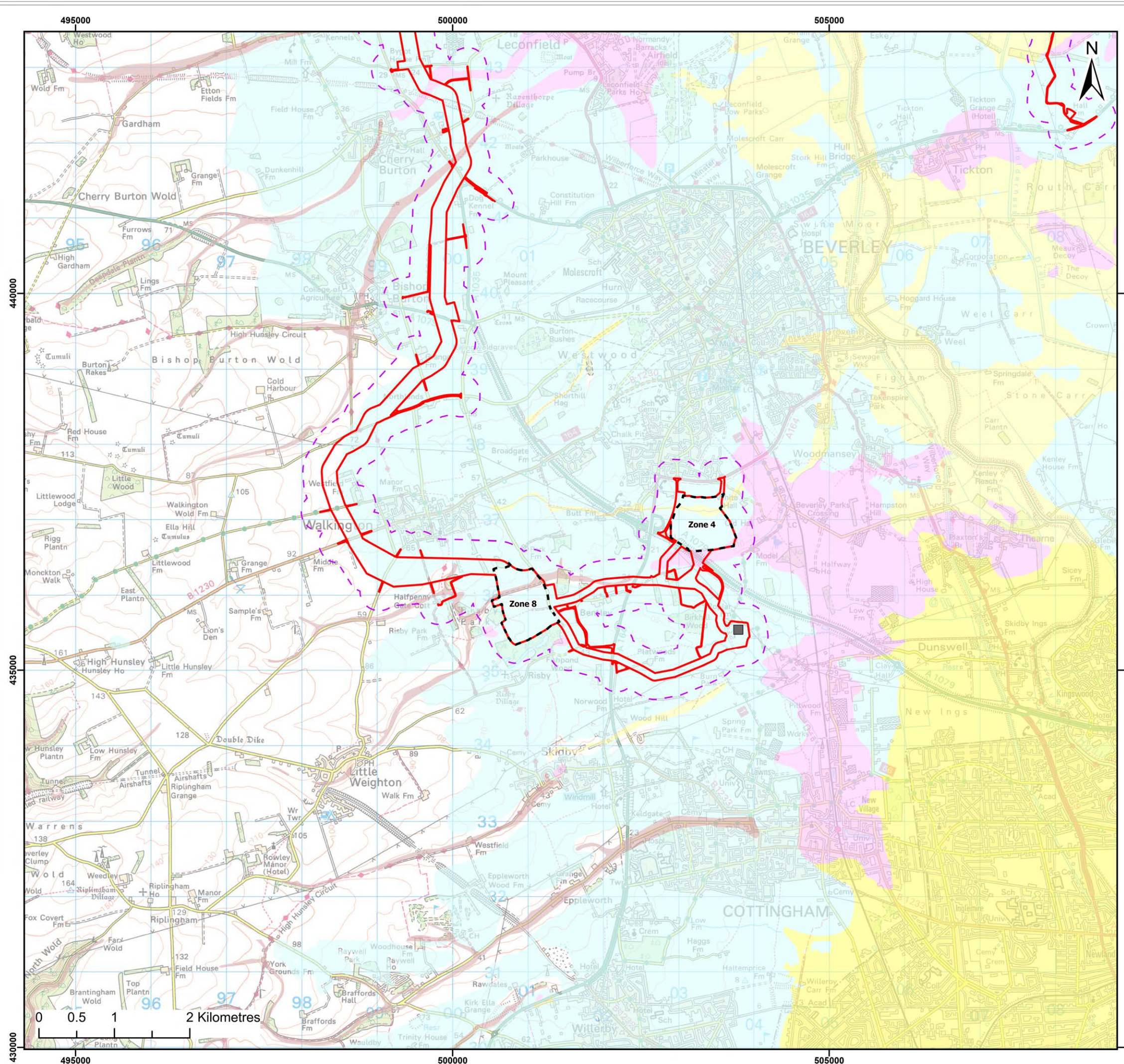
Title:

Superficial Geology
- Sheet 1 of 3

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Co-ordinate system: British National Grid





Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer
- Onshore Converter Station Zone Options
- Indicative Birkhill Wood Substation Location

50k Superficial Geology

- Till
- Glaciofluvial Deposits
- Alluvium
- Storm Beach Deposits
- Lacustrine Deposits
- Head
- Sand and Gravel

Note: Only superficial geology formations that intersect the Onshore Development Area are shown in the legend

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Offshore Wind Farm

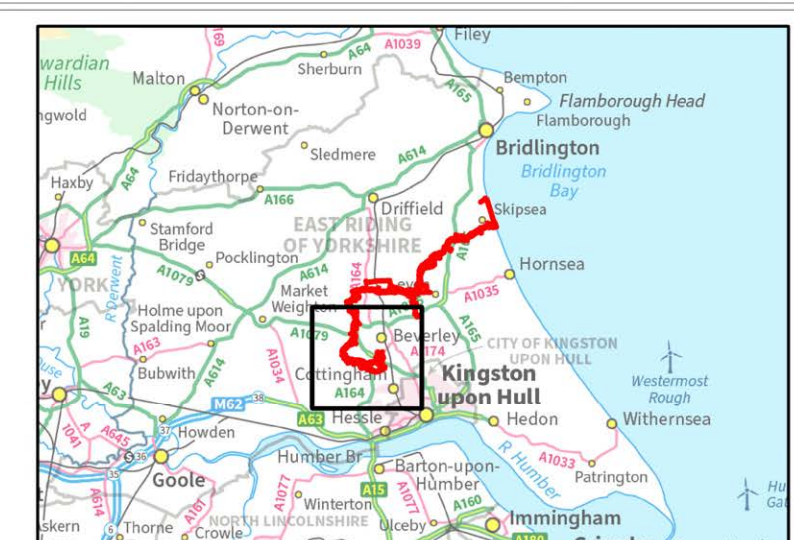
**DOGGER BANK
WIND FARM**

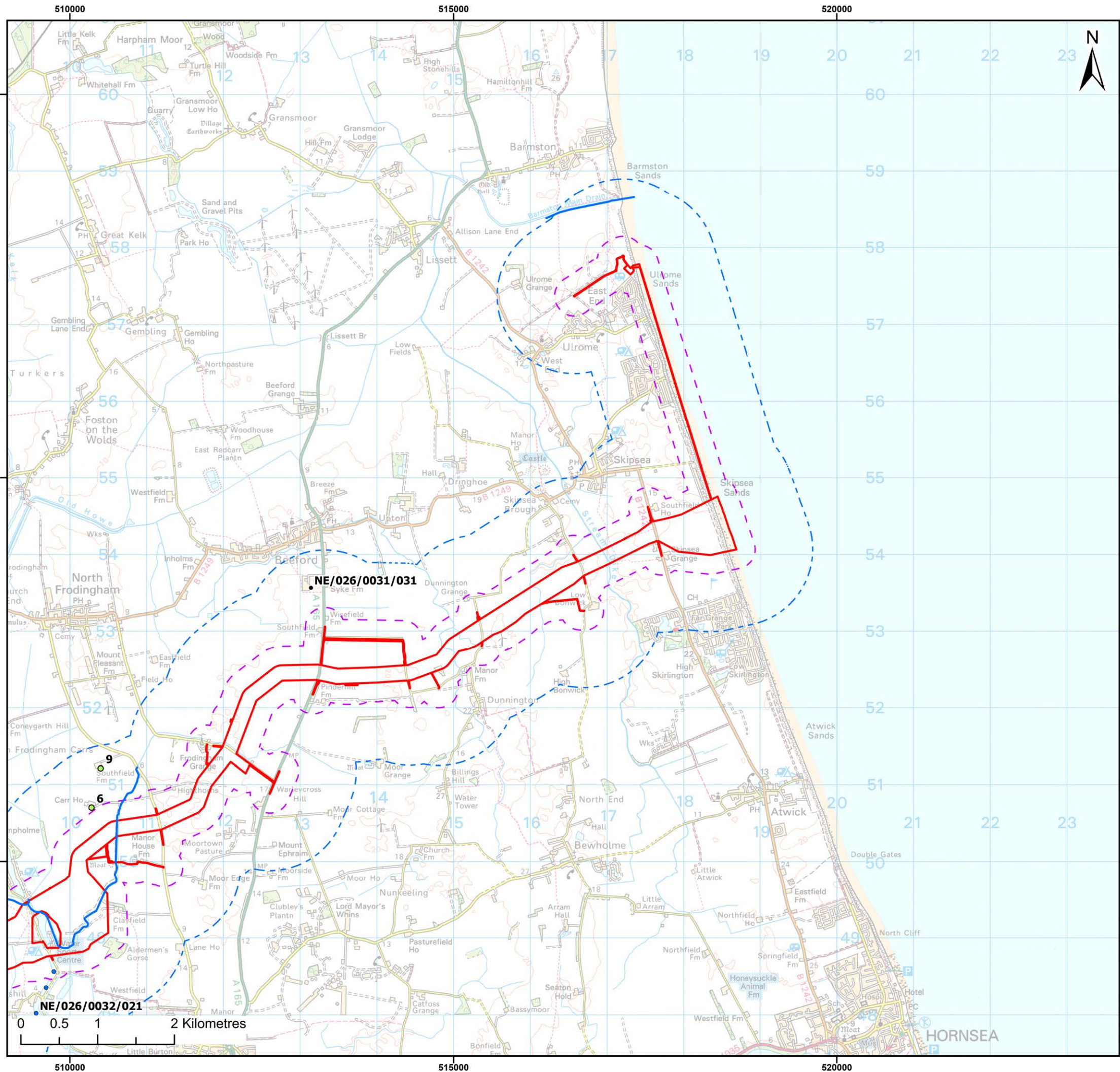
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Superficial Geology
- Sheet 3 of 3

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Co-ordinate system: British National Grid





- Legend:
- Onshore Development Area
 - Onshore Development Area 250m Buffer
 - Onshore Development Area 1km Buffer
 - Statutory Main River Map
 - Domestic abstraction well under the jurisdiction of the Local Authority

Licensed groundwater & surface water abstractions
(labelled licence number eg NE/026/0031/031)

- Groundwater - non potable
- Groundwater - potable

Source Protection Zone

1

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Project:
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DOGGER BANK
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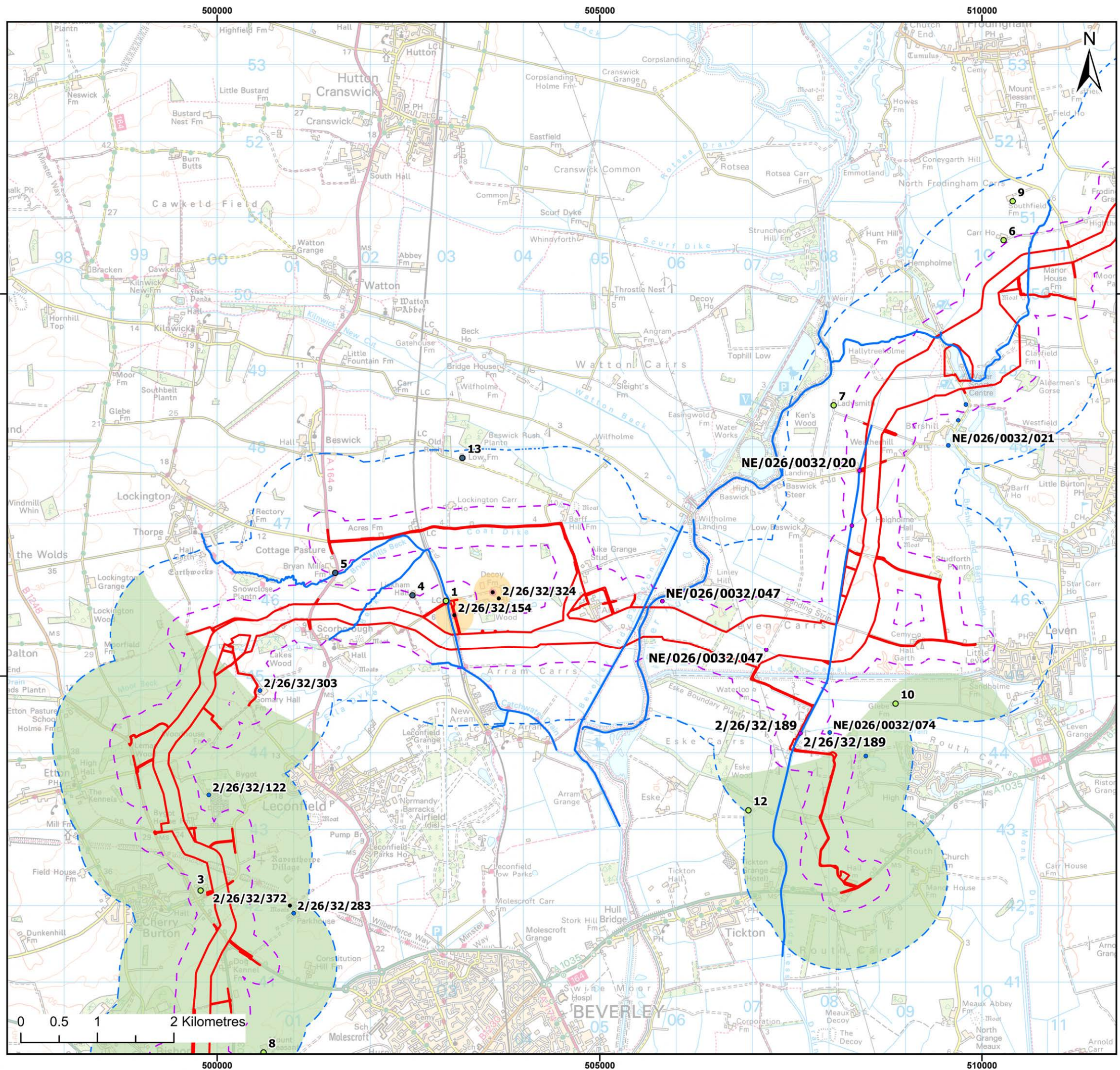
Title:
Hydrogeology and Hydrology
- Sheet 1 of 3

Figure: 19-4 Drawing No: PC6250-RHD-XX-OF-DR-GS-0381

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01	10/01/2025	MW	AB	A3	1:50,000

Co-ordinate system: British National Grid





- Legend:**
- Onshore Development Area
 - Onshore Development Area 250m Buffer
 - Onshore Development Area 1km Buffer
 - Statutory Main River Map
 - Commercial abstraction well under the jurisdiction of the Local Authority
 - Domestic abstraction well under the jurisdiction of the Local Authority

- Licensed groundwater & surface water abstractions**
(labelled licence number eg NE/026/0031/031)
- Groundwater - non potable
 - Groundwater - potable
 - Surface water - non potable

- Source Protection Zone**
- 1
 - 2
 - 3
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Project:
Dogger Bank D
Offshore Wind Farm

**DOGGER BANK
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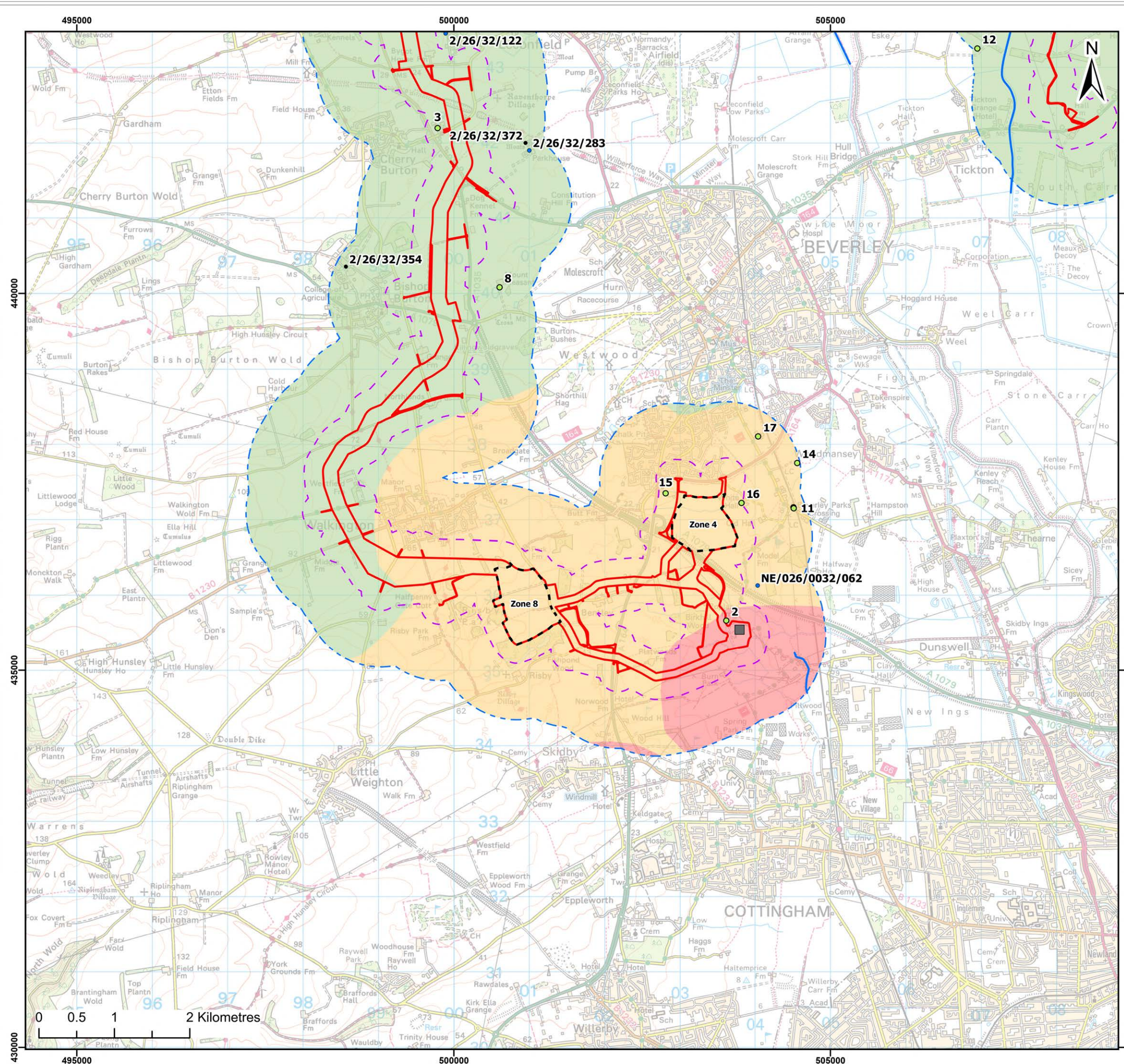
Title:
Hydrogeology and Hydrology
- Sheet 2 of 3

Figure: 19-4 Drawing No: PC6250-RHD-XX-OF-DR-GS-0381

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Co-ordinate system: British National Grid





Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer
- Onshore Development Area 1km Buffer
- Onshore Converter Station Zone Options
- Indicative Birkhill Wood Substation Location
- Statutory Main River Map
- Domestic abstraction well under the jurisdiction of the Local Authority

Licensed groundwater & surface water abstractions
(labelled licence number eg NE/026/0031/031)

- Groundwater - non potable
- Groundwater - potable

Source Protection Zone

- 1
- 2
- 3

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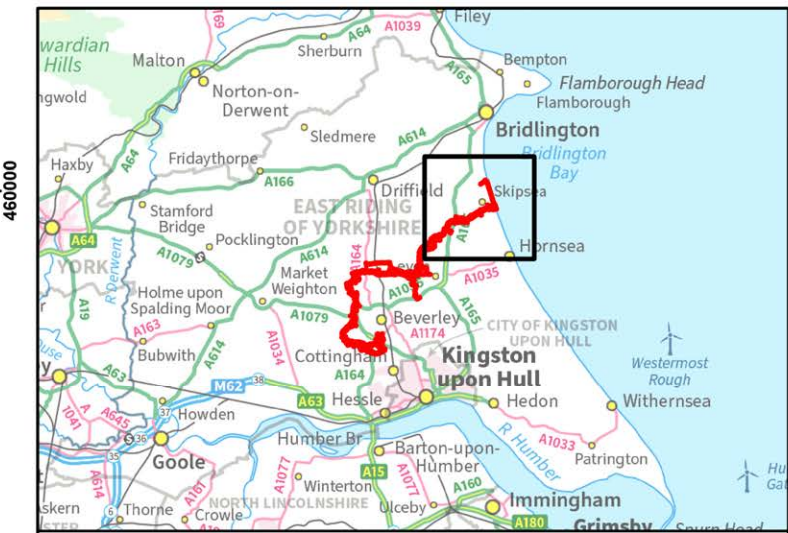
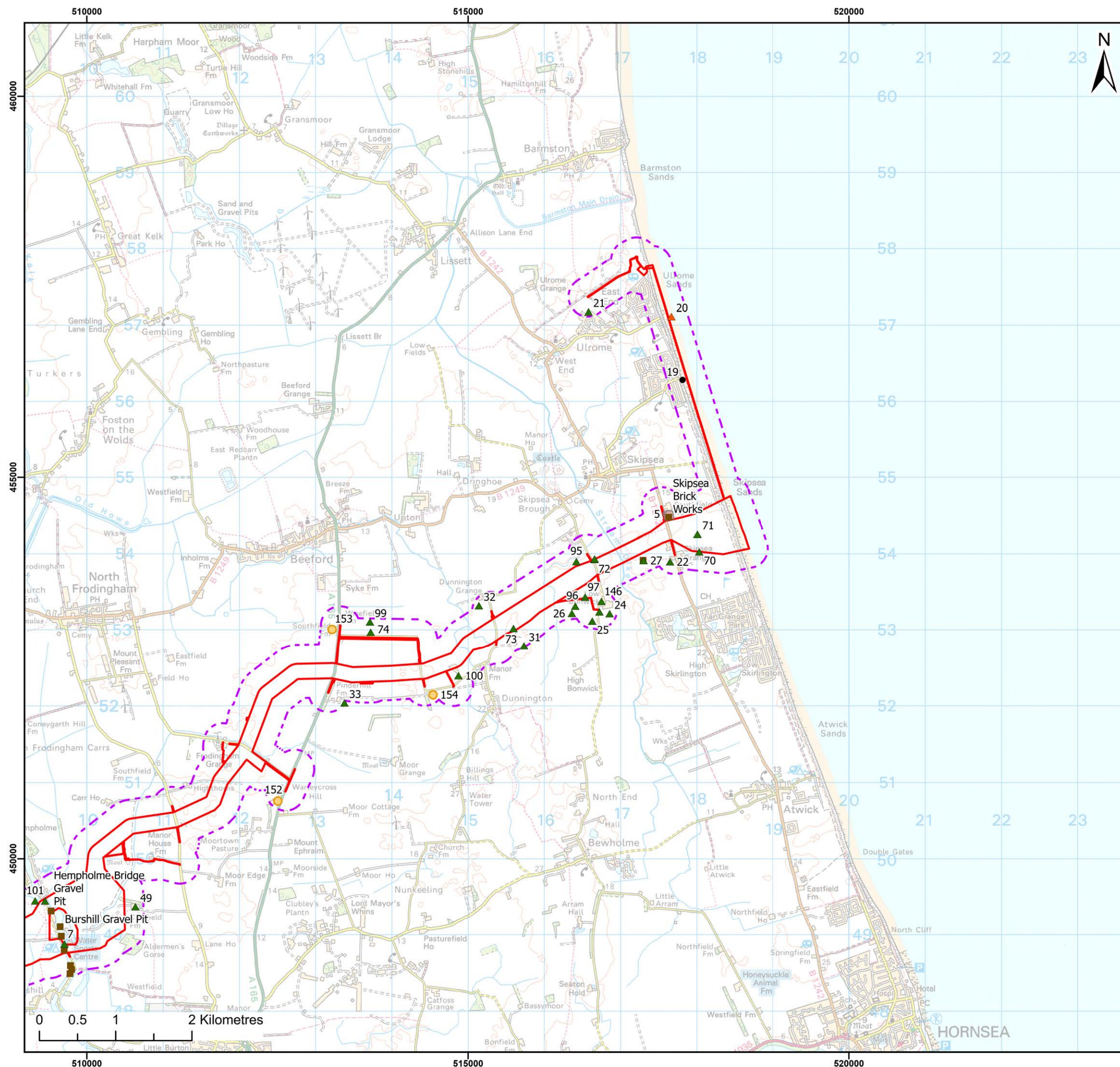
**DOGGER BANK
WIND FARM**

Title:

Hydrogeology and Hydrology
- Sheet 3 of 3

Figure:	19-4	Drawing No:	PC6250-RHD-XX-OF-DR-GS-0381			
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Co-ordinate system: British National Grid



Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer

Energy Features

- Electrical Substation Facilities

Tanks

- Historical Tank Features

Industrial Land Uses

- ▲ Potential pits / ponds / chalk pits / sand pit/ old gravel pits/ infilled land
- BGS Recorded Mineral Site
- ▲ Coastguard station
- Clay bricks & tiles [manufacture]

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Project:

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Offshore Wind Farm

**DOGGER BANK
WIND FARM**

Title:

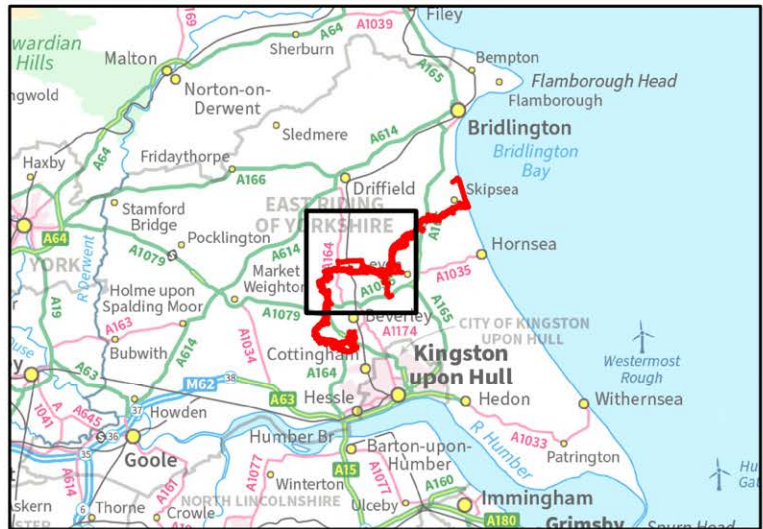
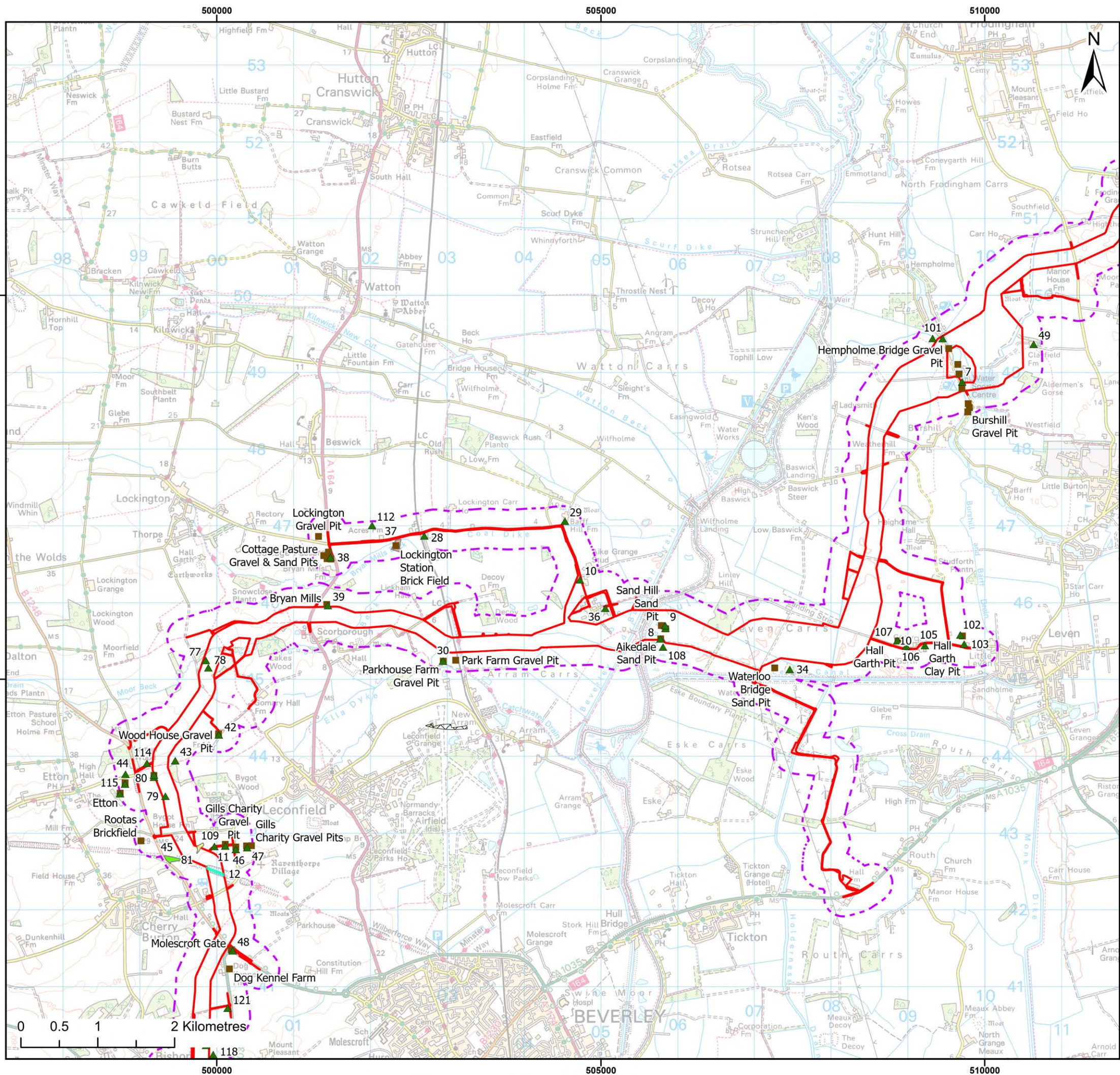
Potentially Contaminative Historical Land Uses
- Sheet 1 of 3

Figure:	19-5	Drawing No:	PC6250-RHD-XX-OF-DR-GS-0382			
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Co-ordinate system: British National Grid

**sse
Renewables**

equinor



Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer

Industrial Land Uses

- Potential pits / ponds / chalk pits / sand pit/ old gravel pits/ infilled land
- BGS Recorded Mineral Site
- Unknown Filled Ground (Pond, marsh, river, stream, dock etc)
- Clay bricks & tiles [manufacture]
- Quarrying of sand & clay, operation of sand & gravel pits
- Railways
- Cutting

Military

- Military Land

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Project:

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**DOGER BANK
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Title:

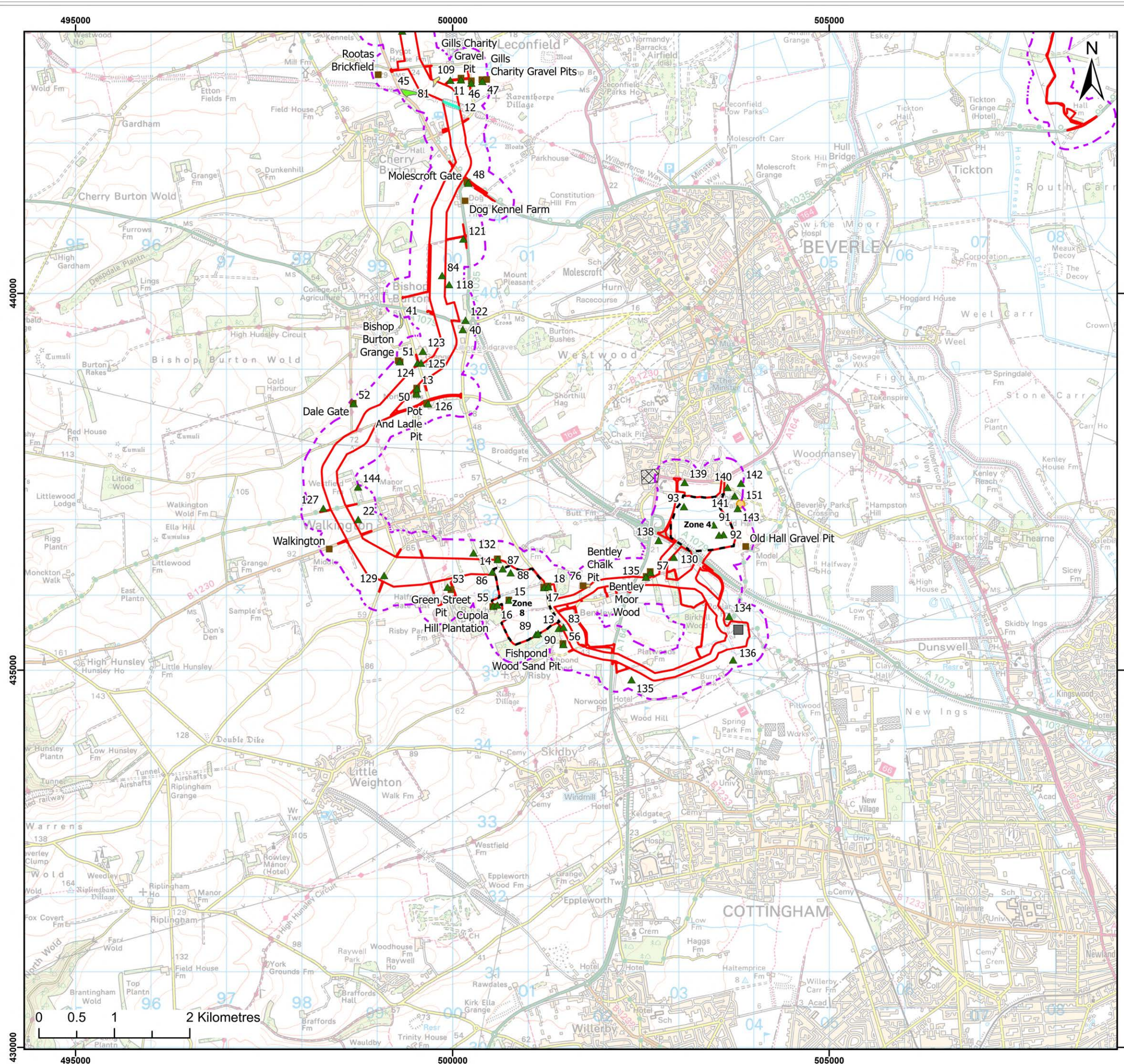
Potentially Contaminative Historical Land Uses
- Sheet 2 of 3

Figure: 19-5 Drawing No: PC6250-RHD-XX-OF-DR-GS-0382

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01	10/01/2025	MW	AB	A3	1:50,000

Co-ordinate system: British National Grid





Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer
- Onshore Converter Station Zone Options
- Indicative Birkhill Wood Substation Location

Tanks

- Historical Tank Features

Industrial Land Uses

- Potential pits / ponds / chalk pits / sand pit/ old gravel pits/ infilled land
- BGS Recorded Mineral Site
- Quarrying of sand & clay, operation of sand & gravel pits
- Railways
- Cutting

Military

- Military Land

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Dogger Bank D Offshore Wind Farm

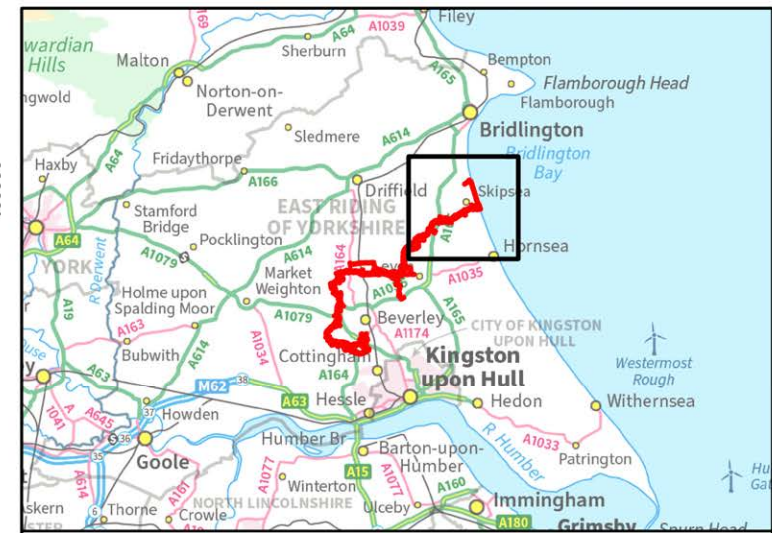
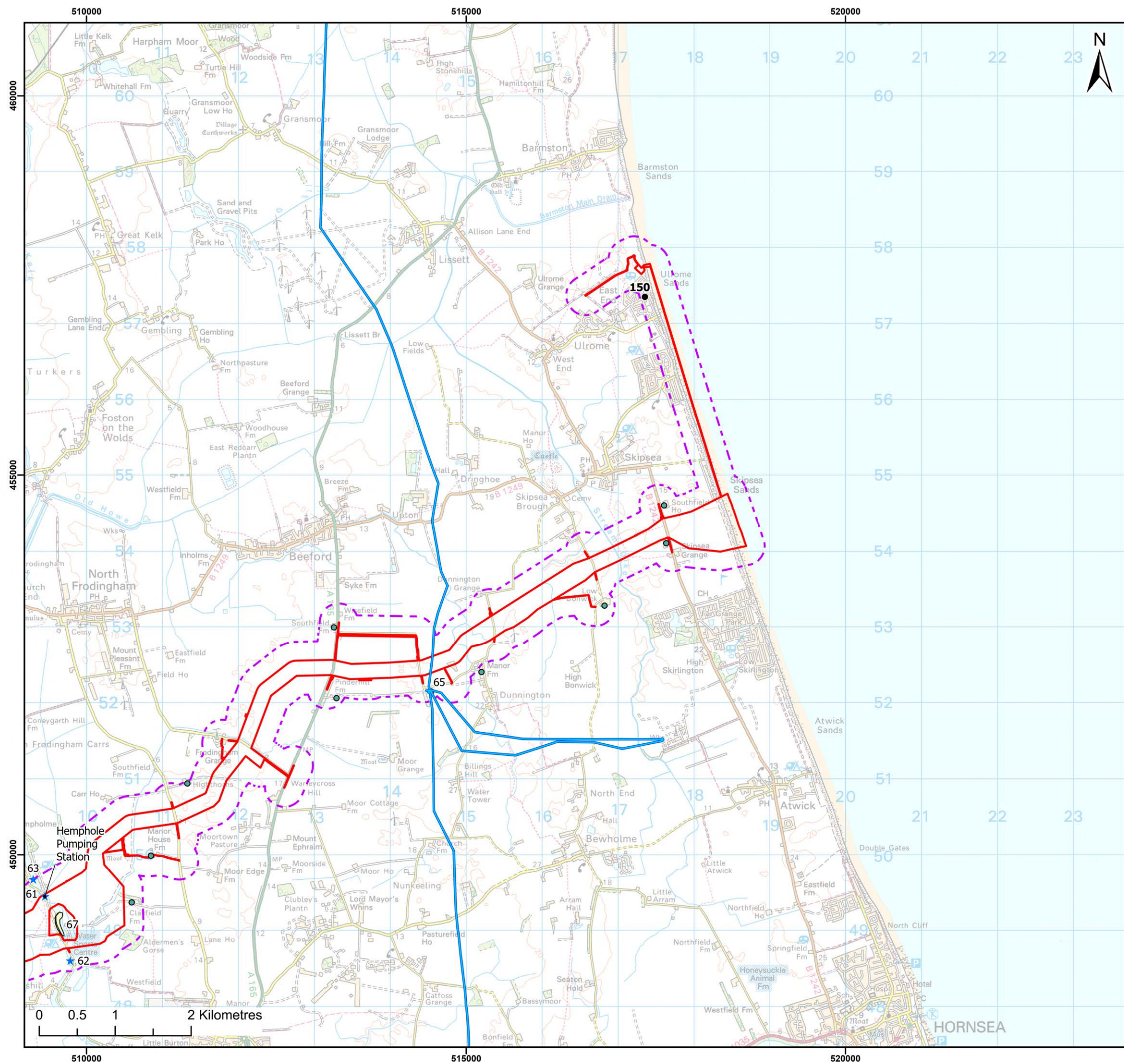
DOGGER BANK WIND FARM

Title:

Potentially Contaminative Historical Land Uses - Sheet 3 of 3

Figure:	19-5	Drawing No:	PC6250-RHD-XX-OF-DR-GS-0382			
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Co-ordinate system: British National Grid



Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer

Energy Features

- Electrical Substation Facilities

Industrial Land Uses

- Potential pits / ponds / chalk pits / sand pit/ old gravel pits/ infilled land
- Gas Valve Compound
- Farm Building
- Hempholme Pumping Station
- Quarrying of sand & clay, operation of sand & gravel pits

Gas Pipelines

- National Grid High Pressure Gas Pipeline

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Project:

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**DOGGER BANK
WIND FARM**



Title:

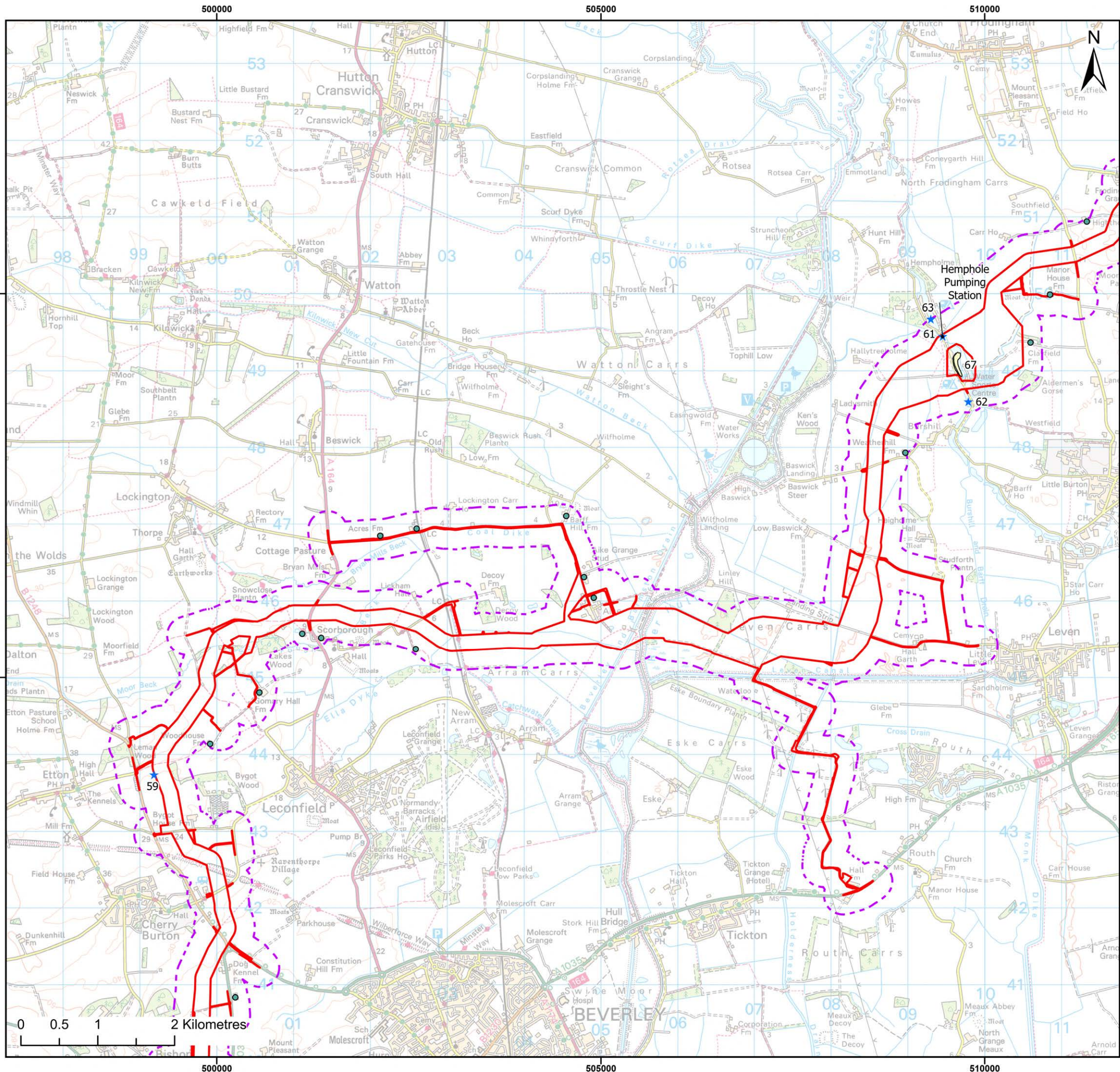
Potentially Contaminative Current Land Uses
- Sheet 1 of 3

Figure: 19-6 Drawing No: PC6250-RHD-XX-OF-DR-GS-0383

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Co-ordinate system: British National Grid



- Legend:
- Onshore Development Area
 - Onshore Development Area 250m Buffer
- Industrial Land Uses
- Potential pits / ponds / chalk pits / sand pit/ old gravel pits/ infilled land
 - Farm Building
 - Hempholme Pumping Station
 - Quarrying of sand & clay, operation of sand & gravel pits

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Offshore Wind Farm

**DOGGER BANK
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Title:

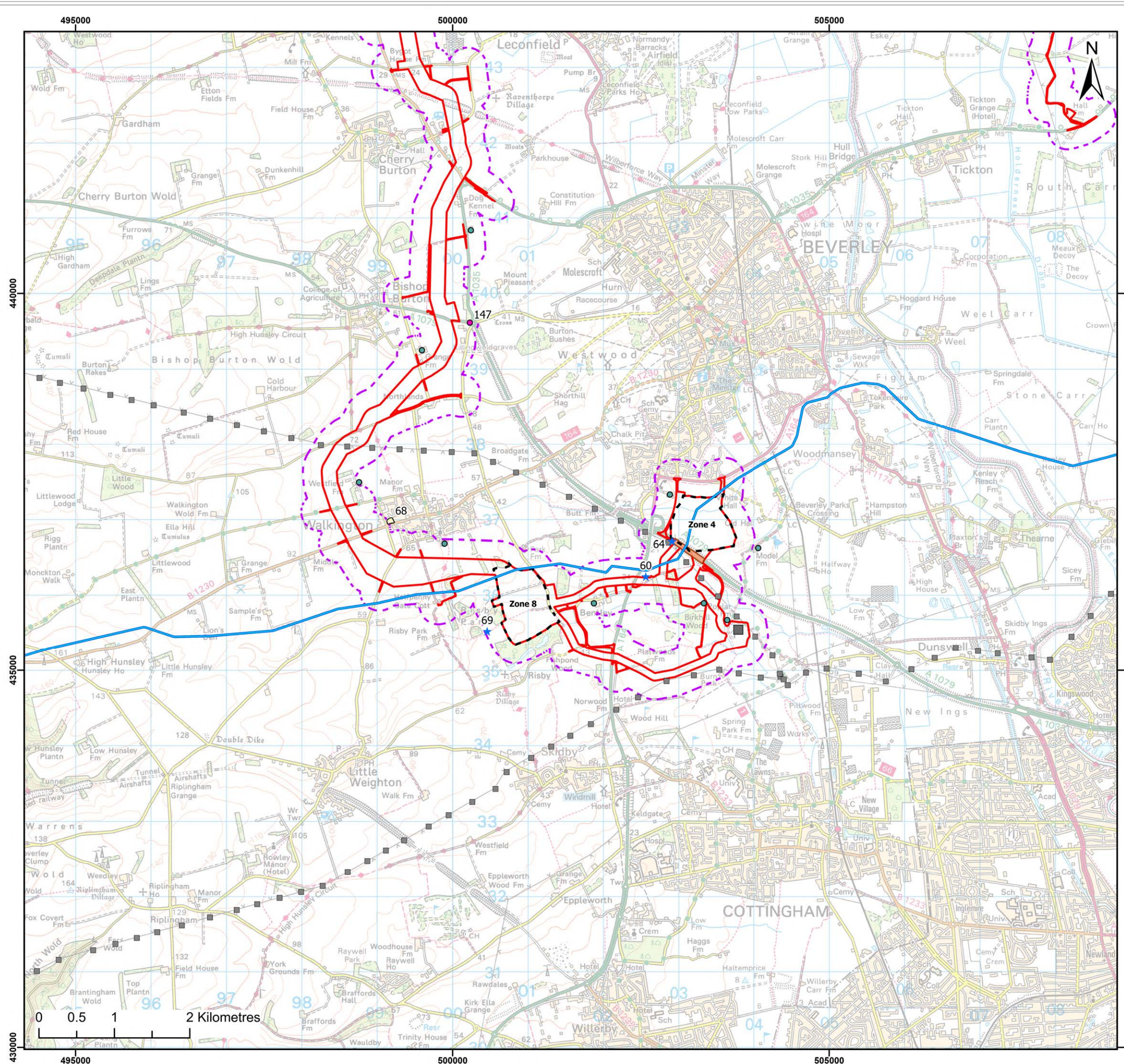
Potentially Contaminative Current Land Uses
- Sheet 2 of 3

Figure: 19-6 Drawing No: PC6250-RHD-XX-OF-DR-GS-0383

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01	10/01/2025	MW	AB	A3	1:50,000

Co-ordinate system: British National Grid





Legend:

- Onshore Development Area
- Onshore Development Area 250m Buffer
- Onshore Converter Station Zone Options
- Indicative Birkhill Wood Substation Location

Industrial Land Uses

- Potential pits / ponds / chalk pits / sand pit/ old gravel pits/ infilled land
- National Grid Pylons
- Fuel Station Points
- Farm Building
- Quarrying of sand & clay, operation of sand & gravel pits
- Cutting

Gas Pipelines

- National Grid High Pressure Gas Pipeline

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Project:

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DOGGER BANK
WIND FARM

Title:

Potentially Contaminative Current Land Uses
- Sheet 3 of 3

Figure:	19-6	Drawing No:	PC6250-RHD-XX-OF-DR-GS-0383			
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Co-ordinate system: British National Grid

19.6.2 Predicted Future Baseline

71. A description of future baseline conditions for geology and ground conditions has been carried out and is described within this section.
72. Sections of the Onshore Development Area are located within areas identified as containing mineral resources. The extraction of these materials would alter the baseline conditions for those areas. The potential changes would also affect the hydrogeology and hydrology. Removal of superficial deposits could impact on groundwater flow patterns and discharges into surface water bodies. The removal of deposits may also expose pre-existing contamination which then has the potential to be mobilised.
73. 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 and increased surface run off due to heavy rainfall following a period of drought / dry weather, dust generation 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).
74. Natural degradation or attenuation of contaminants over time may result in a general improvement in ground conditions.
75. A rise in groundwater levels may result from increased rainfall. A rise in groundwater levels has the potential to mobilise pre-existing contaminants which could in turn adversely impact controlled waters.
76. Climate change will also impact on the hydrology of surface drainage networks, with higher winter flows and a greater number of storm related flood flows. The risk of flooding will be intensified by the predicted increase in rainfall which may result in higher peak river flows and more surface water flooding.
77. Changes in weather patterns as a result of climate change have the potential to increase the rate of erosion observed along the UK coastline. Future trends associated with coastal erosion are covered in **Volume 2, Appendix 31.4 Coastal Erosion Report**.
78. An increase in population and urbanisation may lead to a reduction in land available for agriculture. This may compound pressures for more productive agricultural practices to be used to feed the population. As such, there may be an increase in the use of agricultural chemicals and industrial fertiliser to ensure high crop yields at a high quality.

79. Although there is the potential for increased usage of agricultural chemicals to maintain crop yields, ongoing measures, such as the regulation of agricultural chemicals are likely to improve the baseline environment by reducing the existing pressures on groundwater bodies. The baseline for groundwater quality is also likely to improve over time through the natural breakdown of any chemicals currently present within the baseline environment.
80. Increasing demand from population growth may also drive the expansion of urban areas into new areas, including land that has 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).

19.7 Assessment of Effects

81. The likely significant effects to geology and ground conditions receptors that may occur during construction, O&M and decommissioning of the Project are assessed in the following sections. The assessment follows the methodology set out in **Section 19.5** and is based on the realistic worst-case scenarios defined in **Section 19.4.4**, with consideration of embedded mitigation measures identified in **Section 19.4.3**.
82. As noted in **Section 19.4.5**, the assessment of likely significant effects for the OCS zone infrastructure will remain the same for both development scenarios.

19.7.1 Potential Effects during Construction

19.7.1.1 Impacts to Human Health from On-Site and Off-Site Contamination Sources (GGC-C-01)

83. The excavation of cable trenches, earthworks and piling (if required within the OCS zone and installation of anchors or foundations for trenchless crossing 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.
84. A PRA (see **Volume 2, Appendix 19.2 Preliminary Risk Assessment**) has been undertaken for the Onshore Development Area to identify plausible contaminant linkages resulting from 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.

85. 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, a historical brick manufacturer, railway land and a pumping station (see **Table 19-13**).
86. 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, landowners, land users, residential occupants and neighbouring land users if exposed to these PCOC 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.
87. In the event of exposing soils and stockpiling construction waste (including excavated soils if deemed to be a waste), dust could be generated during dry and windy conditions. Under these conditions, construction workers, landowners, residential occupants, land users and neighbouring land users could temporarily be exposed to contamination via the inhalation of potentially contaminated dusts.
88. 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 works and piling works (if required within the OCS zone and installation of anchors or foundations for trenchless crossing 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, however is typically linked to the presence of domestic landfill. The potential risk from ground gas could represent a risk to human health through asphyxiation and explosion.

19.7.1.1.1 Receptor Sensitivity

89. The sensitivity of construction workers, landowners, land users, residential occupants and neighbouring land users is considered to be **high**.
90. 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.

19.7.1.1.2 Impact Magnitude

91. During the construction phase, there would be the requirement for materials to be excavated along the onshore ECC such as the construction of temporary haul roads, jointing bays, link boxes and temporary construction compounds. Excavation and movement of material would also be required at the landfall and the OCS zone.

92. The total onshore construction period is anticipated to be five years (as reported in **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.
93. 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**.
94. In relation to risks associated with the migration of ground gases and / or vapours, the impacts could be present over the extent of work areas for the duration of the works. This could represent a risk of acute or chronic health effects to workers. However, the embedded mitigation measures for the Project (see **Table 19-5**, Commitment IDs CO39, CO40, CO47, CO48, CO50, CO51, CO53, CO54, and CO94) will reduce the magnitude of this impact through the introduction of good working practices, appropriate safety measures including the provision of the correct PPE and good hygiene practices. In addition, avoiding known areas of contaminated land risk, including authorised and historic landfills, where possible, was adopted as a principle in the site selection process leading up to the identification of the Onshore Development Area and will also be applied during further site selection refinements at ES stage (see **Chapter 5 Site Selection and Consideration of Alternatives** for more details). The magnitude of impact is therefore considered to be **medium**. It should, however, be noted that this is subject to the plausibility of a ground gas or vapour source of contamination and receptor linkage.

19.7.1.1.3 Effect Significance

95. The potential impact to human health associated with the excavation works is **low** on a **high** sensitivity receptor. This therefore results in a **moderate adverse** significance of effect in the absence of additional mitigation, which is **significant** in EIA terms. This risk is only posed where there is an identified contaminant linkage.
96. In relation to potential impacts associated with the migration of ground gases and / or vapours to human health, the magnitude of impact is **medium** on a **high** sensitivity receptor. This therefore results in a **major adverse** significance of effect in the absence of additional mitigation, which is **significant** in EIA terms. This risk is only posed where there is an identified contaminant linkage.

19.7.1.1.4 Additional Mitigation and Residual Effect

97. Areas of potential contamination should be avoided where possible. Where areas of potential contamination cannot be avoided, such as the areas that cross the entire width of the onshore ECC (e.g. historical railway lines), targeted ground investigations may be required prior to construction to determine the presence, extent and source of any contamination (see **Table 19-15**, Commitment ID CO48). 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 tested for include, but are not limited to, metals, PAH, PCB and PFAS.
98. 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 to establish the groundwater regime and to identify, for example, whether contamination is from on-site or off-site sources.
99. 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 authorities prior to the commencement of remedial works and construction activities. The ground investigation, risk assessment and remediation would follow guidance provided within the Environment Agency Land Contamination Risk Management Framework (2023).
100. If a significant source of ground gas / vapour generating material is encountered during construction, further consideration will be required.
101. With the adoption of additional mitigation measures, the magnitude of impact for both excavation works and the migration of ground gas would be **negligible**. The residual effect would therefore be of **minor adverse** significance, which is **not significant** in EIA terms.

19.7.1.2 Impacts on Groundwater Quality and Groundwater Resources (GGC-C-02)

102. Direct impacts to the Secondary A, B and Undifferentiated Aquifers within the superficial deposits may occur due to the intrusive nature of trenching as well as due to deep excavations associated with trenchless crossing techniques. 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.

103. During construction, surface layers would be excavated, which could allow increased infiltration of rainwater and surface run-off to the subsurface in the short term. 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.
104. Direct impacts to the Principal Aquifers and SPZ may occur from deep ground workings related to trenchless crossing operations for cable duct installation beneath surface infrastructure, watercourses and other obstacles. Trenchless installation will also be required at landfall as part of the works to connect onshore and offshore export cables, which may result in direct impacts to the Principal Aquifers associated with the chalk in this area.
105. Trenchless installation works have the potential to create preferential pathways and for drilling mud or other contaminants to leak along the drill path, which could cause contamination of groundwater. The volume of drilling fluid that could be released during trenchless installation works is dependent on several 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.
106. Piling may be required to allow for the installation of anchors for trenchless crossing rigs as well as for the foundations within the OCS zone. Should piling be required, there is the potential to create preferential pathways through a low permeability layer. Although the locations of any potential piling activities associated with the trenchless crossing rigs are yet to be determined, there is the potential for piles to be located within areas designated as an SPZ.
107. In relation to the OCS zone foundations, should piling be required it would be located within an area designated as an SPZ2 (relevant to both OCS Zones 4 and 8). Piling activities undertaken within an area designated as an SPZ may allow potential contamination to migrate into underlying Principal Aquifers and SPZ through the creation of preferential pathways, impacting water quality and associated offsite groundwater abstractions.
108. 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.
109. 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.

19.7.1.2.1 Receptor Sensitivity

110. There are no licensed potable groundwater abstractions extracting more than 20m³ of water per day from the Principal Aquifers within the Onshore Development Area. There are however five licensed potable groundwater abstractions extracting more than 20m³ of water per day recorded within 250m of the Onshore Development Area with the possibility that further unregistered abstractions taking less than 20m³ a day are present. The sensitivity of Principal Aquifers, SPZ2 and SPZ3 as well as private potable abstractions within 250m is **medium**. The sensitivity of the SPZ1 areas is **high**.

19.7.1.2.2 Impact Magnitude

111. During the construction phase, there would be the requirement for materials to be excavated along the onshore ECC such as the construction of cable trenches, temporary haul roads, jointing bays, link boxes and temporary construction compounds. Excavation and movement of material would also be required at the landfall and the OCS zone. Although the total volume of materials required to be excavated is not yet determined, the works would be required along the 55km length of the onshore ECC. The maximum developable area within the OCS zone for the OCS and ESBI is 25 hectares (ha), which includes 4.5ha for two temporary construction compounds serving the OCS and ESBI construction works.
112. The total onshore construction period is anticipated to be five years. 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.
113. 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**.
114. Trenchless installation works will be required as part of the construction works at landfall and where the onshore ECC crosses major obstacles. The foundation design of within the OCS zone (i.e. whether piling is required), and the total number of piles is yet to be determined. Whether piling is required and if so, the total number of piles required to install the anchors for trenchless crossing rigs is also yet to be determined.

115. The Principal Chalk Aquifers present at the landfall are not designated as an SPZ, which is likely due to the saline intrusion from the sea interacting with the groundwater making it unsuitable for use as potable water. Concern has been raised that any potential dewatering activities taking place during construction within the landfall may contribute to saline intrusion within the chalk aquifer, however, through the implementation of the proposed embedded mitigation measures, the magnitude of impact associated with trenchless installation works at landfall is considered to be **low**.

116. The impacts of either trenchless crossings or piling on the underlying Secondary A Aquifers, Principal Aquifers and SPZ are predicted to be of local spatial extent (occurring only at trenchless crossing locations and within the OCS zone if piling is required) and of intermittent occurrence. Embedded mitigation measures (see **Table 19-5**, Commitment IDs CO38, CO39, CO40, CO41, CO42, CO47, CO48, CO51, CO53, CO54, and CO94) including the completion of hydrogeological risk assessments, piling risk assessments and adherence to the CoCP mean that the magnitude of impact associated with trenchless installation and piling activities is considered to be **low**.

19.7.1.2.3 Effect Significance

117. The potential impact to groundwater quality, as the result of trenchless installation works and piling is **low** on a **medium** sensitivity receptor, with the exception of construction work taking place within the identified SPZ1 which would be **low** on a **high** sensitivity receptor.
118. This therefore results in a **minor adverse** significance of effect in the absence of additional mitigation for Secondary A Aquifers, Principal Aquifers, SPZ2 and SPZ3, which is **not significant** in EIA terms, and a **moderate adverse** significance of effect for SPZ1 which is **significant** in EIA terms. This risk is only posed where there is an identified contaminant linkage.

19.7.1.2.4 Additional Mitigation and Residual Effect

119. As discussed in **Section 19.7.1.1.4**, additional mitigation includes measures such as ground investigations to characterise ground conditions (see **Table 19-15**, Commitment ID CO48). 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 authorities. 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.
120. With the adoption of both embedded and additional mitigation measures, the magnitude of impact would be **negligible**. The residual effect would therefore be of **minor adverse** significance, which is **not significant** in EIA terms.

19.7.1.3 Impacts on Surface Water Quality and Associated Ecological Habitats from Contamination (GGC-C-03)

121. As described in **Table 19-14** and the PRA (see **Volume 2, Appendix 19.2 Preliminary Risk Assessment**), potential sources of contamination have been identified within the Onshore Development Area. Installation of the onshore export cables and construction of the OCS and ESBI would require substantial earthworks, as well as the potential for piling. These activities could 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 the 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 waters;
 - 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 construction works through the creation of preferential flow paths into surface water receptors.
122. Impacts relating to surface water quality and ecological habitats are provided in **Chapter 21 Water Resource and Flood Risk** and **Chapter 23 Onshore Ecology and Ornithology**.

19.7.1.3.1 Receptor Sensitivity

123. 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 extends into the Greater Wash SPA and Holderness Inshore Marine Conservation Zone. Although both protected areas are located within the landfall, 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**.

19.7.1.3.2 Impact Magnitude

124. The PRA (see **Volume 2, Appendix 19.2 Preliminary Risk Assessment**) has identified localised potential sources of contamination within the river catchments within the Onshore Development Area. However, the implementation of embedded mitigation measures (see **Table 19-5**, Commitment IDs CO32, CO33, CO35, CO36, CO38, CO39, CO40, CO42, CO47, CO48, CO51, CO53, CO54, and CO94) include the use of trenchless crossing techniques to avoid major watercourses, the provision and implementation of the CoCP, as well as the on-site storage and treatment of any potentially contaminated groundwater to meet the requirements set by either the Environment Agency or local water company. In addition, site selection principles included avoidance of and minimisation of impacts to nationally and locally designated sites for nature conservation, minimising watercourse crossings and aiming for perpendicular crossings of watercourses, where possible, were adopted which resulted in the identification of the Onshore Development Area and will also be applied during further site selection refinements at ES stage (see **Chapter 5 Site Selection and Consideration of Alternatives** for more details). Therefore, the magnitude of impact is assessed as **low**. It should be noted that this impact would only apply to the receptor where there is an identified contaminant linkage through the pathways identified in **Section 19.7.1.3**. In the absence of contamination, the impact would be **negligible**.

19.7.1.3.3 Effect Significance

125. The potential impact to surface water quality and ecological habitats is **low** on a **high** sensitivity receptor. This therefore results in a **moderate adverse** significance of effect in the absence of additional mitigation, which is **significant** in EIA terms. This risk is only posed where there is an identified contaminant linkage.

19.7.1.3.4 Additional Mitigation and Residual Effect

126. The mitigation measures set out in Sections **19.7.1.1.4** and **19.7.1.2.4** (i.e. the completion of targeted ground investigations and if required subsequent production and implementation of soil and groundwater remediation strategies) would also serve to prevent the migration of contamination into surface water bodies (see **Table 19-15**, Commitment ID CO48).
127. With the adoption of additional mitigation measures, the magnitude of impact would be **negligible**. The residual effect would therefore be of **minor adverse** significance, which is **not significant** in EIA terms.

19.7.1.4 Impacts to Designated Geological Sites (GGC-C-04)

128. Within the Onshore Development Area, one nationally designated geological site and one LGS have been identified. Withow Gap SSSI are located at the landfall and Skipsea Drain LGS is located in close proximity of the landfall and overlapping the onshore ECC. Skipsea Bail Mere RIGS and SSSI is located approximately 240m north of the onshore ECC (see **Figure 19.2-4 of Volume 2 Appendix 19.2 Preliminary Risk Assessment**).
129. Where overlaps occur between the landfall or onshore ECC and the designated geological site, construction activities such as excavations or trenchless installation works could physically damage the protected geological features.
130. The Withow Gap SSSI comprises post-glacial lake sediments filling a shallow valley in the surface of the underlying till and exposed in the cliff face at the landfall. The deposits are not thick and the base of the valley (with the upper parts exposed in the cliff) at its deepest point would not be far below beach level. Given, the deposition occurred in a lake it is unlikely that the base level of the deposits a short distance inland will be significantly different to that at the coast. Indeed, as they thin out further inland it is more likely that the base level would rise.

19.7.1.4.1 Receptor Sensitivity

131. Due to the local importance of the Skipsea Drain LGS, its sensitivity is considered to be **low**.
132. Due to the designation of the Withow Gap SSSI and Skipsea Bail Mere SSSI, their sensitivity is considered to be **medium**.

19.7.1.4.2 Impact Magnitude

133. The construction phase of works will use a trenchless installation technique at the landfall location. The trenchless installation trajectory will be located at a suitable depth below the base of the cliff, and so will not interact with the Withow Gap SSSI deposits (see **Table 19-5**, Commitment ID CO23). The base of the SSSI would be above the line of the trenchless installation trajectory. The magnitude of impact is therefore considered to be **negligible**.
134. Construction has the potential to result in the partial loss of the Skipsea Drain LGS. Minimising impacts to LGS will be considered for refinement of the Onshore Development Area at ES stage (see **Chapter 5 Site Selection and Consideration of Alternatives**). With the implementation of embedded mitigation measures (see **Table 19-5**, Commitment IDs CO39, CO40, CO47, CO48, CO51, CO53, and CO94), the impact magnitude for this receptor is considered to be **medium**.
135. Due to the distance to Skipsea Bail Mere SSSI, the magnitude of impact on this receptor is considered to be **negligible**.

19.7.1.4.3 Effect Significance

136. Despite the risk of a potential partial loss of the feature, the potential impact to the Skipsea Drain LGS is **medium** on a **low** sensitivity receptor. This therefore results in a **minor adverse** significance of effect, which is **not significant** in EIA terms.
137. The potential impact to Withow Gap SSSI is **negligible** on a **medium** sensitivity receptor. This therefore results in a **negligible adverse** effect significance, which is **not significant** in EIA terms.
138. The potential impact to the Skipsea Bail Mere SSSI is **negligible** on a **medium** sensitivity receptor. This therefore results in a **negligible adverse** significance of effect, which is **not significant** in EIA terms.

19.7.1.5 Sterilisation of Future Mineral Resources (GGC-C-05)

139. There are multiple MSA located as localised features throughout the Onshore Development Area (see **Figure 19.2-10 of Volume 2 Appendix 19.2 Preliminary Risk Assessment**). Construction activities, such as the installation of onshore export cables within these areas, would prevent the extraction of the identified resources.

19.7.1.5.1 Receptor Sensitivity

140. MSA are of regional importance and therefore the sensitivity of the receptor is considered to be **medium**.

19.7.1.5.2 Impact Magnitude

141. Construction works within the OCS zone have the potential to temporarily sterilise mineral resources within its footprint. OCS Zone 4 is located partially within an MSA whilst OCS Zone 8 is located entirely within an MSA. The total area of MSA impacted during construction will be quantified following further site selection refinement and included within the ES.
142. The footprint required for construction works will be greater than that required for permanent infrastructure during the O&M phase. Therefore, the potential impacts during the construction phase will temporarily sterilise a larger area than that which would be permanently sterilised during O&M (see **Section 19.7.2.5**).
143. Where construction works overlap with mineral safeguarding areas, a Mineral Resource Assessment (MRA) may be 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 (see **Table 19-5**, Commitment ID CO106).

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

145. Following completion of construction works, temporary infrastructure, such as construction compounds and haul roads, 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. This, combined with the implementation of the embedded mitigation measures (see **Table 19-5**, Commitment IDs CO39, CO40, CO47, CO48, CO51, CO53, and CO94), and minimising impacts to Mineral Safeguarding Areas through site selection refinement (see **Chapter 5 Site Selection and Consideration of Alternatives**) results in a magnitude of impact that is considered to be **low**.

19.7.1.5.3 Effect Significance

146. The potential impact to mineral resources is **low** on a **medium** sensitivity receptor. This therefore results in a **minor adverse** significance of effect, which is **not significant** in EIA terms.

19.7.1.6 Impacts to the Built Environment (GGC-C-06)

147. 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.

148. Potential impacts associated with the Onshore Development Area on usage and disruption to the existing utilities, in relation to electricity cables, telecommunications and high-pressure gas pipelines, are discussed in **Chapter 22 Soils and Land Use**.

19.7.1.6.1 Receptor Sensitivity

149. There are commercial, residential and holiday properties within 250m of the Onshore Development Area. Therefore, the sensitivity of the built environment is considered to be **medium**.

19.7.1.6.2 Impact Magnitude

150. Commercial, residential and holiday properties are located within 250m of the construction works. These features are not present along the entirety of the Onshore Development Area but as isolated areas, with the greatest concentrations being the settlements of Leven, Bishop Burton, Walkington and Beverley. The onshore ECC also crosses roads and other infrastructure.

151. Potential impacts to the built environment are considered to be localised to work areas and areas of contamination, though in the case of accumulation and migration of ground gases consequences may be severe. Avoiding known areas of contaminated land risk, including authorised and historic landfills, where possible, was adopted as a principle in the site selection process leading up to the identification of the Onshore Development Area and will also be applied during further site selection refinements at ES stage (see **Chapter 5 Site Selection and Consideration of Alternatives** for more details).

152. In addition to the site selection process, with the implementation of embedded mitigation measures (see **Table 19-5**, Commitment IDs CO39, CO40, CO47, CO48, CO51, CO53, CO54, and CO94), the magnitude of impact is considered to be **medium**.

19.7.1.6.3 Effect Significance

153. The potential impact to the built environment is **medium** on a **medium** sensitivity receptor. This therefore results in a **moderate adverse** significance, which in the absence of additional mitigation is **significant** in EIA terms.

19.7.1.6.4 Additional Mitigation and Residual Effect

154. 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 (see **Table 19-15**, Commitment ID CO48).

155. With the adoption of additional mitigation measures, the magnitude of impact would be **negligible**. The residual effect would therefore be of **negligible adverse** significance, which is **not significant** in EIA terms.

19.7.1.7 Impacts to Agricultural Land (GGC-C-07)

156. 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.

157. Due to the nature of the land use within the Onshore Development Area, it would not be possible to avoid agricultural land. The PRA (see **Volume 2, Appendix 19.2 Preliminary Risk Assessment**) has identified localised areas within the Onshore Development Area with a history of potentially contaminative uses which could represent a contamination risk to agricultural land.
158. Construction activities therefore have the potential to mobilise pre-existing sources of contamination in identified areas or due to the invasive nature of construction activities, 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.
159. Further discussion in relation to potential impacts associated with construction on agricultural land beyond the impacts related to contaminated land can be found in **Chapter 22 Soils and Land Use**.

19.7.1.7.1 Receptor Sensitivity

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

19.7.1.7.2 Impact Magnitude

161. During construction, there will be the requirement for materials to be excavated to construct the onshore elements of the Project, inclusive of temporary haul roads and temporary construction compounds. As mentioned previously, earthworks would not be operating continuously or at the same location during the whole construction phase.
162. 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).
163. With the implementation of the embedded mitigation measures (see **Table 19-5**, Commitment IDs CO39, CO40, CO46, CO47, CO48, CO51, CO53, and CO94) including the provision and implementation of the CoCP and Soil Management Plan, along with the completion of ALC and soil condition surveys prior to the commencement of construction works, the magnitude of impact is considered to be **low**.

19.7.1.7.3 Effect Significance

164. The potential impact to agricultural land is **low** on a **high** sensitivity receptor. This therefore results in a **moderate adverse** significance of effect, which in the absence of additional mitigation is **significant** in EIA terms. This risk is only posed where there is an identified contaminant linkage.

19.7.1.7.4 Additional Mitigation and Residual Effect

165. Mitigation measures discussed in **Sections 19.7.1.1.4, 19.7.1.2.4 and 19.7.1.3.4**, including the avoidance of potential contamination, targeted ground investigations in areas where contamination is suspected to be present, the production of a proportionate Remediation Strategy (if considered necessary) and the appropriate management of potentially contaminated groundwater, would also serve to reduce the magnitude of impact on agricultural land as a result of construction activities (see **Table 19-15**, Commitment ID CO48). Implementation of the measures previously discussed would reduce the magnitude of impact to **negligible**. The residual effect would therefore be **minor adverse**, which is **not significant** in EIA terms.

19.7.2 Potential Effects during Operation

19.7.2.1 Impacts to Human Health from On-Site and Off-Site Contamination Sources (GGC-O-01)

166. During the O&M phase, routine non-intrusive inspection works are anticipated to occur at the landfall TJB, jointing bays and associated link box locations with periodic testing of the onshore export cables at defined inspection points along the onshore ECC which would not require the excavation of soils. In the unlikely event of a cable failure, the affected stretch of export cables between two jointing bays or at the TJB may need to be replaced. This would require excavation at the cable jointing locations to expose the jointing bays / TJB and allow the cables to be pulled out and replaced. O&M works associated with the OCS and ESBI is anticipated to be undertaken during the operational life of the Project, which may include the need for soils to be excavated.
167. If contaminated materials are brought to the surface through excavation during the O&M phase and no mitigation measures are implemented, these materials would be permanently exposed at surface. This creates the potential for O&M workers, landowners, land users and neighbouring land users to come in to direct contact with contaminated soils left in-situ via direct contact pathways.
168. Materials excavated during the installation of onshore export cable and landfall infrastructure and construction of the OCS and ESBI would be re-instated following completion of construction where possible. If a different source of material is used to backfill excavations 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 land within the OCS zone. This may lead to the accumulation of ground gas and vapours within land accessed by O&M workers during the O&M phase. Therefore, risks associated with asphyxia and explosion may be present.

169. If during site characterisation, works areas considered to represent an unacceptable risk to human health are identified, remedial works proportionate to 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.

170. In relation to risks posed by ground gases and vapours, should potential sources of gas or vapour generating materials be identified during site characterisation works or encountered unexpectedly during construction, appropriate mitigation measures, such as interruption of the pathway, are to be implemented.

19.7.2.1.1 Receptor Sensitivity

171. The sensitivity of the workforce, landowners, land users, residential occupants and neighbouring land users is considered to be **high**.

19.7.2.1.2 Impact Magnitude

172. There may be a need for ground excavations to be undertaken at jointing bay locations or at the OCS zone as part of required O&M works. 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 O&M works). However, this impact will be suitably mitigated by the outlined embedded mitigation measures (see **Table 19-5**, Commitment IDs CO49, CO54, and CO97) including the provision and use of appropriate PPE and the creation and adherence to an Onshore O&M Plan. The magnitude of impact is therefore considered to be **negligible**.

19.7.2.1.3 Effect Significance

173. The potential impact to human health associated with O&M works is **negligible** on a **high** sensitivity receptor. This therefore results in a **minor adverse** significance of effect, which is **not significant** in EIA terms.

19.7.2.2 Impacts on Groundwater Quality and Groundwater Resources (GGC-O-02)

174. O&M activities at landfall, along the onshore ECC and at the OCS zone 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, operational equipment or runoff water / foam from firefighting. This could affect water quality within the aquifers underlying the site and the water abstractions they support.

19.7.2.2.1 Receptor Sensitivity

175. There is one licensed potable groundwater abstractions extracting more than 20m³ of water per day from the Principal Aquifers within the Onshore Development Area.

176. There are five licensed potable groundwater abstractions extracting more than 20m³ of water per day recorded within 250m of the Onshore Development Area with the possibility that further unregistered abstractions taking less than 20m³ a day are present. The sensitivity of Principal Aquifers, SPZ2 and SPZ3 as well as private potable abstractions within 250m is **medium**. The sensitivity of the SPZ1 areas is **high**.

19.7.2.2.2 Impact Magnitude

177. Although excavation works will not form part of planned (routine) maintenance activities during the O&M phase, there is the potential for excavations to be undertaken to conduct unplanned, emergency repairs. Should excavation works be required as part of unplanned works, these would be at jointing bay locations along the onshore ECC and TJB at the landfall for cable repairs or at the OCS zone and not involve the entirety of the Project's onshore infrastructure.

178. The impacts are predicted to be of local spatial extent (localised to areas of excavation or maintenance and where contamination may be present). In addition to this, the embedded mitigation measures outlined (see **Table 19-5**, Commitment IDs CO41, CO49, CO54, and CO97), will further reduce the magnitude. Therefore, magnitude of impact is therefore considered to be **negligible** during the O&M phase.

19.7.2.2.3 Effect Significance

179. The potential impact to groundwater quality, as the result of O&M works is **negligible** on a **medium** sensitivity receptor, with the exception of works taking place within the identified SPZ1 which would be **negligible** on a **high** sensitivity receptor. This therefore results in a **minor adverse** significance of effect for Secondary A Aquifers, Principal Aquifers, SPZ2 and SPZ3, which is **not significant** in EIA terms, and a **minor adverse** significance of effect for SPZ1, which is also **not significant** in EIA terms.

19.7.2.3 Impacts on Surface Water Quality and Associated Ecological Habitats from Contamination (GGC-O-03)

180. Maintenance activities at landfall, along the onshore ECC and at the OCS zone 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, operational equipment or runoff water / foam from firefighting. This could affect surface water quality and the ecological habitats they support.

19.7.2.3.1 Receptor Sensitivity

181. The Onshore Development Area extends into the Greater Wash SPA and Holderness Inshore Marine Conservation Zone. Although both protected areas are located within the landfall, 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**.

19.7.2.3.2 Impact Magnitude

182. Although excavation works will not form part of planned (routine) maintenance activities during the O&M phase, there is the potential for excavations to be undertaken to conduct unplanned, emergency repairs. Should excavation works be required as part of unplanned works, these would be at jointing bay locations along the onshore ECC and TJB at the landfall for cable repairs or at the OCS zone and not involve the entirety of the Project's onshore infrastructure.
183. The impacts are predicted to be of local spatial extent (localised to areas of excavation or maintenance and where contamination may be present). In addition to this, the embedded mitigation measures outlined (see **Table 19-5**, Commitment IDs CO32, CO33, CO36, CO44, CO49, CO54, and CO97) will further reduce the magnitude. Therefore, magnitude of impact is considered to be **negligible** during the O&M phase.

19.7.2.3.3 Effect Significance

184. The potential impact to surface water quality and ecological habitats is **negligible** on a **high** sensitivity receptor. This therefore results in a **minor adverse** significance of effect, which is **not significant** in EIA terms.

19.7.2.4 Impacts to Designated Geological Sites (GGC-O-04)

185. During the O&M phase, there would be no planned (routine) maintenance at landfall or along the onshore ECC which would require excavation.
186. It is expected that any jointing bays along the onshore ECC and TJB at the landfall would be located outside of the SSSI area and that in the unlikely event of a cable failure, the stretches of affected export cables beneath Skipsea Drain LGS and Withow Gap SSSI would be repaired using techniques that would cause an impact no more significant than those experienced during construction.

19.7.2.4.1 Receptor Sensitivity

187. Due to the local importance of the Skipsea Drain LGS, its sensitivity is considered to be **low**.

188. Due to the designation of the Withow Gap SSSI, its sensitivity is considered to be **medium**.

19.7.2.4.2 Impact Magnitude

189. There may be a need for ground excavations to be undertaken at jointing bays and the TJB as part of unplanned emergency works. The impacts are predicted to be localised to the areas of work and could result in the partial loss of features within the Skipsea Drain LGS, which overlap with the works area. Considering the embedded mitigation measures (see **Table 19-5**, Commitment IDs CO49, and CO97), the magnitude of impact is considered to be **medium**.
190. It is not anticipated that any maintenance works would interact with the Withow Gap SSSI and therefore the magnitude of impact to this receptor is considered to be **negligible**.

19.7.2.4.3 Effect Significance

191. The potential impact to the Skipsea Drain LGS is **medium** on a **low** sensitivity receptor. This therefore results in a **minor adverse** significance of effect, which is **not significant** in EIA terms.
192. The potential impact to the Withow Gap SSSI is **negligible** on a **medium** sensitivity receptor. This therefore results in a **negligible adverse** significance of effect, which is **not significant** in EIA terms.

19.7.2.5 Sterilisation of Future Mineral Resources (GGC-O-05)

193. Future extraction of resources from within MSA would be prevented within the permanent easement for the onshore export cables, OCS and ESBI and permanent access roads. This would prevent extraction within these areas for the anticipated operational lifetime of 35 years.
194. The impacts are predicted to be present for the duration of the O&M phase of the Project and could affect the receptor directly, however, the proportion of the total MSA that would be effectively sterilised is considered to be small. The total area of MSA impacted during the O&M phase of the Project will be quantified following site selection refinement and included within the ES.

19.7.2.5.1 Receptor Sensitivity

195. MSA are of regional importance and therefore the sensitivity of the receptor is considered to be **medium**.

19.7.2.5.2 Impact Magnitude

196. An indicative 20m wide operational easement will exist along the 50km HVDC export cable corridor and indicative 25m operational easement the along 5km HVAC export cable corridor, which may widen at trenchless crossing locations. This has the potential to sterilise any underlying resources. In all cases, where the onshore ECC crosses an MSA, only part of the area will be impacted and not the whole protected area.
197. Although the permanent footprint of infrastructure will be smaller than the construction footprint, the impacts would be permanent during the O&M phase rather than temporary. Following decommissioning, these areas will become available for mineral extraction once more and so the impacts are considered reversible.
198. Taking into account embedded mitigation for the O&M phase (Commitment IDs CO49 and CO97, **Table 19-5**) and specific mitigation with regards to a Mineral Resource Assessment discussed in **Section 19.7.1.5** (Commitment ID CO106, **Table 19-5**) the magnitude of impact is considered to be **negligible**.

19.7.2.5.3 Effect Significance

199. The potential impact to mineral resources is **negligible** magnitude on a **medium** sensitivity receptor. The effect would therefore be of **negligible adverse** significance, which is **not significant** in EIA terms.

19.7.2.6 Impacts to the Built Environment (GGC-O-06)

200. Materials such as concrete used in the Project's onshore infrastructure 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 OCS and ESBI.
201. 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 OCS and ESBI.
202. 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.

19.7.2.6.1 Receptor Sensitivity

203. Due to the presence of the OCS and ESBI, as well as the neighbouring commercial, residential and holiday properties within 250m of the Onshore Development Area, the sensitivity of the built environment is considered to be **medium**.

19.7.2.6.2 Impact Magnitude

204. Desk-based information indicates that both OCS zones are located in and near to potential sources of ground gases. Depending on the location of the TJB, jointing bays and associated 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 structures at landfall and along the onshore ECC.
205. With the implementation of embedded mitigation (see **Table 19-5**, Commitment IDs CO49, CO54, and CO97), the potential magnitude of impact on the surrounding built environment during the operation is **medium**.

19.7.2.6.3 Effect Significance

206. The potential impact to the built environment is **medium** on a **medium** sensitivity receptor. This therefore results in a **moderate adverse** significance, which in the absence of additional mitigation, is **significant** in EIA terms.

19.7.2.6.4 Additional Mitigation and Residual Effect

207. 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 OCS zone infrastructure would need to be implemented.
208. With the adoption of additional mitigation (see **Table 19-15**, Commitment IDs CO48 and CO107) the magnitude of impact would be **negligible**. The residual effect would therefore be of **minor adverse** significance, which is **not significant** in EIA terms.

19.7.2.7 Impacts to Agricultural Land (GGC-O-07)

209. O&M 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.

19.7.2.7.1 Receptor Sensitivity

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

19.7.2.7.2 Impact Magnitude

211. Although excavation works will not form part of planned (routine) maintenance activities during the O&M phase, there is the potential for excavations to be undertaken to conduct unplanned emergency repairs. Should excavation works be required as part of unplanned works, these would be at jointing bay locations along the onshore ECC and TJB at the landfall for cable repairs or at the OCS zone and not involve the entirety of the Project's onshore infrastructure.
212. The impacts are predicted to be of local spatial extent (localised to areas of excavation or maintenance and where contamination may be present). With the implementation of embedded mitigation measures (see **Table 19-5**, Commitment IDs CO46, CO49, and CO97), the magnitude of impact is considered to be **negligible** during the O&M phase.

19.7.2.7.3 Effect Significance

213. The potential impact to agricultural land is **negligible** on a **high** sensitivity receptor. This therefore results in a **minor adverse** significance of effect, which is **not significant** in EIA terms.

19.7.3 Potential Effects during Decommissioning

19.7.3.1 Impacts to Human Health, Groundwaters, Surface Waters, Designated Geological Sites, Mineral Resources, Built Environment and Agricultural Land (GGC-D-01, GGC-D-02, GGC-D-03, GGC-D-04, GGC-D-05, GGC-D-06 and GGC-D-07)

214. No decision has been made regarding the final decommissioning strategy for the onshore infrastructure, as it is recognised that regulatory requirements and industry best practice change over time.
215. Commitment ID CO56 (see **Table 19-5**) requires an Onshore Decommissioning Plan to be prepared and agreed with the relevant authorities prior to the commencement of onshore decommissioning works. This will ensure that decommissioning impacts on geology and ground conditions receptors will be assessed in accordance with the applicable regulations and guidance at that time of decommissioning where relevant, with appropriate mitigation implemented as necessary to avoid significant effects.
216. The detailed activities and methodology for decommissioning will be determined later within the Project's lifetime, but would be expected to include:
- Deinstallation and removal of electrical equipment, buildings and other infrastructure for the OCS and ESBI;
 - Removal of above-ground link boxes along the onshore ECC;

- Inspection of underground infrastructure to be left in-situ along the onshore ECC and at the landfall (i.e. TJB, jointing bays, underground link boxes, onshore export cables and ducting) to ensure they are safe to remain in place. If considered unsuitable to be left in-situ at the time of decommissioning, these components will be removed; and
- Site reinstatement and landscaping.

217. Whilst a detailed assessment of decommissioning impacts cannot be undertaken at this stage, for this assessment, it is assumed that decommissioning is likely to operate within the parameters identified for construction (i.e. any activities are likely to occur within the temporary construction working areas and require no greater amount or duration of activity than assessed for construction). The decommissioning sequence will generally be the reverse of the construction sequence. It is therefore assumed that decommissioning impacts would likely be of similar nature to, and no worse than, those identified during the construction phase.

19.7.4 Additional Mitigation Measures

218. **Table 19-15** summarises proposed additional mitigation measures relevant to geology and ground conditions that have been identified by the EIA process to reduce likely significant adverse effects to acceptable levels. Full details of all commitments made by the Project are provided within **Volume 2, Appendix 6.3 Commitments Register**.
219. Although the development of a Contaminated Land and Groundwater Scheme as described in Commitment ID CO48 is noted within **Table 19-5** as embedded mitigation, the requirement for further targeted ground investigations and generic quantitative risk assessment and subsequent mitigation / remediation measures in the Remediation Strategy where required would be considered as additional mitigation. This includes the text on the Contaminated Land and Groundwater Scheme detailed in **Table 19-6**.

Table 19-15 Additional Mitigation Measures Relevant to Geology and Ground Conditions

Commitment ID	Proposed Additional Mitigation	How the Additional Mitigation will be Secured	Relevance to Geology and Ground Conditions Assessment	Relevance to Impact ID
CO48	A Contaminated Land and Groundwater Scheme will be provided as part of the Code of Construction Practice (CoCP). The Contaminated Land and Groundwater Scheme will be developed in accordance with the Outline CoCP and will identify	DCO Requirement – Code of Construction Practice	To identify the presence of contamination that may cause impact to the identified receptors.	GGC-C-01 GGC-C-02 GGC-C-03 GGC-C-06 GGC-C-07

Commitment ID	Proposed Additional Mitigation	How the Additional Mitigation will be Secured	Relevance to Geology and Ground Conditions Assessment	Relevance to Impact ID
	any areas of known or potential contamination and provide a protocol for the discovery of unexpected contamination. Where potentially unacceptable ground contamination risks to receptors are identified, targeted ground investigations and generic quantitative risk assessment will be undertaken to determine the presence, magnitude and extent of contaminants and to inform the development of appropriate mitigation measures. Where unacceptable risks are identified, the Contaminated Land and Groundwater Scheme will include a Remediation Strategy.			GGC-O-06
CO107	Where necessary, based on risk assessment, mitigation such as the installation of ground gas protection measures will be implemented within the Onshore Converter Station (OCS) zone.		Reduces the potential impact to identified receptors.	GGC-O-06

19.8 Cumulative Effects

220. Cumulative effects are the result of the impacts of the Project acting in combination with the impacts of other proposed and reasonably foreseeable developments on receptors. This includes plans and projects that are not inherently considered as part of the current baseline.
221. The overarching framework used to identify and assess cumulative effects is set out in **Chapter 6 Environmental Impact Assessment Methodology**. The four-stage approach is based upon the Planning Inspectorate Advice Note Seventeen: Cumulative Effects Assessment (Planning Inspectorate 2024). The fourth stage of the process is the assessment stage, which is detailed within the sections below for potential cumulative effects on geology and ground conditions receptors.

19.8.1 Screening for Potential Cumulative Effects

222. The first step of the CEA identifies which impacts associated with the Project alone, as assessed under **Section 19.7**, have the potential to interact with other plans and projects to give rise to cumulative effects. All potential cumulative effects to be taken forward in the CEA are detailed in **Table 19-16** with a rationale for screening in or out. Only impacts determined to have a residual effect of negligible or greater are included in the CEA. Those assessed as ‘no change’ are excluded, as there is no potential for them to contribute to a cumulative effect.

Table 19-16 Geology and Ground Conditions – Potential Cumulative Effects

Impact ID	Impact and Project Activity	Potential for Cumulative Effects	Rationale
Construction			
GGC-C-01	Impacts to human health from on-site and off-site contamination– construction activities with potential to mobilise pre-existing ground contaminants where present	Yes	The residual effects to construction workers would be confined to the Onshore Development Area. Effects on landowners, land users, residential properties and neighbouring land users may be exacerbated by other projects.
GGC-C-02	Impacts on groundwater quality and groundwater resources – construction activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources, such as trenchless crossings and piling	Yes	Residual effects on Secondary and Principal Aquifers may be exacerbated by other projects which are located within the same aquifer or SPZ.
GGC-C-03	Impacts on surface water quality and associated ecological habitats from contamination – construction activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution	Yes	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.

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Impact ID	Impact and Project Activity	Potential for Cumulative Effects	Rationale
GGC-C-04	Impacts to designated geological sites – ground breaking activities that directly overlap designated geological sites, such as trenching, excavation, piling	Yes	Residual effects to designated geological sites may be exacerbated by other projects if located within the same designated site.
GGC-C-05	Sterilisation of future mineral resources - ground breaking activities that directly overlap mineral resources, such as trenching, excavation, piling	Yes	Residual effects on MSA may be exacerbated by other projects if located within the same safeguarding area.
GGC-C-06	Impacts to the built environment – construction activities with potential to mobilise pre-existing ground contaminants where present, such as trenching, excavation, piling and movement and stockpiling of soil	Yes	Residual effects on the built environment may be exacerbated by other projects if located near to the same structures.
GGC-C-07	Impacts to agricultural land – construction, maintenance and decommissioning activities with potential to mobilise pre-existing ground contaminants where present, such as trenching, excavation, piling and movement and stockpiling of soil	Yes	Residual effects on agricultural land may be exacerbated by other projects if located near the same parcel of agricultural land.
Operation and Maintenance			
GGC-O-01	Impacts to human health from on-site and off-site contamination – O&M activities with potential to mobilise pre-existing ground contaminants where present	Yes	The residual effects to O&M workers would be confined to the Onshore Development Area. Residual effects on landowners, land users, residential occupants and neighbouring land users may be exacerbated by other projects.

Impact ID	Impact and Project Activity	Potential for Cumulative Effects	Rationale
GGC-O-02	Impacts on groundwater quality and groundwater resources – O&M activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources	Yes	Residual effects on Secondary and Principal Aquifers may be exacerbated by other projects which are located within the same aquifer or SPZ.
GGC-O-03	Impacts on surface water quality and associated ecological habitats from contamination – O&M activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution	Yes	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.
GGC-O-04	Impacts to designated geological sites – ground breaking activities and presence of permanent infrastructure that directly overlap designated geological sites	Yes	Residual effects on designated geological sites may be exacerbated by other projects if located in the same designated site.
GGC-O-05	Sterilisation of future mineral resources - ground breaking activities and presence of permanent infrastructure that directly overlap mineral resources	Yes	Residual effects on MSA may be exacerbated by other projects if they are located within the same safeguarding area.
GGC-O-06	Impacts to the built environment – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure	Yes	Residual effects on the built environment may be exacerbated by other projects if located near the same buildings.
GGC-O-07	Impacts to agricultural land – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure	Yes	Residual effects on agricultural land may be exacerbated by other projects if located near the same parcel of agricultural land.

Impact ID	Impact and Project Activity	Potential for Cumulative Effects	Rationale
Decommissioning			
There is insufficient information available on other plans and projects which could have a spatial and temporal overlap with the Project’s onshore decommissioning works. The details and scope of onshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning and provided in the Onshore Decommissioning Plan (see Table 19-5 , Commitment ID CO56). This will include a detailed assessment of decommissioning impacts and appropriate mitigation measures to avoid significant effects, including cumulative effects.			
For this assessment, it is assumed that cumulative decommissioning effects would be of similar nature to, and no worse than, those identified during the construction phase.			

19.8.2 Screening for Other Plans / Projects

223. The second step of the CEA identifies a short-list of other plans and projects that have the potential to interact with the Project to give rise to significant cumulative effects during the construction and O&M phases. The short-list provided in **Table 19-17** has been produced specifically to assess cumulative effects on geology and ground conditions receptors. The exhaustive list of all onshore plans and projects considered in the development of the Project’s CEA framework is provided in **Volume 2, Appendix 6.5 Cumulative Effects Screening Report - Onshore**.
224. Developments that were fully operational during baseline characterisation, including at the time of site-specific surveys, are considered as part of baseline conditions for the surrounding environment. It is assumed that any residual effects associated with these developments are captured within the baseline information. As such, these developments are not subject to further assessment within the CEA and excluded from the screening exercise presented in **Table 19-17**.
225. For developments that were not fully operational, including those in planning or pre-construction stages or under construction, during baseline characterisation and operational developments with potential for ongoing impacts, these are included in the screening exercise presented in **Table 19-17**.
226. The screening exercise has been undertaken based on available information on each plan or project up to and including 31st December 2024. Information has been obtained from the Planning Inspectorate’s NSIP portal and ERYC and Hull City Council’s planning portal. It is noted that further information regarding the identified plans and projects may become available between PEIR publication and DCO application submission or may not be available in detail prior to construction. The assessment presented here is therefore considered to be conservative at the time of PEIR publication. The list of plans and projects will be updated at ES stage to incorporate more recent information at the time of writing.

227. Plans and projects identified in **Table 19-17** have been assigned a tier based on their development status, the level of information available to inform the CEA and the degree of confidence. A three-tier system based on the Planning Inspectorate Advice Note Seventeen has been adopted (Planning Inspectorate, 2024).
228. The zone of influence (Zol) used to identify relevant plans and projects for the geology and ground conditions CEA is 1km.
229. Each plan or project in **Table 19-17** has been considered on a case-by-case basis. Only plans and projects with potential for significant cumulative effects with the Project are taken forward to a detailed assessment, which are screened based on the following criteria:
 - There is potential that a pathway exists whereby an impact could have a cumulative effect on a receptor;
 - The impact on a receptor from the Project and the plan or project in consideration has a spatial overlap (i.e. occurring over the same area);
 - The impact on a receptor from the Project and the plan or project in consideration has a temporal overlap (e.g. occurring at the same time);
 - There is sufficient information available on the plan or project in consideration and moderate to high data confidence to undertake a meaningful assessment; and
 - There is some likelihood that the residual effect (i.e., after accounting for mitigation measures) of the Project could result in significant cumulative effects with the plan or project in consideration.
230. The CEA for geology and ground conditions has not identified any plans or projects where significant cumulative effects could arise in combination with the Project. Therefore, no further consideration of cumulative effects is required.

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Table 19-17 Short List of Plans / Projects for the Geology and Ground Conditions Cumulative Effect Assessment

Project / Plan	Development Type	Status	Tier	Construction / Operation Period	Closest Distance to Onshore ECC (km)	Closest Distance to OCS Zone 4 (km)	Closest Distance to OCS Zone 8 (km)	Potential for Significant Cumulative Effects	Rationale
A164 And Jock's Lodge Junction Improvement Scheme Adjacent to and South of Beverley Road (20/01073/STPLF)	Road Improvement Works	Approved	1	Construction: 2024 to 2026 Operation: 2027+	0.77	0.40	1.94	No	The road scheme will be operational during the construction phase of the Project. Therefore, no cumulative effects on any shared receptors are predicted.
Creyke Beck Solar Farm (21/02335/STPLF)	Solar Farm	Approved	1	Not known	0.33	1.05	1.56	No	Due to the proximity of Creyke Beck Solar Farm to the Project, there is the potential for cumulative effects of a direct / indirect nature on the receptors identified. However, due to the nature of the solar farm and the regulatory regime under which it will be constructed, that appropriate mitigation measures will be incorporated into the design thus limiting the potential for cumulative effects to occur.
Dogger Bank A Offshore Wind Farm (EN010021)	Offshore Wind Farm	Operational	1	Operation: 2025+	0	0.50	2.66	No	Dogger Bank A will be operational during the construction phase of the Project. Therefore, no cumulative effects on any shared receptors are predicted.
Dogger Bank B Offshore Wind Farm (EN010021)	Offshore Wind Farm	Under Construction	1	Construction: 2020 to 2025 Operation: 2026+	0	0.50	2.66	No	Dogger Bank B will be operational during the construction phase of the Project. Therefore, no cumulative effects on any shared receptors are predicted.
Dogger Bank South Offshore Wind Farms (EN010125)	Offshore Wind Farm	Examination	1	Construction: 2026 to 2033 Operation: 2034+	0	0.10	0.30	No	Due to the proximity of Dogger Bank South (DBS) to the Project, there is the potential for cumulative effects of a direct / indirect nature on the receptors identified. However, due to the nature of DBS and the regulatory regime under which it will be constructed, appropriate mitigation measures will be incorporated into the design thus limiting the potential for cumulative effects to occur.

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Project / Plan	Development Type	Status	Tier	Construction / Operation Period	Closest Distance to Onshore ECC (km)	Closest Distance to OCS Zone 4 (km)	Closest Distance to OCS Zone 8 (km)	Potential for Significant Cumulative Effects	Rationale
Hornsea Project Four Offshore Wind Farm (EN010098)	Offshore Wind Farm	Under Construction	1	Construction: 2024 to 2028 Operation: 2029+	0	0.11	0.01	No	Hornsea Four will be operational during the construction phase of the Project. Therefore, no cumulative effects on any shared receptors are predicted.
Wanlass Beck National Grid Substation (24/03819/STPLF)	Electricity Transmission Infrastructure	Pending Consideration	1	Construction: 2026 to 2030 Operation: 2031+	0.91	2.09	3.02	No	Due to the distance between the developments, there is limited potential for cumulative effects to occur.
Pear tree Hill Solar Farm (EN010157)	Solar Farm	Planning	2	Construction: 2026 to 2027 Operation: 2028+	0.42	1.05	2.66	No	Due to the distance between the developments, there is limited potential for cumulative effects to occur.
Birkhill Wood National Grid Substation	Electricity Transmission Infrastructure	Planning	3	Construction: 2026 to 2030 Operation: 2031+	0	1.11	2.31	No	Due to the proximity of Birkhill Wood Substation to the Project, there is the potential for cumulative effects of a direct / indirect nature on the receptors identified. However, due to the nature of the substation and the regulatory regime under which it will be constructed, appropriate mitigation measures will be incorporated into the design thus limiting the potential for cumulative effects to occur.
North Humber to High Marnham Grid Upgrade (EN020034)	Electricity Transmission Infrastructure	Planning	3	Construction: 2028 to 2030 Operation: 2031+	0	0.89	0.41	No	Due to the proximity of the development to the Project, there is the potential for cumulative effects of a direct / indirect nature on the receptors identified. However, due to the nature of the development and the regulatory regime under which it will be constructed, appropriate mitigation measures will be incorporated into the design thus limiting the potential for cumulative effects to occur.

19.9 Inter-Relationships and Effects Interactions

19.9.1 Inter-Relationships

231. Inter-relationships are defined as effects arising from residual effects associated with different environmental topics acting together upon a single receptor or receptor group. Potential inter-relationships between geology and ground conditions and other environmental topics have been considered, where relevant, within the PEIR. **Table 19-18** provides a summary of key inter-relationships and signposts to where they have been addressed in the relevant chapters.

Table 19-18 Geology and Ground Conditions – Inter-Relationships with Other Topics

Impact ID	Impact and Project Activity	Related EIA Topic	Where Assessed in the PEIR Chapter	Rationale
Construction				
GGC-C-02	Impacts on groundwater quality and groundwater resources – construction activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources, such as trenchless crossings and piling	Chapter 21 Water Resources and Flood Risk	Section 19.7.1.2	Any project-related changes to geology and ground conditions (both physically and chemically) during construction could impact on the quantity and quality of groundwater resources and hydrologically connected surface water receptors.

Impact ID	Impact and Project Activity	Related EIA Topic	Where Assessed in the PEIR Chapter	Rationale
GGC-C-03	Impacts on surface water quality and associated ecological habitats from contamination – construction activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution	Chapter 21 Water Resources and Flood Risk and Chapter 23 Onshore Ecology and Ornithology	Section 19.7.1.3	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.
GGC-C-07	Impacts to agricultural land – construction, maintenance and decommissioning activities with potential to mobilise pre-existing ground contaminants where present, such as trenching, excavation, piling and movement and stockpiling of soil	Chapter 22 Soils and Land Use	Section 19.7.1.7	Potential contamination of agricultural land during the construction phase could impact on the ALC grade and productivity of agricultural land.
Operation and Maintenance				
GGC-O-02	Impacts on groundwater quality and groundwater resources – O&M activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources	Chapter 21 Water Resources and Flood Risk	Section 19.7.2.2	Any project-related changes to geology and ground Conditions (both physically and chemically) during operation could impact on the quantity and quality of groundwater resources and hydrologically connected surface water receptors.

Impact ID	Impact and Project Activity	Related EIA Topic	Where Assessed in the PEIR Chapter	Rationale
GGC-O-03	Impacts on surface water quality and associated ecological habitats from contamination – O&M activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution	Chapter 21 Water Resources and Flood Risk and Chapter 23 Onshore Ecology and Ornithology	Section 19.7.2.3	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.
GGC-O-07	Impacts to agricultural land – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure	Chapter 22 Soils and Land Use	19.7.2.7	Potential contamination of agricultural land during the O&M phase could impact on the ALC grade and productivity of agricultural land.

Decommissioning

The details and scope of onshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning and provided in the Onshore Decommissioning Plan (see **Table 19-5**, Commitment ID CO56).

For this assessment, it is assumed that inter-relationships during the decommissioning phase would be of similar nature to those identified during the construction phase.

19.9.2 Interactions

232. The impacts identified and assessed in this chapter have the potential to interact with each other. Potential interactions between impacts are identified in **Table 19-19**. Where there is potential for interaction between impacts, these are assessed in **Table 19-20** for each receptor or receptor group.

233. Interactions are assessed by development phase (“phase assessment”) to see if multiple impacts could increase the overall effect significance experienced by a single receptor or receptor group during each phase. Following from this, a lifetime assessment is undertaken which considers the potential for multiple impacts to accumulate across the construction, O&M and decommissioning phases and result in a greater effect on a single receptor or receptor group. When considering synergistic effects from interactions, it is assumed that the receptor sensitivity remains consistent, while the magnitude of different impacts is additive.

CHAPTER 19 GEOLOGY AND GROUND CONDITIONS

Table 19-19 Geology and Ground Conditions – Potential Interactions between Impacts throughout the Project’s Lifetime

Construction, Operation and Maintenance														
	GGC-C-01	GGC-C-02	GGC-C-03	GGC-C-04	GGC-C-05	GGC-C-06	GGC-C-07	GGC-O-01	GGC-O-02	GGC-O-03	GGC-O-04	GGC-O-05	GGC-O-06	GGC-O-07
Impacts to human health from on-site and off-site contamination (GGC-C-01)		Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Impacts on groundwater quality and groundwater resources (GGC-C-02)	Yes		Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	No	Yes
Impacts on surface water quality and associated ecological habitats from contamination (GGC-C-03)	Yes	Yes		No	No	No	Yes	Yes	Yes	Yes	Np	No	No	Yes
Impacts to designated geological sites (GGC-C-04)	No	No	No		No	No	No	No	No	No	No	No	No	No
Sterilisation of future mineral resources (GGC-C-05)	No	No	No	No		No	No	No	No	No	No	No	No	No
Impacts to the built environment (GGC-C-06)	Yes	No	No	No	No		No	Yes	No	No	No	No	Yes	No
Impacts to agricultural land (GGC-C-07)	Yes	Yes	Yes	No	No	No		Yes	Yes	Yes	No	No	Yes	No
Impacts to human health from on-site and off-site contamination (GGC-O-01)	No	No	No	No	No	No	No		Yes	Yes	No	No	Yes	Yes
Impacts on groundwater quality and groundwater resources (GGC-O-02)	Yes	Yes	Yes	No	No	No	No	Yes		Yes	No	No	No	Yes
Impacts on surface water quality and associated ecological habitats from contamination (GGC-O-03)	Yes	Yes	Yes	No	No	No	No	Yes	Yes		No	No	No	Yes
Impacts to designated geological sites (GGC-O-04)	No	No	No	No	No	No	No	No	No	No		No	No	No

Construction, Operation and Maintenance

	GGC-C-01	GGC-C-02	GGC-C-03	GGC-C-04	GGC-C-05	GGC-C-06	GGC-C-07	GGC-O-01	GGC-O-02	GGC-O-03	GGC-O-04	GGC-O-05	GGC-O-06	GGC-O-07
Sterilisation of future mineral resources (GGC-O-05)	No	No	No	No	No	No	No	No	No	No	No		No	No
Impacts to the built environment (GGC-O-06)	Yes	No	No	No	No	No	No	Yes	No	No	No	No		No
Impacts to agricultural land (GGC-O-07)	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	No	No	

Decommissioning

The details and scope of onshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning and provided in the Onshore Decommissioning Plan (see **Table 19-5**, Commitment ID CO56).

For this assessment, it is assumed that interactions during the decommissioning phase would be of similar nature to, and no worse than, those identified during the construction phase.

CHAPTER 19 GEOLOGY AND GROUND CONDITIONS

Table 19-20 Interaction Assessment – Project Phase and Lifetime Effects

Receptor	Impact ID	Highest Significance Level			Phase Assessment	Lifetime Assessment
		Construction	Operation and Maintenance	Decommissioning		
Human health (e.g. construction workers and neighbouring land users)	GGC-C-01 GGC-C-02 GGC-C-03 GGC-C-06 GGC-C-07 GGC-O-01 GGC-O-02 GGC-O-03 GGC-O-06 GGC-O-07	Minor Adverse	Minor Adverse	TBC – assumed no greater than construction	<p>Construction, Operation and Maintenance: No greater than individually assessed impact. Construction and operational impacts on human health are considered to have a residual effect significance of no greater than minor adverse. This combined with the fact that impacts would be managed through the proposed embedded and additional mitigation measures means that there would either be no pathway for interactions or that the interaction would not result in a more adverse effect significance.</p> <p>Decommissioning: No greater than individually assessed impact. For assessment purposes, it is assumed that decommissioning impacts will be of similar nature to, and no worse than, construction impacts.</p>	<p>No greater than individually assessed impact.</p> <p>Impacts to human health would be managed through the identified mitigation measures.</p> <p>It is therefore considered that over the Project's lifetime, these impacts would not interact to change the overall effect significance.</p>
Controlled waters (ground) (e.g. Principal Aquifers and SPZ)	GGC-C-01 GGC-C-02 GGC-C-03 GGC-C-07 GGC-O-01 GGC-O-02 GGC-O-03 GGC-O-07	Minor Adverse	Minor Adverse	TBC – assumed no greater than construction	<p>Construction, Operation and Maintenance: No greater than individually assessed impact. Construction and operational impacts on ground waters are considered to have a residual effect significance of no greater than minor adverse. This combined with the fact that impacts would be managed through the proposed embedded and additional mitigation measures means that there would either be no pathway for interactions or that the interaction would not result in a more adverse effect significance.</p> <p>Decommissioning: No greater than individually assessed impact. For assessment purposes, it is assumed that decommissioning impacts will be of similar nature to, and no worse than, construction impacts.</p>	<p>No greater than individually assessed impact.</p> <p>Impacts to ground waters would be managed through the identified mitigation measures.</p> <p>It is therefore considered that over the Project's lifetime, these impacts would not interact to change the overall effect significance.</p>

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Receptor	Impact ID	Highest Significance Level			Phase Assessment	Lifetime Assessment
		Construction	Operation and Maintenance	Decommissioning		
Controlled waters (surface) and associated ecological habitats (e.g. Holderness Inshore Marine Conservation Zone)	GGC-C-01 GGC-C-02 GGC-C-03 GGC-C-07 GGC-O-01 GGC-O-02 GGC-O-03 GGC-O-07	Minor Adverse	Minor Adverse	TBC – assumed no greater than construction	<p>Construction, Operation and Maintenance: No greater than individually assessed impact. Construction and operational impacts on surface waters and associated ecological habitats are considered to have a residual effect significance of no greater than minor adverse. This combined with the fact that impacts would be managed through the proposed embedded and additional mitigation measures means that there would either be no pathway for interactions or that the interaction would not result in a more adverse effect significance.</p> <p>Decommissioning: No greater than individually assessed impact. For assessment purposes, it is assumed that decommissioning impacts will be of similar nature to, and no worse than, construction impacts.</p>	<p>No greater than individually assessed impact.</p> <p>Impacts to surface waters and their associated ecological habitats would be managed through the identified mitigation measures.</p> <p>It is therefore considered that over the Project's lifetime, these impacts would not interact to change the overall effect significance.</p>
Built environment (e.g. buildings)	GGC-C-01 GGC-C-06 GGC-C-01 GGC-O-06	Minor Adverse	Minor Adverse	TBC – assumed no greater than construction	<p>Construction, Operation and Maintenance: No greater than individually assessed impact. Construction and operational impacts on the built environment are considered to have a residual effect significance of no greater than minor adverse. This combined with the fact that impacts would be managed through the proposed embedded and additional mitigation measures means that there would either be no pathway for interactions or that the interaction would not result in a more adverse effect significance.</p> <p>Decommissioning: No greater than individually assessed impact. For assessment purposes, it is assumed that decommissioning impacts will be of similar nature to, and no worse than, construction impacts.</p>	<p>No greater than individually assessed impact.</p> <p>Impacts to the built environment would be managed through the identified mitigation measures.</p> <p>It is therefore considered that over the Project's lifetime, these impacts would not interact to change the overall effect significance.</p>

Receptor	Impact ID	Highest Significance Level			Phase Assessment	Lifetime Assessment
		Construction	Operation and Maintenance	Decommissioning		
Agricultural land (e.g. ALC Grade 2 land)	GGC-C-01	Minor Adverse	Minor Adverse	TBC – assumed no greater than construction	Construction, Operation and Maintenance: No greater than individually assessed impact. Construction and operational impacts on agricultural land are considered to have a residual effect significance of no greater than minor adverse. This combined with the fact that impacts would be managed through the proposed embedded and additional mitigation measures means that there would either be no pathway for interactions or that the interaction would not result in a more adverse effect significance. Decommissioning: No greater than individually assessed impact. For assessment purposes, it is assumed that decommissioning impacts will be of similar nature to, and no worse than, construction impacts.	No greater than individually assessed impact. Impacts to agricultural land would be managed through the identified mitigation measures. It is therefore considered that over the Project’s lifetime, these impacts would not interact to change the overall effect significance.
	GGC-C-02					
	GGC-C-03					
	GGC-C-07					
	GGC-O-01					
	GGC-O-02					
	GGC-O-03					
	GGC-O-07					

19.10 Monitoring Measures

234. Potential monitoring measures for geology and ground conditions will be further considered through the EIA process and identified in the ES where required.

19.11 Summary

235. **Table 19-21** presents a summary of the preliminary results of the assessment of likely significant effects on geology and ground conditions during the construction, operation and decommissioning of the Project. These impacts are largely driven by the generation of mobilisation of potential contaminants within soils and groundwater, along with the destruction or reduction in quality of sensitive resources (such as mineral resources and agricultural land).

19.12 Next Steps

236. The Geology and Ground Conditions ES chapter will include an updated baseline environment and impact assessment following further refinement of the Onshore Development Area and the Project Design Envelope. The chapter will also incorporate any additional data which becomes available following PEIR publication, as well as any stakeholder feedback received as part of the statutory consultation.
237. With respect to impacts on mineral resources during construction and operation (GGC-C-04 and GGC-C-05), further details on the area of MSA impacted by the Project will be provided in the ES.

CHAPTER 19 GEOLOGY AND GROUND CONDITIONS

Table 19-21 Summary of Potential Effects Assessed for Geology and Ground Conditions

Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
Construction									
GGC-C-01	Impacts to human health from on-site and off-site contamination– Construction activities with potential to mobilise pre-existing ground contaminants where present.	CO39 CO40 CO47 CO48 CO50 CO51 CO53 CO54 CO94	Human health (e.g. construction workers and neighbouring land users)	High	Low to Medium	Moderate to Major Adverse (Significant)	CO48	Minor Adverse (Not Significant)	N/A
GGC-C-02	Impacts on groundwater quality and groundwater resources – construction activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources, such as trenchless crossings and piling.	CO38 CO39 CO40 CO41 CO42 CO47 CO48 CO51 CO53 CO54 CO94	Controlled waters (ground) (e.g. Principal Aquifers and SPZ)	Medium to High	Low	Minor (Not Significant) to Moderate Adverse (Significant)	CO48	Minor Adverse (Not Significant)	N/A
GGC-C-03	Impacts on surface water quality and associated ecological habitats from contamination – construction activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution.	CO32 CO33 CO35 CO36 CO38 CO39 CO40 CO42	Controlled waters (surface) and associated ecological habitats (e.g. Holderness Inshore Marine Conservation Zone)	High	Low	Moderate Adverse (Significant)	CO48	Minor Adverse (Not Significant)	N/A

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Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
		CO47 CO48 CO51 CO53 CO54 CO94							
GGC-C-04	Impacts to designated geological sites – ground breaking activities that directly overlap designated geological sites, such as trenching, excavation, piling.	CO23 CO39 CO40 CO47 CO48 CO51 CO53 CO94	Designated geological sites (e.g. Skipsea Drain LGS, Withow Gap SSSI)	Low to Medium	Medium to Negligible	Negligible to Minor Adverse (Not Significant)	N/A	Negligible to Minor Adverse (Not Significant)	N/A
GGC-C-05	Sterilisation of future mineral resources - ground breaking activities that directly overlap mineral resources, such as trenching, excavation, piling.	CO39 CO40 CO47 CO48 CO51 CO53 CO94 CO106	Mineral resources (e.g. MSA)	Medium	Low	Minor Adverse (Not Significant)	N/A	Minor Adverse (Not Significant)	N/A
GGC-C-06	Impacts to the built environment – construction activities with potential to mobilise pre-existing ground contaminants where present, such as trenching, excavation, piling and movement and stockpiling of soil.	CO39 CO40 CO47 CO48 CO51 CO53 CO54 CO94	Built environment (e.g. buildings)	Medium	Medium	Moderate Adverse (Significant)	CO48	Negligible Adverse (Not Significant)	N/A

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Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
GGC-C-07	Impacts to agricultural land – construction, maintenance and decommissioning activities with potential to mobilise pre-existing ground contaminants where present, such as trenching, excavation, piling and movement and stockpiling of soil.	CO39 CO40 CO46 CO47 CO48 CO51 CO53 CO94	Agricultural land (e.g. ALC Grade 2 land)	High	Low	Moderate Adverse (Significant)	CO48	Minor Adverse (Not Significant)	N/A
Operation and Maintenance									
GGC-O-01	Impacts to human health from on-site and off-site contamination – O&M activities with potential to mobilise pre-existing ground contaminants where present.	CO49 CO54 CO97	Human health (e.g. O&M workers and neighbouring land users)	High	Negligible	Minor Adverse (Not Significant)	N/A	Minor Adverse (Not Significant)	N/A
GGC-O-02	Impacts on groundwater quality and groundwater resources – O&M activities with potential to mobilise pre-existing ground contaminants where present and increase infiltration of rainwater and surface water to the sub-surface, accidental pollution from spillages, leakages, and temporary discharges, deep ground workings with potential to directly interact with groundwater resources.	CO41 CO49 CO54 CO97	Controlled waters (ground) (e.g. Principal Aquifers and SPZ)	Medium to High	Negligible	Minor Adverse (Not Significant)	N/A	Minor Adverse (Not Significant)	N/A
GGC-O-03	Impacts on surface water quality and associated ecological habitats from contamination – O&M activities with potential to mobilise pre-existing ground contaminants where present and alter surface water flows and accidental pollution.	CO32 CO33 CO36 CO44 CO49 CO54 CO97	Controlled waters (surface) and associated ecological habitats (e.g. Holderness Inshore Marine Conservation Zone)	High	Negligible	Minor Adverse (Not Significant)	N/A	Minor Adverse (Not Significant)	N/A

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Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
GGC-O-04	Impacts to designated geological sites – ground breaking activities and presence of permanent infrastructure that directly overlap designated geological sites.	CO49 CO97	Designated geological sites (e.g. Skipsea Drain LGS, Withow Gap SSSI)	Low to Medium	Negligible to Medium	Negligible to Minor Adverse (Not Significant)	N/A	Negligible to Minor Adverse (Not Significant)	N/A
GGC-O-05	Sterilisation of future mineral resources - ground breaking activities and presence of permanent infrastructure that directly overlap mineral resources.	CO49 CO97 CO106	Mineral resources (e.g. MSA)	Medium	Negligible	Negligible Adverse (Not Significant)	N/A	Negligible Adverse (Not Significant)	N/A
GGC-O-06	Impacts to the built environment – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure.	CO49 CO54 CO97	Built environment (e.g. buildings)	Medium	Medium	Moderate Adverse (Significant)	CO48 CO107	Minor Adverse (Not Significant)	N/A
GGC-O-07	Impacts to agricultural land – O&M activities with potential to mobilise pre-existing ground contaminants where present and the presence of permanent infrastructure.	CO46 CO49 CO97	Agricultural land (e.g. ALC Grade 2 land)	High	Negligible	Minor Adverse (Not Significant)	N/A	Minor Adverse (Not Significant)	N/A
Decommissioning									
GGC-D-01	Impacts to human health from on-site and off-site contamination – decommissioning activities not yet defined.	CO56	<p>The details and scope of onshore decommissioning works will be determined by the relevant regulations and guidance at the time of decommissioning and provided in the Onshore Decommissioning Plan (see Table 19-5, Commitment ID CO56). This will include a detailed assessment of decommissioning impacts and appropriate mitigation measures to avoid significant effects.</p> <p>For this assessment, it is assumed that impacts during the decommissioning phase would be of similar nature to, and no worse than, those identified during the construction phase.</p>						
GGC-D-02	Impacts on groundwater quality and groundwater resources – decommissioning activities not yet defined.								
GGC-D-03	Impacts on surface water quality and associated ecological habitats from contamination – decommissioning activities not yet defined.								
GGC-D-04	Impacts to designated geological sites – decommissioning activities not yet defined.								

Impact ID	Impact and Project Activity	Embedded Mitigation Measures	Receptor	Receptor Sensitivity	Impact Magnitude	Effect Significance	Additional Mitigation Measures	Residual Effect	Monitoring Measures
GGC-D-05	Sterilisation of future mineral resources – decommissioning activities not yet defined.								
GGC-D-06	Impacts to the built environment – decommissioning activities not yet defined.								
GGC-D-07	Impacts to agricultural land – decommissioning activities not yet defined.								

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List of Acronyms

Acronym	Definition
BGS	British Geological Survey
BRE	Building Research Establishment
CDM	Construction Design Management
CL:AIRE	Contaminated Land: Applications in Real Environments
CoCP	Code of Construction Practice
COMAH	Control of Major Accident Hazard sites
DBD	Dogger Bank D Offshore Wind Farm
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
GIS	Geographical Information System
GPCL	Guiding Principles for Contaminated Land
HDD	Horizontal Directional Drilling
IDB	Internal Drainage Board
LNR	Local Nature Reserve
LGS	Local Geological Site
MCA	Mineral Consultation Area
MPS	Minerals Policy Statement
MRA	Mineral Resource Assessment
MSA	Mineral Safeguarding Area
NNR	National Nature Reserve
MNR	Marine Nature Reserve
NVZ	Nitrate Vulnerable Zone
OCS Zone	Onshore Converter Station Zone

Acronym	Definition
OS	Ordnance Survey
PEIR	Preliminary Environmental Information Report
PRA	Preliminary Risk Assessment
PRoW	Public Rights of Way
RIGS	Regionally Important Geological Sites
SAC	Special Area of Conservation
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
WER	Water Environment Regulations