

**The Great Grid Upgrade**

Chesterfield to Willington

# Preliminary Environmental Information Report

Volume 3: Appendix 10A Geo-Environmental Preliminary  
Risk Assessment

March 2026

nationalgrid

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# 10A. Geo-Environmental Preliminary Risk Assessment

## 10A.1 Introduction

### Overview

- 10A.1.1 The Chesterfield to Willington Project (the 'Project') is a proposal by National Grid Electricity Transmission plc (hereafter referred to as 'National Grid') who is responsible for ensuring electricity is transported safely and efficiently from where it is produced to where it is needed and for developing upgrades to the network, as agreed with the industry regulator, the Office of Gas and Electricity Markets.
- 10A.1.2 This Geo-Environmental Preliminary Risk Assessment (PRA) for the Project forms **Appendix 10A of Chapter 10 Geology and Hydrogeology** of the Preliminary Environmental Information Report (PEIR) and presents baseline information relevant to the topic of geology and hydrogeology.

### Development Plans

- 10A.1.3 The Project is a proposal by National Grid to build the following principal components:
- A new 400 kilovolt (kV) overhead line, approximately 60 kilometres (km) in length between a proposed new Chesterfield Substation and the existing Willington Substation. It is anticipated that this would comprise steel lattice pylons in accordance with National Grid's guidance and national planning policy;
  - A new 400 kV Chesterfield Substation, to be built in the vicinity of the existing Chesterfield 275 kV Substation and the existing 132 kV National Grid Electricity Distribution Substation to the south east of Chesterfield (referred to as the 'new Chesterfield Substation'). This is proposed to be a gas insulated switchgear substation.
  - Replacement of short sections of existing overhead line and local changes to the lower voltage distribution networks to facilitate the construction of the Project.
- 10A.1.4 The Project would include other required works, for example, temporary and permanent diversions for works on existing overhead line routes, temporary access roads, highway works, temporary works compounds, work sites and other ancillary works. The Project would also include utility diversions and drainage works. There would also be land required for mitigation, compensation and enhancement of the environment including Biodiversity Net Gain.
- 10A.1.5 The Project would connect into the existing Willington Substation located to the south west of Derby and a proposed new substation at Chesterfield. It is currently anticipated that the new Chesterfield Substation will be consented and delivered as part of a separate National Grid project, Chesterfield to High Marnham, distinct from this Project. However, it is possible that it will be decided to also include the new Chesterfield Substation works as part of the Development Consent Order (DCO)

application for this Project to provide an alternative consenting mechanism to remove reliance on that separate planning application/consent and so mitigate against the risk of delay to the delivery of the Project.

- 10A.1.6 For the purpose of the PEIR the draft Order Limits for the Project have been divided into the following six sections, running from north to south. These six sections are also referred to throughout this PRA.
- Section 1: Chesterfield to Tibshelf;
  - Section 2: Tibshelf to Ripley;
  - Section 3: Ripley to Morley;
  - Section 4: Morley to Ockbrook;
  - Section 5: Ockbrook to Aston-on-Trent; and
  - Section 6: Aston-on-Trent to Willington.
- 10A.1.7 It is anticipated that the overhead line will be supported on 186 no. steel lattice pylons (herein referred to as pylons) and two gantries at both ends of the proposed route alignment (Gantry G-1 and G-2 in the north at Chesterfield Substation and G-3 and G-4 in the south at Willington Substation). At each pylon a temporary working area that is typically approximately 75 m x 75 m will be required. It is anticipated that depending on ground conditions, duration and type of use the working areas would be either stone laid on a geotextile, or formed of interlocking trackway panels. If required, soil stabilisation techniques could be considered subject to local conditions.
- 10A.1.8 As necessary the pylon location numbers have been used when referring to specific features along the proposed route alignment. A site location and layout plan showing the six sections and pylon numbers are presented as **Figure 10A.1** and **Figure 10A.2** in **Annex 10A.1**.
- 10A.1.9 The Project will require a number of temporary construction compounds along the proposed route alignment which will be used for site offices, welfare, storage and laydown of materials and equipment. In addition, the Project will also require a number of smaller satellite compounds at specific working areas to provide welfare and storage facilities. For the purpose of this PRA the temporary construction compounds have been referred to as listed below (listed from north to south down the proposed route alignment). The provisional locations of the temporary construction compounds are shown on **Figure 10A.2** in **Annex 10A.1**.
- Cock Alley Compound (ID: 1);
  - Chesterfield Substation Compound (ID: 4);
  - Temple Normanton Compound (ID: 5);
  - Holmewood Compound (ID: 2);
  - Astwith Compound (ID: 6);
  - Alfreton Compound (ID: 8);
  - Upper Hartshay Compound (ID: 13);
  - Morley Hayes Compound (ID: 12);
  - Ockbrook Compound (ID: 9);

- Thulston Compound (ID: 10);
  - Chellaston (1) Compound (ID: 3);
  - Chellaston (2) Compound (ID: 11); and
  - Twyford Substation Compound (ID: 7).
- 10A.1.10 The Project will comprise construction of approximately 600 km of temporary haul roads. Haul roads would typically be approximately 9.0 m wide with additional width required for passing places. The haul roads are discussed in relation to their position between pylons (i.e. 'the haul road between pylons 144 and 145').
- 10A.1.11 In addition, the Project may also include the following supporting infrastructure and ancillary activities:
- replacement of short sections of existing overhead lines and local diversions/rerouting of lower voltage distribution networks to facilitate the construction of the Project;
  - works to facilitate the connection of the new overhead line into the proposed new 400 kV Chesterfield Substation and the connection into the existing 400 kV Willington Substation;
  - at the time of this assessment limited undergrounding of cables is proposed and where proposed is restricted to the 132 kV cable approach to the substations; where required, clear rationality for the need of undergrounding of cables is provided in **Chapter 3 Main Alternatives Considered**;
  - potential utility diversions and/or modifications may also be required to facilitate the construction of the Project; and
  - small scale earthworks – topsoil and, subject to ground conditions, subsoil may be required to be stripped from the access tracks, site compounds and pylon locations to form suitable working areas.
- 10A.1.12 Further information on the Project is provided in **Chapter 4 Description of the Project**.

## Assessment Aims and Objectives

- 10A.1.13 The aim of this assessment is to identify potential sources of land contamination and potential geotechnical constraints associated with the Project. The assessment will provide a PRA and Preliminary Geotechnical Risk Register (GRR) to identify potential soil and groundwater contaminant linkages as well as geotechnical risks. This will support siting decisions and the design evolution of the Project. This assessment forms **Appendix 10A Geo-Environmental Preliminary Risk Assessment of Chapter 10 Geology and Hydrogeology**.
- 10A.1.14 A main objective of the assessment at this stage is the development of a Conceptual Site Model (CSM). The formulation and development of the CSM is fundamental to the overall process of understanding the risks and drivers of any potential contamination risks of the Project. It identifies potential sources of contamination, receptors and exposure pathways that may be present and the possible relationships between them which may present potential contaminant linkages.

10A.1.15 Completion of this assessment enables subsequent ground investigations to be proportionately targeted, and potential risks to be identified and subsequently addressed during development.

## Scope of Works

10A.1.16 To meet the aims and objectives identified in this section, the following scope of works have been undertaken:

- purchase and review of Groundsure reports for Sections 1 to 6 of the Project;
- review of publicly available historical maps and plans to understand former land uses and potential contaminative activities on and surrounding the Project;
- review of regulatory databases;
- review of relevant publicly available information relating to hydrological features, hydrogeology, neighbouring land use, ecologically sensitive uses and geology in order to establish the environmental setting of the Project;
- a targeted site walkover of identified key features of potential contaminative land use;
- development of a preliminary CSM via the source-pathway-receptor contaminant linkage approach;
- assessment of the environmental risks and/or opportunities surrounding ground, groundwater and ground gas conditions, which have the potential to arise associated with the future development of the Project; and
- production of a Geo-Environmental PRA report to include a preliminary GRR.

## Legislation and Planning Policy

10A.1.17 The Planning Act 2008 (Ref 10A.1) sets out the decision-making framework for Nationally Significant Infrastructure Projects (NSIPs) in conjunction with relevant National Policy Statements (NPSs)<sup>1</sup>.

10A.1.18 The Overarching National Policy Statement for Energy (NPS EN-1) (Ref 10A.2) requires that for developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.

10A.1.19 The National Planning Policy Framework (Ref 10A.3) does not contain specific policies for NSIPs; however, it sets out the government's planning policies and how these should be applied, and it is a material consideration in planning decisions.

10A.1.20 The statutory definition of contaminated land is given under Part 2A of the Environmental Protection Act 1990 (Ref 10A.4). This generally does not include land that is already regulated through other means, such as waste management legislation or the Environmental Permitting (England and Wales) Regulations 2016

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<sup>1</sup> The updated NPSs came into force on 6 January 2026; however, this post-dated the drafting and assessment work within this chapter and so are not reflected within the relevant policy descriptions in this chapter, which are instead based on the 2023 versions of the NPSs that were in force at the time of preparing the Chapter. These sections will be updated in the ES as part of the Application; however, after initial review and consideration, it is not anticipated that the updates to the NPS will result in any material changes to the assessment methodology or the conclusions in this chapter.

(Ref 10A.5). Therefore, sites currently regulated under those Regulations or other current regimes are not included in this assessment.

## Sources of Information

- 10A.1.21 Groundsure Enviro+Geo Insight reports were ordered for each of the six Sections of the proposed route alignment, as listed below. The Groundsure reports were ordered based on Design Freeze 1.75 (DF1.75) (the working boundary at the time) and are dated May 2025 (Ref 10A.6). The Groundsure reports are provided in **Annex 10A.2**.
- Section 1: WSP-OT5-7MI-AZ4-MQD;
  - Section 2: WSP-3BQ-IR5-Z4J-JMR;
  - Section 3: WSP-W5W-PTQ-ZKK-OH1;
  - Section 4: WSP-SJB-SJ2-WDM-DZA;
  - Section 5: WSP-7U8-TWZ-H6V-Z7D; and
  - Section 6: WSP-ZNX-NFD-PUC-SOP.
- 10A.1.22 There are six areas within the draft Order Limits which are not covered by the Groundsure reports; these include the following areas:
- directly north of the construction compound Cock Alley (ID: 1);
  - 640 m east of pylon 15;
  - 550 m east of pylon 32;
  - 560 m south east of pylon 50;
  - a linear route that follows the draft Order Limits along Horsley Road, beginning 620 m east of pylon 86 and 585 m north of pylon 96; and
  - 560 m south of pylon 181.
- 10A.1.23 These areas and any areas introduced in future design refinements prior to the submission of the DCO application for the Project will be covered by an update to the Groundsure reports if deemed necessary.
- 10A.1.24 In addition to the Groundsure reports, the following key sources of information have also been used in preparation of this report:
- Groundsure – Interactive map viewer (Ref 10A.7);
  - British Geological Survey (BGS), 2012, Chesterfield, England and Wales Sheet 112, Bedrock and Superficial Deposits, 1:50,000 (Ref 10A.8);
  - BGS, 2014, Derby, England and Wales Sheet 125, Bedrock and Superficial Deposits, 1:50,000 (Ref 10A.9);
  - BGS, 2001, Loughborough, England and Wales Sheet 141, Solid and Drift Geology, 1:50,000 Scale (Ref 10A.10);
  - BGS, 1967, Geology of the country around Chesterfield, Matlock and Mansfield. Explanation of one-inch geological sheet 112, New Series (Ref 10A.11);
  - BGS, 1979, Geology of the country north of Derby. Memoir for 1:50 000 Sheet 125 (Ref 10A.12);

- BGS, 2002, Geology of the Loughborough district - a brief explanation of the geological map Sheet 141, Loughborough (Ref 10A.13);
- BGS GeoIndex (Ref 10A.14);
- UK maps of radon (Ref 10A.15);
- The Mining Remediation Authority Consultants Coal Mining Reports, provided in **Annex 10A.3**.
- The Mining Remediation Authority – Interactive Maps (Ref 10A.16);
- BGS Non-coal Mining Plans, held on the BGS GeoIndex, accessed in July 2025 (Ref 10A.14);
- Ordnance Survey mapping including (Ref 10A.17):
  - Map of Derby, 259, 2015;
  - Map of Chesterfield & Alfreton, 269, 2015;
  - Map of Nottingham, 260, 2015; and
  - Map of The National Forest, 245, 2015.
- Zetica Limited UXO Desk Study & Constraints Assessment (Ref 10A.18) provided in **Annex 10A.4**;
- Environment Agency (EA) website Flood Risk Map (Ref 10A.19); and
- Department for Environment, Food and Rural Affairs (Defra) Multi-Agency Geographic Information for the Countryside (MAGIC) Map (Ref 10A.20).

## Assessment Methodology

- 10A.1.25 It is important to understand that any risks identified during a preliminary assessment, such as the ones presented in this document, are perceived risks based on the information reviewed. A more detailed assessment of the actual risks can only be assessed following further, intrusive investigations.
- 10A.1.26 The preliminary assessments presented herein are qualitative, based on professional judgements following the review of available data and within the context of the existing/proposed use. The contaminated land risk categories presented (very low, low, low to moderate, moderate, high and very high) follow guidance presented in Construction Industry Research and Information Association (CIRIA) Publication C552, Contaminated Land Risk Assessment – A Guide to Good Practice (CIRIA 552) (Ref 10A.21). CIRIA 552 states that the risk levels should be based on an understanding of both the probability (likelihood) of a risk occurring and the magnitude of the potential consequence (severity) of a risk.
- 10A.1.27 CIRIA 552 defines four levels of probability and four levels of severity with relation to contaminated land, as presented in **Annex 10A.5**.

## 10A.2 Site Background Information and Setting

### Site Description and Current Use

- 10A.2.1 A site location plan showing the Project Sections is presented in **Figure 10A.1** and **Figure 10A.2** in **Annex 10A.1**.
- 10A.2.2 A targeted site walkover was undertaken over four days between 23 and 29 July 2025. The walkover was undertaken on selected elements of the Project where desk-based information indicated that geo-environmental features of interest are likely to be present. Where access was not possible, information on the current land use along the proposed route alignment has been established from the latest aerial imagery and online resources such as Google Street View (Ref 10A.22).
- 10A.2.3 A general description of the proposed route alignment and observations from the walkover are presented in **Table 10A.1** and **Table 10A.2**. Site walkover photographs and site walkover photograph locations are presented in **Annex 10A.6**.

**Table 10A.1: Chesterfield Substation area and Sections 1 to 3 site description**

Detail	Site Description
Site Location	The proposed route alignment of the Project in Sections 1 to 3 starts at the proposed new Chesterfield Substation approximately 2.7 km south east of Chesterfield town centre at SK408695. Sections 1 to 3 extend southwards for approximately 34 km past the settlements of Holmewood, Tibshelf, Alfreton and Ripley and then Section 3 ends at the A608 approximately 800 m north of the village of Morley. Section 3 ends at approximate grid reference SK395417.
Site Description and Use	<p>The site of the new proposed Chesterfield Substation is currently laid to open agricultural fields which appear to be currently used for livestock grazing.</p> <p>Sections 1 to 3 pass over primarily agricultural land but also pass over numerous minor roads and several A roads including the A617, A6175, A61, A615, A610, A609, A38 and the A608 where Section 3 ends. Sections 1 to 3 also pass over a railway line between pylons 43 and 44 at SK423590. A golf course is present in the approximate centre of Section 2.</p> <p>An existing overhead electricity line is connected to the existing Chesterfield Substation and runs south approximately 45 m to 185 m north of pylons 1 to 6.</p>
Site Setting and Surrounding Land Uses	<p>The site of the proposed new Chesterfield Substation is bound by the existing Chesterfield Substation immediately to the north and by agricultural fields laid to livestock grazing and crops to the east, south and west. The A617 carriageway is located approximately 570 m to the west.</p> <p>Sections 1 to 3 are predominantly surrounded by agricultural land, villages and small towns including Holmewood, Tibshelf, Alfreton and Ripley and the village of Morley.</p>

Detail	Site Description
Topography	<p>The topography at the proposed new Chesterfield Substation is generally level in the region of 108 m Above Ordnance Datum (m AOD). The topography to the south and west falls gently towards the A617 and ‘Calow Brook’ located approximately 450 m south of the substation.</p> <p>The topography of Sections 1 to 3 is generally gently undulating except in localised areas near watercourses and at road or railway cuttings and embankments. The elevation of the proposed route sections is between approximately 56 m AOD and 185 m AOD. The highest elevation within the proposed route sections is near to the village of Hardstoft located in Section 1 at SK438629.</p>
Site Walkover Findings	<p>A summary of the sites visited, the nearest Project feature and targeted source of potential contamination during the walkover across Sections 1 to 3 is outlined below along with photograph and figure references that can be viewed within <b>Annex 10A.6</b>.</p> <p><b>Section 1.</b></p> <ul style="list-style-type: none"> <li>• Pylon 2 was visited due to an opencast working being identified on historical mapping in 1962. No evidence of historical opencast workings was observed on-site and the area was laid to grassland (Photos 1.1–1.2).</li> <li>• Pylon 3 was visited due to an opencast working being identified in historical mapping in 1967. No evidence of historical opencast workings was observed on-site and the area was laid to shrubland (Photos 1.3–1.4). Small fragments of coal were observed on a disturbed patch of ground approximately 100 m from pylon 3 (Photos 1.5–1.6).</li> <li>• Pylon 5 was visited due to a dismantled railway line and an opencast working being identified on historical mapping in 1899 and 1980 respectively. No evidence of historical railway lines or opencast workings were visible. The area consisted of agricultural fields (Photo 1.7) and Made Ground was visible in the fields (Photo 1.8). A small mound of Made Ground was also observed nearby (Photo 1.9).</li> <li>• Pylons 15, 16 and 17 were visited due to an opencast working and an old tank being identified on historical mapping in 1967. No evidence of historical opencast workings or an old tank were visible and the surrounding area at all three locations consisted of agricultural land (Photos 1.10–1.11). Overhead cables run across the proposed haul road by pylon 17 (Photo 1.12).</li> <li>• The Holmewood Compound (ID: 2), near pylons 17 and 18, was visited due to an old colliery spoil being identified on historical mapping in 1967. No evidence of a historical colliery spoil was visible and the area was laid to grassland (Photo 1.13).</li> <li>• Pylon 18 and pylon 19 were visited due to Made Ground mapped at these locations. No Made Ground was observed from the closest accessible point (<b>Figure 1.7 in Annex 10A.6</b>; Photos 1.14–1.15).</li> <li>• Pylon 23 was visited due to Made Ground mapped at the location. No Made Ground was observed, and the area comprised a field with horse paddocks (Photo 1.16).</li> </ul>

### Section 2

- Pylon 54 was visited due to a pond being identified on historical mapping in 1961. No evidence of a pond or potentially infilled land was visible and the area was laid to grassland (Photo 2.1).
- Pylon 55 was visited due to a pond being identified on historical mapping in 1987. No evidence of a pond or potentially infilled land was visible nearby (**Figure 2.2 in Annex 10A.6**) and the area consisted mainly of bramble vegetation (Photo 2.2).
- Pylon 57 was visited as Sheep Lane Opencast Coal site was mapped at the location. No evidence of historical opencast workings was visible and the land was laid to grassland (Photo 2.4).
- The Alfreton Compound (ID: 8) near pylon 57 was visited as Wren Opencast Coal site was mapped at the location. No evidence of historical opencast workings was visible. The area was laid to grassland used for grazing horses and infilled land was visible (Photo 2.5).
- Pylon 58 was visited due to an old coal shaft identified on historical mapping in 1913. No evidence of a historical coal shaft was visible and the area was laid to grassland (Photo 2.6).
- Pylon 63 was visited due to a historical landfill site mapped near the location. No evidence of a historical landfill was visible and the area was laid to grassland (Photos 2.8–2.9).

### Section 3

- Pylon 71 was visited due to a dismantled railway being identified on historical mapping in 1900. No evidence of a historical railway was visible, and the area was laid to grassland (Photos 3.1–3.2).
- Pylon 72 was visited due to a tramway being identified on historical mapping in 1870. No evidence of a historical tramway was visible and the area was laid to grassland (Photos 3.3–3.4).
- Pylon 76 was visited as Morley Park Opencast Coal site was mapped at the location. No evidence of historical opencast workings was visible and the area was laid to grassland for grazing livestock (Photo 3.5). A small ditch with remnants of a derelict fence was visible (Photo 3.6).
- Pylon 77 was visited due to an old tramway and sidings being identified on historical mapping in 1880 and 1959 respectively. No evidence of a historical tramway or sidings was visible and the area was laid to grassland for grazing livestock (Photos 3.6–3.7).
- Pylon 78 was visited due to an old shaft being identified on historical mapping in 1880, and Morley Park Opencast Coal site was mapped at the location. No evidence of historical opencast workings or an old shaft was visible and the area was laid to grassland for grazing livestock (Photo 3.8).
- Pylon 84 was visited due to a railway line and a sewage works being identified on historical mapping in 1880 and 1983 respectively. The area was laid to grassland for grazing livestock (Photo 3.9). No evidence of historical sewage works was visible. The railway line was not present,

Detail	Site Description
	<p>but an electrical feature was visible at the site of the historical railway (Photos 3.10–3.11).</p> <ul style="list-style-type: none"> <li>• Pylons 100 and 101 were visited as Abbots Rough Opencast Coal site was mapped at these locations. No evidence of historical opencast workings was visible, and the area was laid to grassland for grazing livestock (Photos 3.12; and 3.14–3.15). Evidence of land subsidence was visible near the haul roads by pylon 100 (Photo 3.13).</li> </ul>

**Table 10A.2: Willington Substation area and Sections 4 to 6 site description**

Detail	Site Description
Site Location	<p>Sections 4 to 6 begin at the A608 north of the village of Morley and have a total approximate length of 26 km. Section 4 starts near the village of Morley (SK395417) and travels south east to Ockbrook where it turns south (at pylon 127 SK430365), passes into Section 5 and travels between the settlements of Borrowwash and Draycott.</p> <p>In Section 5 the Project turns south west after Draycott towards Chellaston before which it passes into Section 6 and turns west. The proposed route alignment of the overhead line ends at the Willington Substation (SK300288). The Willington Substation and last pylon in the proposed route alignment (pylon 186) are located approximately 0.6 km east north east of Willington town centre.</p>
Site Description and Use	<p>Sections 4 to 6 are dominated by agricultural land. The Sections cross over numerous minor roads and several A road carriageways including the A6096, A52, A6005, A6, A50 and A514. The proposed route sections pass over railway lines between pylons 135 to 136 (SK432336) and pylons 171 to 172 (SK347292). Section 6 also passes over the former Willington Power Station (present from 1960), associated marshalling and coal yard between pylons 182 to 186.</p> <p>The existing Willington Substation comprises an electrical plant and equipment, hard standing and ancillary buildings. An existing overhead electricity line is connected to the existing Willington Substation. The line is located approximately 150 m south of Gantry G-4 and then runs south, south east and east away from the draft Order Limits of the Project.</p>
Site Setting and Surrounding Land Uses	<p>Sections 4 to 6 are predominantly surrounded by agricultural land. The proposed route alignment passes the settlements of Morley to the south, Ockbrook and Borrowwash to the west, Draycott to the east, Chellaston to the north and Willington to the west south west.</p> <p>The site of the Willington Substation is bound by a railway line to the north, by agricultural fields to the east and south and by the town of Willington to the west.</p>
Topography	<p>The elevation of Sections 4 ranges from approximately 136 m to 35 m AOD between the start and end of Section 4. In Sections 5 and 6 the elevations remain generally level lying with elevations shown to be around 70 m AOD at the start of Section 5 and 45 m AOD at the end of Section 6.</p>

Detail	Site Description
Site Walkover Findings	<p>The topography of the Sections is generally gently undulating except in localised areas near watercourses and at road or railway cuttings and embankments. The topography at the Willington Substation is generally level. The topography to the south and south east decreases in elevation towards the River Trent which is located approximately 0.9 km south of the last pylon (pylon 186).</p> <p>A summary of the sites visited, the nearest Project feature and targeted source of potential contamination during the walkover at Sections 4 and 6 is provided below along with photograph and figure references that can be viewed within <b>Annex 10A.6</b>.</p> <p>No sites were visited across Section 5 due to access limitations at the time of the surveys. It is proposed that sites across Section 5 will be visited as required to inform the ES.</p> <p><b>Section 4</b></p> <p>Pylon 109 was visited as Moses Lane Opencast Coal site was mapped in this location. No evidence of historical opencast workings was visible. The area was laid to agricultural fields with growing crops and overhead power lines were visible north of pylon 109 (Photo 4.1).</p> <p><b>Section 6</b></p> <ul style="list-style-type: none"> <li>• Chellaston (1) Compound (ID: 3) by pylon 163 was visited due to a potentially infilled pond being identified on historical mapping in 1899 and 1901. No evidence of a pond or potentially infilled land was visible (Photo 6.1), the area was laid to tall grass in the west where the historical pond was previously located (Photo 6.1) and agricultural land in the east where the proposed compound (Chellaston (1) (ID: 3)) will be constructed (Photo 6.2).</li> <li>• Pylon 167 was visited due to a mineral extraction pit being identified on historical mapping in 1899. No evidence of a pit was visible and the area consisted of an agricultural field (Photo 6.3).</li> <li>• The haul road near pylon 176 was visited due to a potentially infilled pond being identified on historical mapping in 1901. No evidence of a pond or potentially infilled land was visible, and the area was laid to grassland (Photo 6.4).</li> </ul>

## 10A.3 Site History

- 10A.3.1 This chapter presents a summary of the historical land use along Sections 1 to 6. The historical land use has been established through a review of historical OS maps provided by Groundsure. The mapping has been reviewed to identify potential sources of contamination within 250 m of the draft Order Limits. The historical mapping is presented alongside the Groundsure reports which can be found within **Annex 10A.2**.
- 10A.3.2 The following sections provide information on the historical land uses that are considered potential sources of contamination within close proximity (i.e. at or within 50 m) of the pylons, compounds and haul roads that could be affected during construction. Further detail on the historical land use is provided in **Figure 10A.3** in **Annex 10A.1** which shows all historical land uses identified by the historical mapping review. Each of the historical land uses identified has been labelled with a feature map ID which corresponds with the column in the following **Table 10A.3** to **Table 10A.8**.

## Section 1: Chesterfield Substation to Tibshelf

**Table 10A.3: Section 1 site history summary (within 50 m of pylon/feature)**

<b>Pylon/Feature</b>	<b>Land Use/Feature</b>	<b>Map (Scale)</b>	<b>Feature Location (Centroid Grid Reference)</b>	<b>Feature Map ID</b>
Pylon 1 and haul road, Gantry G-1 and G-2	Opencast Workings	1967 (1:2,500)	SG407695	1-66
Pylon 2 and haul road	Opencast Workings	1962 (1:2,500)	SK410693	1-178
Pylon 3 and haul road	Opencast Workings	1967 (1:10,560)	SK411688	1-65
Pylon 5 and haul road	Opencast Workings	1980 (1:2,500)	SK416683	1-191
Pylon 5 haul road	Dismantled Railway	1899 (1:2,500)	SK415687	1-404
Pylons 6 & 7 and associated haul roads and Temple Normanton Compound (ID: 5)	Opencast Workings	1967 (1:2,500)	SK419682	1-64
Pylon 8 and haul road	Bond's Main Colliery	1898 (1:10,560)	SK421679	1-42
Pylon 9 and haul road	Spoil Heap	1970 (1:2,500)	SK424677	1-70
Pylons 10 & 11 and associated haul roads	Opencast Workings	1970 (1:10,000)	SK428675	1-80
Pylon 11 and haul road	Railway Land	1898 (1:2,500)	SK432673	1-397
Pylon 12 haul road	Air Shaft	1977 (1:10,650)	SK434675	1-202
Pylon 14 and haul road	Old Coal Pits	1898 (1:2,500)	SK438674	1-172
Pylon 15, 16 & 17 and associated haul roads	Opencast Workings	1967 (1:10,560)	SK442668	1-192
Holmewood Compound (ID: 2)	Colliery Spoil	1967 (1:10,560)	SK436657	1-62

Pylon/Feature	Land Use/Feature	Map (Scale)	Feature Location (Centroid Grid Reference)	Feature Map ID
Pylon 22 haul road	Quarry	1877 (1:10,560)	SK436650	1-18
Pylon 34 haul road	Disused Railway	1897 (1:10,560)	SK433620	1-392
Pylon 37 and haul road	Opencast Workings	1967 (1:10,560)	SK435609	1-60

10A.3.3 In addition to the potential historical sources at or close to Section 1, as identified in **Table 10A.3**, the following land uses have been identified in the wider area within 250 m of Section 1:

- infilled ponds;
- rifle range;
- mineral extraction sites (collieries, opencasts, gravel pits and quarries);
- smithies;
- railway land;
- brick yards;
- electrical substations;
- sewage works;
- tips (refuse and slag); and
- industrial estates.

### Summary

10A.3.4 The historical land use of Section 1 is dominated by open agricultural land containing a number of farms, woodlands, roads, ponds and watercourses. The historical mapping indicates that industrial land uses were generally isolated throughout the central and southern part of the Section but more predominant in the north.

10A.3.5 In the first edition (1877) mapping Section 1 is dominated by open agricultural land but contains a number of small collieries and coal pits mainly in the north. By the early 1900s mineral extraction activities start to become the dominant land use in the far north of the Section with the identification of Bond's Main Colliery and its associated railway lines and marshalling yards near pylon 8. In addition, railway infrastructure is established within the north, central and southern parts of the Section.

10A.3.6 Further mineral extraction activities are identified in the north during the 1960s when opencast workings are shown to dominate the land use between pylons 1 to 9 and between pylons 15 to 17. Further opencast workings are identified near pylon 37 in the southern part of Section 1.

10A.3.7 By the 1970s the opencast sites in the north of Section 1 appear to have been restored to agricultural land. At the same time opencast workings are identified at

pylons 10 and 11 in the north of the Section which are restored by the 1980s by which time opencast workings are identified in the central west of the Section.

## Section 2: Tibshelf to Ripley

**Table 10A.4: Section 2 site history summary (within 50 m of pylon/feature)**

Pylon/Feature	Land Use/Feature	Map (Scale)	Feature Location (Centroid Grid Reference)	Feature Map ID
Pylon 44 haul road	Sidings	1938 (1:10,560)	SK423589	2-100
Pylon 45	Sewage works	1890 (1:10,560)	SK418586	2-69
Pylon 51 haul road	Filling Station	1961 (1:2,500)	SK405576	2-116
Pylon 54 and haul road	Potentially Infilled Land	1961 (1:2,500)	SK398566	2-294 2-130
Pylon 55	Potentially Infilled Land	1987 (1:2,500)	SK396562	2-146
Pylon 58 haul road	Old Shaft	1913 (1:10,560)	SK394553	2-263
Pylon 59 and haul road	Disused Colliery (Highfield and Oakerthorpe)	1870 (1:10,560)	SK396550	2-10
Pylon 60 haul road	Old Shafts	1870 (1:10,560)	SK393546	2-13 2-14
Pylon 65 haul road	Mine	1962 (1:2,500)	SK386530	2-120

10A.3.8 In addition to the potential historical sources at or close to Section 2, the following land uses have been identified in the wider area within 250 m of Section 2:

- surface water features (e.g. ponds, springs);
- old shafts and opencast workings;
- sewage works;
- railways (including junctions, sidings, and tramway); and
- pumps.

### Summary

10A.3.9 The historical land use of Section 2 is dominated by open agricultural land containing a number of farms, woodlands, roads, railways, ponds and watercourses. The historical mapping reveals that industrial land uses were generally isolated throughout Section 2 but predominantly in the central portion of the Section.

- 10A.3.10 In the first available mapping (1875), Section 2 is dominated by open agricultural land but contains disused collieries and coal pits in the central portion of the Section and two small towns in the centre and south. By the early 1900s the railways had undergone development and expanded infrastructure is indicated on historical maps near pylons 44 and 45. By 1910 the colliery in the central portion of the Section had been redeveloped into a golf course (between pylons 57 and 59). The limekiln, colliery and sewage works to the south of the Section had been redeveloped into various industrial uses including a railway and depots. A sewage works was present 10 m adjacent to the north west of pylon 45.
- 10A.3.11 The historical mapping also identifies mineral extraction activities, including quarries, a lime kiln, shafts, collieries, mines and opencast workings which have occurred throughout since the earliest available mapping. A mine was mapped in 1962 and was located 25 m north of the haul road to pylon 65. The most recent extractive processes include a quarry identified in 1990 mapping approximately 530 m west of pylon 63.

### Section 3: Ripley to Morley

**Table 10A.5: Section 3 site history summary (within 50 m of pylon/feature)**

<b>Pylon/Feature</b>	<b>Land Use/Feature</b>	<b>Map (Scale)</b>	<b>Feature Location (Centroid Grid Reference)</b>	<b>Feature Map ID</b>
Pylon 70 haul road	Opencast Workings	1967 (1:10,560)	SK381513	3-113
Pylon 71 haul road	Railway	1900 (1:2,500)	SK382511	3-321
Pylon 72 haul road	Mineral Railway	1913 (1:10,560)	SK384510	3-310
Pylon 72 and haul road	Tramway	1870 (1:10,560)	SK384508	3-306
Pylon 73	Colliery	1930 (1:10,560)	SK386504	3-34
Pylons 74 and 75 haul road	Brick Field and Associated Works	1880 (1:10,560)	SK382503	3-31
Pylon 77 haul road	Old Tramway	1880 (1:10,560)	SK379495	3-108 3-308
Pylon 78 and haul road	Old Shaft	1880 (1:10,560)	SK377492	3-203
Pylon 84 haul road	Railway	1880 (1:10,560)	SK372473	3-313

<b>Pylon/Feature</b>	<b>Land Use/Feature</b>	<b>Map (Scale)</b>	<b>Feature Location (Centroid Grid Reference)</b>	<b>Feature Map ID</b>
Pylon 84 haul road	Sewage Works (Belper R.C.Council)	1938 (1:2,500)	SK372471	3-103
Pylon 91 and haul road	Holdbrook Sewage Works (Belper R.C.Council)	1913 (1:10,560)	SK369449	3-85
Pylon 93 haul road	Railways	1880 (1:10,560)	SK369443 SK369443	3-314 3-315

10A.3.12 In addition to the potential historical sources at or close to Section 3, the following land uses have been identified in the wider area within 250 m of Section 3:

- mineral extraction sites (collieries, opencasts, gravel pits, shafts and quarries);
- railways (including the Mineral Railway);
- surface water features (including ponds); and
- tanks (unspecified).

### **Summary**

10A.3.13 The historical land use of Section 3, indicated in the earliest available mapping (1875), is dominated by mineral extraction and industrial activity in the northern half of the Section. These activities included collieries, ironworks, and brickfields with associated railways. The southern half of Section 3 is largely agricultural with plantations, railways, roads, and various farms. A quarry is indicated to the south of the section from the earliest available mapping (1875). This quarry was marked as disused by 1980.

10A.3.14 Pylon 71 is surrounded by industrial activities that included opencast workings and collieries. The opencast workings are indicated in mapping from 1967 to 1978. Collieries are also identified to the east of pylons 72, 73, and 74. By the 1980s, these collieries have been restored to open fields. Opencast workings are shown to the east of pylons 80, 81, and 85. The opencast coal workings near pylons 80 and 81 are annotated until the 1980s after which they are no longer annotated. The available mapping from 1992 identifies opencast workings near pylon 85.

10A.3.15 Pylon 91 is located 65 m north west of a former sewage works dated 1913 which is no longer indicated by mapping dated 1990 with open fields in its place.

## Section 4: Morley to Ockbrook

**Table 10A.6: Section 4 site history summary (within 50 m of pylon/feature)**

<b>Pylon/Feature</b>	<b>Land Use/Feature</b>	<b>Map (Scale)</b>	<b>Feature Location (Centroid Grid Reference)</b>	<b>Feature Map ID</b>
Pylon 112 and haul road	Opencast Workings	1960 (1:2,500)	SK394413	4-24
Pylon 113 and haul road	Opencast Workings	1960 (1:2,500)	SK394413	4-24
Pylon 114 haul road	Colliery	1901 (1:2,500)	SK410396	4-4

10A.3.16 In addition to the potential historical sources at or close to Section 4, the following land uses have been identified in the wider area within 250 m of Section 4:

- railway land and embankments;
- an electrical substation;
- a smithy;
- sewage works;
- potentially infilled land;
- tanks; and
- mineral extraction features (opencast workings, quarries, shafts, pits).

### **Summary**

10A.3.17 The historical land use of Section 4 is predominantly agricultural land and industrial uses (including some mineral extraction activities). Mapping dated 1967 indicates mineral extraction activities (collieries, quarries) at and surrounding pylons 112, 113 and 114. In the mid-section, a railway embankment and railway land intersect the proposed route alignment approximately 100 m to the south east of pylon 111. Historical development features are relatively infrequent in Section 4, with few development features impacted.

## Section 5: Ockbrook to Aston-on-Trent

**Table 10A.7: Section 5 site history summary (within 50 m of pylon/feature)**

Pylon/Feature	Land Use/Feature	Map (Scale)	Feature Location (Centroid Grid Reference)	Feature Map ID
Pylon 129 haul road	Potential Infilled Land	1967 (1:10,560)	SK430357	5-201
Pylon 136	Railway Embankment	1881 (1:10,560)	SK432336	5-3
Pylon 141	Gravel pits (latterly landfill)	1990 (1:2,500)	SK434321	5-216
Pylon 142	Gravel pits (latterly landfill)	1990 (1:2,500)	SK434321	5-216

10A.3.18 In addition to the potential historical sources at or close to Section 5, the following land uses have been identified in the wider area within 250 m of Section 5:

- railway land and embankments;
- general works;
- electrical substations;
- sewage works;
- potentially infilled land;
- tanks; and
- mineral extraction features (quarries, shafts, pits).

### Summary

10A.3.19 The historical land use is predominantly agricultural land with a few industrial uses (including works, substations, sewage works and railway land). There is potential infilled land adjacent to the haul road near pylon 129. The haul road is also shown to intersect a railway embankment to the north of pylon 136. Historical development features are relatively infrequent in Section 5, with few development features impacted.

## Section 6: Aston-on-Trent to Willington Substation

**Table 10A.8: Section 6 site history summary (within 50 m of pylon/feature)**

Pylon/Feature	Land Use/Feature	Map (Scale)	Feature Location (Centroid Grid Reference)	Feature Map ID
Chellaston Compound (ID: 3)	Potential Infilled Pond	1901 (1:2,500)	SK375293	6-109
Pylon 167 haul road	Pit	1899 (1:10,560)	SK363291	6-100

<b>Pylon/Feature</b>	<b>Land Use/Feature</b>	<b>Map (Scale)</b>	<b>Feature Location (Centroid Grid Reference)</b>	<b>Feature Map ID</b>
Pylons 182, 183 & 184 and associated haul roads	Power Station	1969 (1:2,500)	SK309289	6-151
Pylon 184, 185 & 186 and associated haul roads	Railway Marshalling Yard	1969 (1:2,500)	SK305291	6-152

10A.3.20 In addition to the potential historical sources at or close to Section 6, the following land uses have been identified in the wider area within 250 m of Section 6:

- infilled ponds;
- mineral extraction sites (gravel pits, shafts, mines);
- smithy;
- garages;
- railway land;
- tanks;
- sewage works; and
- slag tip.

### **Summary**

10A.3.21 The historical land use of Section 6 is dominated by open agricultural land containing farms, small woodlands, roads, ponds and watercourses. There are few historical land uses mapped along Section 6 until the railway and Willington Power Station are mapped in the 1960s. These features are present between pylon 182 and the westernmost extent of the Section 6 draft Order Limits. In the first edition mapping (1880) railway land and canals are shown to run through the Section from near pylon 162 west to Willington Substation. Industrial land uses generally comprised localised mineral extraction activities such as quarries, gravel pits and coal pits. There is then little significant change to the land use within the Section until the 1960s when Willington Power Station is identified in the west of the proposed route alignment to the south of pylons 182 to 184. At the same time a large marshalling yard is identified at the location of pylons 184, 185 and 186. Further development of Willington Power Station is identified in the 1970s with the inclusion of a slag tip to the south of pylons 182 and 183 as well as Willington Substation between pylon 185 to Gantry: G-3.

## 10A.4 Environmental Setting

### Geology

#### Published geology

##### Artificial ground

10A.4.1 BGS mapping indicates that the Sections contain numerous areas of artificial ground (Made Ground), the majority of which is identified within Sections 1, 2 and 3. The BGS mapping indicates Made Ground is present at the following pylon locations:

- Section 1 – Made Ground is mainly identified between pylons 2 and 11 and between pylons 15 and 24;
- Section 2 – Made Ground is mainly identified between pylons 40 and 52;
- Section 3 – Made Ground is mainly identified between pylons 71 and 72 and between pylons 75 and 79;
- Section 4 – Made Ground is generally localised;
- Section 5 – Made Ground is generally localised; and
- Section 6 – Made Ground is generally localised.

10A.4.2 In general, many of the areas of Made Ground are associated with opencast workings identified in historical mapping and the Mining Remediation Authority Legacy Coal Mining Geographic Information System (GIS) Datasets that will be summarised in a coal mining risk assessment which is to be prepared separately to this assessment.

10A.4.3 A summary of the artificial ground identified on available mapping at the Project is provided in **Table 10A.9** and shown in **Figure 10A.4** in **Annex 10A.1**.

**Table 10A.9: Summary of artificial ground**

Section	Proposed Development
1	<ul style="list-style-type: none"><li>• pylons 4, 5, 8, 9, 10, 16, 18, 19, 23 and 39;</li><li>• haul roads to pylons 2, 3, 4, 5, 8, 9, 10, 15, 16, 18, 19, 21, 22, 23, 31, 37 and 39; and</li><li>• Holmewood Compound (ID: 2).</li></ul>
2	<ul style="list-style-type: none"><li>• pylons 40, 42, 43, 48, 50, 56, and 61; and</li><li>• haul roads to pylons 40, 41, 42, 43, 44, 47, 48, 50, 51, 57 and 61.</li></ul>
3	<ul style="list-style-type: none"><li>• pylon 81;</li><li>• haul roads to pylons 71, 75, 76, 77, 78, 79, 81, 82, 83, 84, 85, 100 and 101; and</li><li>• Upper Hartshay Compound (ID: 13).</li></ul>

Section	Proposed Development
4	<ul style="list-style-type: none"> <li>no Made Ground is identified at any of the pylons, construction compounds or haul roads.</li> </ul>
5	<ul style="list-style-type: none"> <li>pylons 141 and 142; and</li> <li>haul roads to pylons 141 and 142.</li> </ul>
6	<ul style="list-style-type: none"> <li>no Made Ground is identified at any of the pylons or construction compounds.</li> <li>however, Made Ground is likely to be at pylons 182 to 186 and the Gantries given the historical land uses at these pylons which included a Power Station (including a slag tip).</li> </ul>

## Superficial geology

### Sections 1 to 4 Chesterfield Substation to Ockbrook

- 10A.4.4 BGS mapping indicates that Sections 1 to 4 pass through an area predominantly underlain by thin or absent superficial deposits. However, pockets of Alluvium deposits comprising clay, silt, sand and gravel are shown to be present along watercourses. In addition, Glacial Till and Head Deposit are present within isolated pockets within Sections 3 and 4.
- 10A.4.5 A summary of the superficial deposits at Sections 1 to 4 is provided in **Table 10A.10** and shown in **Figure 10A.5** in **Annex 10A.1**.

**Table 10A.10: Summary of the superficial geology of Sections 1 to 4**

Superficial Geology	Project Coverage
Alluvium – clay, silt, sand and gravel	<ul style="list-style-type: none"> <li>pylons 45, 46 and 93; and</li> <li>haul road between pylons 2 to 3, 36 to 37, 44 to 47, 92 to 93, 96 to 98, 127 to 128.</li> </ul>
Glacial Till – heterogenous mix of clay, silt, sand, gravel, cobbles and boulders (diamicton)	<ul style="list-style-type: none"> <li>pylons 66, 67, 75 and 114; and</li> <li>haul road between pylons 66 to 67, 74 to 76, 78 to 80 and 113 to 114.</li> </ul>
Head Deposits – clay, silt, sand and gravel	<ul style="list-style-type: none"> <li>haul road between pylons 98 to 99.</li> </ul>

### Sections 5 and 6 Ockbrook to Willington Substation

- 10A.4.6 BGS mapping indicates that Sections 5 and 6 are underlain by variable superficial deposits that include:
- Alluvium;
  - Head Deposits;
  - River Terrace Deposits:
    - Borrowash Sand and Gravel Member;

- Allenton Terrace Deposits;
- Etwall Sand and Gravel Member;
- Eagle Moor Sand and Gravel Member;
- Beeston Sand and Gravel Member;
- Hemington Member; and
- Holme Pierrepont Sand and Gravel Member.
- Thrussington Member (Glacial Till – diamicton);
- Oadby Member (Glacial Till – diamicton);
- Glaciolacustrine Deposits; and
- Glaciofluvial Deposits.

10A.4.7 A summary of the superficial deposits at Sections 5 to 6 is provided in **Table 10A.11** and shown in **Figure 10A.5** in **Annex 10A.1**.

**Table 10A.11: Summary of the superficial geology of Sections 5 and 6**

Superficial Geology	Project Coverage
Alluvium – clay, silt, sand and gravel	<ul style="list-style-type: none"> <li>• pylons 140, 151, 163, 182, 183, 184, 185 and 186;</li> <li>• haul road between pylons 139 to 140, 146 to 147, 150 to 151, 173 to 174 to 182 and 186;</li> <li>• haul road to pylon 163; and</li> <li>• south east and south west corner of the Chellaston (1) and (2) Compounds (ID: 3 and 11), respectively.</li> </ul>
Head Deposits	<ul style="list-style-type: none"> <li>• pylons 133, 152, 153 and 154;</li> <li>• haul road between pylons 132 to 133 and 152 to 154; and</li> <li>• haul road to pylon 131.</li> </ul>
Borrowash Sand and Gravel Member – sand and gravel	<ul style="list-style-type: none"> <li>• pylon 134; and</li> <li>• haul road to pylon 134.</li> </ul>
Allenton Terrace Deposits – sand and gravel	<ul style="list-style-type: none"> <li>• pylons 136, 137, 138, 139, 148, 149 and 150;</li> <li>• haul road between pylons 136 to 138 and 149 to 150; and</li> <li>• Thulston Construction Compound (ID: 10).</li> </ul>
Etwall Sand and Gravel Member – sand and gravel	<ul style="list-style-type: none"> <li>• pylon 168; and</li> <li>• haul road between pylons 167 to 168.</li> </ul>
Eagle Moor Sand and Gravel Member – sand and gravel	<ul style="list-style-type: none"> <li>• haul road between pylons 170 and 171.</li> </ul>

Superficial Geology	Project Coverage
Beeston Sand and Gravel Member – sand and gravel	<ul style="list-style-type: none"> <li>• pylon 171; and</li> <li>• haul road to pylon 171.</li> </ul>
Hemington Member – silt and gravel	<ul style="list-style-type: none"> <li>• pylons 143, 144, 145, 146, 147 and 176;</li> <li>• haul road between pylons 139 to 140, 143 to 147 and 176 to 178; and</li> <li>• Gantry G-4.</li> </ul>
Holme Pierrepont Sand and Gravel Member – sand and gravel	<ul style="list-style-type: none"> <li>• pylons 172, 173, 174, 175, 177, 178, 179, 180 and 181;</li> <li>• haul road between pylons 172 to 178 and 179 to 181;</li> <li>• Twyford Compound (ID: 7); and</li> <li>• Gantry G-3.</li> </ul>
Thrussington Member – Diamicton	<ul style="list-style-type: none"> <li>• pylons 142, 162, 165 and 167;</li> <li>• haul road between pylons 164 to 169 and 170 to 171;</li> <li>• haul road to pylon 142;</li> <li>• central part of the Chellaston (1) Compound (ID: 3); and</li> <li>• western part of the Chellaston (2) Compound (ID: 11).</li> </ul>
Oadby member – Diamicton	<ul style="list-style-type: none"> <li>• pylons 156, 157, 159, 160, 161 and 170;</li> <li>• haul road between pylons 156 to 157, 159 to 161 and 169 to 171; and</li> <li>• eastern part of the Chellaston (2) Compound (ID: 11).</li> </ul>
Glaciolacustrine Deposits	<ul style="list-style-type: none"> <li>• pylon 158;</li> <li>• haul road between pylons 158 to 160;</li> <li>• northern part of the Chellaston (1) Compound (ID: 3); and</li> <li>• central part of the Chellaston (2) Compound (ID: 11).</li> </ul>
Glaciofluvial Deposits	<ul style="list-style-type: none"> <li>• pylon 164; and</li> <li>• haul road between pylons 164 to 167.</li> </ul>

## Bedrock geology

- 10A.4.8 BGS mapping indicates that the northern part of the Project from Section 1 to the southern part of Section 3 is predominantly underlain by the Lower and Middle Pennine Coal Measures. These are part of the Pennine Coal Measures Group which generally comprises a cyclical sequence of mudstone, siltstone, sandstone, seat earth and frequent coal seams and ironstone beds (or nodules).
- 10A.4.9 From the southern part of Section 3 to the central part of Section 5 BGS mapping indicates bedrock to be variable comprising the following formations:
- Tupton Rock – sandstone;
  - Rosedale Formation – mudstone and sandstone;
  - Tarporley Siltstone Formation – mudstone, siltstone and sandstone;
  - Moira Formation – breccia;
  - Chester Formation – sandstone (gravelly);
  - Gunthorpe Member – mudstone;
  - Wingfield Flags – sandstone;
  - Edwalton Member – mudstone;
  - Loxley Edge Rock – sandstone;
  - Branscombe Mudstone Formation – mudstone; and
  - Chatworth Grit – sandstone.
- 10A.4.10 From the central part of Section 5 to Willington Substation in Section 6 BGS mapping indicates that the Project is predominantly underlain by the Branscombe Mudstone Formation and the Gunthorpe Member which comprise mudstone. In the southern part of the Project, Sections 5 and 6 also contain small areas of the following formations:
- Edwalton Member – mudstone;
  - Arden Sandstone Formation – sandstone; and
  - Tarporley Siltstone Formation – mudstone, siltstone and sandstone.
- 10A.4.11 The BGS mapping indicates that there are numerous inferred and observed coal seams and geological faults throughout Sections 1, 2, and 3 and the northern part of Section 4, which are underlain by the Pennine Coal Measures Group. In the southern part of the Project, Sections 5 and 6 also contain geological faults and inferred mineral veins that cross through the mudstone geology but at a lower frequency than in Sections 1 to 4.
- 10A.4.12 A summary of the bedrock geology underlying the Project is shown in **Figure 10A.6** in **Annex 10A.1** and summarised in **Table 10A.12**.

**Table 10A.12: Summary of the bedrock geology**

Formation Name	Proposed Development Coverage
Pennine Lower Coal Measures – mudstone, siltstone, sandstone and coal seams	<ul style="list-style-type: none"> <li>• G-1 and G-2;</li> <li>• pylons 28 to 32, 52 to 55, 59 to 63, 65, 66, 69 to 72, 75 to 77, 79, 81, 86 to 90, 92, 93, 96, 97, 101, 102, 108 to 112 and 114 to 117;</li> <li>• Chesterfield Substation Compound (ID: 4);</li> <li>• Cock Alley Compound (ID: 1);</li> <li>• Upper Hartshay Compound (ID: 13); and</li> <li>• Morley Hayes Compound (ID: 12).</li> </ul>
Pennine Middle Coal Measures – mudstone, siltstone, sandstone and coal seams	<ul style="list-style-type: none"> <li>• pylons 2 to 6, 8 to 12, 15, 16, 18 to 24, 26, 33 to 37, 39 to 48, 50, 51, 56 to 58, 73 and 74;</li> <li>• Temple Normanton Compound (ID: 5);</li> <li>• Astwith Compound (ID: 6);</li> <li>• Alfreton Compound (ID: 8); and</li> <li>• Holmewood Compound (ID: 2).</li> </ul>
Pennine Lower Coal Measures – sandstone	<ul style="list-style-type: none"> <li>• pylons 7, 67, 78 and 80;</li> <li>• Chesterfield Substation Compound (ID: 4);</li> <li>• Cock Alley Compound (ID: 1); and</li> <li>• Upper Hartshay Compound (ID: 13).</li> </ul>
Pennine Middle Coal Measures – sandstone	<ul style="list-style-type: none"> <li>• pylons 11, 25, 27 and 49; and</li> <li>• Astwith Compound (ID: 6).</li> </ul>
Pennine Lower Coal Measures – Deep Hard Rock sandstone <sup>1</sup>	<ul style="list-style-type: none"> <li>• pylons 1 and 68.</li> </ul>
Pennine Lower Coal Measures – Tupton Rock sandstone <sup>1</sup>	<ul style="list-style-type: none"> <li>• pylon 64.</li> </ul>
Pennine Middle Coal Measures – Top Hard Rock sandstone <sup>1</sup>	<ul style="list-style-type: none"> <li>• pylons 13, 14, 17, 38; and</li> <li>• Holmwood Compound (ID: 2).</li> </ul>
Pennine Middle Coal Measures – Crawshaw Sandstone <sup>1</sup>	<ul style="list-style-type: none"> <li>• pylon 102.</li> </ul>
Rossendale Formation – mudstone and sandstone	<ul style="list-style-type: none"> <li>• pylon 103.</li> </ul>
Tarpurley Siltstone Formation – mudstone, siltstone and sandstone	<ul style="list-style-type: none"> <li>• pylons 105, 106 and 118 to 130;</li> <li>• Morley Hayes Compound (ID: 12); and</li> <li>• Ockbrook Compound (ID: 9).</li> </ul>
Moira Formation – breccia	<ul style="list-style-type: none"> <li>• pylon 107.</li> </ul>
Chester Formation – sandstone (gravelly)	<ul style="list-style-type: none"> <li>• pylon 113.</li> </ul>

Formation Name	Proposed Development Coverage
Gunthorpe Member – mudstone	<ul style="list-style-type: none"> <li>pylons 131 to 134 and 171 to 186;</li> <li>G-3 and G-4; and</li> <li>Twyford Compound (ID: 7).</li> </ul>
Wingfield Flags – sandstone	<ul style="list-style-type: none"> <li>pylons 82 to 85 and 98.</li> </ul>
Edwalton Member – mudstone	<ul style="list-style-type: none"> <li>pylons 135 to 137, 158, 159 and 170.</li> </ul>
Loxley Edge Rock – sandstone	<ul style="list-style-type: none"> <li>pylons 91, 94, 95, 99 and 100.</li> </ul>
Branscome Mudstone Formation – mudstone	<ul style="list-style-type: none"> <li>pylons 138 to 157 and 160 to 169;</li> <li>Thulston Compound (ID: 10);</li> <li>Chellaston (1) Compound (ID: 3); and</li> <li>Chellaston (2) Compound (ID: 11).</li> </ul>
Chatsworth Grit – sandstone	<ul style="list-style-type: none"> <li>pylon 104.</li> </ul>

Notes: 1 – These are major named sandstone beds within the Lower and Middle Pennine Coal Measure Formation.

## Unexploded Ordnance (UXO)

10A.4.13 A UXO desk study and constraints assessment at and nearby to the draft Order Limits has been undertaken by Zetica UK Ltd, dated June 2025 (Ref 10A.18). The full report is provided in **Annex 10A.4**. A summary of the nearby UXO records and associated historical hazards (anti-aircraft defences, anti-invasion defences, small arms ranges, aircraft crashes, military airfields, explosives and ordnance factories, munitions depots and disposal areas and military training areas) is summarised in the following sections and is shown in **Figure 10A.7** in **Annex 10A.1**.

### Section 1

10A.4.14 No UXO or associated historical hazards were identified within the draft Order Limits of Section 1 of the Project. The nearest identified hazard was located 550 m west of pylon 32 and is detailed as an aircraft crash. The UXO report indicates this constraint presents a low UXO hazard level to Section 1 of the Project.

### Section 2

10A.4.15 No UXO or associated historical hazards were identified within or within 1 km of the draft Order Limits of Section 2 of the Project.

### Section 3

10A.4.16 No UXO or associated historical hazards were identified within or within 1 km of the draft Order Limits of Section 3 of the Project.

### Section 4

10A.4.17 No UXO or associated historical hazards were identified within or within 1 km of the draft Order Limits of Section 4 of the Project.

## Section 5

- 10A.4.18 One UXO/associated historical hazard is located within the draft Order Limits of Section 5 of the Project. This hazard is located a maximum of 10 m within the draft Order Limits and is located 155 m west of pylon 145. The hazard is detailed as a searchlight position with a possible light anti-aircraft gun and associated accommodation camp. The UXO report indicates this constraint presents a low UXO hazard level to Section 5 of the Project.
- 10A.4.19 The 500 m hazard buffer zone that surrounds two bombing decoy sites are located within the draft Order Limits of Section 5 of the Project.
- 10A.4.20 The first bombing decoy site is located 445 m south east of pylon 141. The 500 m hazard buffer zone encompasses pylons 141 and 142. This hazard is detailed as a bombing decoy site that used lighting to simulate an urban area and intended to deflect bombing away from central Derby. The UXO report indicates this constraint presents a high UXO hazard level.
- 10A.4.21 The second bombing decoy site is located 600 m south east of pylon 152. The 500 m hazard buffer zone is located 100 m south of pylon 152 and 90 m east of pylon 153. This hazard is detailed as a bombing decoy site that used both lighting and controlled fires to simulate an urban area/burning urban area, respectively. The UXO report indicates this constraint presents a high UXO hazard level.

## Section 6

- 10A.4.22 One UXO/associated historical hazard is located within the draft Order Limits of Section 6 of the Project. This hazard is located a maximum of 45 m within the draft Order Limits and is located approximately 118 m north east of pylon 179. The hazard is detailed as a small arms range (Derby Rifle and Pistol Club) which had three ranges used for competition shooting. The UXO report indicates this constraint presents a low UXO hazard level to Section 6 of the Project.
- 10A.4.23 The 500 m hazard buffer zone that surrounds one bombing decoy site is located within the draft Order Limits of Section 6 of the Project.
- 10A.4.24 The bombing decoy site is located 640 m north of pylon 167. The 500 m hazard buffer zone is located 138 m north of pylon 166, 142 m north of pylon 167 and 40 m north east of pylon 168. The hazard is detailed as a bombing decoy site that used lighting to simulate an urban area and intended to deflect bombing away from central Derby. The UXO report indicates this constraint presents a high UXO hazard level.

## Previous Investigations

### BGS borehole records

- 10A.4.25 A search of the BGS Single Onshore Borehole Index (Ref 10A.14) has been undertaken to identify historical exploratory hole records that are relevant to the Project (i.e. that started from ground level and within close proximity to the pylons and compounds). A summary of the borehole records reviewed is provided in the following sections. The selected BGS borehole locations are shown in **Figure 10A.6** in **Annex 10A.1** and the borehole geological logs are presented in **Annex 10A.7**.

## Section 1

10A.4.26 The search reveals that there are only four records within the draft Order Limits of Section 1 of the Project. The records relevant to the Project are summarised in **Table 10A.13**.

**Table 10A.13: Summary of the Section 1 BGS borehole records**

BGS Record IDs	Project Location	Description
SK46NW241	Gantry: G-1 and G-2 (20 m north Gantry G-2)	The record indicates that the gantry location is underlain by topsoil over shallow Made Ground comprising firm to stiff (or hard) gravelly laminated clay to a depth of 1.10 m Below Ground Level (m BGL). This is underlain by Made Ground of opencast backfill material recorded as medium dense to dense very silty clayey gravel of sandstone, siltstone, mudstone with rare coal and ironstone nodules to a depth of 23.30 m BGL.
SK46SW11	Pylon 37 (50 m south)	<p>It is noted that the borehole is dated 1952 and is located within an area of recorded opencast coal workings. As such, the record may not represent the current ground conditions underlying the pylon due to historical opencast mining since the original borehole was drilled.</p> <p>The record describes superficial deposits as soil or clay with sandstone to a depth of approximately 3.0 m BGL. The rockhead was recorded as the Top Hard Sandstone to approximately 4.2 m BGL. This was underlain by coal, shale and sandstone. The borehole encountered coal seams at approximately 4.2 m, 11.2 m and 21.3 m BGL with thicknesses of approximately 1.10 m, 0.25 m and 0.05 m BGL. A further 11 coal seams are encountered from approximately 43.0 m BGL to the base of the borehole at 189 m BGL.</p>

## Section 2

10A.4.27 The search reveals that there are five records within the draft Order Limits of Section 2 of the Project. The records relevant to the Project are summarised in **Table 10A.14**.

**Table 10A.14: Summary of the Section 2 BGS borehole records**

BGS Record IDs	Project Location	Description
SK45NW300	Haul road to pylon 41 (130 m south)	The borehole encountered approximately 3.0 m of clay underlain by coal with a thickness of approximately 1.5 m BGL. This is underlain by cyclical beds of mudstone, siltstone, sandstone and very thin seams of coal to the base of the borehole at approximately 137 m BGL. The borehole records thick seams of coal at 4.57 m, 11.6 m, 21.0 m, 32.9 m, 46.5 m, 55 m, 63.2 m, 67.5 m, 75.6 m,

BGS Record IDs	Project Location	Description
		91.2 m, 118.3 m and 161.6 m BGL. No record of groundwater was documented on the borehole log.
SK35SE9	Pylon 59 (115 m north east)	The borehole encountered cyclical beds of mudstone, siltstone, sandstone and seams of coal to the base of the borehole at approximately 94.7 m BGL. The borehole records thick seams of coal at 27.4 m and 29.5 m BGL. No record of groundwater was documented on the borehole log.
SK35SE76	Pylon 70 (91 m east)	The borehole encountered a surface layer of clay to a depth of 3.05 m BGL. This is underlain by silty mudstone becoming increasingly sandy with depth to 5.83 m BGL. This is underlain by silty sandstone up to 7.0 m BGL. No groundwater was recorded during drilling.

### Section 3

10A.4.28 The search reveals that there are 11 records within the draft Order Limits of Section 3 of the Project. The records relevant to the Project are summarised in **Table 10A.15**.

**Table 10A.15: Summary of the Section 3 BGS borehole records**

BGS Record IDs	Project Location	Description
SK35SE15	Haul road between pylon 75 and 74 (14 m south of the haul road)	The record indicates 0.2 m of topsoil underlain by firm sandy clay to 1.2 m BGL. This is underlain by a grey to pale brown slightly silty sandstone to a depth of 5.40 m BGL. A mudstone is recorded from 5.40 m BGL to the base of the borehole at 17.0 m BGL. The mudstone from 9.20 m BGL contains sandy laminations and bedding. By 12.50 m BGL the mudstone becomes less sandy. No groundwater was recorded during drilling.
SK34SE14	Pylon 93 (120 m east)	The borehole was open hole drilled to a depth of 3.66 m BGL. A highly fractured silty laminated mudstone with occasional clayey seams and bands is described from 3.66 m to the depth of the borehole at 12.0 m BGL. Groundwater is recorded at 3.66 m BGL at the end of the borehole.
SK34SE2	Pylon 95 (144 m south)	The record indicates clay with gravels to a depth of 1.80 m BGL. The clay soils are underlain cyclical variations of grey to dark blue shale, yellow sandstone and coal seams to the base of the borehole at a depth of approximately 66.75 m BGL. The shale is detailed to contain ironstone nodules throughout. The borehole records thick seams of coal at 10.6 m, 36.7 m, 43.2 m, 44.0 m, 48.15 m, 59.5 m and 58.8 m BGL. Groundwater

BGS Record IDs	Project Location	Description
		was recorded at 1.80 m BGL at the termination of the borehole.
SK34SE8	North west corner of Morley Hayes Compound (ID: 12)	The record indicates 4.10 m of red sand underlain by sandy shale to a depth of 7.55 m BGL. A dark grey shale interbedded to coal seams is recorded to a depth of 14.50 m BGL. The borehole records thick seams of coal at 9.26 m and 12.30 m BGL. A hard sandstone is recorded from 14.50 m to the termination depth of the borehole at 15.25 m BGL. Groundwater depths are not detailed on this record.

#### Section 4

10A.4.29 The search reveals that there are two records within the draft Order Limits for Section 4. Only one record is located at a suitable distance from the Project to be considered relevant; however, this record does not contain any geological borehole logs.

#### Section 5

10A.4.30 The search reveals that there are five records within the draft Order Limits for Section 5. The records relevant to the Project are summarised in **Table 10A.16**.

**Table 10A.16: Summary of the Section 5 BGS borehole records**

BGS Record IDs	Project Location	Description
SK43SW36	Pylon 134 (220 m south east)	The record indicates a medium to coarse sand and fine to medium coarse gravel to a depth of 1.83 m BGL. A fluvio-glacial gravel (dense well graded sand and gravel) is recorded underlying to a depth of 3.20 m BGL. Keuper Marl (stiff becoming hard silty marl with hard siltstone hands) is recorded underlying the fluvio-glacial deposits to the termination depth of 12.50 m BGL. Groundwater was recorded at 2.29 m BGL when the borehole was at a depth of 3.20 m BGL and again at 8.53 m BGL when the borehole was at a depth of 9.14 m BGL.
SK43SW113/A-B	Pylon 33 (35 m north east)	The record indicates that topsoil is present to a depth of 0.30 m BGL underlain by river terrace deposits comprising brown clayey sand with gravel and cobbles to a depth of 3.70 m BGL. Keuper Marl comprising red silty clay or very silty clay with occasional mudstone bands becoming stiff at a depth of 9.30 m BGL is recorded to the termination depth of 10.20 m BGL. Groundwater was recorded at 9.10 m BGL at the end of the borehole.

BGS Record IDs	Project Location	Description
SK43SW70	Pylon 149 (200 m east)	The record indicates that topsoil is present to a depth of 0.40 m BGL underlain by river terrace deposits comprising brown gravel and sand with clay traces to a depth of 2.50 m BGL. Keuper Marl comprising red clayey silt with occasional green specks is recorded underlying the river terrace deposits to the termination depth of 12.0 m BGL. Groundwater was recorded at 6.0 m BGL.

## Section 6

- 10A.4.31 The search reveals that there are 50 borehole records within the draft Order Limits of Section 6 of the Project. The records relevant to the Project are summarised in **Table 10A.17**.
- 10A.4.32 A total of 22 borehole records are shown within 200 m of pylon 155. However, these records do not contain readable borehole logs. The records include borehole and trial pit location plans with associated coordinates.

**Table 10A.17: Summary of the Section 6 BGS borehole records**

BGS Record IDs	Project Location	Description
SK32NE360	Pylon 159 (168 m north)	The record indicates that topsoil is present to a depth of 0.40 m BGL.  The topsoil is recorded as being underlain by glacial deposits comprising brown sandy clay and silt to a depth of 3.80 m BGL. Glacial lacustrine deposits generally comprising silty sandy clay with gravels of sandstone, chalk, coal and chert are recorded underlying the glacial deposits to a depth of 6.50 m BGL. Glacial till deposits are recorded from 6.50 m BGL to the borehole termination depth of 24.35 m BGL. Groundwater was recorded at 12.20 m BGL at the termination depth of the borehole.
SK32NE241	Haul road (approximately 40 m north of pylon 161)	Topsoil is recorded to a depth of 0.30 m BGL. This is underlain by stiff to very stiff laminated grey-brown clay with fine to medium gravel to a depth of 9.0 m BGL. The borehole encountered fine to coarse sand and gravel in a matrix of sandy silty clay from 9.0 m to 10.0 m BGL. Bedrock is recorded as comprising fissured red-brown calcareous silty mudstone, clayey in parts, with bands of green-grey sandy siltstone to the termination depth at 12.15 m BGL. No groundwater was encountered during drilling.
SK32NE27	Haul road to pylon 163 (25 m south)	The record indicates that topsoil is present to a depth of 0.46 m BGL. The topsoil is recorded as being underlain by weather Keuper Marl comprising stiff red brown silty marl

BGS Record IDs	Project Location	Description
		with thin bands of hard green marl. The borehole records the marl down to the termination depth of the borehole at 15.09 m BGL. Groundwater is recorded at 4.27 m BGL when the borehole was at a depth of 4.88 m BGL and again at 1.20 m BGL at termination of the borehole.
SK32NE31	Haul road to pylon 168 (70 m north)	The record indicates that topsoil is present to a depth of 0.40 m BGL. The topsoil is recorded as being underlain by firm to stiff red clayey silt. At a depth of 2.40 m the clayey silt becomes very stiff and very friable with bands of very weak siltstone and by 9.0 m BGL it is recorded as hard. At a depth of 12.60 m BGL a very dense grey and brown clayey sand and weak fine grained sandstone is recorded to the depth of the borehole termination at 15.45 m BGL. A groundwater seepage was recorded at 14.0 m BGL.
SK32NW5	Gantry G-3 (30 m north east)	<p>The record indicates that sandy topsoil is present to a depth of 0.46 m BGL.</p> <p>The topsoil is recorded as being underlain by a medium compact brown coarse sandy gravel to a depth of 3.96 m BGL. The gravel is underlain by a firm reddish brown silty clay, becoming stiffer and darker with depth, to a depth of 6.40 m BGL. Stiff to hard reddish brown clay is recorded from 6.40 m to 9.60 m BGL. The final strata prior to borehole termination at 11.13 m BGL is recorded as dense fine-grained reddish sand with some stones.</p> <p>A water strike was recorded at 9.60 m BGL, rising quickly to 3.66 m BGL. A quick rise to 0.91 m BGL was recorded when the casing was withdrawn.</p>

## Radon

- 10A.4.33 The Indicative Atlas of Radon in Great Britain (Ref 10A.15) indicates that the Project is predominantly within an area where less than 1 per cent to 3 per cent of properties are above the Action Level. In these areas no radon measures are required for new developments.
- 10A.4.34 In the northern part of the Project, Sections 1 to 3 also contain areas where between 3 per cent and 10 per cent of properties are above the Action Level where basic radon protection measures would be required for new developments. These Sections also contain areas where between 10 per cent and 30 per cent of properties are above the Action Level and which would require full protection measures for new developments.
- 10A.4.35 Given the nature of the Project, overhead transmission lines, it is considered unlikely that there is a pathway for exposure to radon during construction and operation of the majority of the Project. However, as the new Chesterfield Substation is likely to include permanent occupied spaces such as offices and associated welfare, radon has been considered as a potential source.

## Mineral Extraction

### Mining Remediation Authority

- 10A.4.36 All development features to the north of, and including, pylon 124 are shown as lying within a Coal Mining Reporting Area.
- 10A.4.37 All development features to the north of, and including, pylon 116 are shown as lying within or adjacent to a Development High Risk Area.
- 10A.4.38 All development features to the north of, and including, pylon 118 are shown as lying within a Surface Coal Resource Area.
- 10A.4.39 A high concentration of coal outcrops, probable shallow mine workings, surface mining (past and current), mine entries and mine entry potential zones of influence are shown across Sections 1, 2, 3 and much of Section 4. No coal outcrops are shown within Sections 5, 6 and the southern third of Section 4 as these areas lie beyond the East Midlands coalfield. The coal outcrops, probable shallow mine workings, surface mining (past and current) and mine entries are shown in **Figure 10A.8** in **Annex 10A.1**.
- 10A.4.40 Given that a significant proportion of the proposed route alignment lies within Development High Risk Areas, a coal mining risk assessment is to be completed separately to this assessment. The coal mining risk assessment will determine the potential for coal mining hazards to affect the structural integrity of the new pylons.
- 10A.4.41 The primary risk mechanisms likely to affect the pylons are mining void collapse and upwards propagation causing surface subsidence and crowning; and residual settlement of un-engineered colliery spoil backfill, both of which are likely to cause a loss of structural integrity and serviceability of the pylons.

### Non-coal mining

- 10A.4.42 All development features in Sections 1 and 2 lie within areas listed as having potential for historical Iron Ore (Bedded) mining. The Groundsure reports state that underground mine workings may have occurred in the past or current mines may be working at significant depth to modern engineering standards. Potential for difficult ground conditions are unlikely and are at a level where they need not be considered.
- 10A.4.43 Most development features in Section 3 lie within or near to areas with the potential for historical Iron Ore (Bedded) mining. pylons 102, 103 and 104 lie within an area listed as having potential for historical Vein Mineral mining. The Groundsure reports state that underground mine workings are uncommon, although the geology is similar to that worked elsewhere. Potential for difficult ground conditions are unlikely and are at a level where they need not be considered.
- 10A.4.44 All pylons in the northern half of Section 4 (pylons 106 to 118) lie within or adjacent to areas listed as having potential for historical Iron Ore (Bedded) mining. The Groundsure reports state that underground mine workings may have occurred in the past or current mines may be working at significant depth to modern engineering standards. Potential for difficult ground conditions are unlikely and are at a level where they need not be considered.
- 10A.4.45 All development features in the southern half of Section 4 and all of Section 5 are not listed as being impacted by any non-coal mining. An area of Evaporite and Gypsum mining is shown within the survey boundary, approximately 365 m to the south of pylon 144.

10A.4.46 Most of the development features in Section 6 are not shown to be impacted by any non-coal mining. Pylons 156 and 157 lie within or adjacent to an area impacted by Gypsum mining. The Groundsure reports state that underground mining is known or considered likely within or very close to the area. The location, extent and nature of mining should be considered in any site investigation. Potential for difficult ground conditions in this area should be considered.

### **BGS recorded sites**

10A.4.47 Most of the BGS recorded sites within the draft Order Limits of the Project align with underground and surface ground workings listed in the Groundsure reports and shown on historical mapping. Several BGS recorded sites do not align with workings listed elsewhere within this report and are discussed within this section.

#### **Section 1**

10A.4.48 The Spa Croft Opencast Coal Site (OCCS), located approximately 20 m to the south west of pylon 39, is listed as a BGS Recorded Site for the surface mining of coal. The Nethermoor Quarry, located approximately 25 m to the east of the haul road between pylons 39 and 40, is listed for the extraction of sandstone.

#### **Section 2**

10A.4.49 The following locations have been described by the BGS as a surface mineral working for coal:

- the Tibshelf (OCCS) pit, located approximately 40 m south west of pylon 40;
- Love Lane (OCCS), approximately 75 m north east of pylon 41 and situated on a proposed haul road;
- Glade (OCCS), approximately 34 m east of pylon 48 and approximately 8 m north west of the haul road;
- Crimea (OCCS), approximately 69 m south west of pylon 50; and
- Sheep Lane Opencast Site, approximately 30 m east and 40 m west of the access road to pylon 57 and approximately 112 m north of pylon 57; Sheep Lane Opencast Site is also listed approximately 150 m north east of pylon 56.

#### **Section 3**

10A.4.50 The following locations have been described by the BGS as a surface mineral working for coal:

- Morley Park Farm (OCCS), approximately 34 m south west of pylon 76, and 53 m south of pylon 78; and
- Abbots Rough (OCCS), situated on the access road to pylon 101, located approximately 134 m north of pylon 101.

#### **Section 4**

10A.4.51 Moses Lane Extension (OCCS) for the surface mining of coal is listed approximately 90 m south west of the access road to pylon 108 and 109.

## Section 5

- 10A.4.52 Elvaston Gravel Pit for extraction of sand and gravel is listed approximately 95 m south of the access road to pylon 144.

## Section 6

- 10A.4.53 The Duddles Workings Air Shaft for the underground mining of alabaster is listed approximately 65 m to the north west of pylon 158.

## Ground Stability

- 10A.4.54 Information on potential ground stability hazards as assessed by the BGS and included within the Groundsure reports is summarised below.

### Shrink swell clays

- 10A.4.55 The Project is predominantly within an area of Very Low Risk where the ground conditions are considered to have a low plasticity. The Project crosses over numerous areas of Negligible Risk which correlate to sandstone sub-crops where the ground conditions are predominantly low plasticity.
- 10A.4.56 In Sections 2, 3, 4 and 5 there are several small areas of Low risk where the ground conditions are predominantly medium plasticity. In addition, larger areas of Low risk are identified in Section 6.

### Landslides

- 10A.4.57 The Project is predominantly within an area of Very Low Risk where slope instability problems are not likely to occur. However, the BGS indicate that consideration to potential problems of adjacent areas impacting on the site should always be considered.
- 10A.4.58 The Project also contains areas of Low and Moderate risk, with areas of Low risk dominating the southern parts of Sections 3 and 4. The areas of Low and Moderate risk are summarised as follows:
- at pylons 20, 37, 63, 73, 90, 96, 103, 105, 106, 108, 110, 118 to 130;
  - near pylons 1, 2, 4, 5, 8, 9, 10, 19, 21, 33, 39, 44, 45, 46, 48, 62, 67 to 70, 72, 74, 82 to 85, 89, 91, 93, 94, 97, 99 to 102, 109, 112, 113, 157 to 163 and 170; and
  - near Chellaston (1) Compound (ID: 3).

### Ground dissolution of soluble rocks

- 10A.4.59 The ground dissolution risk for the majority of the Project is considered to be Negligible as soluble bedrock is either not present or not prone to dissolution therefore dissolution features are unlikely to be present.
- 10A.4.60 There is one area of the Project at the intersection of Sections 5 and 6 where the ground dissolution risk is considered to be Low. In these areas soluble bedrock is present, and some dissolution features may be present. As such, there is the potential for difficult ground conditions which may need to be considered but localised subsidence does not necessarily need to be considered, except in exceptional circumstances.

10A.4.61 The Project elements within the area of Low risk are summarised as follows:

- pylons 154, 155, 156 and 157.

### Compressible deposits

10A.4.62 The Project is predominantly within an area of Negligible to Very Low Risk of issues associated with compressible deposits. However, the BGS indicate that consideration to potential problems of adjacent areas impacting on the site should always be considered.

10A.4.63 The Project also contains areas of Low and Moderate risk scattered across all six Sections. The Project elements within areas of Low to Moderate risk are summarised as follows:

- at pylons 4, 5, 9, 10, 16, 18, 19, 23, 39, 40, 42, 43, 45, 46, 48, 50, 56, 61, 64, 81, 93, 140 to 142, 151, 158, 163 and 182 to 186;
- Upper Hartshay Compound (ID: 13), Chellaston (1) and Chellaston (2) Compounds (ID: 3 and ID: 11);
- near pylons 2, 3, 17, 37, 47, 53, 54, 57, 59, 62, 64, 72, 75 to 79, 82 to 85, 89, 92, 97, 100, 101, 128, 139, 140, 147, 160, 161, 163, 174, 179 and Gantry G-3 and G-4; and
- near Alfreton Compound (ID: 8), Temple Normanton Compound (ID: 5) and Thulston Compound (ID: 10).

### Collapsible deposits

10A.4.64 The Project is entirely within an area consisting of Negligible to Very Low Risk of issues associated with collapsible deposits.

## Mine Gas

10A.4.65 The Contaminated Land: Applications in Real Environments (CL:AIRE) Good Practice for Risk Assessment for Coal Mine Gas Emissions (October 2021) (Ref 10A.23) has been used to assess the risks associated with mine gas at the Project construction compounds and the proposed new Chesterfield Substation.

10A.4.66 All development features to the south of, and including, pylon 125 do not lie within a Mining Remediation Authority defined Coal Mining Reporting Area and are therefore considered to not be at risk of mine gas.

10A.4.67 The CL:AIRE Coal Mine Gas Emissions guidance document provides a decision support tool for mine gas risk assessment. The tool uses mine entries, workings, faults and presence of superficial deposits to assess mine gas risk and assign a risk grading for potential developments. **Table 10A.18** summaries mine gas risk assessments completed for each construction compound to the north of pylon 125 and the proposed new Chesterfield Substation.

**Table 10A.18: Mine gas risk assessment at construction compounds**

<b>Construction Compound/ Chesterfield Substation</b>	<b>Nearest Outcrops</b>	<b>Nearest Mine Entries</b>	<b>Nearest Workings</b>	<b>Nearest Faults and Potential Pathways</b>	<b>Superficial Deposits</b>	<b>Assigned Risk Zone Grading</b>
Cock Alley Compound (ID: 1)	At the compound	None present	None present	None present	None present	Negligible
Holmewood Compound (ID: 2)	150 m to the east	Shaft at the compound	Probable workings at the compound	Fault at the compound	None present	High
Chesterfield Substation Compound (ID: 4)	At the compound	Adit 50 m to the south west	Shallow workings at the compound	None present	None present	High
Temple Normanton Compound (ID: 5)	At the compound	Shaft 65 m to the west	Probable workings at the compound	Inferred fault at the compound	None present	High
Astwith Compound (ID: 6)	At the compound	None present	Probable workings at the compound	Inferred coal seams at the compound	None present	High
Alfreton Compound (ID: 8)	At the compound	None present	Probable workings 45 m to the south east	None present	None present	Negligible
Ockbrook Compound (ID: 9)	None present	None present	None present	None present	None present	Negligible
Morley Hayes Compound (ID: 12)	165 m to the east	None present	165 m to the east	None present	None present	Negligible
Upper Hartshay Compound (ID: 13)	At the compound	Two shafts 35 m to the east and 80 m to the west	Probable workings at the compound	Inferred and observed coal seams at the compound	None present	High
Chesterfield Substation	At the substation	A shaft and adit within footprint in south east	Shallow workings at the substation	None present	None present	High

10A.4.68 The CL:AIRE decision support tool indicates that a detailed mine gas risk assessment is required for development features lying within high risk zones to determine if risk can be mitigated effectively. Further risk assessment should take into account the design of the compounds.

## Hydrogeology

### Groundwater bodies

10A.4.69 A summary of Water Framework Directive (WFD) groundwater bodies listed across the site is provided as **Table 10A.19**.

**Table 10A.19: Summary of WFD groundwater bodies**

Groundwater Body	Overall Status (2019)	Biological Status (2019)	Chemical Status (2019)	Associated Project Elements
Don & Rother Millstone Grit and Coal Measures	Poor	Good	Poor	<ul style="list-style-type: none"> <li>pylons 1 to 30 (and adjacent haul roads);</li> <li>Gantries G-1 and G-2;</li> <li>Cock Alley Compound (ID: 1);</li> <li>Chesterfield Substation Compound (ID: 4);</li> <li>Temple Normanton Compound (ID: 5), Holmewood Compound (ID: 2) and Astwith Compound (ID: 6); and</li> <li>Chesterfield Substation.</li> </ul>
Derwent Secondary Combined	Poor	Good	Poor	<ul style="list-style-type: none"> <li>pylons 31 to 105 (and adjacent haul roads);</li> <li>pylons 121 to 148 (and adjacent haul roads);</li> <li>Upper Hartshay Compound (ID: 13);</li> <li>Alfreton Compound (ID: 8); and</li> <li>the western half of Morley Hayes Compound (ID: 12).</li> </ul>
Lower Trent Erewash – Coal Measures	Good	Good	Good	<ul style="list-style-type: none"> <li>pylons 106 to 119 (and adjacent haul roads);</li> <li>the eastern half of Morley Hayes Compound (ID: 12).</li> </ul>

<b>Groundwater Body</b>	<b>Overall Status (2019)</b>	<b>Biological Status (2019)</b>	<b>Chemical Status (2019)</b>	<b>Associated Project Elements</b>
Idle Torne – PT Sandstone Nottinghamshire and Doncaster	Poor	Poor	Poor	<ul style="list-style-type: none"> <li>• pylon 120 (and adjacent haul road); and</li> <li>• haul road between pylons 113 and 114.</li> </ul>
Lower Trent Erewash – Secondary Combined	Good	Good	Good	<ul style="list-style-type: none"> <li>• pylons 149 to 186 (and adjacent haul roads);</li> <li>• Gentries G-3 and G-4;</li> <li>• Ockbrook Compound (ID: 9);</li> <li>• Thulston Compound (ID: 10), Chellaston (1) and Chellaston (2) Compounds (ID: 3 and 11); and</li> <li>• Twyford Compound (ID: 7).</li> </ul>

### **Groundwater aquifers**

10A.4.70 Information on groundwater aquifers at and nearby to the Project included within the Groundsure reports is summarised below.

#### **Section 1**

10A.4.71 The Alluvial Silts and Clays identified sparsely across Section 1 are classified as a Secondary A Aquifer.

10A.4.72 The bedrock (comprising Pennie Lower and Middle Coal Measures) underlying the entirety of Section 1 is classified as a Secondary A Aquifer.

#### **Section 2**

10A.4.73 The Alluvium (clay, silt, sand and gravel) indicated sparsely across Section 2 is classified as a Secondary A Aquifer.

10A.4.74 The bedrock (comprising Pennie Lower and Middle Coal Measures and Tupton Rock) underlying the entirety of Section 2 is classified as a Secondary A Aquifer.

#### **Section 3**

10A.4.75 The Alluvium (clay, silt, sand and gravel) indicated sparsely across Section 3 is classified as a Secondary A Aquifer. The Glacial Till and Head deposits identified sparsely across Section 3 are classified as a Secondary (undifferentiated) Aquifer.

10A.4.76 The bedrock (comprising Pennie Lower and Middle Coal Measures, Rossendale Formation, Loxley Edge Rock, Wingfield Flags, Crawshaw Sandstone, Marsden Formation and Chatsworth Grit) underlying most of Section 3 is classified as a Secondary A Aquifer. The Tarporley Siltstone Formation located in the southernmost extent of Section 3 (between pylons 104 to 108) is classified as a Secondary B Aquifer.

## Section 4

- 10A.4.77 The Alluvium (clay, silt, sand and gravel) indicated sparsely across Section 4 is classified as a Secondary A Aquifer. The Glacial Till identified sparsely (between pylon 113 and 115) across Section 4 is classified as a Secondary (undifferentiated) Aquifer.
- 10A.4.78 The Tarporley Siltstone Formation and Moira Formation located in the northern and southernmost extents of Section 4 are classified as a Secondary A Aquifer. The Pennine Lower Coal Measures Formation that is located primarily in the centre of Section 4 is classified as a Secondary B Aquifer.

## Section 5

- 10A.4.79 The Thrussington Member and Head deposits identified across Section 5 are classified as Secondary (undifferentiated) Aquifers. The Allenton Terrace Deposits, Alluvium, Hemington Member and Borrowash sand and gravel identified across Section 5 are classified as Secondary A Aquifers.
- 10A.4.80 The bedrock underlying the entirety of Section 5 is classified as a Secondary B Aquifer.

## Section 6

- 10A.4.81 The Alluvial Deposits, Glaciofluvial Deposits, Etwall Sand and Gravel Member, Eagle Moor Sand and Gravel Member, Beeston Sand and Gravel Member, Holme Pierrepont Sand and Gravel Member and Hemington Member are all classified as Secondary A Aquifers.
- 10A.4.82 The Oadby Member and Thrussington Member are classified as Secondary Undifferentiated Aquifers, whilst the Glaciolacustrine Deposits are classified as Unproductive Strata.
- 10A.4.83 The bedrock (Branscombe Mudstone Formation, Edwalton Member and Gunthorpe Member) underlying the entirety of Section 6 is classified as a Secondary B Aquifer.

## Groundwater abstractions

- 10A.4.84 Information on groundwater abstractions at and nearby to the Project included within the Groundsure reports and consultation received from the EA in February 2025 and local planning authorities in July and August 2025 (as provided in **Annex 10A.8**) is summarised below.
- 10A.4.85 No historical or active groundwater abstraction licences are listed within 250 m of Sections 1, 2, 3 or 4 of the draft Order Limits.
- 10A.4.86 One historical groundwater abstraction licence is listed 25 m to the east of the draft Order Limits for Section 5. This abstraction license is reported as having been used for general farming and domestic use purposes. There is one active licensed groundwater abstraction identified in the EA consultation response that is located 580 m south of pylon 144.
- 10A.4.87 Eight historical groundwater abstraction licences are listed within the Section 6 draft Order Limits. These abstraction licences are reported as having been used for spray irrigation, process water, general use and general farming and domestic purposes. Two further historical groundwater abstraction licences are listed within 250 m of the Section 6 draft Order Limits, both of which are reported as having been used for

general farming and domestic purposes. There are two active licensed groundwater abstractions identified in the EA consultation response that are located between 810 m to 890 m south of pylon 174.

- 10A.4.88 North East Derbyshire District Council confirmed that there are no known private water supplies within North East Derbyshire within the 500 m hydrogeology Study Area of either Section 1 or Section 2.
- 10A.4.89 Also relating to Section 1 and Section 2, Bolsover District Council confirmed that there are no known private water supplies to any council owned housing and none of the corporate properties have private water supplies within their district.
- 10A.4.90 Responses in relation to known private water supplies in Sections 3 to 6 have not yet been received from the relevant local authorities.

### **Groundwater Source Protection Zones**

- 10A.4.91 There are no groundwater Source Protection Zones identified within 500 m of the draft Order Limits (Sections 1 – 6).

### **Groundwater sensitivity**

- 10A.4.92 Groundwater sensitivity has been assessed using the EA's R&D Publication 66: Guidance for the Safe Development of Housing on Land Affected by Contamination (Ref 10A.24).
- 10A.4.93 The bedrock aquifer underlying the haul road between pylons 119 and 120 is described as a Principal Aquifer of high vulnerability. Whilst there are no groundwater abstraction points within the immediate vicinity, the aquifer should be characterised as High (H2) Sensitivity.
- 10A.4.94 All features to the north of, and including, pylon 117 are listed as being underlain by a Secondary A bedrock aquifer, along with the haul roads near pylons 134, 135, 163 and 170. As there are no groundwater abstraction points within the immediate vicinity, these aquifers should be characterised as Moderate (M2) Sensitivity.
- 10A.4.95 The remainder of the site can be categorised as Low (L1) Sensitivity in relation to the bedrock aquifers.
- 10A.4.96 Groundwater vulnerability in strata underlying Sections 1, 2 and the northern half of Section 3 is generally described as Medium. The aquifers indicated between pylons 10 and 16, 70 m to the west of pylon 62, and the southern half of Section 3 (from pylon 88), are described as High sensitivity.
- 10A.4.97 Groundwater vulnerability in strata underlying Section 4 comprises a mix of High, Medium and Low categories. The northern, central and southern sections (between pylons 106 and 108, 117 and 118, and 126 to 128) are described as High sensitivity. The north and south of the section (between pylons 108 and 117 and 123 to 126) are described as Medium sensitivity, with the remainder of the section being Low sensitivity.
- 10A.4.98 Groundwater vulnerability in strata underlying Sections 5 and 6 comprises a majority of High sensitivity classification. The aquifers indicated at pylons 156, 157, 159 to 161 and 186 are described as Medium sensitivity. The aquifers indicated at pylons 141 and 158 are described as Low sensitivity.

# Hydrology

## Surface watercourses and features

- 10A.4.99 Information on surface watercourses and features at and nearby to the Project included within the Groundsure reports is summarised below. Additional information relating to WFD surface water bodies is provided in **Appendix 9B Water Framework Directive Screening Assessment of Chapter 9 Hydrology and Land Drainage** of the PEIR.

### Section 1

- 10A.4.100 Two WFD Surface Water Bodies are shown to run approximately 250 m to the east (Calow Brook Tributary 5) and 225 m to the south west of pylon 1 (Calow Brook), respectively. These converge as Calow Brook at approximately 80 m to the south east of pylon 2. Calow Brook runs within 130 m of the proposed route alignment between pylon 2 and pylon 10, intersecting the haul road approximately 50 m south west of pylon 2, 65 m south east of pylon 4, and 45 m north west of pylon 5. Another linear WFD Surface Water Body (River Doe Lea Tributary 4) is shown to intersect the haul road approximately 120 m to the south west of pylon 19. The haul road is shown to be similarly intersected approximately 75 m to the north east of pylon 37 by Westwood Brook.
- 10A.4.101 A surface water line feature not classified under the WFD (Westwood Brook Tributary 1) is shown to intersect the haul road approximately 85 m to the north east of pylon 33 and 110 m to the north east of pylon 35.
- 10A.4.102 Several surface water features not classified under the WFD are shown within the draft Order Limits for Section 1, the closest of which lies 35 m to the south east of the haul road adjacent to pylon 38 (unnamed surface water feature).

### Section 2

- 10A.4.103 Within Section 2, a Surface Water Body (Morton Brook Tributary 4) is shown to intersect the draft Order Limits boundary to the east of pylon 42, crossing the haul road approximately 60 m north east of pylon 45 and 150 m east of pylon 48, respectively. A WFD Surface Water Body (Alfreton Brook) is shown crossing the Section approximately 50 m to the south of pylon 53.
- 10A.4.104 Several non-WFD surface water features are shown across Section 2. These are shown to intersect haul roads near pylons 46 (Meadow Farm Brook), 51 and 52 (Alfreton Brook Tributary 3), 53 (Alfreton Brook Tributary 4), 54 and 55 (Church Street Ditch 1) and 67 and 68 (Wood Lane Brook).

### Section 3

- 10A.4.105 The River Amber, a WFD Surface Water Body, is shown to intersect the haul road approximately 275 m north east of pylon 71. A WFD Surface Water Body (Bottle Brook) is shown to cross the Section approximately 45 m to the south east of pylon 93.
- 10A.4.106 Several non-WFD surface water features are shown across Section 3. These are shown to intersect haul roads near pylons 79 (Coppice Brook), 93 (Mushroom Wood Brook), 97 (Park Brook), 98 (Park Brook Tributary 7), 99 (Park Brook Tributary 6), 100 (Park Brook Tributary 4) and 105 (unnamed surface water feature).

## Section 4

10A.4.107 No WFD Surface Water Bodies are shown in Section 4.

10A.4.108 Several non-WFD surface water features are shown across Section 4. These are shown to intersect haul roads near pylons 108 (Moses Lane Brook), 112 (Manor Farm Ditch 3), 113 (Manor Farm Ditch 4), 123 (Ock Brook Tributary 2), 124, (Ock Brook Tributary 3), 125 (Ock Brook Tributary 5) and 127 (Ock Brook).

## Section 5

10A.4.109 The River Derwent, a WFD Surface Water Body, is shown to intersect Section 5 approximately 465 m west of pylon 137. The River Derwent runs within approximately 150 m of pylons 138, 139, 142 and 141, leaving the Section approximately 300 m to the south east of pylon 140.

10A.4.110 Several non-WFD surface water features are shown across Section 5. These are shown to intersect haul roads near pylons 133 (Borrowash Brook), 141 and 142 (Ambaston Ditch 9, 10, 11 and 13), 144 (Ambaston Ditch 16 and 18), 145 (Ambaston Ditch 20), 146 (Thulston Brook), 151 (Chellaston Lane Brook 1) and 152 (Chellaston Lane Brook 2).

## Section 6

10A.4.111 A WFD Surface Water Body (Cuttle Brook) is shown running north to south approximately 160 m to the west of pylon 163. A WFD Artificial Water Body (Trent and Mersey Canal) is shown approximately 115 m to the south of the haul road near pylons 164, 165 and 166. This body intersects the proposed route alignment between pylons 171 and 172 and passes 100 m to the north west of pylon 186. A WFD Surface Water Body (Twyford Brook) is shown directly adjacent to the haul road near pylon 178, also intersecting the proposed route alignment between pylons 178 and 179.

10A.4.112 Several non-WFD surface water features are shown across Section 6. These are shown to intersect haul roads near pylons 174 (River Trent Tributary), 176 (Extension of River Trent Tributary), 177 (Merrybower Ditch 1), 179 (Frizams Lane Ditch), 182 (Power Station Ditch 7) and 186 (Power Station Ditch 1).

## Main Rivers

10A.4.113 The following surface watercourses identified above are also classified as Main Rivers:

- Alfreton Brook;
- River Amber;
- Bottle Brook;
- Ock Brook (Main River from south of A52);
- River Derwent;
- Thulston Brook;
- Cuttle Brook; and
- Twyford Brook.

## **Surface water abstractions**

10A.4.114 Information on surface water abstractions at and nearby to the Project included within the Groundsure reports is summarised below.

### **Section 1**

10A.4.115 There are no EA listed surface water abstractions shown within 250 m of Section 1.

### **Section 2**

10A.4.116 Within 250 m of Section 2, there are two records of surface water abstractions, both within the draft Order Limits and associated with direct spray irrigation. The licences are located between pylons 53 and 54, approximately 300 m south west and 290 m north west, respectively, and approximately 127 m north west of pylon 59.

### **Section 3**

10A.4.117 There is one EA listed surface water abstraction located 550 m north east of pylon 99 and is listed as a direct irrigation spray license.

### **Section 4**

10A.4.118 One EA listed surface water abstraction is shown approximately 165 m to the south of pylon 111. The abstraction is shown as historical, for direct spray irrigation and general farming and domestic.

### **Section 5**

10A.4.119 There are no EA listed surface water abstractions shown within 250 m of Section 5.

### **Section 6**

10A.4.120 A historical abstraction point licensed for direct spray irrigation is shown approximately 570 m to the south of pylon 169. Two linear historical abstractions licensed for direct spray irrigation are shown crossing the proposed route alignment approximately 70 m and 130 m to the north east of pylon 172, respectively. Both linear licences are oriented approximately south east to north west. A historical abstraction point licensed as a Pond Throughflow is shown approximately 210 m to the north west of pylon 179.

## **Surface water sensitivity**

10A.4.121 Information on surface water sensitivity at and nearby to the Project included within the Groundsure reports is summarised below.

### **Section 1**

10A.4.122 Pylons 1 to 14, pylon 16, Gantries G-1 and G-2, Chesterfield Substation Compound (ID: 4), Cock Alley Compound (ID: 1) and Chesterfield Substation lie directly adjacent to a poor quality WFD surface water body. As maximum permeability is described as very high, sensitivity is assessed as Moderate (M2).

10A.4.123 Pylon 15, pylons 17 to 23, pylon 29 and Holmewood Compound (ID: 2) and Astwith Compound (ID: 6) lie within the catchment for a moderate quality WFD surface water

body which crosses between pylons 19 and 20. Sensitivity is assessed as Moderately High (M1).

10A.4.124 Pylons 30 to 39 lie within the catchment for a moderate quality WFD surface water body which crosses between pylons 36 and 37. Sensitivity is assessed as Moderately High (M1).

10A.4.125 The rest of the section is assessed as Low (L1) sensitivity.

### Section 2

10A.4.126 All Section 2 development features lie within WFD surface water catchments for moderate quality surface water bodies. WFD water bodies are shown in the north, centre and south of the section, underlain by possibly high permeability superficial deposits. Surface water sensitivity is assessed as Moderately High (M1).

### Section 3

10A.4.127 All Section 3 development features lie within WFD surface water catchments for moderate quality surface water bodies. WFD water bodies are shown in the north and centre of the section. Surface water sensitivity is assessed as Moderately High (M1).

### Section 4

10A.4.128 Pylons 114 to 129 and Ockbrook Compound (ID: 9) lie within WFD surface water catchments for moderate quality watercourses. As this part of the Section is crossed by several unclassified surface water features, sensitivity is assessed as Moderately High (M1). The rest of Section 4 is assessed as Low (L1) sensitivity.

### Section 5

10A.4.129 All Section 5 development features lie within WFD surface water catchments for moderate quality surface water bodies. A WFD water body is shown in the centre of the section, underlain by possibly high permeability superficial deposits. Surface water sensitivity is assessed as Moderately High (M1).

### Section 6

10A.4.130 All Section 6 development features lie within WFD surface water catchments for moderate quality surface water bodies. WFD water bodies are shown across much of the section, underlain by possibly high permeability superficial deposits. Surface water sensitivity is assessed as Moderately High (M1).

## Flooding

10A.4.131 Information on flooding at and nearby to the Project included within the Groundsure reports is summarised below. Further detail with respect to flooding is provided in the Preliminary Flood Risk Assessment presented as **Appendix 9A Preliminary Flood Risk Assessment of Chapter 9 Hydrology and Land Drainage** of the PEIR.

### Flooding from rivers and the sea

10A.4.132 Most of the Project is not listed as being at risk of flooding from rivers and the sea. Parts of the site, particularly in Sections 5 and 6, are listed as being at High risk of river and coastal flooding. Project elements shown within or adjacent to areas of High risk are:

- Pylons 2, 3, 4, 5, 8, 9, 10, 45, 46, 47, 48, 53, 54, 59, 70, 71, 79, 80, 86, 93, 97, 127, 139 to 147, 163, 176, 177, 178, 179, 180, 181 and 182;
- Twyford Compound (ID: 7); and
- Chellaston (1) Compound (ID: 3).

10A.4.133 Much of the Project does not lie within any designated Flood Zones, described as areas of land at risk of flooding, when the presence of flood defences are ignored. Flood Zone 3 covers land with a 1 in 100 (1 per cent) or greater chance of flooding each year from rivers or a 1 in 200 (0.5 per cent) or greater chance of flooding each year from the sea. Project elements situated on land within a Flood Zone 3 are:

- Pylons 53, 93, 140 to 146, 178 and 179; and
- Twyford Compound (ID: 7).

10A.4.134 Flood Zone 2 covers land between Flood Zone 3 and the extent of the flooding from rivers or the sea with a 1 in 1,000 (0.1 per cent) chance of flooding each year. Project elements situated on land within a Flood Zone 2 are:

- Pylons 97, 138, 139, 147, 176 and 180.

### Surface water flooding

10A.4.135 Most of the Project is not listed as being at risk of surface water flooding. Small areas of the Project situated adjacent to surface water features including brooks, ponds, canals and rivers are shown to be at risk of surface water flooding. The highest possible flood risk listed in the Groundsure reports is represented by a 1.0 m flood with a 1-in-30-year return period. These are shown across all six Sections of the site.

### Groundwater flooding

10A.4.136 Risk of groundwater flooding is shown to be Low to Negligible within Sections 1, 2, 3 and 4. Groundwater flooding risk in Sections 5 and 6 is generally Low to Negligible with areas of Moderate risk. Project elements shown to be located within areas of Moderate risk are:

- Pylons 136, 137, 168, 169 and 175 to 185;
- Gantries G-3 and G-4; and
- Twyford Compound (ID: 7).

### Designated Sites

10A.4.137 Information on designated sites at and nearby to the draft Order Limits for the Project included within the Groundsure reports is summarised below. Further information in relation to designated sites is provided in **Chapter 7 Ecology and Biodiversity** of the PEIR.

### Regionally Important Geological Sites

10A.4.138 Regionally Important Geological Sites (RIGS) are locally designated sites of local, national and regional importance, designated on the basis of geological and geomorphological interest. Three RIGS have been identified within or within 250 m of the draft Order Limits of the Project as summarised in **Table 10A.20**.

**Table 10A.20: RIGS within or within 250 m of the draft Order Limits**

<b>RIGS Name</b>	<b>Location</b>	<b>Description</b>
Coxbench Quarries	Section 3 Eastern extent of the RIGS is approximately 200 m to the south west of the draft Order Limits, approximately 68 m to the south west of pylon 99.	Coarse sandstone showing cross-bedding and large ferruginous concretions. Historic interest, exposures are overgrown but the adjacent later and larger Coxbench Quarry has been infilled
Dunnshill	Section 4 Eastern extent of the RIGS encroaches slightly into the draft Order Limits. Boundary of the RIGS approximately 370 m to the north east of pylon 120.	Exposures of Lower Mottled Sandstone and junction with Bunter Pebble Beds. Numerous dry valley features in the escarpment, together with surface gravels (possibly periglacial), head deposits and cambering
Sinfin Moor	Section 6 Pylon 163 is situated within the RIGS. The RIGS extensive area extending to the north of the draft Order Limits	A large area that has been identified as a glacial lake. Underlain by gleyed, calcareous blue-grey lacustrine clays containing a molluscan fauna

### **Sites of Special Scientific Interest (SSSIs)**

- 10A.4.139 SSSIs are described as sites providing statutory protection for the best examples of UK flora, fauna, or geological or physiographical features. Natural England lists the Morley Brick Pits, located approximately 175 m to the south of pylon 104, as a SSSI.
- 10A.4.140 The Morley Brick Pits has been designated SSSI status due to its biological interest. The site consists of a series of flooded pits, originally dug for clay and now colonised by a range of plants and animals.
- 10A.4.141 SSSI Impact Risk Zones were developed to allow rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts. Several SSSI Impact Risk Zones are shown along the draft Order Limits but only two of these list pylons and overhead cables as a type of development requiring consultation.
- 10A.4.142 The previously mentioned Morley Brick Pits SSSI has an Impact Risk Zone that includes:
- Pylons 102, 103, 104, 105, 106, 107 and 108; and
  - Morley Hayes Compound (ID: 12).

10A.4.143 The Boulton Moor SSSI, located 1,677 m to the west of the southernmost point of the Section 5 survey boundary, has an Impact Risk Zone that includes pylons 154 and 155.

10A.4.144 Pylons 100, 109, 113, 152, 153, 156 and 157 all lie within 150 m of a SSSI Impact Risk Zone.

### **Green Belt**

10A.4.145 All Project elements between and including pylons 66 and 157 are located within designated Green Belt land.

### **Nitrate Vulnerable Zones**

10A.4.146 All Project elements within Sections 1, 2 and 3, except for pylons 75 to 80, lie within surface water Nitrate Vulnerable Zones.

10A.4.147 Pylons 105 to 113 and pylon 117 lie within a eutrophic water Nitrate Vulnerable Zones.

10A.4.148 No Project elements within Sections 5 and 6 lie within a Nitrate Vulnerable Zone. A groundwater Nitrate Vulnerable Zone is shown in the south of Section 6, approximately 100 m away from the nearest Project element.

### **Priority Habitat Inventory**

10A.4.149 The Groundsure reports record that deciduous woodland is listed in the Priority Habitat Inventory at pylons 8 and 186; the haul road near pylons 8, 58, 59 and 185 to 186; and between pylons 19 and 20. Good quality semi-improved grassland is present at the haul road between pylons 129 and 130. Coastal and floodplain grazing marsh is present at pylon 181 and the adjacent haul road. Additional (non-main) habitats are also present at the haul road near pylon 22.

## **Heritage**

10A.4.150 The following information in relation to heritage is a summary of the information provided within the Groundsure reports. Additional information is provided in **Chapter 8 Historic Environment** of the PEIR.

### **World Heritage Sites**

10A.4.151 The Derwent Valley Mills Buffer Zone World Heritage Site covers parts of Section 3 to the west of pylons 81, 82, 83 and 84, coming within 30 m of the haul road to the west of the proposed route alignment.

### **Scheduled ancient monuments**

10A.4.152 All scheduled ancient monuments listed in the Groundsure reports to be within the draft Order Limits are in Section 6.

10A.4.153 A scheduled ancient monument listed as the 'Swarkestone Lows round barrow cemetery and part of an aggregate field system' is shown approximately 135 m and 185 m to the north of pylons 165 and 166, respectively.

10A.4.154 A scheduled ancient monument is shown to intersect the haul road between pylons 180 and 181, listed as a Cursus and mini henges, of Neolithic date, round barrows of

Neolithic/Early Bronze Age date, and settlements, enclosures and fields of late Iron Age/Romano-British date. This scheduled ancient monument is split into two parts, the second of which is located approximately 390 m to the south of Gantry G-4.

### Listed buildings

- 10A.4.155 A Grade 2 listed building known as High House Farmhouse is shown approximately 60 m to the north of the haul road adjacent to pylon 13.
- 10A.4.156 A Grade 2 listed building detailed as a former Sunday School is shown approximately 180 m east of the haul road between pylon 29 and 30.
- 10A.4.157 A Grade 2 listed building detailed as Furnaces at Morley Park Iron Works is shown approximately 100 m south of Upper Hartshay Compound (ID: 13).
- 10A.4.158 A Grade 2 listed structure known as Nooning Lane Bridge is shown approximately 85 m north west of the haul road to pylon 136.
- 10A.4.159 Five Grade 2 listed elements of canal infrastructure are located approximately between 90 m and 140 m to the south of the haul road between pylons 164 and 166. A canal bridge located approximately 50 m to the south west of the haul road near pylon 171 is also listed.
- 10A.4.160 The Lowes Farmhouse and Attached Farm Buildings are Grade 2 listed, located approximately 145 m to the north west of pylon 166.
- 10A.4.161 A listed building known as the Old School House is shown approximately 45 m to the east of Twyford Compound (ID: 7).

## Climate Change

### Future climate change under RCP8.5 scenario

- 10A.4.162 The following section has been prepared in line with the Society of Brownfield Risk Assessment (SoBRA) guidance (Ref 10A.25) for the assessment of risks to controlled waters from future climate change. An overall conservative approach has been applied in consideration of 'far future' projections (to 2100) alongside the worst case scenario using Representative Concentration Pathway 8.5 (RCP8.5 Scenario), reflective of 'business as usual' with regards climate change, i.e. no measures in place to reduce the effects of climate change

### Sea level rise/flood risk

- 10A.4.163 The Project is located approximately 100 km east of the North Sea. As such, any projected sea level rise due to climate change will not affect the Project.
- 10A.4.164 Most of the Project is not listed as being at risk of flooding from rivers and the sea. Parts of the site, particularly Sections 5 and 6, are listed as being at High risk of river and coastal flooding. Note that climate change may result in changes to the frequency of extreme weather events and associated flooding.

### Projected changes to groundwater level

- 10A.4.165 The Project is shown to have a Low to Negligible risk of groundwater flooding within Sections 1, 2, 3 and 4. Groundwater flooding risk in Sections 5 and 6 is overwhelmingly Low to Negligible with some areas of Moderate risk.

10A.4.166 The eFLaG project far-future (2050–2079) (Ref 10A.26) projections for groundwater recharge across the five groundwater catchment bodies report between a 0.05 mm to 0.3 mm per day increase for the winter months. No change to current recharge is indicated for other seasons. This indicates potential future increases in groundwater level, at least during winter, relative to the current baseline.

## 10A.5 Regulatory Information

10A.5.1 The Groundsure reports in **Annex 10A.2** include information and data collected from several organisations including the EA, the local authority, the BGS, Defra and Health and Safety Executive. In addition, information has been identified in the EA consultation response received October 2025 (as provided in **Annex 10A.8**). **Table 10A.21** to **Table 10A.26** summarise this information.

**Table 10A.21: Section 1 regulatory information**

<b>Database Source</b>	<b>At the Project</b>	<b>Within the Draft Order Limits</b>	<b>0–50 m</b>	<b>50–250 m</b>	<b>Description</b>
Pollution Incidents	0	3	8	5	A pollution incident with a Minor land impact was recorded 25 m north of the Chesterfield Substation Compound (ID: 4).
Waste Exemptions	4	69	77	227	<p>Waste exemptions for the storage of sludge on a farm are shown in the centre of Cock Alley Compound (ID: 1) and in the centre-south of Astwith Compound (ID: 6).</p> <p>A waste exemption for the use of waste in the construction of entertainment or educational installations is shown in the north of the Chesterfield Substation.</p> <p>A waste exemption for the storage of sludge (non-agricultural waste only) is shown at pylon 31.</p>
Licensed Waste Sites	0	0	0	12	N/A
Licensed Discharges to Controlled Waters	0	29	3	6	<p>Historical discharges are listed within 200 m of pylons 2, 3, 4, 9, 32 and 37. The nearest discharge is located approximately 150 m to the east of pylon 3. This discharge is inactive and is located upstream, related to the haul road between pylons 2 and 3.</p>
Licensed Pollutant Release (Part A(2)/B)	0	0	1	4	The closest licensed pollutant release is located 20 m to the north of the access track at Holmewood Compound (ID: 2), listed for the unloading of petrol into storage at service stations.
Industrial Control of Major Accident Hazards (CoMAH)	0	0	0	1	The only CoMAH site within 250 m of Section 1 is located approximately 230 m to the south west of Holmewood Compound (ID: 2) (approximate centre at: SK438659), operated by Caldic (UK) Limited.

10A.5.2 No Pollution Inventory Substances or Pollution Inventory Waste Transfers are listed at or near Section 1.

**Table 10A.22: Section 2 regulatory information**

Database Source	At the Project	Within the Draft Order Limits	0–50 m	50–250 m	Description
Pollution Incidents	0	1	0	4	Nearest record to the Project within the draft Order Limits is for a pollution incident, with no impact to the environment, recorded in 2001, approximately 108 m south of pylon 40.
Waste Exemptions	0	1	61	177	The exemption closest to the Project within its draft Order Limits is for the storage of waste. The exemptions are approximately 108 m south of pylon 40.
Licensed Waste Sites	0	1	0	0	The only licensed waste site recorded within the draft Order Limits of Section 2 is listed as a mobile plant site, approximately 102 m to the east of pylon 70 <sup>2</sup> .
Licensed Discharges to Controlled Waters	0	0	2	5	An active sewage discharge from a pumping station is listed approximately 200 m to the east of pylon 45. The discharge point is located upstream of the pylon.
Licensed Pollutant Release (Part A(2)/B)	0	0	1	0	The closest licensed pollutant release is approximately 298 m north of pylon 51 and is recorded as the unloading of petrol into storage at service stations.
Pollution Incident (data sourced directly from EA)	0	0	3		The closest pollution incident sourced from the EA consultation response is approximately 143 m west of pylon 54 and is recorded as the burning of waste.

10A.5.3 No CoMAH sites, Pollution Inventory Substances or Pollution Inventory Waste Transfers are listed at or near Section 2.

<sup>2</sup> It is noted that the site address (Former Save Petrol Station, Wilmslow, Cheshire) listed within the Groundsure report does not relate to the study area.

**Table 10A.23: Section 3 regulatory information**

<b>Database Source</b>	<b>At the Project</b>	<b>Within the Draft Order Limits</b>	<b>0–50 m</b>	<b>50–250 m</b>	<b>Description</b>
Pollution Incidents	0	1	2	5	Nearest record to the Project within the draft Order Limits is for a pollution incident, with Minor impact to air, recorded in 2002 approximately 171 m west of pylon 87.
Waste Exemptions	0	4	52	81	The exemption closest to the Project within its draft Order Limits is for the use of waste in construction and burning of waste in the open. These exemptions are approximately 144 m south west of pylon 87.
Licensed Waste Sites	0	0	0	1	The only licensed waste site within 250m of the draft Order Limits of Section 3 is listed as a physical treatment facility, situated approximately 400 m east of pylon 99.
Licensed Discharges to Controlled Waters	1	2	13	29	The closest licensed discharge is shown on the haul road near pylon 102, listed for the discharge of sewage and is inactive.
Licensed Pollutant Release (Part A(2)/B)	0	0	0	2	The closest licensed pollutant release is located approximately 180 m west of pylon 83, recorded for coating processes.
Pollution Inventory Substances	0	0	0	31	The record closest to the Section is 400 m east of pylon 99 regarding nonylphenols and nonylphenol ethoxylates.
Pollution Inventory Waste Transfers	0	0	0	1	The record closest to the Section is 400 m east of pylon 99 regarding the deposit of waste into or onto land (e.g. landfills).
Sites determined as Contaminated Land under Part 2A	0	0	0	1	Site name – Cinderhill, Kilburn, Derbyshire. Described as tar pits, seepage, remediation statement given. Designated as a Special Site.

Database Source	At the Project	Within the Draft Order Limits	0–50 m	50–250 m	Description
Pollution Incident (data sourced directly from EA)	2	5	6	3	The closest pollution incident sourced from the EA consultation response is approximately 12 m west of the haul road between pylon 84 and 85. The incident is recorded as a sewer containment failure resulting in an overflow of sewage material.

10A.5.4 No CoMAH sites are listed at or near Section 3.

**Table 10A.24: Section 4 regulatory information**

Database Source	At the Project	Within the Draft Order Limits	0–50 m	50–250 m	Description
Pollution Incidents	0	0	0	4	Release of lubricating oils with a minor impact to water recorded in 2003, approximately 310 m to the south east of pylon 127.
Waste Exemptions	0	35	136	111	Waste exemption for the use of waste in construction is listed 25 m to the north east of the haul road between pylons 125 and 126.
Pollution Incident (data sourced directly from EA)	0	0	0	3	The closest pollution incident sourced from the EA consultation response is approximately 185 m south west of pylon 111 and is recorded as an illegal waste site with the waste noted as inert construction waste.

10A.5.5 No Licensed Waste Sites, Licensed Discharges to Controlled Waters, Licensed Pollutant Releases (Part A(2)/B), CoMAH sites, Pollution Inventory Substances or Pollution Inventory Waste Transfers are listed at or near Section 4.

**Table 10A.25: Section 5 regulatory information**

<b>Database Source</b>	<b>At the Project</b>	<b>Within the Draft Order Limits</b>	<b>0–50 m</b>	<b>50–250 m</b>	<b>Description</b>
Pollution Incidents	0	3	2	2	Pollution incident involving construction and demolition materials and wastes with a minor impact to land recorded approximately 145 m to the north of pylon 134.
Waste Exemptions	0	4	24	67	The nearest waste exemption relates to active sewage discharges from a pumping station, located approximately 95 m to the east of the haul road between pylons 137 and 138.
Licensed Discharges to Controlled Waters	0	0	2	3	The nearest licensed discharge relates to active sewage discharges from a pumping station, located approximately 195 m to the north west of pylon 142.
Licensed Pollutant Release (Part A(2)/B)	0	0	0	1	N/A

10A.5.6 No Licensed Waste Sites, CoMAH sites, Pollution Inventory Substances or Pollution Inventory Waste Transfers are listed at or near Section 5.

**Table 10A.26: Section 6 regulatory information**

<b>Database Source</b>	<b>At the Project</b>	<b>Within the Draft Order Limits</b>	<b>0–50 m</b>	<b>50–250 m</b>	<b>Description</b>
Pollution Incidents	0	7	10	8	Nearest record to the Project within the draft Order Limits is for a pollution incident with Minor impact to air and water, recorded in 2003, approximately 45 m to the south west of the haul road to the south of pylon 171.
Waste Exemptions	0	0	3	112	The nearest waste exemption is listed for the use of waste in construction (not on a farm), approximately 100 m to the south west of pylon 161.

Database Source	At the Project	Within the Draft Order Limits	0–50 m	50–250 m	Description
					No other waste exemptions are recorded within 200 m of any Project elements.
Licensed Waste Sites	0	0	1	1	The only licensed waste site within 250m of the draft Order Limits is listed as a metal recycling site at the River Don Works, approximately 255 m to the south of pylon 161.
Licensed Discharges to Controlled Waters	0	0	3	4	The closest licensed discharge is shown approximately 50 m to the south of the haul road south of pylon 174, listed for the discharge of sewage and is inactive.
Pollution Inventory Substances	0	0	0	25	All 25 records within 250 m of the draft Order Limits are listed at the Sheffield Forgemasters River Don Works, located approximately 250 m to the south of pylon 161.
Pollution Inventory Waste Transfers	0	0	0	1	The only record within 250 m of the draft Orders limits is for ferrous metal producing, melting or refining at the Sheffield Forgemasters River Don Works, located approximately 250 m to the south of pylon 161.
Pollution Incident (data sourced directly from EA)	0	3	3	4	The closest pollution incident sourced from the EA consultation response is approximately 87 m south west of pylon 160 and is recorded as a diesel incident with a minor impact to land and no impact to water.

10A.5.7 No Licensed Pollutant Releases (Part A(2)/B) or CoMAH sites are listed at or near Section 6.

## Landfill Sites

10A.5.8 The Groundsure reports show active, recent and historical landfill sites recorded by the EA, BGS and local authorities. All landfill sites related to the Project are listed for each Section. The landfill locations are shown in **Figure 10A.9** in **Annex 10A.1**.

### Section 1

10A.5.9 No active or recent landfill sites are recorded within 250 m of the Section 1 draft Order Limits. Three historical landfill sites are recorded within the draft Order Limits

of Section 1. The nearest recorded historical landfill to a Project element is for a Refuse Tip recorded in 1961 and 1962, approximately 120 m to the south of Temple Normanton Compound (ID: 5). No historical landfill sites are recorded within 250 m of the draft Order Limits for Section 1.

## Section 2

- 10A.5.10 No active or recent landfill sites are recorded within 250 m of the Section 2 draft Order Limits. One historical landfill site is recorded within the draft Order Limits of Section 2. The nearest recorded historical landfill to a Project element is located 80 m south west of pylon 63 and 135 m north of pylon 64 and was for inert industrial waste. Information received from the EA consultation response received October 2025 (as provided in **Annex 10A.8**) indicates the waste comprised waste contaminated with oil, putrescible waste, bio-degradable paper, cardboard, plasterboard and empty or partially empty containers. The landfill was surrendered in 1994. No historical landfill sites are recorded within 250 m of the draft Order Limits for Section 2.

## Section 3

- 10A.5.11 No active or recent landfill sites are recorded within 250 m of the Section 3 draft Order Limits. One historical landfill site is recorded within the draft Order Limits of Section 3. The nearest recorded historical landfill to a Project element is located 68 m north of pylon 71 and was for inert industrial waste. The landfill was surrendered in 1994.
- 10A.5.12 One historical landfill site is located within 250 m of the draft Order Limits of Section 3. This historical landfill is located approximately 294 m east of pylon 85. The landfill is named Cinderhill Farm. The wastes associated with this landfill are listed as inert and industrial waste on the Groundsure report. However, publicly available information indicates that the site was more specifically used as a tar and ash disposal site. The tar deposits were a byproduct of an oil recycling industry that was based in Belper. The oil was mixed with sulphuric acid and dumped in the Cinderhill Farm landfill site from circa 1972 to circa 1978. The site was abandoned in 1978 after legislation change put a stop to the dumping of tar waste by this method. This area is known as Cinderhill Tar Pits and has been determined as Contaminated Land and designated as a Special Site under section 78C of Part 2A of the Environmental Protection Act 1990 (Ref 10A.4).

## Section 4

- 10A.5.13 No active or recent landfill sites are recorded within 250 m of the Section 4 draft Order Limits. No historical landfill sites are recorded within the draft Order Limits of Section 4 or within 250 m of the draft Order Limits of Section 4.

## Section 5

- 10A.5.14 No active or recent landfill sites are recorded within 250 m of the Section 5 draft Order Limits. Four historical landfill sites are recorded within the draft Order Limits of Section 5, all related to the Elvaston Quarry. Pylons 141 and 142 are shown to lie within areas of historical landfill, listed to comprise industrial, commercial and household waste. One additional historical landfill is recorded within 250 m of the draft Order Limits and is also related to the Elvaston Quarry landfill, located 300 m south east of the haul road to pylon 140. Information received from the EA consultation response received October 2025 (as provided in **Annex 10A.8**) indicates

the waste at the Elvaston Quarry landfills comprised solid pulverised ash, incinerator residues, non-hazardous industrial, construction, sewage press cake, asbestos, slag, mineral processing waste, silt and dredgings, metal scrap, polymeric materials and manufacturing scrap, scrap rubber, tyres, filter materials, contaminated rubbish and empty used containers.

## Section 6

- 10A.5.15 No active or recent landfill sites are recorded within 250 m of the Section 6 draft Order Limits. One historical landfill site is recorded within the draft Order Limits of Section 6. The nearest historical landfill to a Project element is located between pylons 161 and 162 and was for inert, industrial, commercial and household waste. Information received from the EA consultation response received October 2025 (as provided in **Annex 10A.8**) indicates the waste comprised ash, incinerator residues, construction and demolition waste. The landfill was opened in 1976 and surrendered in 1982.
- 10A.5.16 Six historical landfill sites are recorded within 250 m of the Section 6 draft Order Limits. The records that provide details on the landfills state that these landfills were for inert, industrial, commercial and household waste and were opened between 1977 to 1981, they were surrendered between 1982 to 1988.

## 10A.6 Preliminary Conceptual Site Model

### Introduction

- 10A.6.1 The preliminary CSM is based upon the environmental conditions of the site as described in the previous sections. The methods used in this assessment followed a risk-based approach with the potential environmental risk assessed qualitatively using the ‘source-pathway-receptor’ contaminant linkages concept introduced in the guidance document (principally the EA’s Land Contamination Risk Management Guidance (Ref 10A.27)) on the practical implementation of the Environmental Protection Act 1990 (Ref 10A.4).
- 10A.6.2 Environmental risk can be defined as the combination of the consequence of a harmful effect and the probability of its occurrence. The existence of a contaminant linkage is primarily dependent on site usage and environmental conditions.
- 10A.6.3 The contaminated land risk categories presented (very low, low, low to moderate, moderate, high and very high) follow guidance presented in CIRIA Publication C552, Contaminated Land Risk Assessment – A Guide to Good Practice (CIRIA 552) (Ref 10A.21). CIRIA 552 states that the risk levels should be based on an understanding of both the probability (likelihood) of a risk occurring and the magnitude of the potential consequence (severity) of a risk.
- 10A.6.4 CIRIA 552 defines four levels of probability and four levels of severity with relation to contaminated land, as presented in **Annex 10A.5**.
- 10A.6.5 The environmental risk assessment has been carried out identifying and evaluating the significance of the following:
- Potential Sources of Contamination: these include any actual pollution incidents, releases to the environment or historical activities of concern, located either on or in the vicinity of the site;

- Potential Pathways: these are the routes or mechanisms by which the contaminant of concern may migrate from the source to the receptor; and
- Potential Receptors: these include current or future land users, activities or persons at the site that could be harmed by the contaminants of concern.

## Potential Sources of Contamination

10A.6.6 **Table 10A.27** and **Figure 10A.3** in **Annex 10A.1** provide a summary of the potential sources of contamination that may be present at the Project, as well as the likely distribution of such sources.

**Table 10A.27: Potential sources of contamination**

Source ID	Potential Source	Location	Source To Be Considered Further?
<b>Section 1</b>			
1-18, 1-42, 1-60, 1-62, 1-64, 1-65, 1-66, 1-70, 1-80, 1-202, 1-172, 1-178, 1-191, 1-192, 1-410, 1-411, 1-412, 1-413, 1-414, 1-415, 1-416, 1-417, 1-418, 1-419, 1-422, 1-423, 1-424	Mineral Extraction (opencasts, collieries, spoil heaps and shafts)	Pylons 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 23, 33, 39 and nearby haul roads Haul roads between pylons 21 and 22, 23, 30 and 31, 37 and 38, 39 and 40 (in Section 2) Haul road near pylon 12, 22 and 37. Gantries G-1 and G-2 Temple Normanton Compound (ID: 5) Holmewood Compound (ID: 2)	Yes
1-392, 1-397, 1-404	Railway Land	Pylon 11 Haul roads near pylons 5, 11 and 34	Yes
1-406, 1-407, 1-408	Waste Exemptions (Storage of Sludge)	Cock Alley Compound (ID: 1) Astwith Compound (ID: 6) Pylon 31	Yes
1-409	Licensed Pollutant Release (Unloading of Petrol into Tanks)	Holmewood Compound (ID: 2)	Yes
<b>Section 2</b>			
2-100	Railway Land	Pylon 44	Yes
2-130, 2-294, 2-146	Potentially Infilled Land	Pylon 54 and 55	Yes

Source ID	Potential Source	Location	Source To Be Considered Further?
		Haul road to pylon 54	
2-328	Waste Activity (Landfill)	Pylon 63	Yes
2-10, 2-137, 2-138, 2-321, 2-322, 2-323, 2-324, 2-325, 2-326, 2-327	Mineral Extraction (opencasts, colliery and mine)	Pylons 40, 42, 43, 45, 48, 50, 56, 59 and 61 Haul road to pylon 47 and 65 Haul road near pylons 48 and 57	Yes
2-320	Licensed Discharge of Sewage	Haul road near pylon 45	Yes
2-69	Sewage Works	Pylon 45 and 46	Yes
<b>Section 3</b>			
3-24, 3-174, 3-175, 3-326, 3-327, 3-328, 3-329, 3-330, 3-331, 3-332, 3-333	Mineral Extraction (opencasts and colliery)	Pylon 100 Pylon 81 and adjacent haul road Near pylon 73 Between pylons 84 and 85 Haul roads between pylons 71 and 72, 75 to 80 and 101	Yes
3-108, 3-306, 3-308, 3-310, 3-313, 3-314, 3-315, 3-321	Railway Land	Pylon 73 and near pylon 77 Haul roads near pylons 71, 72, 73, 77, 84 and 93	Yes
3-334	Waste Activity (Landfill)	Pylon 71	No
3-85, 3-103	Sewage Works	Pylon 91 Haul roads near pylons 84 and 91	Yes
3-325	Licensed Discharge of Sewage	Haul road near pylon 102	Yes

Source ID	Potential Source	Location	Source To Be Considered Further?
<b>Section 4</b>			
4-4, 4-24, 4-218	Mineral Extraction (opencasts)	Pylons 112 and 113 Haul roads near 108, 112, 113 and 114	Yes
4-217	Waste Activity (Construction and demolition Waste)	Haul road near pylons 125 and 126	Yes
<b>Section 5</b>			
5-201	Potentially Infilled Land	Haul road near pylon 129	Yes
5-3	Railway Land	Pylon 136	Yes
5-217	Waste Activity (Sewage Discharge)	Haul road near pylons 137 and 138	Yes
5-216	Waste Activity (Landfill)	Pylons 141 and 142 and nearby haul roads	Yes
<b>Section 6</b>			
6-109	Potentially Infilled Land	Chellaston (1) Construction Compound (ID: 3) and haul road to pylon 163	Yes
6-318	Waste Activity (Landfill)	Pylon 162 and nearby haul road	Yes
6-100, 6-405	Mineral Extraction	Haul road between pylons 155 and 156 Haul road near pylon 167	Yes
6-151	Power Station	Pylons 182, 183, 184, Gantry: G-4 and nearby haul roads	Yes
6-152	Railway Land	Pylons 184, 185, 186 and nearby haul roads	Yes

- 10A.6.7 All of the identified potential contaminants of concern, except for the waste activity (landfill) in Section 3 (Source ID: 3-334), have been carried forward into the CSM **Table 10A.29**. The waste activity (landfill) in Section 3 has not been carried forward due to the landfill being located downgradient from pylon 71.
- 10A.6.8 The potential for coal mine gas emissions (as discussed in section 10.4) and for peat containing superficial alluvium deposits to generate natural gas emissions at the proposed construction compounds has also not been carried forward into the CSM. This is because the structures at the construction compounds will be constructed with an air gap between ground level and floor level to limit migration and all of the construction compound structures will be temporary. Future site operatives are unlikely to be at risk of gas and vapours as the development does not include any enclosed structures or confined spaces.
- 10A.6.9 Potential contaminants of concern associated with the identified sources are presented in **Table 10A.28**.

**Table 10A.28: Contaminants of concern associated with identified sources of contaminant**

<b>Contaminant of Concern Contamination Source</b>	<b>Mineral Extraction (Opencasts, Collieries, Spoil Heaps, Shafts)</b>	<b>Railway Land</b>	<b>Potentially Infilled Land</b>	<b>Sewage Works and Waste Activity (Landfill)</b>	<b>Waste Exemptions (Storage of Sludge) and Discharge of Sewage</b>	<b>Waste Activity (Construction and Demolition Waste)</b>	<b>Power Station</b>	<b>Licensed Pollutant Release (Unloading of Petrol into Tanks)</b>
Asbestos	X	X	X	X		X	X	
Metals	X	X	X	X		X	X	
Heavy metals	X	X	X	X		X	X	
Inorganics	X	X	X	X			X	X
Polycyclic Aromatic Hydrocarbons (PAHs)	X	X	X	X		X	X	X
Total Petroleum Hydrocarbons (TPH)	X	X	X	X		X	X	X
Benzene Toluene Ethylbenzene Xylene (BTEX)	X	X	X	X			X	X
Volatile Organic Compounds (VOCs)	X	X	X	X			X	X

Contaminant of Concern Contamination Source	Mineral Extraction (Opencasts, Collieries, Spoil Heaps, Shafts)	Railway Land	Potentially Infilled Land	Sewage Works and Waste Activity (Landfill)	Waste Exemptions (Storage of Sludge) and Discharge of Sewage	Waste Activity (Construction and Demolition Waste)	Power Station	Licensed Pollutant Release (Unloading of Petrol into Tanks)
Ground Gases (methane and carbon dioxide)	X		X	X			X	X
Cyanide				X	X			
Sulphur				X	X			
Ammonium				X	X			
Abnormal pH				X	X			
Pathogens				X	X			
Polyfluoroalkyl substances (PFAS)				X	X		X	
Oils & Mineral Oils				X			X	X
Polychlorinated Biphenyls (PCBs)				X			X	

## Potential Pathways

10A.6.10 In the context of the proposed development within the Project's draft Order Limits the potential exposure or migration pathways associated with the identified potential sources have been identified as follows:

- pathways to human health receptors:
  - dermal contact with soils and groundwater;
  - ingestion of dust/soil particles;
  - inhalation of dusts and fibres;
  - inhalation of hazardous ground gases/vapours; and
  - inhalation of hazardous mine gases.
- pathways to controlled water receptors:
  - leaching/migration of contaminants and Non-Aqueous Phase Liquids (NAPL) through the unsaturated zone and subsequent impact on groundwater within the underlying aquifers;
  - lateral migration of contaminants within groundwater and subsequent impact of surface water receptors;
  - migration of contaminants via on-site preferential pathways (e.g. via excavation of foundations and piles); and
  - lateral migration of contaminants and NAPL within groundwater to the site from nearby off-site sources.
- pathways applicable to site infrastructure:
  - direct contact with contaminants (e.g. abnormal pH and sulphates) in the soil and groundwater with below ground structures (e.g. buried concrete); and
  - accumulation of hazardous ground gases within enclosed spaces/structures (explosive risk).

## Potential Receptors

10A.6.11 In the context of the Project, the following potential receptors were identified with regards to human health:

- overhead line, construction compounds, third party services diversions and haul roads:
  - construction workers and future maintenance workers;
  - future site users (general public and trespassers (during construction only and only where a public right of way is present next to the works)); and
  - off-site users (during construction but not operation).
- proposed new Chesterfield Substation:
  - construction workers and future maintenance workers;
  - future site users (including the general public and trespassers); and

- off-site users.

10A.6.12 In the context of the Project, the following potential receptors were identified with regards to controlled waters:

- superficial Secondary A Aquifer;
- bedrock Aquifers (Secondary A and Secondary B);
- surface water bodies, including:
  - Section 1: Calow Brook and Calow Brook Tributary 5, River Doe Lea Tributary 4, Westwood Brook and Westwood Brook Tributary 1, and an unnamed surface water feature;
  - Section 2: Morton Brook Tributary 4, Meadow Farm Brook, Alfreton Brook and Alfreton Brook Tributary 3 and 4, Church Street Ditch 1 and Wood Lane Brook;
  - Section 3: Bottle Brook, Coppice Brook, Mushroom Wood Brook, Park Brook, Park Brook Tributary 4, 6 and 7 and an unnamed surface water feature;
  - Section 4: Moses Lane Brook, Manor Farm Ditch 3 and 4, Ock Brook and Ock Brook Tributary 2, 3 and 5;
  - Section 5: The River Derwent, Borrowash Brook, Ambaston Ditch 9, 10, 11, 13 16, 18 and 20, Thulston Brook and Chellaston Lane Brook 1 and 2; and
  - Section 6: Cuttle Brook, Trent and Mersey Canal, Twyford Brook, River Trent Tributary and Extension of River Trent Tributary, Merrybower Ditch 1, Frizams Lane Ditch and Power Station Ditch 1 and 7.
- services and building fabric; and
- future Project including pylon foundations.

10A.6.13 The risk to construction workers has been included in the PRA but should not be considered the risk driver. Risks during construction are dealt with under the Health and Safety at Work etc. Act 1974 (Ref 10A.29) and regulations made under the Act. The Project is located on largely agricultural land with large areas (in the northern sections) of historical opencast workings; as such, risks to construction/maintenance workers should be managed by undertaking a bespoke risk assessment that is appropriate to the type of work and potential contamination at a specified location. Where practicable the risks should be designed out and any residual risks managed by appropriate control measures.

10A.6.14 The use of a generic risk assessment approach where neither the scope of work, nor the specific location/depth/duration of excavation works, have been defined can lead to an inappropriate and/or misleading risk classification. The inclusion of construction workers within the risk assessment should not be considered by others as an assessment of health and safety risks to construction workers and as such site/work specific risk assessments are required to be completed to inform any such planned works.

## Preliminary Conceptual Site Model

- 10A.6.15 The CSM identifies the potential contamination sources, receptors, and the exposure pathways by which they may be linked. A source-pathway-receptor linkage (SPRL) is present if a viable pathway exists between a potential source and an identified receptor.
- 10A.6.16 The CSM includes potential risks which may exist to the site during the construction and maintenance. However, it is assumed that mitigation procedures during construction, such as the use of appropriate Personal Protective Equipment (PPE), will be implemented in accordance with the Code of Construction Practice (CoCP), provided as **Appendix 4A Draft Outline Code of Construction Practice** of the PEIR.
- 10A.6.17 The preliminary CSM and explanation of the risk characterisation process is presented as **Annex 10A.5**. A summary of potential contaminant linkages identified in the preliminary CSM is provided in **Table 10A.29**.

**Table 10A.29: SPRLs based on proposed end use**

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
SPRL 1	Potential infilled land and mineral extraction sites	Dermal contact and ingestion of soils, soil dusts/particles and groundwater.	Future site users	Unlikely	Medium	<b>Low</b>	Under normal forms of use by the private landowners/general public during operation ground breaking activities are considered unlikely.
SPRL 2			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	
SPRL 3		Inhalation of dust and soil particles	Future site users	Unlikely	Medium	<b>Low</b>	During construction ground disturbance is anticipated to be limited due to the relatively small foundations required for the pylons. In addition, the likely methods of construction for temporary tracks and compounds are also likely to require limited earthworks. Where required, levelling activities are anticipated to involve building up with imported materials, protected by an impermeable membrane.
SPRL 4			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	
SPRL 5			Off-site users	Unlikely	Medium	<b>Low</b>	
SPRL 6	Inhalation of asbestos fibres	Future site operatives	Unlikely	Medium	<b>Low</b>		
SPRL 7		Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>		
SPRL 8		Off-site users	Unlikely	Medium	<b>Low</b>	During normal operation it is anticipated that that there will be no	

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							<p>groundbreaking works and as such it is considered unlikely that dust and fibres will be released.</p> <p>Risks to construction and maintenance workers should be appropriately managed in accordance with the Health and Safety at Work etc. Act 1974 and regulations made under the Act.</p> <p>Asbestos fibre generation is likely to be limited to the immediate development and construction site. It is unlikely that off-site users will be exposed to asbestos fibres due to the limited nature of the excavations and distance to receptors. A ground investigation will be undertaken and where asbestos or contamination is encountered further assessment and mitigation measures will be employed to minimise risks to receptors.</p>
SPRL 9		Migration and accumulation of hazardous ground gas, mine gas and vapours into enclosed spaces	Future site users	Low Likelihood	Severe	<b>Moderate</b>	The proposed new Chesterfield Substation includes enclosed spaces (e.g. offices, meeting room, mess room and toilets); however, the overhead line, construction compounds and haul road for the Project are unlikely to include enclosed spaces due to the nature of the development.
SPRL 10			Construction Workers	Unlikely	Medium	<b>Low</b>	

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							<p>Ground gas, mine gas and vapours have the potential to accumulate in confined spaces and may pose a risk of asphyxiation or explosion at the proposed new Chesterfield Substation. The potential for ground gases to be generated from infilled ground and infilled ground associated with mineral extraction sites should be assessed by ground gas monitoring undertaken to assess the risks from these potential on-site gas sources.</p> <p>At the construction compounds, temporary offices/welfare will be well ventilated and constructed with an air gap between ground level and floor level to limit the potential for migration.</p>
SPRL 11		<p>Movement of mobile contaminants and/or leaching via infiltration, and migration into groundwater</p> <p>Migration of contaminants via on-site preferential</p>	<p>Superficial (Secondary A) and Bedrock (Secondary A) and Secondary B) aquifers</p>	Likely	Medium	<b>Moderate</b>	<p>Based on the current use comprising areas of open, agricultural space, and proposed development in areas of historical land use/artificial ground there is the potential for the infiltration of rainfall and subsequent leaching of contaminants to the underlying aquifers within the superficial deposits and shallow bedrock.</p> <p>If a piled foundation solution is used, pathways may be created for the migration of contaminants into bedrock aquifers. For pylons with piled</p>

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
		pathways (e.g. via excavation of foundations and piles)					foundations a piling risk assessment should be completed.
SPRL 12		Lateral migration of contaminants through groundwater and surface water run-off	Surface water bodies	Low Likelihood	Medium	<b>Low/ Moderate</b>	<p>WFD surface water bodies are shown across the development; however, most development features are located greater than 250 m away from these.</p> <p>As excavation works are expected to be limited to minor excavations at pylon foundations, it is not anticipated that gross contamination will be mobilised significantly enough to impact the chemical or biological status of any nearby surface water bodies. It should also be noted that although potential contamination sources have been identified, significant sources of gross contamination are not anticipated.</p> <p>If a piled foundation solution is used, pathways may be created between shallow Made Ground and basal groundwater flow, which may subsequently result in contaminant migrating into surface water bodies. Risks posed by piling should be assessed further in a development specific piling risk assessment.</p>

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
SPRL 13		Direct contact	Pylon foundations	Likely	Mild	<b>Low/Moderate</b>	Appropriate concrete design will be required to ensure existing contamination within the Made Ground does not result in the degradation of concrete foundations.
SPRL 14	Construction and demolition waste	Inhalation of asbestos fibres	Future site operatives	Unlikely	Medium	<b>Low</b>	During construction a watching brief will be used, and intrusive works will be ceased and the area cleared if potential asbestos or asbestos containing materials are observed. Site operations are not anticipated to involve intrusive works. In addition, future site operatives are unlikely to encounter potential asbestos and asbestos containing materials from construction and demolition waste as the waste activity will be located a significant distance from the completed development.
SPRL 15			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	
SPRL 16		Inhalation of dust and soil particles	Future site users	Unlikely	Medium	<b>Low</b>	
SPRL 17			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	
SPRL 18			Off-site users	Unlikely	Medium	<b>Low</b>	

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							<p>During normal operation it is anticipated that that there will be no groundbreaking works and as such it is considered unlikely that dust and soil particles will be released.</p> <p>Risks to construction and maintenance workers should be appropriately managed in accordance with the Health and Safety at Work etc. Act 1974 and regulations made under the Act. Due to the scale and location of the development features it is not anticipated that off-site users will be impacted.</p>
SPRL 19		Dermal contact and ingestion of soils, soil dusts/particles and groundwater.	Future site operatives	Unlikely	Medium	<b>Low</b>	Exposure times are likely to be limited and the probability of exposure will be reduced to low by using appropriate PPE. In addition, under normal forms of use during operation ground breaking activities are considered unlikely.
SPRL 20			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	
SPRL 21	Sewage treatment works, sewage sludge storage and sewage discharge	Dermal contact and ingestion of residual contamination	Future site operatives	Unlikely	Medium	<b>Low</b>	<p>Site operations are not anticipated to involve intrusive works.</p> <p>Exposure times are likely to be limited, and the probability of exposure will be reduced to low by using appropriate PPE. In addition, under normal forms of use during operation ground</p>

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							breaking activities are considered unlikely.
SPRL 22			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	If gross residual contamination is encountered prior to or during intrusive works, activities will be ceased until the working area can be made safe. The probability of exposure will be reduced to low by using appropriate PPE.
SPRL 23		Inhalation of contaminated dust and soil particles	Future site operatives	Unlikely	Medium	<b>Low</b>	During construction ground disturbance is anticipated to be limited due to the relatively small foundations required for the pylons. Earthworks at the construction compounds are anticipated to be minimal, with levelling activities anticipated to involve building up with imported materials, protected by an impermeable membrane. During normal operation it is anticipated that there will be no groundbreaking works and as such it is considered unlikely that dust and soil particles will be released. Risks to construction and maintenance workers should be appropriately managed in accordance with the Health and Safety at Work etc. Act 1974 and regulations made under the
SPRL 24	Construction workers		Low Likelihood	Medium	<b>Low/Moderate</b>		
SPRL 25	Off-site users		Unlikely	Medium	<b>Low</b>		

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							Act. Due to the scale and location of the development features it is not anticipated that off-site users will be impacted.
SPRL 26		Migration and accumulation of hazardous ground gas and vapours into enclosed spaces	Future site operatives	Unlikely	Severe	<b>Low/Moderate</b>	The proposed new Chesterfield Substation includes enclosed spaces (e.g. offices, meeting room, mess room and toilets); however, the substation is not located near to any sources relating to sewage treatment works, sewage sludge storage and sewage discharge.
SPRL 27			Construction workers	Unlikely	Severe	<b>Low/Moderate</b>	<p>Confined space entry is considered unlikely during construction of the overhead line, construction compounds and haul roads due to the nature of the development as above ground, non-enclosed structures with small foundations.</p> <p>Structures at the construction compounds will be constructed with an air gap between ground level and floor level to limit migration. All construction compound structures will be temporary.</p> <p>Future site operatives are unlikely to be at risk of gas and vapours as the development does not include any enclosed structures or confined spaces.</p>

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
SPRL 28		<p>Movement of mobile contaminants and/or leaching via infiltration, and migration into groundwater</p> <p>Migration of contaminants via on-site preferential pathways (e.g. via excavation of foundations and piles)</p>	<p>Superficial (Secondary A) and Bedrock (Secondary A and Secondary B) aquifers</p>	<p>Low Likelihood</p>	<p>Medium</p>	<p><b>Low/Moderate</b></p>	<p>Based on the current use and proposed development comprising areas of open, agricultural space, there is the potential for the infiltration of rainfall and subsequent leaching of contaminants to the underlying aquifers within the superficial deposits and shallow bedrock.</p> <p>If a piled foundation solution is used, pathways may be created for the migration of contaminants into bedrock aquifers.</p> <p>A piling risk assessment should be undertaken prior to establishing the correct method of piling.</p>
SPRL 29		<p>Lateral migration of contaminants through groundwater and surface water run-off</p>	<p>Surface water bodies</p>	<p>Low Likelihood</p>	<p>Medium</p>	<p><b>Low/Moderate</b></p>	<p>WFD surface water bodies are shown across the development; however, these are all located at least 60 m from any development features potentially impacted by residual Made Ground and contamination related to sewage activities.</p> <p>As intrusive works are expected to be limited to pylon foundations, it is not anticipated that gross contamination will be mobilised significantly enough to impact the chemical or biological</p>

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							status of any nearby surface water bodies. If a piled foundation solution is used, pathways may be created between shallow Made Ground and basal groundwater flow, which may subsequently result in contaminant migrating into surface water bodies.
SPRL 30		Direct Contact	Pylon foundations	Likely	Mild	<b>Low/Moderate</b>	Appropriate concrete design will be required to ensure existing contamination within the Made Ground does not result in the degradation of concrete foundations.
SPRL 31	Historical landfills	Dermal contact and ingestion of soils, soil dusts/particles and groundwater.	Future site operatives	Unlikely	Medium	<b>Low</b>	Exposure times are likely to be limited and the probability of exposure will be reduced to low by using appropriate PPE. In addition, under normal forms of use during operation ground breaking activities are considered unlikely.
SPRL 32			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	
SPRL 33			Future site operatives	Unlikely	Medium	<b>Low</b>	
SPRL 34		Inhalation of dust and soil particles	Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	During groundbreaking construction activities, there is the potential for asbestos fibre release. In these circumstances the risk is considered to be Low–Moderate. A watching brief will be used, and intrusive works will be ceased and the area cleared if
SPRL 35	Off-site users		Unlikely	Medium	<b>Low</b>		

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
SPRL 36		Inhalation of asbestos fibres	Future site operatives	Unlikely	Medium	<b>Low</b>	potential asbestos or asbestos containing materials are observed.
SPRL 37			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	During construction ground disturbance is anticipated to be limited due to the relatively small foundations required for the pylons. The foundations for pylons 141 and 142, which are located in an area of historical landfill, are likely to be driven piles with pile caps which extend above ground level with the aim of minimising disturbance to landfill materials. In addition, the pylons at these locations are likely to be raised on concrete plinths (above ground pile caps).
SPRL 38			Off-site users	Unlikely	Medium	<b>Low</b>	During normal operation it is anticipated that that there will be no groundbreaking works and as such it is considered unlikely that dust and fibres will be released. Risks to construction and maintenance workers should be appropriately managed in accordance with the Health and Safety at Work etc. Act 1974 and regulations made under the Act. Asbestos fibre generation is likely to be limited to the immediate development and construction site. It

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							is unlikely that off-site users will encounter airborne asbestos. Due to the scale and location of the development features it is not anticipated that off-site users will be impacted.
SPRL 39		Migration and accumulation of hazardous landfill gas and vapours into enclosed spaces	Future site operatives	Unlikely	Severe	<b>Low/ Moderate</b>	Confined space entry is considered unlikely during construction due to the nature of the development comprising above ground pylons which are non-enclosed structures with small foundations. Structures at the construction compounds will be constructed with an air gap between ground level and floor level to limit migration of landfill gases. All construction compound structures will be temporary. Future site operatives are unlikely to be at risk of gas and vapours as the development does not include any enclosed structures or confined spaces.
SPRL 40	Construction workers		Unlikely	Severe	<b>Low/ Moderate</b>		
SPRL 41		Movement of mobile contaminants and/or leaching via infiltration, and migration	Superficial (Secondary A) and Bedrock (Secondary B) aquifers	Unlikely	Medium	<b>Low</b>	Based on the current use comprising open/agricultural space and the proposed development, there is the potential for the infiltration of rainfall and subsequent leaching of contaminants to the underlying

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
		into groundwater  Migration of contaminants via on-site preferential pathways (e.g. via excavation of foundations and piles)					aquifers within the superficial deposits and shallow bedrock. There is an increased potential at pylons 63, 71 and 162 due to their location to nearby historical landfills.  A piling risk assessment should be undertaken prior to establishing the correct method of piling.
SPRL 42		Lateral migration of contaminants through groundwater and surface water run-off	Surface water bodies	Unlikely	Medium	<b>Low</b>	WFD surface water bodies are shown across the development; however, most development features are located a significant distance away from these. Non-WFD surface water bodies are shown to cross the area potentially impacted by historical landfill activities.  As intrusive works are expected to be limited to pylon foundations, it is not anticipated that gross contamination will be mobilised significantly enough to impact the chemical or biological status of any nearby surface water bodies.  A piling risk assessment should be undertaken prior to establishing the correct method of piling.

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
SPRL 43		Direct contact	Pylon foundations	Likely	Mild	<b>Low/ Moderate</b>	Appropriate concrete design will be required to ensure existing contamination within the Made Ground does not result in the degradation of concrete foundations.
SPRL 44	Licensed Pollutant Release (Unloading of Petrol into Tanks)	Dermal contact and ingestion of soils, soil dusts/particles and groundwater.	Future site operatives	Unlikely	Medium	<b>Low</b>	Exposure times are likely to be limited and the probability of exposure will be reduced to low by using appropriate PPE. In addition, under normal forms of use during operation ground breaking activities are considered unlikely.  Contamination associated with garages and fuel emission is not anticipated at any proposed pylon location.
SPRL 45			Construction workers	Low Likelihood	Medium	<b>Low/ Moderate</b>	
SPRL 46			Future site operatives	Unlikely	Medium	<b>Low</b>	
SPRL 47		Inhalation of dust and soil particles	Construction workers	Low Likelihood	Medium	<b>Low/ Moderate</b>	Contamination associated with garages and fuel emission is not anticipated at any proposed pylon location.
SPRL 48	Off-site users		Unlikely	Medium	<b>Low</b>	Earthworks at the construction compounds are anticipated to be minimal, with levelling activities anticipated to involve building up with imported materials, protected by an impermeable membrane.  During normal operation it is anticipated that that there will be no groundbreaking works and as such it	

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							<p>is considered unlikely that dust and fibres will be released.</p> <p>Risks to construction and maintenance workers should be appropriately managed in accordance with the Health and Safety at Work etc. Act 1974 and regulations made under the Act.</p> <p>Due to the scale and location of the development features it is not anticipated that off-site users will be impacted.</p>
SPRL 49		Migration and accumulation of hazardous ground gas and vapours into enclosed spaces	Future site users	Unlikely	Severe	<b>Low/Moderate</b>	Confined space entry is considered unlikely during construction due to the nature of the development as above ground, non-enclosed structures with small foundations.
SPRL 50			Construction workers	Unlikely	Severe	<b>Low/Moderate</b>	Structures at the construction compounds will be constructed with an air gap between ground level and floor level to limit migration of landfill gases. All construction compound structures will be temporary. Future site operatives are unlikely to be at risk of gas and vapours as the development does not include any enclosed structures or confined spaces.

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
SPRL 51		Movement of mobile contaminants and/or leaching via infiltration, and migration into groundwater	Bedrock (Secondary A) aquifer	Unlikely	Medium	<b>Low</b>	<p>Based on the current use and proposed development comprising areas of open, agricultural space, there is the potential for the infiltration of rainfall and subsequent leaching of contaminants to the underlying aquifers within the superficial deposits and shallow bedrock.</p> <p>Contamination associated with garages and fuel emission is not anticipated at any proposed pylon location.</p>
SPRL 52		Lateral migration of contaminants through groundwater and surface water run-off	Surface water bodies	Low Likelihood	Medium	<b>Low/Moderate</b>	<p>WFD surface water bodies are shown across the development; however, most development features are located a significant distance away from these. Non-WFD surface water bodies are shown to cross the area potentially impacted by garages and unloading of petrol.</p> <p>As intrusive works are expected to be limited to pylon foundations, and contamination associated with garages and fuel emission is not anticipated at any proposed pylon location, it is not anticipated that gross contamination will be mobilised significantly enough to impact the chemical or biological status of any nearby surface water bodies.</p>

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments	
SPRL 53		Direct Contact	Pylon Foundations	Unlikely	Mild	<b>Very Low</b>	Contamination associated with garages and fuel emission is not anticipated at any proposed pylon location.	
SPRL 54	Railway land	Dermal contact and ingestion of soils, soil dusts/particles and groundwater.	Future site operatives	Unlikely	Medium	<b>Low</b>	Exposure times are likely to be limited and the probability of exposure will be reduced to low by using appropriate PPE. In addition, under normal forms of use during operation ground breaking activities are considered unlikely.	
SPRL 55			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>		
SPRL 56		Inhalation of dust and soil particles	Future site operatives	Unlikely	Medium	<b>Low</b>		
SPRL 57			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>		
SPRL 58			Off-site users	Unlikely	Medium	<b>Low</b>		
SPRL 59		Inhalation of asbestos fibres	Future site operatives	Unlikely	Medium	<b>Low</b>		During groundbreaking construction activities, there is the potential for asbestos fibre release. In these circumstances the risk is considered to be Low–Moderate. A watching brief will be used, and intrusive works will be ceased and the area cleared if potential asbestos or asbestos containing materials are observed. During construction ground disturbance is anticipated to be limited due to the relatively small foundations required for the pylons. Residual contamination associated with railway land is not anticipated at any construction compounds. During normal operation it is anticipated that that there will be no
SPRL 60			Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>		
SPRL 61	Off-site users		Unlikely	Medium	<b>Low</b>			

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							<p>groundbreaking works and as such it is considered unlikely that dust and fibres will be released.</p> <p>Risks to construction and maintenance workers should be appropriately managed in accordance with the Health and Safety at Work etc. Act 1974 and regulations made under the Act.</p> <p>Made Ground at historical railway yards is known to often contain asbestos because of historical locomotive maintenance and assembly activities. Asbestos fibre generation is likely to be limited to the immediate development and construction site. It is unlikely that off-site users will encounter airborne asbestos.</p> <p>Due to the scale and location of the development features it is not anticipated that off-site users will be impacted.</p>
SPRL 62		Migration and accumulation of hazardous landfill gas and vapours into enclosed spaces	Future site operatives	Unlikely	Medium	<b>Low</b>	Confined space entry is considered unlikely during construction due to the nature of the development as above ground, non-enclosed structures with small foundations.
SPRL 63			Construction workers	Unlikely	Medium	<b>Low</b>	

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							Residual contamination associated with railway land is not anticipated at any construction compounds. Future site operatives are unlikely to be at risk of gas and vapours as the development does not include any enclosed structures or confined spaces.
SPRL 64		Movement of mobile contaminants and/or leaching via infiltration, and migration into groundwater  Migration of contaminants via on-site preferential pathways (e.g. via excavation of foundations and piles)	Superficial (Secondary A) and Bedrock (Secondary A and Secondary B) aquifers	Unlikely	Medium	<b>Low</b>	Based on the current use and proposed development comprising areas of open, agricultural space, there is the potential for the infiltration of rainfall and subsequent leaching of contaminants to the underlying aquifers within the superficial deposits and shallow bedrock.  If a piled foundation solution is used, pathways may be created for the migration of contaminants into bedrock aquifers.
SPRL 65		Lateral migration of contaminants through	Surface water bodies	Unlikely	Medium	<b>Low</b>	WFD surface water bodies are shown across the development; however, these are all located at least 45 m from any development features potentially

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
		groundwater and surface water run-off					<p>impacted by residual Made Ground and contamination related to railway land. Non-WFD surface water bodies are shown to cross the area potentially impacted by railway land, which may be tributaries of WFD surface water bodies.</p> <p>As intrusive works are expected to be limited to pylon foundations, it is not anticipated that gross contamination will be mobilised significantly enough to impact the chemical or biological status of any nearby surface water bodies.</p> <p>If a piled foundation solution is used, pathways may be created between shallow Made Ground and basal groundwater flow, which may subsequently result in contaminant migrating into surface water bodies.</p>
SPRL 66		Direct Contact	Pylon foundations	Likely	Mild	<b>Low/Moderate</b>	Appropriate concrete design will be required to ensure existing contamination within the Made Ground does not result in the degradation of concrete foundations.
SPRL 67	Power station	Dermal contact and ingestion of	Future site operatives	Unlikely	Medium	<b>Low</b>	Exposure times are likely to be limited and the probability of exposure will be

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
SPRL 68		residual contamination	Construction workers	Low Likelihood	Medium	<b>Low/Moderate</b>	reduced to low by using appropriate PPE. In addition, under normal forms of use during operation ground breaking activities are considered unlikely.
SPRL 69		Inhalation of dust and soil particles	Future site operatives	Unlikely	Medium	<b>Low</b>	During groundbreaking construction activities, there is the potential for asbestos fibre release. In these circumstances the risk is considered to be Low–Moderate. A watching brief will be used, and intrusive works will be ceased and the area cleared if potential asbestos or asbestos containing materials are observed. During construction ground disturbance is anticipated to be limited due to the relatively small foundations required for the pylons. Earthworks at the construction compounds are anticipated to be minimal, with levelling activities anticipated to involve building up with imported materials, protected by an impermeable membrane. During normal operation it is anticipated that that there will be no groundbreaking works and as such it is considered unlikely that dust and fibres will be released.
SPRL 70	Construction workers		Low Likelihood	Medium	<b>Low/Moderate</b>		
SPRL 71	Off-site users		Unlikely	Medium	<b>Low</b>		
SPRL 72		Inhalation of asbestos fibres	Future site operatives	Unlikely	Medium	<b>Low</b>	
SPRL 73	Construction workers		Low Likelihood	Medium	<b>Low/Moderate</b>		
SPRL 74	Off-site users		Unlikely	Medium	<b>Low</b>		

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							<p>Risks to construction and maintenance workers should be appropriately managed in accordance with the Health and Safety at Work etc. Act 1974 and regulations made under the Act.</p> <p>Asbestos fibre generation is likely to be limited to the immediate development and construction site. It is unlikely that off-site users will encounter airborne asbestos.</p> <p>Due to the scale and location of the development feature it is not anticipated that off-site users will be impacted.</p>
SPRL 75		Migration and accumulation of hazardous ground gas and vapours into enclosed spaces	Future site operatives	Unlikely	Severe	<b>Low/Moderate</b>	Confined space entry is considered unlikely during construction due to the nature of the development as above ground, non-enclosed structures with small foundations.
SPRL 76			Construction workers	Unlikely	Severe	<b>Low/Moderate</b>	Structures at the construction compounds will be constructed with an air gap between ground level and floor level to limit migration. All construction compound structures will be temporary. Future site operatives are unlikely to be at risk of gas and vapours as the development does not include any

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							enclosed structures or confined spaces.
SPRL 77		<p>Movement of mobile contaminants and/or leaching via infiltration, and migration into groundwater</p> <p>Migration of contaminants via on-site preferential pathways (e.g. via excavation of foundations and piles)</p>	Superficial (Secondary A) and Bedrock (Secondary B) aquifers	Unlikely	Medium	<b>Low</b>	<p>Based on the current use and proposed development comprising areas of open, agricultural space, there is the potential for the infiltration of rainfall and subsequent leaching of contaminants to the underlying aquifers within the superficial deposits and shallow bedrock.</p> <p>If a piled foundation solution is used, pathways may be created for the migration of contaminants into bedrock aquifers.</p>
SPRL 78		Lateral migration of contaminants through groundwater and surface water run-off	Surface water bodies	Unlikely	Medium	<b>Low</b>	WFD surface water bodies are shown across the development; however, these are all located over 100 m from any development features potentially impacted by residual Made Ground and contamination related to the power station. As intrusive works are expected to be limited to pylon foundations, it is not anticipated that gross contamination will be mobilised

SPRL	Potential Source	Pathway	Receptor	Probability	Severity	Preliminary Risk Rating	Comments
							significantly enough to impact the chemical or biological status of any nearby surface water bodies. If a piled foundation solution is used, pathways may be created between shallow Made Ground and basal groundwater flow, which may subsequently result in contaminant migrating into surface water bodies.
SPRL 79		Direct Contact	Pylon foundations	Likely	Mild	<b>Low/ Moderate</b>	Appropriate concrete design will be required to ensure existing contamination within the Made Ground does not result in the degradation of concrete foundations.
SPRL 80	Radon	Migration and potential accumulation of radon gas in enclosed spaces	Future site users (Chesterfield Substation)	Low Likelihood	Severe	<b>Moderate</b>	The proposed new Chesterfield Substation includes enclosed spaces (e.g. offices, meeting room, mess room and toilets) in which radon gas could potentially accumulate. Exposure to high levels of radon increases the risk of developing lung cancer. Potential requirement for full radon protection measures.
			Construction Workers	Unlikely	Medium	<b>Low</b>	Risks to construction workers are considered low, given that radon gas will disperse into the air and exposure times will be limited.

## 10A.7 Preliminary Geotechnical Considerations

### Preliminary Ground Model

#### Made Ground

- 10A.7.1 Areas of Made Ground are anticipated to be encountered predominantly within Sections 1 to 3, associated with previous areas of opencast workings, yet there may also be localised areas of Made Ground along the entire length of the proposed route alignment. The composition of these areas of Made Ground is unknown, and may be highly variable; however, it is likely to consist of spoil and reworked natural materials.

#### Superficial geology

- 10A.7.2 The superficial geology is shown to be highly variable along the proposed route alignment, with thin or absent superficial deposits across Sections 1 to 4, and superficial materials starting to be encountered at more significant depths from the end of Section 4 to the end of the proposed route alignment.
- 10A.7.3 Information was obtained from borehole logs along the proposed route alignment, predominately nearby pylon location investigations. Localised deposits of Alluvium, consisting of clay, silt, sands and gravels are indicated along watercourses within Sections 1 to 4, at shallow depths, ranging between 1.2 m BGL and 3.0 m BGL.
- 10A.7.4 More variable superficial deposits are indicated within Sections 5 and 6, with borehole logs recording areas of Alluvium (clay, silt, sands and gravels), Head Deposits (poorly sorted gravel, sands, and clays with potential for local compressible lenses), River Terrace Deposits (sands and gravels), Glacial Till (clay, silt, sands, gravels), Glaciolacustrine Deposits (sands, silts, and clays), and Glaciofluvial Deposits (boulders, silt, sands, and clay). The depths suggested by the borehole logs are up to 1.8 m thickness of River Terrace Deposits, and up to 3.2 m thickness for Fluvio-glacial Gravels. Areas of deep superficial deposits should also be considered, with one borehole log indicating Glacial Till Deposits within Section 6 up to depths of around 24 m BGL.

#### Bedrock geology

- 10A.7.5 The bedrock geology varies along the proposed route alignment, with Sections 1 to 3 being underlain by the Pennine Coal Measures Group (mudstones, siltstones, sandstones and frequent coal seams and ironstone beds); and Sections 4 to 6 encountering various bedrock formations, predominately comprised of sandstones, mudstones and rarely siltstone.
- 10A.7.6 Within the Pennine Coal Measures group, there are numerous inferred and observed coal seams, with significant areas of previous workings. Outside of the Coal Measures, within Sections 4 to 6, there are also several inferred mineral veins recorded within the mudstone geology.
- 10A.7.7 Available borehole logs along the proposed route alignment, taken from nearby pylon investigations, indicate that generally and where open cast coal extraction has not taken place, depth to rockhead appears relatively shallow along the length of the proposed route alignment, suggesting rockhead depths around: 4.2 m BGL within Section 1; 3 m BGL within Section 2; between 1.2 m BGL and 3.66 m BGL within

Section 3; 3.2 m BGL within Section 5; and between 0.5 m BGL and 2.5 m BGL within Section 6. No records were available to suggest rockhead depths for Section 4.

- 10A.7.8 There are also numerous faults recorded within the bedrock geology along the proposed route alignment, with the general regional dip varying along the route. Sections 1 to 3 of the proposed route alignment tend to be positioned to the right of an anticline, running approximately north to south. Whilst the proposed route alignment continues to be affected by faulting within Sections 4 to 6, the frequency is much less.

## Ground Subsidence Risk

### Coal mining related risks

- 10A.7.9 The analysis of the mining information documented in Mining Remediation Authority legacy coal mining GIS Datasets is discussed in section 10.4, which highlights that approximately 40 per cent of the pylon locations along the proposed route alignment are located in areas of High Risk from legacy coal mining hazards, with a further 22 per cent of pylon locations located in areas of Medium Risk. This risk is categorised by uncontrolled open cast backfill, shallow underground mine workings and the proximity of coal mining entrances (shafts and adits). These conditions present either ground settlement risks during loading or a potential for void propagation and the destabilisation of above ground structures.
- 10A.7.10 Due to the potential risk and uncertainty, it is recommended that the thickness of any colliery spoil, the depth and condition of any worked underground seams, and the thickness of competent rock cover is determined for each pylon location, to ensure the associated risks are suitably addressed. It is also recommended that mine gas monitoring is carried out to confirm the short-term construction risks to site workers.

### Non-coal mining related risks

- 10A.7.11 There is also potential risk for other non-coal workings along the proposed route alignment. Section 10.4 also discusses the risk in detail, with Sections 1 to 4 all being identified as located within areas of potential historical Iron Ore workings, with Section 2 also being flagged as potential risk of historical Vein mining. However, the Groundsure reports suggests that although such workings may have occurred, they are likely to be at sufficient depth, therefore the potential for difficult ground conditions is unlikely.
- 10A.7.12 There are two distinct areas (pylon 144, and pylons 156–157) within Sections 4 to 6 which the Groundsure reports indicate as being located within or adjacent to an area of Evaporite or Gypsum mining. This risk should be carefully considered, and it is recommended that further investigation is undertaken to characterise these areas, to ensure the risk is suitably addressed.
- 10A.7.13 Localised areas of shallow superficial deposits across all sections of the proposed route alignment have the potential to contain layers of soft clays and peat deposits (compressible deposits) which are susceptible to settlement under loading. The risk categorised by the Groundsure reports identified areas of Low to Moderate risk. Additionally, throughout Sections 2 to 5, there are areas of Low risk of medium plasticity deposits (shrink-swell clays), which may lead to uneven settlement and potential for ground heave.

- 10A.7.14 Generally, the risk of ground dissolution along the proposed route alignment is negligible; however, at one area of the route, at the intersection of Sections 5 and 6, the risk is classified as Low. This risk should be mitigated alongside the additional investigation to characterise and determine the extents of the risks from previous workings along the proposed route alignment (both coal and non-coal mining).
- 10A.7.15 Additionally, areas of Low and Moderate risk of landslides have been identified predominantly within Sections 3 and 4. This may cause potential slope instability problems, therefore should be considered within each pylon design.

## Structural Foundations

### Pylons

- 10A.7.16 For moderate structural loading, shallow footings should be achievable within the natural Alluvial, Glacial and River Terrace Deposits; however, the strength and consistency of such deposits is likely to vary. Depending on findings of ground investigations and any outcomes from remedial works which may be required, departures from the standard foundations may be required to manage the residual ground risk. This may include the use of enhanced foundation reinforcement and/or the use of foundation piles to safely support the pylon structural loading. This would derive bearing resistance from suitably competent layers at depth, particularly the dense granular layers, or bedrock.
- 10A.7.17 In general, the Pennine Measures bedrock, and the other varying bedrock measures south of Section 4 (sandstone, mudstone, and siltstone) should provide suitable founding stratum if required, provided they are not affected by a significant void propagation risk associated with historical underground mining. Foundation design within these strata should carefully consider the potential for highly variable weathering profile thickness and voiding, and within mudstone bedrock in particular, the shrink-swell potential and sulphate/sulphide content.
- 10A.7.18 Ground conditions are anticipated to vary considerably along the proposed route alignment, and the structural foundation solutions ultimately adopted as part of the detailed design will need to be confirmed following a site-specific geotechnical ground investigation. This will allow an appropriate ground model to be developed, and a numerical assessment of the bearing capacity, to confirm the foundation suitability. Targeted ground investigation would also provide groundwater condition information, alongside the mining/historical working risk categorisation to inform the design.

### Excavations

- 10A.7.19 Excavations are likely to be required for construction of foundations, services, and potentially also for temporary works to enable the construction of the pylons.
- 10A.7.20 Excavations are anticipated to be through Made Ground and Alluvium predominately, with potential for excavations also to be required within River Terrace Deposits, Glacial Deposits, and bedrock (including varying Measures of mudstone, sandstone and siltstone) and the Pennine Middle Coal Measures. Vertical unsupported excavations in the Made Ground, Alluvium and Glacial deposits are not expected to have long stand-up times. Excavation in the superficial materials should be possible using conventional excavation techniques and equipment. Specialised equipment may however be required for excavation into bedrock.

- 10A.7.21 There are a few nearby boreholes along the proposed route alignment which indicate relatively high groundwater levels; however, detailed site-specific information on the groundwater conditions is limited. Based on experience of working within similar geology, perched, shallow groundwater should be expected within the superficial deposits which will impact the stability of excavations.
- 10A.7.22 All excavations for foundations and service construction should be undertaken following adequate consideration and design of appropriate mitigation measures for stability and any temporary support. These measures may include, but not be limited to, battering temporary slopes to safe angles, trench support/shoring, and groundwater management such as sump pumping.
- 10A.7.23 Site-specific ground investigation is required to assess the ground and groundwater conditions and to inform design.

### Earthworks

- 10A.7.24 Earthworks are likely to be required as part of temporary access works for the construction of the pylons and haul roads. However, it is considered unlikely that there would be significant changes to the existing site levels. Design of earthworks should be assessed when the earthworks levels are known.

### Geotechnical Risks and Constraints

- 10A.7.25 A preliminary Geotechnical Risk Register has been prepared for the proposed Project and is presented in **Table 10A.31**. The risks highlighted in **Table 10A.31** have been considered following a review of the available preliminary data only and will assess the potential geotechnical hazards. These risks shall form the basis of a 'live' risk register document, which should be maintained for the lifetime of the Project, updated on every review of the geotechnical risks/every design stage, as undertaken.
- 10A.7.26 **Table 10A.31** provides a risk register classification before and after design control measures are implemented. The scoring system used in this register is presented in **Table 10A.30**.

**Table 10A.30: Preliminary Geotechnical Risk Register scoring system**

Probability (P)		Impact/Consequence (I)		Risk P x I = R	Impact/Consequence				
					1	2	3	4	5
Very Likely	5	Very High	5	Probability	1	2	3	4	5
Probable	4	High	4		2	4	6	8	10
Likely	3	Medium	3		3	6	9	12	15
Unlikely	2	Low	2		4	8	12	16	20
Negligible	1	Very Low	1		5	10	15	20	25

**Table 10A.31: Preliminary Geotechnical Risk Register**

Item	Design/Construction Risk	Cause	Consequence	P	I	R	Design Control Measure	P	I	R
1	Aggressive ground conditions and sulphate attack on concrete.	Naturally aggressive ground conditions, or due to contaminated ground.	Damage to concrete foundations required for structures.	2	3	6	Undertake a ground investigation that samples and tests the encountered soils within the ground.  Implement all recommendations of BRE Special Digest 1 for design and composition of buried concrete Ref 10A.28). If aggressive groundwaters are identified, then the use of a sulphate-resistant binder should be considered.	1	3	3
2	Unknown groundwater regime.	High water table or perched water table within superficial deposits.	Drainage issues having impact on settlement and on longevity of design.	3	4	12	Groundwater levels to be investigated during ground investigation. Design will need to consider working with unknown groundwater regime and potential surface water will need to be included within the buildability of the Project.  Temporary works designer to assess the need of pumping if required.	1	4	4
3	Excessive or differential settlement and insufficient bearing resistance.	Unknown thickness and composition of superficial deposits and Made Ground (reworked ground from mining/colliery spoil) on-site. Depth and composition of bedrock is also unknown.	Failure of structure, repair costs, risk to life.	4	4	16	Undertake suitable ground investigation and laboratory testing to identify strata thickness and geotechnical properties.  Consider removing soft spots, incorporating ground improvement (if superficial deposits are unsuitable founding material) or surcharging high risk areas.	1	4	4

Item	Design/Construction Risk	Cause	Consequence	P	I	R	Design Control Measure	P	I	R
4	Soft spots within excavations.	Variability within the composition of the superficial deposits, which are highly variable along the proposed route alignment.	Collapse of excavations, potential damage to nearby structures, costs of repairs.	3	3	9	Undertake thorough ground investigations with the supervision of a geotechnical/geological engineer. During construction on-site representatives to be made aware of any soft spots and advise on treatment.	1	3	3
5	Made Ground	Mapping and historical records indicate areas of Made Ground along the proposed route alignment may consist of Colliery Spoil. Limited information regarding thickness and composition.	Incorrect design assumption of engineered fill. Leading to potential differential settlements of heterogenous Made Ground. Loss of serviceability, damage to structures, costs of repairs.	3	3	9	Undertake thorough ground investigation to confirm presence of any Made Ground depth and composition. Structures to be designed in accordance with design standards. Geo-environmental testing of samples required. Potential for capping or removal of contaminated land.	1	3	3
6	Mining and ground workings	Surface mineral working pits, and deeper seams being worked, resulting in voids.	Collapse of excavations, potential damage to nearby structures, cost of repairs.	4	3	12	Undertake detailed ground investigation to confirm if any ground treatment is required.	2	3	6

## 10A.8 Conclusions and Recommendations

### Conclusions

#### Contaminated land

- 10A.8.1 The CSM has identified potential sources of contamination associated with the historical and current day land uses within the draft Order Limits for the Project, which include the following:
- historical mineral extraction activity;
  - historical landfills;
  - sewage treatment works;
  - sewage sludge storage;
  - sewage discharge;
  - waste activity (construction and demolition waste);
  - licensed pollutant release (unloading of petrol into tanks);
  - railway land; and
  - a power station.
- 10A.8.2 The PRA has identified four potentially unacceptable potential contaminant linkages representing Moderate preliminary risk ratings. The identified preliminary risk ratings of Moderate along with the associated comments are summarised in **Table 10A.32**.

**Table 10A.32: Identified contaminant linkages representing Moderate preliminary risk ratings**

SPRL	Potential Source	Pathway	Receptor	Comments
SPRL 9	Potential infilled land and mineral extraction sites.	Migration and accumulation of hazardous ground gas, mine gas and vapours into enclosed spaces.	Future site users.	The proposed new Chesterfield Substation includes enclosed spaces (e.g. offices, meeting room, mess room and toilets). Ground gas, mine gas and vapours have the potential to accumulate in confined spaces and may pose a risk of asphyxiation or explosion at the

SPRL	Potential Source	Pathway	Receptor	Comments
SPRL 11	Potential infilled land and mineral extraction sites.	<p>Movement of mobile contaminants and/or leaching via infiltration, and migration into groundwater.</p> <p>Migration of contaminants via on-site preferential pathways (e.g. via excavation of foundations and piles).</p>	<p>Superficial (Secondary A) and Bedrock (Secondary A and Secondary B) aquifers.</p>	<p>proposed new Chesterfield Substation. The potential for ground gases to be generated from infilled ground and infilled ground associated with mineral extraction sites should be assessed by ground gas monitoring undertaken to assess the risks from these potential on-site gas sources.</p> <p>Based on the current use comprising areas of open, agricultural space, and proposed development in areas of historical land use/artificial ground there is the potential for the infiltration of rainfall and subsequent leaching of contaminants to the underlying aquifers within the superficial deposits and shallow bedrock.</p> <p>If a piled foundation solution is used, pathways may be created for the migration of contaminants into bedrock aquifers. For pylons with</p>

SPRL	Potential Source	Pathway	Receptor	Comments
SPRL 28	Sewage treatment works, sewage sludge storage and sewage discharge.	<p>Movement of mobile contaminants and/or leaching via infiltration, and migration into groundwater.</p> <p>Migration of contaminants via on-site preferential pathways (e.g. via excavation of foundations and piles).</p>	Superficial (Secondary A) and Bedrock (Secondary A and Secondary B) aquifers.	<p>piled foundations a piling risk assessment should be completed.</p> <p>Based on the current use comprising areas of open, agricultural space, and proposed development in areas of historical land use/artificial ground there is the potential for the infiltration of rainfall and subsequent leaching of contaminants to the underlying aquifers within the superficial deposits and shallow bedrock.</p> <p>If a piled foundation solution is used, pathways may be created for the migration of contaminants into bedrock aquifers.</p> <p>A piling risk assessment should be undertaken prior to establishing the correct method of piling.</p>
SPRL 80	Radon gas.	Migration and accumulation in occupied spaces (new Chesterfield Substation).	Future site users.	Potential for migration and accumulation of radon gas. Potential requirement for full radon protection

SPRL	Potential Source	Pathway	Receptor	Comments
				measures in occupied buildings. Further information relating to radon risk to be sought from BGS.

10A.8.3 In addition, the PRA has identified 34 potential contaminant linkages representing Low/Moderate preliminary risk ratings. In general, these linkages relate to potential risks to construction workers involved in excavation works during construction of the Project. However, the risks to construction workers during construction will be appropriately mitigated by the appointed Main Works Contractor.

10A.8.4 In addition, potential risks to controlled waters (surface water bodies) have been identified due to the risk of using a piled foundation solution that may create a pathway between shallow Made Ground/contamination and basal groundwater flow. This may subsequently result in contaminant migration into surface water bodies. If a piled foundation solution is used, the risk posed by piling should be assessed further in a development specific piling risk assessment.

10A.8.5 It is anticipated that unacceptable linkages can be mitigated through appropriate design of the proposed development as well as environmental management plans, risk assessments, method statements and health and safety plans for the works.

### Geotechnical

10A.8.6 The potential for Made Ground varies along the proposed route alignment, therefore, there remains a requirement to characterise the thickness and components of the Made Ground through a detailed ground investigation. The superficial deposits are also likely to vary significantly along the proposed route alignment, therefore the risk of both the Made Ground and superficial deposits to undergo differential settlement below structural foundations is high, unless a detailed ground investigation to characterise the material parameters is carried out.

10A.8.7 There is also significant risk from ground subsidence and void propagation associated with former coal mining and other historical workings along the proposed route alignment. This is considered to be a significant geotechnical risk to development. To understand these risks on a pylon-by-pylon basis, the thickness of any colliery spoil below each pylon footprint needs to be ascertained along with the depth of competent rock cover above any worked coal seam horizons.

10A.8.8 In addition to the above an understanding of the groundwater and ground gas regime at each pylon location needs to be understood to assess the short-term contractor human health risk during foundation excavation and the controlled waters risk that would be associated with any remedial grouting operations required.

10A.8.9 All structural foundation solutions adopted as part of the detailed Project design should be informed through site-specific ground investigations and where beneficial, geophysical surveys. This will allow a ground model to be developed and a numerical assessment of bearing capacity to confirm the foundation suitability.

## Recommendations

- 10A.8.10 A Draft Outline CoCP has been prepared for the Project to support the PEIR; this is presented as **Appendix 4A Draft Outline Code of Construction Practice** of the PEIR. The draft outline CoCP summarises the environmental mitigation and management measures that will be required during construction of the Project. The mitigation measures relevant to geology and hydrogeology are included in the Draft Outline CoCP as reference IDs GH01 to GH09.
- 10A.8.11 Draft Outline CoCP mitigation measure reference ID GH01 outlines the requirement for completion of a geo-environmental and geotechnical intrusive ground investigation in accordance with current best practice. This would be undertaken as part of the detailed pre-construction survey and the data obtained used for detailed design of the Project. Key objectives of the intrusive ground investigation are outlined below.
- 10A.8.12 The intrusive ground investigation would be designed to support the characterisation of the identified potential contamination sources (including ground gas and vapour) and the geotechnical ground and groundwater conditions. It is also recommended that information on groundwater conditions is obtained during post works monitoring to characterise the groundwater levels (including tidal influences) and the groundwater quality.
- 10A.8.13 The objectives of the ground investigation should be to:
- obtain information on the ground and groundwater conditions at proposed infrastructure locations;
  - characterise the key on-site potential sources of contamination and contaminant linkages that are considered to pose unacceptable risks to receptors (i.e. those that pose a moderate or higher risk);
  - characterise the composition and extent of landfills located at pylons 141 and 142;
  - investigate and geotechnically characterise the depth, nature and extent of any Made Ground, shallow mine workings, underlying superficial deposits and bedrock at the pylons, haul roads and construction compounds;
  - establish groundwater conditions (elevations and quality);
  - establish the ground gas regime and assess gas risks to future users at the proposed new Chesterfield Substation;
  - establish suitable geotechnical and geo-environmental design parameters, including a piling risk assessment as required, for the strata underlying the site;
  - inform human health and controlled waters Generic Quantitative Risk Assessment;
  - make recommendations for further Detailed Quantitative Risk Assessment (DQRA) and remediation strategies, if required; and
  - enable an appropriate foundation design solution to be developed for surface infrastructure.
- 10A.8.14 A Mining Remediation Authority permit will be required for any intrusive works proposed which are likely to encounter coal seams or be on or in the vicinity of a mine entry.

- 10A.8.15 Prior to undertaking ground investigation works the presence of utilities on the site should be established through a review of desk-based information and site survey. A UXO detailed desk study should also be undertaken by a specialist UXO consultant to confirm the potential UXO hazards identified in the UXO desk study and constraints assessment (Ref 10A.18) (as summarised in section 10.4 and contained within **Annex 10A.4**) and confirm the UXO hazard level along the proposed route alignment prior to the ground investigation.
- 10A.8.16 The new Chesterfield Substation is located within an area where potentially between 10 per cent and 30 per cent of properties are above the Action Level where full radon protection is required. It is recommended that a site-specific radon risk report is obtained from the BGS; this will further inform the risk level associated with radon.
- 10A.8.17 Once the site has been characterised following the ground investigation, further assessment such as DQRA, and remedial/mitigation measures may be recommended.
- 10A.8.18 As the design progresses, Foundation Works Risk Assessments will be required to understand the potential risks posed to controlled waters and recommend, if required, measures to mitigate the potential risks. This requirement is outlined in GH02 of the CoCP.
- 10A.8.19 The use of appropriate PPE during construction is outlined in GH03 of the CoCP.
- 10A.8.20 As the design of the Project progresses further understanding on the extent of earthworks required and potential for reuse of site won materials will be gained. In accordance with CL:AIRE guidance Definition of Waste: Code of Practice (Ref 10A.30), a Materials Management Plan will be required should site won materials be reused on-site. This requirement is summarised in GH05 of the draft outline CoCP.
- 10A.8.21 As part of the design and prior to construction, engagement with both the local authority and Mining Remediation Authority is recommended; this is summarised in the **Draft Outline CoCP**, Ref ID GH08.

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# **Annex 10A.1**

## **Figures – Available Upon Request**

# **Annex 10A.2 Groundsure Reports – Available Upon Request**

**Annex 10A.3  
The Mining  
Remediation  
Authority Consultants  
Coal Mining Reports –  
Available Upon  
Request**

**Annex 10A.4  
Zetica UXO Desk  
Study and  
Constraints  
Assessment –  
Available Upon  
Request**

**Annex 10A.5  
Qualitative Risk  
Assessment and CSM  
Methodology –  
Available Upon  
Request**

**Annex 10A.6  
Site Photographs –  
Available Upon  
Request**

**Annex 10A.7  
BGS Borehole  
Records – Available  
Upon Request**

**Annex 10A.8  
Consultation  
Responses –  
Available Upon  
Request**

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