

13. Ground Conditions and Contamination

Introduction

- 13.1 This Chapter reports the outcome of the assessment of likely significant environmental effects arising from the Project for Assessment in relation to Ground Conditions and Contamination. It also reports the likely significant environmental effects associated with the Proposed Scheme, which comprises the planning application.
- 13.2 The Chapter describes the technical consultation that has been undertaken during the EIA, the scope of the assessment and assessment methodology, and a summary of the baseline information that has informed the assessment.
- 13.3 In line with **Chapter 2: Approach to EIA**, the assessment reports on the likely significant environmental effects, the further mitigation measures required to prevent, reduce or offset any significant adverse effects, or further enhance beneficial effects. The conclusions are provided both in terms of the residual effects and whether these are considered significant. The assessment of effects takes into consideration both primary and tertiary mitigation (see **Chapter 2: Approach to EIA** for further details) and is informed by the EIA Scoping process (**Appendix 2.1 – 2.2**) and iterative scoping process where applicable.
- 13.4 This Chapter, and its associated **Figures 13.1 – 13.5** and the Geo-environmental and Geotechnical Desk Study and Coal Mining Risk Assessment Report (**Appendix 13.1**), are intended to be read as part of the wider ES with particular reference to the introductory Chapters of this ES (**Chapters 1 – 6**), as well as **Chapter 12: Hydrology, Flood Risk and Water Quality**, **Chapter 14: Archaeology**, and **Chapter 15: Built Heritage**.
- 13.5 In addition, this Chapter should be read in conjunction with **Chapter 19: Assessment of Cumulative Effects**.

Summary of Consultation

- 13.6 **Table 13.1** provides an overview of the consultation that has been undertaken to inform the EIA, including the consideration of likely significant effects and the methodology for assessment.

Table 13.1: Summary of Consultation

Body/ Organisation	Contact	Date/Form of Consultation	Summary of Consultation Outputs
Coal Authority (name changed to Mining Remediation Authority (MRA) on 28 th	Geotechnical and Development Manager	19 th July 2024, Teams meeting	A meeting was held with the MRA regarding the mine workings and mine shafts. The MRA’s position is that mine shafts should not be built over unless a justifiable reason as to why they should be built over, can be provided.

Body/ Organisation	Contact	Date/Form of Consultation	Summary of Consultation Outputs
November 2024)			They suggested an increased area for geophysical surveys, to potentially locate unrecorded mine shafts / presence of bell pits. This has been incorporated into the pending preliminary ground investigation specification, albeit this does not inform this Chapter. Given the identified presence of mine workings on-site, the MRA will expect mine gas to be assessed. Obtaining initial data for ground gas assessment is also part of the pending preliminary ground investigation specification.
		3 rd October 2024, Teams meeting	In the meeting, Turley provided an overview of the planning status and requirements to assume build over based on the need for flexibility for the outline planning application. The MRA confirmed their general position regarding mineshafts which is to avoid building over them wherever possible (in accordance with their Position Statement). It was concluded that if a strong justification to maintain flexibility to build over mine entries was put forward as part of the planning application, then the MRA would be relatively comfortable as long as this was supported by a robust strategy to mitigate the risks. The build over strategy has been provided as part of the Planning Statement. MRA will expect the outline application to be subject to a planning condition requiring a detailed ground investigation to address unknown coal mining risks so that mitigation can be designed accordingly.
		7 th November 2024 Consultation Response to EIA Scoping Report	The response dated the 7th November 2024 from the MRA indicates that they concur there are risks posed by shallow mining and potential collapse of mine entries which will need to be addressed. This is fully addressed in this Chapter. They also confirm their position that building over mine entries should be

Body/ Organisation	Contact	Date/Form of Consultation	Summary of Consultation Outputs
			avoided wherever possible. Please refer to the Planning Statement .
Rochdale Borough Council (RBC)	Environmental Health Senior Officer (who has since left RBC)	6 th August 2024, Teams meeting	RBC's view was that the risk of significant contamination is low given the historic and current agricultural land use. The Application will likely receive typical conditions regarding contamination, such as submission of more detailed targeted ground investigation reports as well as a remediation strategy (if required following ground investigation and assessment), remediation verification (if required) and unexpected contamination clauses.
Bury Council (BC)	Environmental Protection	5 th November 2024, Teams meeting	The meeting was between Tetra Tech and BC with the following being discussed: • BC advised that RBC have posted an advert for the position of Contaminated Land Officer with a possible start date being March – May 2025. BC may be asked to be involved for the whole area due to resourcing in the interim. • BC requested that the drawings relating to ground conditions in the desk study and ES, in particular both constraints plans, show the Bury / RBC boundary. This has been completed on Figures 13.1 – 13.5. • BC requested the Desk Study. Tetra Tech advised that this would be provided. • BC asked Tetra Tech to check that the Desk Study adequately assesses radon due to levels being elevated for housing in 10 – 30% of cases locally. This matter is addressed within the desk study (Appendix 13.1). • BC asked Tetra Tech to check we have a note on unrecorded tipping. This matter is included in the desk study (Appendix 13.1). • BC asked whether an Materials Management Plan (MMP) will be

Body/ Organisation	Contact	Date/Form of Consultation	Summary of Consultation Outputs
			produced for the Proposed Scheme. Tetra Tech confirmed that it would, potentially by the contractor, when the cut/fill and earthworks requirements are known.
BC	Environmental Protection	11 th November 2024 Consultation Response to EIA Scoping Report	BC state that the scoping assessment concludes that the potential risk of mining and ground collapse was an effect likely / significant during construction and operation in the identified area of Assessment Boundary and that this should be carried forward to the ES. They state that the assessment is satisfactory in concluding that the below are considered to have an unlikely or not significant effect: • Potential Risk of Exposure to Contamination; • Potential Risks from the Release/Migration of Contamination to Controlled Waters; • Potential Risks from Ground, Landfill and Mine Gas to Human Health and the Built Environment; and • Potential Risks from the Presence of Unstable and Compressible Ground (non-mining related) on Human Health and the Built Environment. BC state that any risks identified from the above aspects are likely to be mitigated during construction by Remedial Actions that may have been identified following site investigation and risk assessment undertaken during subsequent planning applications. The following planning conditions may be recommended: • CL01 – Site Characterisation and Risk Assessment; • CL02 – Remediation Strategy and Verification;

Body/ Organisation	Contact	Date/Form of Consultation	Summary of Consultation Outputs
			• CL03- Remediation and Verification; • CL04 – Unexpected Contamination; and • CL05 – Imported Soil.
Environment Agency (EA)	Green Growth Team	12 Nov 2025	Effects of contamination to controlled waters. Potential for contamination will be dealt with through Phase 1 (Appendix 13.1) and subsequent remedial actions that may have been identified following site investigation and risk assessment undertaken (as detailed above).

Scope of the Assessment

13.7 An EIA Scoping Report was submitted to BC and RBC on 17th October 2024, as presented as **Appendix 2.1**. A Scoping Opinion has not been received to date; however a number of consultation responses have been received and are provided in **Appendix 2.2**. A response to the comments in **Appendix 2.2** are provided in **Appendix 2.3**. This section provides an update on the scope of the assessment presented within this Chapter following submission of the EIA Scoping Report.

Effects Not Considered to be Significant

13.8 The following effects were not considered significant as part of the EIA Scoping Report (**Appendix 2.1**) and are not considered further in this Chapter:

- Potential Risk of Exposure to Contamination;
- Potential Risks from the Release/Migration of Contamination to Controlled Waters;
- Potential Risks from Ground, Landfill and Mine Gas to Human Health and the Built Environment; and
- Potential Risks from the Presence of Unstable and Compressible Ground (non-mining related) on Human Health and the Built Environment.

13.9 Whilst the above effects are not considered to be significant; a risk assessment of the potential risks to identified receptors has been undertaken using the CIRIA C552 methodology and is presented in **Appendix 13.1** Potential effects / risks are controlled though tertiary mitigation measures as detailed in **Chapters 4 and 5** and **Volume 3: Environmental Management Plan** and are considered to be as low as reasonably practicable.

Effects Considered Likely to be Significant

13.10 The following effects (**Table 13.2**) were considered likely to be significant and are reported within this Chapter:

Table 13.2: Effects Considered Likely to be Significant

Likely Significant Effect	Receptor(s)	Applicable Development Stage	Spatial Zone
Potential risk of mining and ground collapse	Existing and proposed buildings (commercial and residential) and infrastructure Construction workers	Construction	A, B, C, D, F, AA, AAA and BBB

- 13.11 The spatial zones identified for assessment have been amended following review of further baseline information (as detailed under *Baseline Conditions*).
- 13.12 It should be noted that although likely significant effects during the operational stage were identified as part of the EIA Scoping Report (**Appendix 2.1**), however, these will be mitigated during construction, i.e. the same risks will not be present during the operational stage. Therefore, the assessment of construction related effects is considered to comprehensively assess all likely significant impacts.

Assessment Methodology

Legislative Framework, Policy and Guidance

- 13.13 There is no relevant legislation or policy for the assessment presented within this Chapter.
- 13.14 The following guidance has informed the assessment of effects within this Chapter:
- CIRIA C758D Abandoned Mine Workings Manual (C758D) 2019¹;
 - MRA Policy for Building Over or Within the Influencing Distance of a Mine Entry (2012)²;
 - CIRIA C665 Assessing risks posed by hazardous ground gases to buildings 2007³; and
 - BS EN 1997-2:2007, Eurocode 7 Geotechnical Design – Ground Investigation and Testing.

Defining the Study Area

- 13.15 The study area comprises the Assessment Boundary, defined by the blue line shown on **Figure 1.1**. The assessment of the study area results in the conclusion that only Plots A, B, C, D, AA, AAA, BBB, have the potential to be impacted by coal mining (**Figure 13.1**). Application Plots A, B, C and D lie within the Application Boundary, with Plots AA, AAA, BBB falling within the wider Assessment Boundary shown on **Figure 1.2**.
- 13.16 The Geo-environmental and Geotechnical Desk Study and Coal Mining Risk Assessment Report (**Appendix 13.1**) assesses this Assessment Boundary and also considers relevant sources outside of the Assessment Boundary as part of the assessment.

Background Studies to Inform the ES / Establishing the Baseline

13.17 **Table 13.3** summarises all studies undertaken to inform the assessment presented within this Chapter.

Table 13.3: Background Studies

Study / Survey / Analysis / Evaluation	Overview	Date of Completion
Geo-environmental and Geotechnical Desk Study and Coal Mining Risk Assessment Report (Appendix 13.1)	Desk Based Assessment of geological, hydrogeological, contaminated land, geotechnical risks, coal mining and potential pollutant risk. Based on the Assessment Boundary.	February 2025

Assessment Process

- 13.18 No Coal Authority Abandonment plans were available, however, BGS records of the National Coal Board's Opencast prospecting works were reviewed within the Geo-environmental and Geotechnical Desk Study and Coal Mining Risk Assessment Report (**Appendix 13.1**), which identified previously unrecorded mine workings, confirmed the location of two mine entries, and potentially a previously unrecorded location. The investigation identified shallow mine workings underlying the Site from 3.20m bgl to 57.70m bgl within Application Plots A, B, C and D. The BGS boreholes did not record any mine workings within Application Plot F and Assessment Plots AA, AAA and BBB. No boreholes were undertaken with BBB.
- 13.19 The information gathered for the Coal Mining Risk Assessment of the works was used to evaluate the level of risk presented to the Project for Assessment in line with CIRIA C758D which in turn has been used to produce a scope of works for ground investigation within the Application Boundary. This has been agreed following consultation with the Mining Remediation Authority and will be conditioned as part of the planning application. The Coal Mining Risk Assessment is detailed as part of the Geo-environmental and Geotechnical Desk Study and Coal Mining Risk Assessment Report (**Appendix 13.1**).
- 13.20 A site walkover was undertaken as part of the desk study works to assess whether there was any existing evidence of coal mining features within the Assessment Boundary.
- 13.21 The above was used to determine the Baseline Conditions described below.

Reporting of the Environmental Effects and Significance Criteria

- 13.22 The assessment of likely significant environmental effects as a result of the Project for Assessment has taken into account the construction and operational stage. The following sections define the approach adopted within the assessment for the determination of sensitivity (or value/importance), magnitude of change (or impact), the level of effect and significance.

Determining Sensitivity of Receptor

- 13.23 The sensitivity of affected receptors has been considered on a scale of **high, medium, low** or **Negligible** as described in **Table 13.4**.

Table 13.4: Sensitivity Criteria

Category	Criteria
High	Residential Properties, Schools, Community Facilities, Workers / Visitors
Medium	Commercial and Industrial Properties
Low	Highways Infrastructure and Public Open Space
Negligible	Agricultural Land

Determining the Magnitude of Change

- 13.24 The magnitude of change has been considered as the change experienced from the current baseline conditions at the sensitive receptor and has been considered on a scale of **large**, **medium**, **small** or **negligible** as described in **Table 13.5**.

Table 13.5: Magnitude of change (or Impact) Criteria

Category	Criteria
Large	Catastrophic damage to buildings, structures and / loss of human life; or land which would prevent use / remove integrity. This would be likely in the short-term and almost inevitable over the long-term
Medium	Damage to buildings, structures and / or land which would affect the use / integrity. This would not be inevitable but possible in the short-term and likely over the long-term
Small	Limited damage to buildings, structures or land which would not affect the use / integrity. This would not be inevitable in the long-term and is less likely in the short-term
Negligible	Minimal damage to buildings, structures and / or land which would not affect the use / integrity. This would be improbable

Determining the Level of Effect

- 13.25 The level of effect has been informed by the magnitude of change due to the Project for Assessment and the evaluation of the sensitivity of the affected receptor. The level of effect has been determined using professional judgement and **Table 13.6** has been a tool which has assisted with this process.
- 13.26 Whilst **Table 13.6** provides ranges, the level of effect is confirmed as a single level and not a range, informed by professional judgement. For each effect, it has been concluded whether the effect is '*beneficial*' or '*adverse*'.

Table 13.6: Matrix to Support Determining the Level of Effect

Magnitude of change (or impact)	Sensitivity (or value, importance, etc.)				
		High	Medium	Low	Negligible
	Large	Major	Moderate to Major	Minor to Moderate	Negligible
	Medium	Moderate to Major	Moderate	Minor	Negligible
	Small	Minor to Moderate	Minor	Negligible to Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

13.27 The following terms have been used to define the level of the effects identified and these can be 'beneficial' or 'adverse':

- **Major effect:** where the Project for Assessment / Proposed Scheme is likely to cause a considerable change from the baseline conditions and the receptor has limited adaptability, tolerance or recoverability or is of the highest sensitivity;
- **Moderate effect:** where the Project for Assessment / Proposed Scheme is likely to cause either a considerable change from the baseline conditions at a receptor which has a degree of adaptability, tolerance or recoverability or a less than considerable change at a receptor that has limited adaptability, tolerance or recoverability;
- **Minor effect:** where the Project for Assessment / Proposed Scheme is likely to cause a small, but noticeable change from the baseline conditions on a receptor which has limited adaptability, tolerance or recoverability or is of the highest sensitivity; or where the Proposed Scheme is likely to cause a considerable change from the baseline conditions at a receptor which can adapt, is tolerant of the change or/and can recover from the change; and
- **Negligible:** where the Project for Assessment / Proposed Scheme is unlikely to cause a noticeable change at a receptor, despite its level of sensitivity or there is a considerable change at a receptor which is not considered sensitive to a change.

13.28 The duration of the effect has been assessed as either 'short-term', 'medium-term' or 'long-term'. Short-term is considered to be up to 1 year, medium-term is considered to be between 1 and 10 years and long-term is considered to be greater than 10 years.

Determining Significance

13.29 For each effect, a statement has been made as to whether the level of effect is '**Significant**' or '**Not Significant**'. This determination has been based on professional judgement and/or relevant guidance/legislation where applicable.

13.30 Significance has only been concluded for residual effects (i.e. following the identification of secondary mitigation).

Baseline Conditions

Historic mapping

- 13.31 The historical mapping reviewed indicates that the land with the Assessment Boundary has been primarily in agricultural use since at least 1848 with farmsteads, ponds and multiple sand/sandstone, gravel quarries recorded across the area. There is one reference to coal mining recorded on the mapping within Application Plot A from 1848 around Coal Pits Farm, though there are no records about the type of mining undertaken or details about the present condition.

Geology

- 13.32 The geology, as defined by the BGS Geoindex viewer, of the Assessment Boundary is shown on **Figure 13.2**, which describes Made Ground as 'infilled ground' and 'worked ground'. The Made Ground identified by the BGS relates to the infilled sand and gravel pit in Application Plot D. It is anticipated that further Made Ground is present across the Assessment Boundary though unrecorded by the BGS.
- 13.33 The Groundsure reports indicate that worked ground is recorded along the southern boundary of Application Plot D and Assessment Plots CC, DD and BBB associated with the M62 within the Application Boundary as well as being present along the western boundary of Assessment Plots EE and FF associated with the M66. Whilst Made Ground is not recorded, in Infrastructure Area CCC for South Heywood, it is known to be present associated with the former landfill.
- 13.34 The superficial strata are described as being glacial, primarily of Till across the Assessment Boundary and Application Boundary with:
- Glaciofluvial deposits of sand and gravel, recorded within Application Plot D and Assessment Plot BB;
 - Head deposits of clay, silt, sand and gravel are present along Brightley Brook, Application Plots A, B, D and Infrastructure Areas AAA, AAAA as well as Whittle Brook along the boundary of Application Plot D and Assessment Plots DD and FF; and
 - Lacustrine deposits of sand and gravel are present within Application Plot F and Assessment Plots AA, BB and Infrastructure Area CCC.
- 13.35 The BGS opencast prospecting boreholes indicate that the superficial strata are variable across the Assessment Boundary and extend to depths of:
- Application Plot A, up to 4.30 metres below ground level (m bgl);
 - Application Plot B, up to 5.40m bgl;
 - Application Plot C, up to 12.00m bgl;
 - Application Plot D, the superficial strata vary around Higher Barn Farm, extending to depths of up to 5.80m bgl in the northeast, up to 9.40m bgl in the northwest, up to 25.00m bgl in the southeast, and up to 31.70m bgl in the southwest;
 - Application Plot F, up to 7.10m bgl;

- Assessment Plot AA, up to 7.10m bgl; and
 - Assessment Plot BB, up to 23.00m bgl.
- 13.36 In Application Plot D, the strata to the northeast of Higher Barn Farm typically extend to a depth of approximately 5.80m bgl. In this area two boreholes, Nos. 257 and 267, undertaken as part of the NCB Opencast Prospecting works indicated anomalous depths of soft strata. No. 257 was terminated at 14.00m bgl in “soft fill” and was considered by the supervising engineer to be a shaft. The borehole’s coordinates located it adjacent to Shaft 4 on **Figure 13.1**. Borehole 267, recorded superficial strata to an anomalous depth of 28.5m bgl, which may indicate an unrecorded shaft.
- 13.37 The historical borehole locations of the National Coal Board (NCB) opencast prospecting works are shown on **Figure 13.4**.
- 13.38 The bedrock strata are described as the Pennine Lower Coal Measures of mudstone, siltstone and sandstone across the majority of the Assessment Boundary and across all of the Application Boundary. The bedrock locally comprises the Rossendale Formation of Rough Rock and Rossendale Formation of sandstone within Application Plots A, B and Infrastructure Areas AAA and AAAA to the north.
- 13.39 Coal seams are recorded as outcropping and subcropping primarily within the Application Boundary within Application Plots A, B, C and D, though locally in Assessment Plot AA and Infrastructure Areas, AAA, CCC and AAAA, detailed on **Figure 13.1**. The seams are described as:
- Lower Mountain Coal Seam approximately 1.30m thick;
 - Bassey Coal Seam approximately 1.20m thick;
 - Subcrenatum Marine Band 0.15m thick; and
 - Sand Rock Coal Seam approximately 0.70m thick.
- 13.40 The historical BGS opencast prospecting boreholes do not record the depth of the Lower Mountain Coal and Bassey Coal Seams but they do record:
- The Subcrenatum Marine Band encountered at the shallowest depth of 4.60m bgl and a deepest depth of 52.65m bgl; and
 - The Sand Rock Coal Seam was encountered at the shallowest depth of 3.20m bgl and a deepest depth of 57.70m bgl.

Coal Mining

- 13.41 The MRA Interactive viewer indicated the Assessment Boundary fell within a Coal Mining Reporting Area with Application and Assessment Plots falling within Development High Risk Areas with respect to shallow coal. Application Plots A, B, C, D and F and Assessment Plot AA, and Infrastructure Areas AAA, BBB and CCC are shown to have Development High Risk Areas (**Figure 13.1**) across their boundaries.

- 13.42 Five mine shafts of unknown condition are shown as present (**Figure 13.1**), Shafts 1-4 are within Application Plot D though Shaft 5, falls outside of the Application Boundary. Therefore, a Coal Mining Risk Assessment was required and as such a Consultants Mining Report was obtained as part of the Geo-environmental and Geotechnical Desk Study and Coal Mining Risk Assessment Report (**Appendix 13.1**).
- 13.43 The report made reference to available abandonment plans for the Assessment Boundary and as such the MRA were contacted regarding the plans, though said they held none and passed the query onto the British Geological Survey (BGS). The BGS held records of the National Coal Board's Opencast prospecting works undertaken in the 1980s. These identify previously unrecorded mine workings, the location of two of the mine entries, and potentially a previously unrecorded location. The investigation identified shallow mine workings underlying the Assessment Boundary from 3.20m bgl to 57.70m bgl within Application Plots A, B, C and D with NCB boreholes undertaken in Application Plots A, B, C, D, F and Assessment Plots AA and BB though no further workings were identified in Application Plot F and Assessment Plots AA and BB.
- 13.44 A site walkover was undertaken as part of the desk study works. The walkover found no evidence of the recorded mine entries, Shafts 1 – 4 on **Figure 13.1**. Two locations were noted as being potential unrecorded mine entries found in Application Plot B and Application Plot D.
- 13.45 The coal seams recorded as outcropping and subcropping within the Application and Assessment Boundaries, are detailed by **Figure 13.1**. The seams are described as:
- Lower Mountain Coal Seam approximately 1.30m thick;
 - Bassey Coal Seam approximately 1.20m thick;
 - Subcrenatum Marine Band 0.15m thick; and
 - Sand Rock Coal Seam approximately 0.70m thick.
- 13.46 The historical BGS opencast prospecting boreholes do not record the depth of the Lower Mountain Coal and Bassey Coal Seams, though they do record:
- The Subcrenatum Marine Band was encountered from the shallowest depth of 4.60m bgl and a deepest depth of 52.65m bgl; and
 - The Sand Rock Coal Seam was encountered from the shallowest depth of 3.20m bgl and a deepest depth 57.70m bgl.
- 13.47 The BGS boreholes indicate that mine workings were recorded within the Sand Rock Coal Seam and impact the below Application Plots and are recorded on **Figure 13.1**:
- 3.20 – 8.90m bgl to the west of Coal Pits Farm (Application Plot B);
 - 10.83 – 20.90m bgl to the northeast of Higher Barn Farm (Application Plot D) and west of Higher Fields (Application Plot C);

- 23.20 – 29.70m bgl to the north and southeast of Higher Barn Farm (Application Plot D);
- 32.00 – 40.50m bgl to the northeast of Meadowcroft Fold (Application Plot D);
- 40.20 – 51.00m bgl to the northwest of Higher Barn Farm and north of Meadowcroft Fold (Application Plot D); and
- 56.70 – 57.70m bgl north of Meadowcroft fold (Application Plot D).

13.48 The only BGS boreholes undertaken in the Assessment Plots shown on **Figure 13.1**, are within Assessment Plots AA and BB and do not record any mine workings.

13.49 From data reviewed, Infrastructure Area CCC has been previously investigated as part of the South Heywood Application and indicated that mine workings were not recorded and therefore will not need to be assessed further.

13.50 Based on the findings of the above, Tetra Tech determined that Application Plots A, B, C and D are deemed to have a high risk from recorded and unrecorded mine entries as well as from shallow recorded and unrecorded mine workings.

Peat

13.51 Peat is recorded by the BGS interactive viewer across Assessment Plot EE and into Assessment Plot DD, **Figure 13.2**. There are no other areas of peat shown on the British Geological Survey online mapping. Tetra Tech was provided with two ground investigations reports, (1a. 2230520 - M60 Simister Island Interchange GIFR Logs, (Ian Farmers 2021) and CCG-C-23-14270, Ground Investigation at Unsworth Moss Farm, November, (CCG 2023)), which targeted the potential peat in these Assessment Plots. The reports identified traces of peaty material as a secondary constituent in four boreholes, (BH-N07, BH-N19, WS-N04 and WS-N04A) and peat is only recorded as pockets or traces as located by **Figure 13.5**.

13.52 There are some references to ‘traces of peat’ in the NCB boreholes in the northeast of the Assessment Boundary, (Assessment Plot BB) near Stock Nook Farm (BH 135 - 137) with one borehole (BH 137) describing a 1.15m thick presence of peat. However, this is from an openhole borehole record and as such was determined by chippings only and may be inaccurate. Similarly, in BH207, in Application Plot D, there is reference to a 2.50m thick ‘soft clay peat’, determined by openholing and which occurs in a low point onsite and as such is anticipated to be organic clay. As part of the initial ground investigation, described in Future Baseline, the location in Plot D will be reviewed and validated using ground investigation technique.

Future Baseline

13.53 In the absence of the Project for Assessment (or other planned development), it is anticipated that the baseline would experience limited change.

Primary and Tertiary Mitigation

Construction Stage

13.54 The following primary and tertiary mitigation which has been evaluated as part of the construction stage assessment is outlined in the table below. It is worth noting that those

which are relevant to the Proposed Scheme can be controlled through **Volume 3: Environmental Management Plan**, although those that apply to the Project for Assessment are a matter for when planning applications are made for those relevant areas.

Table 13.7: Primary and Tertiary Mitigation to Inform Assessment of Construction Effects

Mitigation	Relevant to	
	Project for Assessment	Proposed Scheme
Completion of ground investigation(s) to confirm all contamination and geotechnical risks. Where required, a Remedial Strategy will be prepared and agreed with Bury and Rochdale Councils. A verification report will then be prepared following the completion of remedial works, to be submitted to the councils.	✓ All Assessment Plots	✓ All Application Plots
Ground Investigation(s) targeting the areas of mine workings, recorded and potential unrecorded mine entries will be undertaken under a MRA Permit and in line with CIRIA C758D ¹ , Abandoned Mine Workings Manual guidance, to prove the extent and condition of them. Mine workings will be excavated or treated as required to mitigate risk to the development. The mitigation including any grouting specifications will be agreed with the MRA. Mine entries will be capped or excavated as required to mitigate risk to the development. The mine stabilisation works will be designed in consultation with the MRA and in a manner so as not to create any environmental impact to controlled waters or the adjacent properties (including addressing any gas risk). Further detail is provided below under Ground Investigation for the Proposed Scheme.	✓ Assessment Plots AA, AAA and BBB.	✓ Application Plots A, B, C, D and F.

- 13.55 For the Proposed Scheme, the works will be managed under pre-commencement condition such that all mine workings and mineshafts are investigated and appropriately mitigated to address the risks to the development within the Proposed Scheme. This is detailed below.

- 13.56 It is assumed that the same or similar mitigation will apply to the Project for Assessment, although this is a matter for when planning applications are made for those relevant areas. The coal mining risk associated with Assessment Plots AA and Infrastructure Areas, AAA and BBB will be investigated in later phases of ground Investigation and are expected to be conditioned as part of future application. This is likely to include ground investigation works comprising rotary open hole and cored boreholes only, as the risk is considered to be from potential unrecorded mine workings only.

Ground Investigation for the Proposed Scheme (Application Plots A, B, C, D and F)

- 13.57 The first phase of future Ground Investigation will be preliminary and is looking to review the potential for significant coal mining effects, in Application Plots A, B, C, D and F. This will be likely carried out in phases as the development progresses, with further works required to obtain more detailed information by Plot as needed.
- 13.58 The Geo-environmental and Geotechnical Desk Study and Coal Mining Risk Assessment Report is included as **Appendix 13.1**. The desk study refers to the National Coal Board Investigation of Pilsworth Opencast prospecting boreholes which comprised over 200 boreholes to locate potential shallow coal seams. The available ground investigation exploratory holes have been overlaid onto **Figure 13.4**. These boreholes, as well as existing BGS borehole data, have been used to inform the design of the first phase of ground investigation for the Proposed Scheme, which is expected to be undertaken in 2025. The ground investigation will provide characterisation information for the Proposed Scheme which includes Application Plots A, B, C D and F.
- 13.59 The initial phase of ground investigation will be undertaken primarily on the Proposed Scheme, Application Plots A to F and will generate an overall ground model. The Proposed Scheme will be target:
- Areas of anticipated contamination;
 - Determining the extent of the shallow mining;
 - Determining the condition and location of the recorded mineshafts;
 - Identifying unrecorded mineshafts;
 - Assessing ground gas associated with mining features and infilled ground;
 - Identifying locations of backfilled quarries and nature of the fill; and
 - Obtaining a general spread of exploratory hole locations across the Proposed Scheme to develop a general ground model which will inform constraints assessments and cut and fill modelling.

Ground Investigation for Mine Workings

- 13.60 The extent of the identified mine workings shown on **Figure 13.1**, Application Plots A, B, C, D and F will be investigated by undertaking rotary boreholes using both open hole and sampling (dynamic / coring) methodologies in order to investigate the bedrock strata. The open hole boreholes will extend below the recorded workings to confirm the presence of solid bedrock beneath. These boreholes will be constructed to approximately 5.00m beneath the depth of the recorded mine workings described by **Figure 13.1** and therefore are

expected to extend to depths of between 15.00m and 65.00m bgl, the depth to workings being greater in the southwest of the worked area. This will inform the mitigation requirements for the Proposed Scheme. The rotary cored boreholes will include disturbed and undisturbed (U100) sampling of the superficial and weathered bedrock strata with in-situ testing (Standard Penetration tests) as well as coring of the bedrock strata to obtain samples for geotechnical and chemical tests. This will facilitate the development of an initial ground model. The rotary boreholes will be installed with a standpipe to monitor gas and groundwater within the workings where present. Once the proposed development for each Application Plot is known, further ground investigation will be required for the specific development to facilitate detailed design in line with BS EN 1997-2:2007, Eurocode 7 Geotechnical Design – Ground Investigation and Testing⁵ and CIRIA C758D Abandoned Mine Workings Manual February 2018¹.

Ground Investigation to Locate Recorded and Unrecorded Mine Entries

- 13.61 Geophysical surveys will be undertaken across Application Plot D where the four recorded mine entries are, as well as a fifth potentially unrecorded mine entry, borehole 267 **Figure 13.4**. The works will be undertaken using electromagnetic conductivity and magnetometry and will aim to locate both recorded and unrecorded mine entries, identified by anomalous readings in the data and then will be plotted onto a plan. Following completion of the survey works, anomalous results will be investigated using an excavator which will dig out and expose the anomalous locations in order to confirm the presence or absence of mine entries.

Ground Investigation (Non-mining)

- 13.62 Cable Percussion boreholes will be undertaken across Application Plots and will including disturbed and undisturbed (U100) sampling of the superficial/weathered bedrock strata with *insitu* testing (Standard Penetration tests) to obtain samples for geotechnical and chemical tests. This will facilitate the development of an initial ground model. The cable percussion boreholes will be installed with standpipes to monitor groundwater levels within the superficial strata and bedrock as appropriate and to monitor for ground gas. Once the proposed development for each Assessment and Application Plot is known, further ground investigation will be required for the specific development in line with Land Contamination risk management (LCRM) ; BS 10175; BS EN 1997-2:2007, Eurocode 7 Geotechnical Design – Ground Investigation and Testing and CIRIA C758D Abandoned Mine Workings Manual February 2018¹.
- 13.63 Consultation with the MRA will be undertaken as part of the ground investigation and an MRA permit will be obtained and safe drilling and excavation practices will be adhered to.

Reporting and Assessment

- 13.64 The ground investigation undertaken within the Proposed Scheme, will be presented in a factual report and assessed and interpreted an interpretative Report.
- 13.65 The factual report will present all factual data including:
- borehole and trial pit logs;
 - geophysical results;
 - chemical and geotechnical laboratory test results;
 - photographs from the site works; and

- gas and groundwater monitoring results.

13.66 The interpretative report will include the following:

- A detailed review of the ground conditions identified during the ground investigation and incorporating the historical borehole data;
- A detailed review of groundwater level data obtained;
- Production of an initial geological model including cross sections;
- Review of all data relating to mineworkings and mine entries and a refined Coal Mining Risk Assessment;
- High level geotechnical consideration of foundations and cut and fill earthworks based upon the masterplan and cut/fill modelling which are current at the time of writing the report;
- A review of all geotechnical information to produce an updated geotechnical risk register;
- Updated conceptual site model for contamination sources, pathways and receptors;
- Assessment of site and chemical lab data to produce an updated contamination risk assessment Generic Tier 1 contaminant screening;
- Updated contamination risk assessment;
- High level consideration of contamination remediation requirements (not a remediation strategy); and
- Recommendations for next steps.

13.67 The refined Coal Mining Risk Assessment will assess the findings of the rotary boreholes, geophysical surveys and trial pitting. The Coal Mining Risk Assessment will confirm the location of the mine workings, the depth and condition of them as well as the location of mine entries encountered during the geophysical and trial pitting investigations. The zone of influence of each mine entry will be calculated based upon the ground investigation data. This information will then inform the mitigation measures (see below). Further boreholes and geophysical surveys may be required for the Application Plots once the development has been confirmed.

Mitigation

13.68 As per the ground investigations; it is assumed that the same or similar following mitigation will apply to the wider Project for Assessment, however this is a matter for when planning applications are made for those relevant areas.

Cut and fill

13.69 In order to create the development platform there will be a requirement for cut and fill earthworks schemes which will take place across the Application Boundary informed by the findings of the ground investigation works. These earthworks, required for the development,

may remove some of the located mine entries and workings thereby mitigating the Coal Mining Risk to the Proposed Scheme. The mitigation works would need to be designed based off appropriate ground investigation for the affected Plots before being submitted to and agreed with the MRA before the works could be undertaken under a MRA permit as an asset is being removed.

- 13.70 A site strip is also expected to be required across the Application Plots (even where filling to raise levels is proposed) which will enable identification of any remaining previously unidentified mine entries. A site strip will likely be undertaken.

Construction over Mine Entries

- 13.71 The MRA policy regarding mine entries² is to avoid building over the mine entry or within its influencing wherever possible. At this stage, as detailed as part of the **Planning Statement**, flexibility is to be maintained to enable construction over a mine entry to enable development to come forward. Nonetheless, construction over mine entries will be avoided where possible.

Mine Entry Treatment

- 13.72 The minimum requirement placed upon the owner of an abandoned mine entry, is to make sure that it is securely enclosed to prevent accident entry as well as the legal requirement in respect of maintaining security, maintenance and inspections. If construction over mine entries is essential to facilitate the development, suitable engineering design to be developed considering safety and environmental risk factors included risks from mine gas and mine water. Approval of the design and works will be obtained from the MRA prior to construction and will consider the following in line with CIRIA C758D¹:

- Whether construction over the mine entry can be avoided even with optimum engineering treatment;
- The potential collapse zone around a shaft will also be considered for treatment;
- Development / construction is located so that it is not within the potential collapse zone around an untreated mine entry and if it is to be then treatment measures should be considered; and
- Works will be undertaken in line with a MRA Permit and with cognisance of the mine entry owner.

- 13.73 The selected method of treatment will depend on the below as detailed in CIRIA C758D¹:

- Whether the feature will be later built over or buried;
- Any requirement for continued access and/or maintain a pathway for gas / groundwater as a controlled pathway;
- The number of treated mine entries in proximity to each other;
- Nature of the development; and
- Requirements of the MRA and other applicable regulators.

13.74 The minimum treatment related to situational risk for located features is detailed by Table 14.3 in CIRIA C758D¹ and includes the below types of mitigation. These will be informed by the ground investigation and chosen development and therefore situational risk as part of the Revised Coal Mining Risk Assessment for each relevant Plot/Area.

13.75 For Shafts:

- Fencing with a grille, geosynthetic membrane or mounded hardcore;
- Drill and Grout or use of bulk engineering-controlled fill material; and
- Installation of a ground bearing or piled concrete cap at rockhead.

13.76 For Adits:

- Fenced and bricked off with installation of drainage and bat letterbox;
- Move back entrance by excavating or repair entrance, install drainage; and
- Grout or bulk engineering-controlled fill material, install drainage.

13.77 Dependent on the situational risk it may be advisable to utilise a combination of these techniques in line with Table 14.3 from CIRIA.

Mine workings

13.78 The NCB boreholes described in the Desk Study¹ have identified that workings are present in Application Plots A, B, C and D. Mitigation of mine workings will comprise more detailed ground investigations of the impacted Application Plots A, B, C and D in order to determine the depth, nature and condition of them workings. Once the workings have located and depth known the workings will be treated by one of the four main engineering categories in line with CIRIA C758D¹. These comprise:

- Earthworks Solutions i.e. removal during cutting to reduce site levels;
- Drill and grout, by drilling new boreholes into the workings and injecting a cement grout into them to infill the residual void space left by the mining operations;
- Bulk filling underground and of surface industrial features; and
- Bridging techniques by hard or soft engineering such as raft foundations or geosynthetic mattresses.

13.79 The first two options listed above are the most likely to be implemented.

13.80 The design of the mitigation will be determined by an assessment of the parameters described by section 13.2.5 in CIRIA C758D¹ and requires a review of: factors relating to the mining circumstances, such as type of workings, depth, whether flooded etc; Factors relating to the development; and Factors relating to regulatory and reporting requirements, including MRA requirements etc. It also needs to consider what impacts the chosen scheme will have on mine gas, contaminated water as well as potential mine workings in underlying seams, causing collapse of the underlying workings once the grout load is added. Once these are known an appropriate mitigation specification will be produced which will detail how the

works will be undertaken and submitted to the MRA, and any other involved regulators, before the works are completed by a competent contractor.

- 13.81 Treatment of the mine workings and mine entries, as well as ground engineering, will help mitigate the flow of gas beneath the site by removing the pathway for mine gas through the workings and mine entries as well as fractured ground.

Foundations

- 13.82 It is anticipated that commercial buildings will be highly loaded structures founded on piles which will need to pass through the grouted, worked seams. Therefore, the competence of the strata below the worked seams will be assessed by ground investigation. The borehole depth needs to account for negative skin friction that could be accrued from disturbed strata. Foundation selection will require careful consideration, as areas of broken ground by void migration may influence foundations.

Operational Stage

- 13.83 No primary or tertiary mitigation has been identified as part of the operational stage.

Assessment of Effects, Secondary Mitigation and Residual Effects

Construction Stage

Potential risk of mining and ground collapse (Project for Assessment and Proposed Scheme)

- 13.84 As outlined above, the Project for Assessment is located within a Coal Mining Reporting Area and Development High Risk Areas are shown as crossing Application Plots A, B, C, D, F, Assessment Plots AA and Infrastructure Areas, AAA and BBB as well as known mine entries recorded by the MRA Interactive viewer. Further to this, mine workings were identified across Application Plots A, B, C and D as part of the BGS records for the NCB Opencast Prospecting Borehole works summarised above and described in detail in the Geo-environmental and Geotechnical Desk Study and Coal Mining Risk Assessment Report (**Appendix 13.1**). The locations of the NCB boreholes are shown by **Figure 13.4** and the extent of these workings are shown by **Figure 13.1** particularly across Application Plots A, B, C, D and F. Whilst the Plots/ Areas, AA, AAA and BBB, lay within a Coal Mining Reporting Area and Surface Coal Resource Area, no recorded mine entries are present, with the risk considered to be associated with unrecorded mine workings.
- 13.85 As the details of the phasing of the demolition and construction stage are not known, an assessment of all existing and proposed buildings has been considered as a worst case scenario during the construction stage.

Project for Assessment

- 13.86 The sensitivity of the commercial properties across the Assessment Boundary are considered to be medium. The sensitivity of the residential properties and construction workers are considered to be high and the sensitivity of the highways infrastructure is considered to be low. The magnitude of change is considered to be negligible following the primary and tertiary mitigation works undertaken at the construction stage and as detailed above. Therefore, there is likely to be a direct, permanent, long-term, beneficial effect which is considered to be negligible.

Proposed Scheme

13.87 The effects for commercial properties, residential properties, construction workers, and highways infrastructure is the same as that reported for the Project for Assessment.

Secondary Mitigation or Enhancement

13.88 No secondary mitigation or enhancement is required/has been identified.

Residual Effect

13.89 In the absence of secondary mitigation the residual effects for commercial properties, residential properties, construction workers and highways infrastructure is that same as that reported in the pre-mitigation scenario.

Significance

13.90 This effect is considered to be **Not Significant** for the Project for Assessment and the Proposed Scheme.

Limitations and Assumptions

13.91 To ensure transparency within the EIA process, the following limitations and assumptions have been identified.

- The information reviewed for the Assessment Plot CCC is that which is available on the RBC planning portal for application number 16/01399/HYBR.
- The ground investigation is expected to be undertaken during drier months in 2025 and therefore will not be submitted as part of the planning application.
- The findings of the preliminary ground investigation and any supplementary ground investigations or works required as part of any planning conditions will be incorporated into the CEMP such that an appropriate level of mitigation is provided.
- The preliminary ground investigation will be for the Proposed Scheme and as such does not include the Assessment Plots outside of the Application Boundary; and The Applicant does not have reliance on the existing historic ground Investigation works undertaken to date and as such will require further works in these areas.

Summary

13.92 **Table 13.9** provides a summary of the effects, receptors, residual effects and conclusions of significance considered within the Chapter, with reference to both the Project for Assessment and Proposed Scheme.

13.93 The table only provides a summary of the residual effects identified within the assessment. Details of all primary, secondary and tertiary mitigation that has been taken into account is summarised within **Volume 3: Environmental Management Plan**.

Table 13.8: Summary of Residual and Significant Effects for the Project for Assessment and Proposed Scheme

Effect	Receptor	Project for Assessment		Proposed Scheme	
		Residual Effect	Is the Effect Significant?	Residual Effect	Is the Effect Significant?
Construction Stage					
Potential risk of mining and ground collapse	Commercial Properties	Negligible Beneficial	NO	Negligible Beneficial	NO
	Residential Properties				
	Construction Workers				
	Highways Infrastructure				

References

¹ CIRIA, C758D (February 2019). Abandoned Mine Workings Manual.

² Mining Remediation Authority, (2012). Policy for Building Over or Within the Influencing Distance of a Mine Entry.

⁴ CIRIA C665, (December 2007). Assessing risks posed by hazardous ground gases to buildings.

⁵ BSI, (April 2007). BS EN 1997-2:2007, Eurocode 7 Geotechnical Design – Ground Investigation and Testing.