



Scotland England Green Link 2 - English Onshore Scheme

Environmental Statement:
Volume 2

Chapter 10: Geology and Hydrogeology

May 2022

For: National Grid Electricity Transmission

Table of Contents

10.	Geology and Hydrogeology	10-1
10.1	Introduction	10-1
10.2	Planning Policy and Applicable Legislation	10-1
10.2.1	Introduction	10-1
10.2.2	Legislation	10-1
10.2.3	Policy Frameworks	10-2
10.3	Approach to Assessment	10-4
10.3.1	Introduction	10-4
10.3.2	Summary of Consultation	10-4
10.3.3	Assessment Method	10-7
10.4	Study Area	10-10
10.5	Baseline Environment	10-25
10.5.1	Section 1 – Landfall to Bainton	10-25
10.5.2	Section 2 – Bainton to Market Weighton	10-31
10.5.3	Section 3 – Market Weighton to River Ouse	10-39
10.5.4	Section 4 – River Ouse to Drax Substation	10-46
10.6	Potential Impacts	10-51
10.6.1	Introduction	10-51
10.6.2	Mitigation by Design	10-51
10.6.3	Assessment of Potential Impacts: Construction Phase	10-54
10.6.4	Assessment of Potential Impacts: Operational Phase	10-60
10.6.5	Assessment of Potential Impacts: Decommissioning Phase	10-60
10.7	Project Specific Mitigation	10-63
10.7.1	Construction Phase Mitigation	10-63
10.7.2	Operational Phase Mitigation	10-64
10.8	Residual Effects	10-65
10.8.1	Assessment of Residual Effects: Construction Phase	10-65
10.8.2	Assessment of Residual Effects: Operational Phase	10-74
10.9	Cumulative Effects	10-80
10.9.1	Assessment of Intra-project Cumulative Effects	10-80
10.9.2	Assessment of Inter-project Cumulative Effects	10-80
10.10	Summary of Assessment	10-80
10.11	References	10-82

Figures

Figure 10-1:	Study Area	10-13
Figure 10-2:	1:50,000 Superficial Deposits	10-14
Figure 10-3:	1:50,000 Bedrock	10-15
Figure 10-4:	Coal Mining and Non-Coal Mining Features	10-16
Figure 10-5:	Compressible Deposits	10-17
Figure 10-6:	Landslides	10-18
Figure 10-7:	Running Sand	10-19
Figure 10-8:	Superficial Aquifer Classification	10-20
Figure 10-9:	Bedrock Aquifer Classification	10-21
Figure 10-10:	Source Protection Zones, Drinking Water Safeguarding Zones and Private Water Supplies	10-22
Figure 10-11:	Historical Sources of Potential Contamination	10-23

Figure 10-12: Radon..... 10-24

Tables

Table 10-1 Relevant Legislation for Geology and Hydrogeology	10-1
Table 10-2 Relevant Policies for Geology and Hydrogeology.....	10-3
Table 10-3: Scoping Opinion (Geology and Hydrogeology).....	10-4
Table 10-4: Additional Consultation (Geology and Hydrogeology).....	10-6
Table 10-5 Criteria to Determine the Sensitivity of Potential Effect to Receptors	10-8
Table 10-6 Criteria to Determine the Magnitude of Receptors.....	10-9
Table 10-7 Table of Significance Categories.....	10-10
Table 10-8: Summary of Geology from BGS 1:50,000 Mapping.....	10-25
Table 10-9 Summary of BGS Geo-Index Boreholes.....	10-25
Table 10-10 Regionally Important Geological Sites.....	10-26
Table 10-11 Summary of Natural Ground Subsidence	10-26
Table 10-12 Summary of Aquifer Classifications.....	10-28
Table 10-13 Summary of Historic Potentially Contaminative Land Uses	10-29
Table 10-14 Summary of Current and Historic Landfills	10-30
Table 10-15 Summary of Geology from BGS 1:50,000 Mapping.....	10-31
Table 10-16 Summary of BGS Geo-Index Boreholes.....	10-32
Table 10-17 Regionally Important Geological Sites.....	10-32
Table 10-18 Summary of Natural Ground Subsidence Features	10-33
Table 10-19 Summary of Aquifer Classifications.....	10-34
Table 10-20 Summary of Historic Potentially Contaminative Land Uses	10-36
Table 10-21 Summary of Geology from BGS 1:50,000 Mapping.....	10-39
Table 10-22 Summary of BGs Geo-Index Boreholes	10-40
Table 10-23 Summary of Natural Ground Subsidence Features	10-40
Table 10-24 Summary of Aquifer Classifications.....	10-42
Table 10-25 Summary of Historic Potentially Contaminative Land Uses	10-44
Table 10-26 Summary of Current and Historic Landfills	10-45
Table 10-27 Summary of Geology from BGS 1:50,000 Mapping.....	10-46
Table 10-28 Summary of BGS Geo-Index Boreholes.....	10-47
Table 10-29 Summary of Natural Ground Subsidence Features	10-47
Table 10-30 Summary of Aquifer Classifications.....	10-49
Table 10-31 Historic Potentially Contaminative Land Uses	10-50
Table 10-32: General Construction Phase Mitigation Measures included in the CEMP.....	10-52
Table 10-33: Assessment of Potential Impacts: Construction Phase (Sections 1 - 4).....	10-56
Table 10-34: Assessment of Potential Impacts: Operational Phase (Section 4 only).....	10-61
Table 10-35: Assessment of Residual Effects: Construction Phase (Sections 1 – 4)	10-66
Table 10-36: Assessment of Residual Effects: Operational Phase (Section 4 only)	10-75

10. Geology and Hydrogeology

10.1 Introduction

This chapter of the Environmental Statement (ES) presents the results of baseline studies and the assessment of the potential impacts of the English Onshore Scheme on geology and hydrogeology. The chapter details the methodology followed for the assessment, summarises the regulatory and policy framework related geology and hydrogeology and describes the geological setting in the area surrounding the English Onshore Scheme. The assessment has identified the likely significant impacts to arise during the construction or operational phases of the English Onshore Scheme and identifies mitigation necessary to avoid or reduce these impacts where possible.

This chapter should be read in conjunction with **Chapter 11: Hydrology and Land Drainage**, and **Chapter 12: Agriculture & Soils** of this ES.

This chapter is supported by the following figures:

- **Figure 10-1:** Study Area;
- **Figure 10-2:** 1:50,000 Superficial Deposits;
- **Figure 10-3:** 1:50,000 Bedrock;
- **Figure 10-4:** Coal Mining and Non-Coal Mining Features;
- **Figure 10-5:** Compressible Deposits;
- **Figure 10-6:** Landslides;
- **Figure 10-7:** Running Sands;
- **Figure 10-8:** Superficial Aquifer Classification;
- **Figure 10-9:** Bedrock Aquifer Classification;
- **Figure 10-10:** Source Protection Zones, Drinking Water Safeguard Zones and Private Water Supplies;
- **Figure 10-11:** Historical Sources of Potential Contamination; and
- **Figure 10-12:** Radon.

Figures are presented across the whole English Onshore Scheme, however these are supported further by copies of the above figures provided in **Appendix 10A** that are split across the four Route Sections, as described in **Chapter 3: Description of the English Onshore Scheme**.

10.2 Planning Policy and Applicable Legislation

10.2.1 Introduction

This section sets out the relevant legislation and policy framework for geology and hydrogeology in the UK. These, and the pertinence of each to the English Onshore Scheme in relation to geology and hydrogeology, are presented in Table 10-1 Relevant Legislation for Geology and Hydrogeology **Table 10-1** and **Table 10-2**.

10.2.2 Legislation

Table 10-1 Relevant Legislation for Geology and Hydrogeology

Level	Legislation	Pertinence to Scheme in relation to Geology and Hydrogeology
European	The Water Framework Directive (2000/60/EC)	Requires European Union member states to achieve good qualitative and quantitative status of all water bodies.

Level	Legislation	Pertinence to Scheme in relation to Geology and Hydrogeology
	The Groundwater Directive (2006/118/EC)	The components of the Water Framework Directive dealing with groundwater bodies. Protective of groundwater bodies against pollution and deterioration.
	The Priority Substances Directive (2008/105/EC)	Requires the progressive reduction or phasing out of substances listed under the directive. Applies limits on concentrations of priority substances in surface waters.
National	Environmental Protection Act (1990)	The contaminated land regime under Part IIA of the Environmental Protection Act 1990 provides the means of identifying and remediating land that poses unacceptable risk to various receptors i.e. controlled waters and human health.
	The Environment Act (1995)	Statutory Act that introduced 'Part IIA of the Environmental Protection Act 1990'.
	The Contaminated Land (England) Regulations, 2006 SI 1380	Regulations that implemented Part IIA of the Environmental Protection Act 1990. The regulations put a duty of local authorities within England to identify any contaminated land in their areas. The regulations places a duty of local authorities to bring about the remediation of contaminated land and gives local authorities powers to serve remediation notices to land owners should remediation be required.
	Groundwater (England and Wales) Regulations, 2009 SI 2902	Regulations aiming to prevent the entry into groundwater of 'hazardous substances' and the pollution of groundwater by 'non-hazardous' pollutants.
	Environmental Damage (Prevention and Remediation) (England) Regulations, 2015 SI 810	Regulations that impose obligations on certain activities of operators requiring the prevention or remediation of environmental damage. Environmental damage applying to protected species, natural habitats, land and water and sites of special scientific interest (SSSIs).
	The Water Act 2003	A statutory act that relates to matters within the responsibilities of holding and issuing licenses for water abstractions. The four broad aims of the Act are to ensure sustainable use of water resources, to strengthen the voice of consumers, to increase competition and to promote water conservation.
	The Water Resources Act 1991 (as amended)	Statutory Act that set's out the responsibilities of the Environment Agency in relation to water pollution and resource management.
	The Land Drainage Act 1991 (as amended)	An act that requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The owner must accept the natural flow from upstream but need not carry out work to cater for increased flows resulting from some types of works carried out upstream.
	The Environmental Permitting (England and Wales) Regulations 2016 SI 1154	Regulations that consolidates the system of environmental permitting in England and Wales. Sets out key activities that are regulated under the Environmental Permitting Regulations.
	The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 SI 407	Regulation that aims to protect and improve the ecological and chemical health of rivers, lakes, estuaries, coastal waters and groundwater.

10.2.3 Policy Frameworks

As outlined in **Chapter 4: Planning Policy Context**, relevant policies of the National Planning Policy Framework (NPPF) and relevant National Policy Statements (NPS) are material considerations in the determination of Town and Country Planning Act applications, however they do not override the primacy

of local policies. Key aspects of the NPPF and relevant NPSs, which have been considered during the development of this chapter, are included in the table below.

Table 10-2 Relevant Policies for Geology and Hydrogeology

Level	Policies	Pertinence to Scheme in relation to Geology and Hydrogeology
National	National Planning Policy Framework (2019)	Planning policy to ensure enhancement of both the natural and local environment by preventing new and existing developments from contributing to, or being adversely impacted by, unacceptable levels of soil and water pollution and or land instability. Policy details that development land should help to improve local environmental conditions.
	National Policy Statements (2011)	National Policy Statement (NPS) EN1 (Energy) controls developments resulting in potential discharges affecting water or land quality, and resulting effects to the environment or human health, for example by imposing conditions relating to pollution control. The policy also details the importance of geological conservation to ensure that potential effects on geologically important sites are duly considered, as well as potential effects on groundwater quality and resource value during construction or operation of developments. A draft version of NPS EN-1 was published for consultation September 2021. With relation to geology and impacts to water or land quality no material changes have been made.
Local	Selby District Local Plan (2005)	Plan detailing a number of existing and potential sources of pollution within the plan area. The Plan details that the underlying Sherwood Sandstone Aquifer within the plan area is sensitive due to frequent areas of exposed aquifers. Measures to control impacts through the use of source protection zones.
	Selby District Core Strategy Local Plan (2013)	The core strategy local plan states that consideration must be given to the protection of water quality within groundwater and prevention of pollution to the groundwater supply. The policy details that development proposals should exploit opportunities for reclamation and reinstatement of contaminated land.
	East Riding Local Plan (2016)	Policy ENV6: Managing environmental hazards. Policy within the local plan states that developments will avoid increasing potential of risk for groundwater pollution. This is to be managed by: Avoiding developments that increase risk of pollution to Source Protection Zones. Where this is not possible then appropriate mitigation measures are to be employed; Supporting developments which decrease risk of pollution in Source Protection Zones by cleaning up contaminated land and incorporating pollution-prevention measures; Preventing inappropriate uses/activities in Source Protection Zone 1 and 2, unless adequate safeguards against possible contamination is agreed; and Ensuring re-development of previously developed sites does not contaminate under-lying aquifers. Policy EC5: Supporting the energy sector. Policy within the local plan states that proposals for development 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

Level	Policies	Pertinence to Scheme in relation to Geology and Hydrogeology
		biodiversity, geodiversity and nature in relation to designations, displacement, disturbance and collision and the impacts of emissions/ contamination; and the land, including land stability, contamination and soil resources.
	East Rising of Yorkshire and Kingston-upon-Hull Joint Minerals Local Plan (2019)	The Plan provides the framework against which applications for development will be assessed; defines Mineral Safeguarding areas and allocations for future mineral workings.

10.3 Approach to Assessment

10.3.1 Introduction

This section describes the approach to the identification and assessment of impacts resulting from the construction and operation of the English Onshore Scheme on geology and hydrogeology.

10.3.2 Summary of Consultation

10.3.2.1 Scoping Opinion Review

Table 10-3 summarises the scoping opinions received from relevant stakeholders in relation to geology and hydrogeology and outlines how these have been addressed in subsequent sections of this chapter of the ES. A copy of the scoping opinion is included in **Appendix 5B**.

Table 10-3: Scoping Opinion (Geology and Hydrogeology)

Consultee	Summary of comment	How and where addressed
Natural England	The Environmental Impact Assessment (EIA) should consider impacts to geological sites due to the importance of these sites for geodiversity. The Environmental Statement (ES) should include an assessment of potential impacts on geodiversity including proposals for mitigation of any impacts and compensation measures, if appropriate.	Two Regionally Important Geological and Geomorphological sites are located adjacent to the planning application boundary where a Horizontal Directional Drill (HDD) crossing is scheduled. These are Kiplingcotes Nature Reserve and Kiplingcotes Station Quarry. The potential impacts of this have been assessed in Section 10.6.3 and Section 10.6.4 of this Chapter. All phases of the development of the Scheme are designed to ensure good site practice and management through the development and adherence to a Construction Environmental Management Plan (see Chapter 18: Outline Construction Environmental Management Plan).
Environment Agency	Sensitive controlled waters are present within the Scheme as the proposed development overlies a Principal Aquifer and areas of the Scheme are located within Source Protection Zones.	Potential Controlled Waters receptors located within the study area are identified within Section 10.5.1.7, Section 10.5.2.7, Section 10.5.3.7 and Section 10.5.4.7 of this chapter for the baseline environmental assessment. Further assessment on the potential impacts and mitigation measures, if required, are detailed in Section 10.6.2 and Section 10.7 of this chapter.

Consultee	Summary of comment	How and where addressed
Environment Agency	<p>Attention was drawn to Statement C of the Environment Agency's approach to groundwater protection '<i>Statement C: Pipelines and High Voltage Fluid Filled Cables</i>'. The EA normally objects to pipelines or fluid filled cables that transport pollutants that pass through Source Protection Zones 1 and 2. If this is unavoidable then operators need to adopt Best Available Techniques and operate in accordance with the Energy Networks Association Guidance. Where existing pipelines or fluid filled cables are already below the water table, or if the water level subsequently rises, the EA will work with operators to mitigate the risks. The EA will only agree to any redevelopment scheme with sub water table pipelines or fluid filled cables for the transport of hazardous substances where there are substantial mitigating factors. The EA expects operators to carry out a site-specific risk assessment prior to the decommissioning of pipelines or fluid filled cables in SPZ1 and SPZ2. It will then work with operators to agree the best available environmental option. Operators should consider the lifetime of the pipeline or cable in their assessment of depth to groundwater.</p>	<p>Underground AC and DC cables are not fluid-filled. Cable ducts are to be backfilled with cement-bound sand (CBS) or other suitable material. Further details of the design of the underground AC and DC cables is provided in Chapter 3: Description of the English Onshore Scheme.</p> <p>Due to the shallow depth of the cable trenches (1.5m below ground level) they are unlikely to be below the water table. Potential impacts of construction (i.e. placement of CBS as a fluid before 'going off' and becoming solid) are addressed in Section 10.6.3 of this chapter.</p>
Environment Agency	<p>Supporting evidence required to demonstrate that risks to controlled waters from the development can be managed. This is required to ensure the development does not contribute to, and is not put at unacceptable risk from or adversely affected by water pollution, in line with the National Planning Policy Framework. Consideration should be given to contamination that may already be present in the ground and the effects of the construction which may result in mobilisation of sediments into groundwater.</p>	<p>Potential sources of contamination (from the English Onshore Scheme and existing) are discussed in Section 10.5.1.8, Section 10.5.2.8, Section 10.5.3.8 and Section 10.5.4.8, and an assessment of potential effects is presented in Section 10.9 of this chapter. Mitigation measures are presented in Section 10.7. A more detailed hydrogeological assessment has been undertaken and reported within this chapter where trenchless techniques or dewatering is required in high sensitivity groundwater environments or where dewatering is required to facilitate open cut installation. This is detailed in Section 10.6 of this chapter.</p>
Environment Agency	<p>Chapter 8, Section 8.2.6.3 'Other Hydrogeological Classification and Features', of the Scoping Report, should be updated to include the potential impact on licensed abstractions.</p>	<p>Data has been obtained on public and private groundwater and surface water abstractions as part of the baseline assessment (Section 10.5 of this chapter). Assessment of the potential impacts are included in Section 10.6 of this chapter.</p>
East Riding of Yorkshire Council (ERYC)	<p>The ES should detail a full assessment of the geology and hydrology within the local area and identify all relevant water dependent receptors and assess the risk from the Scheme. A Conceptual Site Model should be developed as part of the ES to show any potential impacts to both ground and surface water from the proposed development (i.e. proposed drainage scheme, dewatering activities, physical disturbance of an aquifer etc). Within the ES, appropriate monitoring and/or mitigation measures should be proposed to protect against impacts to</p>	<p>A Conceptual Site Model is presented in Section 10.6 of this chapter. Mitigation measures are detailed in Sections 10.6.2 and 10.7 of this chapter.</p> <p>Potential impacts of groundwater management (e.g. dewatering during construction) are assessed in Section 10.6.3.</p> <p>The hydrological assessment of the English Onshore Scheme through construction and operation is presented in Chapter 11: Hydrology and Land Drainage of this ES.</p>

Consultee	Summary of comment	How and where addressed
	groundwater and surface waters and water dependent habitats, as well as pollution prevention methods throughout the lifetime of the proposal. The ES should also outline all water requirement needs during the proposed development.	
East Riding of Yorkshire Council – Coastal Engineer	Documents need to include parts of the construction phase which have potential negative impacts to the coastline. In addition, consideration should be given to coastal erosion, which in the long-term could lead to exposure of the pipeline either in the cliff face or the foreshore.	Details of the proposed cable installation method at the landfall at Fraisthorpe are detailed in Chapter 3: Description of the English Onshore Scheme . This sets out the rationale of the positioning of the Transition Joint Pit (TJP) in regard to long-term coastal erosion. Potential impacts to the coastline are therefore scoped out from the assessment.
City of York Council	Approach in relation to contamination deemed acceptable. Must consider land contamination through the planning process. Phase 1 and Phase 2 investigations are recommended to be carried out and submitted with associated individual planning applications. If contamination is found then appropriate remedial action will be required to make the site safe and suitable for its proposed use.	Desk-based (Phase 1) and site investigation (Phase 2) data relevant to the English Onshore Scheme are presented as part of the baseline conditions in Section 5 of this chapter. Assessment of effects (Section 10.9) identifies remedial actions/mitigation measures required as a result of land contamination.
Selby District Council	Further assessment of baseline conditions and potential effects will be undertaken as part of the Environmental Statement through more detailed desk study, site walkovers, and consultation as the scheme design progresses. The proposed approach with regard to contamination is acceptable.	Further assessment of baseline conditions are presented in Section 10.5 of this chapter. An assessment of the potential effects are presented in Section 10.9. Site walkovers were completed on the 6 th and the 7 th November 2021.

10.3.2.2 Additional Consultation

Table 10-4 summarises additional consultation undertaken with relevant statutory and non-statutory consultees in relation to geology and hydrogeology for the English Onshore Scheme and outlines how and where this has been addressed in subsequent sections of this chapter of the ES.

Table 10-4: Additional Consultation (Geology and Hydrogeology)

Consultee	Nature of additional consultation	How and where addressed
Environment Agency (EA)	The EA were contacted on the 30 th June 2021 under the EIR to provide information relating to the following two questions: 1 - The grid reference location, type of source, an estimate of the average daily volume of water supplied in cubic meters and the type of premises supplied for any Regulation 9 or Regulation 10 (as per the Private Water Supplies Regulations 2016) private water supplies for which you hold records; and 2 – Any information relating to water quality, both surface and groundwater, in regard to any physical/chemical data as per the Water Framework Directive (WFD) / River Basin Management Plan (RBMP) and any historic / current	A response to the information request was received on 10 th September 2021. The information provided in EA's responses are discussed in the relevant sections of this chapter.

Consultee	Nature of additional consultation	How and where addressed
	monitoring locations within the search area provided.	
East Riding of Yorkshire Council (ERYC)	<p>East Riding of Yorkshire Council were contacted on the 30th June 2021 under the EIR to provide information relating to the following two questions:</p> <p>1 - Any information on previous ground investigations and or known remediation schemes (relating to soil and groundwater) that have taken place; and</p> <p>2 - The grid reference location, type of source, an estimate of the average daily volume of water supplied in cubic metres and the type of premises supplied for any Regulation 9 or Regulation 10 (as per the Private Water Supplies Regulations 2016) private water supplies for which you hold records. In addition to this please may any other public and known abstraction points or wells be provided.</p> <p>EYRC indicated that they did not have any information on pollution incidents, spills, accidents or other regulatory actions, sites which feature Part A(2) or Part B processes, geo-environmental data relating to RIGS (regionally important geological sites) and quarrying/mining sites, water quality, natural background contamination e.g. naturally occurring elevated concentrations of metals in soils, areas of known ground gas production and radon or licensed waste operations or historic landfill sites, other than that available in the public domain.</p>	<p>A response to the information request was received on the 18th October 2021. The information provided included a single ground investigation undertaken in 2003 in Hutton located approximately 400 m east of the planning application boundary. The ground investigation was carried out to identify impacts to soil and groundwater from a former above ground storage tank. No impacts to soil and groundwater were observed. Due to the distance from the planning application boundary and the findings of the investigation, the ground investigation is not considered relevant to the baseline environment.</p> <p>Information was also provided on private water supplies within the study area. These are detailed in Section 10.5.1.7, Section 10.5.2.7, Section 10.5.3.7 and Section 10.5.4.7.</p>

10.3.3 Assessment Method

10.3.3.1 Overview

The baseline and potential effects have been established by a review of the following information:

- Environmental database information ('Geo-insight' and 'Enviro-insight' Groundsure data 'Groundsure GIS');
- Publicly available online resources (e.g. British Geological Survey, Coal Authority and 'MAGIC' online mapping);
- Records and geo-environmental data held by Local Planning Authorities (LPAs) relating to current and historical contaminative land uses, including waste sites;
- Records and geo-environmental data held by LPAs relating to Regionally Important Geological Sites (RIGS) and quarrying/mining sites;
- Records held by LPAs of water abstractions and Private Drinking Water supplies;
- Site walkovers undertaken by AECOM on the 6th and 7th December 2021 of areas of interest such as potential sources of contamination including various unspecified pits and heaps, former and current chalk pits, former railways and associated infrastructure and a former inert landfill; and
- Existing ground investigation information.

Utilising this information and consultation with statutory consultees, a combination of qualitative and quantitative risk assessment have been undertaken to assess the potential effects of the existing ground

conditions on the development, and the potential effects of the development on the geology and hydrogeology.

In relation to ground contamination, the risk assessment has been based on the source-pathway-receptor methodology outlined in Land Contamination Risk Management (LCRM) (Ref 10-1) and promoted by the Department of Environment, Food and Rural Affairs (DEFRA) and the EA. For there to be an identifiable risk, not only must there be contaminants present on the site (source) there must also be a receptor and a viable pathway which allows the source to impact on the receptor.

The overall assessment methodology is summarised in **Chapter 5: Approach to Environmental Assessment**. However, the assessment of the significance of the potential effects on geology and hydrogeology has been based on guidance in the Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils (geology) (Ref. 10-2) and LA 113 Road Drainage and the Water Environment (groundwater) (Ref. 10-3). There is no specific guidance in relation to cable schemes for assessing geology and hydrogeology, therefore, DMRB has been used as it is considered to be the most appropriate methodology for the English Onshore Scheme (including 'point' features, i.e. landfill location and converter station) because it is designed for assessing effects on linear schemes, albeit road schemes. It is also a well-established and tested methodology, familiar to the statutory consultees. Examples of magnitude of effects, sensitivity of receptors and significance in the context of DMRB assessment are presented below.

10.3.3.2 Sensitivity

The sensitivity of the receptor reflects the quality of the receptor and its ability to absorb an effect without perceptible change. Descriptions and examples of sensitivity relevant to geology and hydrogeology are presented in **Table 10-5**.

Table 10-5 Criteria to Determine the Sensitivity of Potential Effect to Receptors

Sensitivity/Value	Description/Criteria	Typical Examples
High	<p><u>Geology</u> Very rare and of international importance with no potential for replacement.</p> <p><u>Hydrogeology</u> Nationally significant attribute of high importance.</p>	<p><u>Geology</u></p> <ul style="list-style-type: none"> • UNESCO World Heritage Sites; • SSSIs of international importance; or • Global Geoparks. <p><u>Contamination</u></p> <ul style="list-style-type: none"> • Very high sensitivity land use (e.g. residential). <p><u>Hydrogeology</u></p> <ul style="list-style-type: none"> • Principal aquifer providing a regionally important resource and/ or supporting site protected under European and UK habitat legislation; • Source Protection Zone 1; or • Groundwater supports Groundwater Dependent Terrestrial Ecosystem (GWDTE).
Medium	<p><u>Geology</u> Rare and of national importance with little potential for replacement.</p> <p><u>Hydrogeology</u> Locally significant attribute of high importance.</p>	<p><u>Geology</u></p> <ul style="list-style-type: none"> • SSSIs; or • National Nature Reserves. <p><u>Contamination</u></p> <ul style="list-style-type: none"> • High sensitivity land use (e.g. public open space). <p><u>Hydrogeology</u></p> <ul style="list-style-type: none"> • Principal aquifer providing a locally important resource or supporting a river ecosystem; • Source Protection Zone 2; or • Groundwater supports Groundwater Dependent Terrestrial Ecosystem (GWDTE).
Low	<p><u>Geology</u> Of regional importance with limited potential for replacement.</p> <p><u>Hydrogeology</u></p>	<p><u>Geology</u></p> <ul style="list-style-type: none"> • RIGS. <p><u>Contamination</u></p> <ul style="list-style-type: none"> • Medium sensitivity land use (e.g. commercial). <p><u>Hydrogeology</u></p> <ul style="list-style-type: none"> • Aquifer providing water for agricultural or industrial use with limited connection to surface water; or

Sensitivity/Value	Description/Criteria	Typical Examples
	Of moderate quality and rarity.	<ul style="list-style-type: none"> • Source Protection Zone 3.
Negligible	<p><u>Geology</u> Of local importance / interest with potential for replacement or little/ no local interest.</p> <p><u>Hydrogeology</u> Lower quality.</p>	<p><u>Geology</u></p> <ul style="list-style-type: none"> • Non-designated geological exposures; • No geological exposures; or • Former quarries / mining sites. <p><u>Contamination</u></p> <ul style="list-style-type: none"> • Low sensitivity land use (e.g. highways and rail); or • No sensitive land use proposed. <p><u>Hydrogeology</u></p> <ul style="list-style-type: none"> • Unproductive strata.

10.3.3.3 Magnitude

The magnitude of a potential effect considers the scale of the predicted change to the baseline condition taking into account its duration (i.e. the magnitude may be moderated by the effect being temporary, rather than permanent, short term rather than long term). Descriptions and examples of magnitude relevant to geology and hydrogeology are presented in **Table 10-6**. It is unlikely that any effects on geology and soils would be beneficial, so the examples of magnitude all relate to adverse effects.

Table 10-6 Criteria to Determine the Magnitude of Receptors

Magnitude	Description/Criteria	Typical Examples
High	<p><u>Geology</u> Loss of feature/ designation and/ or quality and integrity, severe damage to key characteristics.</p> <p><u>Hydrogeology</u> Loss of attribute and/or quality and integrity of the attribute.</p>	<p><u>Geology</u></p> <ul style="list-style-type: none"> • Destruction of features at a protected site; i.e. SSSIs of international importance; or Global Geoparks. <p><u>Contamination</u></p> <ul style="list-style-type: none"> • Significant contamination identified; • Contaminant concentrations significantly exceed background levels and relevant screening criteria; • Potential for significant harm to human health; or • Contamination heavily restricts future use of land. <p><u>Hydrogeology</u></p> <ul style="list-style-type: none"> • Loss of, or extensive change to, an aquifer; • Loss of regionally important water supply; • Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies; • Reduction in water body WFD classification; or • Loss or significant damage to major structures through subsidence or similar effects.
Medium	<p><u>Geology</u> Partial loss of feature / designation, potentially adversely affecting integrity; partial loss of/damage to key characteristics, features or elements.</p> <p><u>Hydrogeology</u> Results in effect on integrity of attribute, or loss of part of attribute.</p>	<p><u>Geology</u></p> <ul style="list-style-type: none"> • Partial loss of features at a protected site; i.e SSSIs; National Nature Reserves, .Mineral Safeguarding areas. <p><u>Contamination</u></p> <ul style="list-style-type: none"> • Contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria; • Significant contamination can be present; or • Control/remediation measures are required to reduce risks to human health / make land suitable for intended use. <p><u>Hydrogeology</u></p> <ul style="list-style-type: none"> • Partial loss or change to an aquifer; • Degradation of regionally important public water supply or loss of significant commercial/ industrial/ agricultural supplies; • Partial loss of the integrity of GWDTE;

Magnitude	Description/Criteria	Typical Examples
		<ul style="list-style-type: none"> • Contribution to reduction in water body WFD classification; or • Damage to major structures through subsidence or similar effects or loss of minor structures.
Low	<p><u>Geology</u> Minor measurable change in geological feature / designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.</p> <p><u>Hydrogeology</u> Results in some measurable change in attributes, quality or vulnerability.</p>	<p><u>Geology</u></p> <ul style="list-style-type: none"> • Minor change of features at Geological sites; i.e RIGS <p><u>Contamination</u></p> <ul style="list-style-type: none"> • Contaminant concentrations are below relevant screening criteria; • Significant contamination is unlikely with a low risk to human health; or • Best practice measures can be required to minimise risks to human health. <p><u>Hydrogeology</u></p> <ul style="list-style-type: none"> • Minor effects on an aquifer, GWDTes, abstractions and structures.
Negligible	<p><u>Geology</u> Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature / designation. Overall integrity of resource not affected.</p> <p><u>Hydrogeology</u> Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.</p>	<p><u>Geology</u></p> <ul style="list-style-type: none"> • Very minor change of features at sites of local importance, i.e. former mining sites or non-designated geological sites. <p><u>Contamination</u></p> <ul style="list-style-type: none"> • Contaminant concentrations substantially below relevant screening criteria; or • No requirements for control measures to reduce risks to human health/make land suitable for intended use. <p><u>Hydrogeology</u></p> <ul style="list-style-type: none"> • No measurable impact upon an aquifer and/or groundwater receptors.

10.3.3.4 Significance Criteria

The significance of a specific potential effect is derived from both the sensitivity of the feature and the magnitude of the impact and can be then determined using the matrix presented in **Table 10-7**. Effects can be beneficial, adverse or negligible and their significance Major, Moderate, Minor or Negligible.

Table 10-7 Table of Significance Categories.

		Magnitude of Change			
		Negligible	Low	Medium	High
Sensitivity of Receptor	High	Negligible/ Minor	Moderate	Major	Major
	Medium	Negligible	Minor	Moderate	Major
	Low	Negligible	Negligible	Minor	Moderate
	Negligible	Negligible	Negligible	Negligible	Negligible/ Minor

Any effect predicted to be **Negligible** or **Minor** is considered to be 'Not Significant'. Effects assessed as **Moderate** or **Major** are considered to be 'Significant'.

10.4 Study Area

The study area in relation to geology and hydrogeology extends from the landfall at Fraisthorpe Beach to Drax Substation (i.e. the 'Planning Application Boundary' as defined in **Chapter 3: Description of the English Onshore Scheme** and shown on Figure 3-2), and including the area of land approximately 400 m either side of the planning application boundary. The lateral and vertical extent of the study area assumed for this assessment varies depending on the nature of the identified sources (e.g. of contamination) and potential geological and hydrogeological receptors. In general, the receptors and

sources of contamination identified are located within the study area. However, in rare cases, such as public drinking water abstractions that potentially draw water from large areas, these may be located outside the study area. The extent of the study areas adopted for each of the geological and hydrogeological resources identified are listed in Section 10.5.1, Section 10.5.2, Section 10.5.3 and Section 10.5.4.

Given the scale and geographical extent of the English Onshore Scheme, and its location within the administrative areas of both East Riding of Yorkshire Council (ERYC) and Selby District Council (SDC), for ease of assessment by the LPAs and consultees the study area has been divided into four sections:

- Section 1 – Landfall to Bainton (covering approximately 2,340 ha of the study area and approximately 25.6 km in length);
- Section 2 – Bainton to Market Weighton (covering approximately 1,690 ha of the study area and approximately 17.4 km in length);
- Section 3 – Market Weighton to River Ouse (covering approximately 2,400 ha of the study area and approximately 24.8 km in length); and
- Section 4 – River Ouse to Drax Substation (covering approximately 440 ha of the study area and approximately 1.7 km in length).

Sections 1 to 3 lie in the administrative area of ERYC, whilst Section 4 lies in the administrative area of SDC. The geographical extent of each Section is shown in **Figure 10-1**. Data for each Section are presented separately in the following sub-sections of this chapter.

Figure 10-1 demonstrates the study area for the entirety of the English Onshore Scheme for the geology and hydrogeology chapter.

Figures 10-2 to 10-13 show the baseline geological and hydrogeological receptors across the English Onshore Scheme within the study area, and as described in Section 10.5. These should be viewed in conjunction with the most detailed figures presented in **Appendix 10A**.

