



SPECIFICATION FOR THE STABILISATION OF SHALLOW MINEWORKINGS, HOPWOOD HALL COLLEGE, ROCHDALE

TE1880-TE-00-XX-RP-GE-005-V02

VERSION 2.0

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FINAL

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APPENDICES

Appendix A - Drawings



**SPECIFICATION FOR THE STABILISATION OF
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1. INTRODUCTION

Tier Environmental was commissioned by Willmott Dixon Construction Ltd to undertake the following reports to assess the land underlying Hopwood Hall College, Rochdale.

- Phase 1 Preliminary Risk Assessment Report for Hopwood Hall College, Rochdale. (Report Ref TE1880-TE-00-XX-RP-GE-001-V01 dated 30th January 2025).
- Ground Investigation Report Hopwood Hall College, Rochdale. (Report Ref TE1880-TE-00-XX-RP-GE-002-V02 dated 3rd March 2025).
- Coal Mining Risk Assessment for Hopwood Hall College, Rochdale. (Report Ref TE1880-TE-00-XX-RP-GE-003-V01 dated 6th February 2025).

The Coal Mining Risk Assessment recommended a programme of proof drilling together with the provision for grouting beneath the proposed building, substation, sprinkler tank and attenuation tank footprints owing to the presence of potential shallow coal workings across the entire site area. It is recommended that the proof drilling operations are conducted underneath the building footprint on a primary grid of 6 m grid, with sufficient extension beyond proposed building footprints and utilities. It is understood that drainage will now comprise plastic pipework and gravel, which will be more tolerant of settlement and therefore will not require grouting beneath the proposed drainage route.

Treatment of shallow mine workings is required to mitigate the potential risk of ground instability. The purpose of this document is to detail the site and geological setting of the site to allow for the development of a suitable programme of grouting at the site and to provide a specification for these works are to take place.

This document has been written in general accordance with the following reference material:

- BS 5930:2020 'Code of Practice for Ground Investigations';
- ENV 1997-1:1994 Eurocode 7: Geotechnical Design – Part 1: General Rules;
- CIRIA C758 Construction Over Abandoned Mine Workings;
- BS EN 12715:2000 Execution of Special Geotechnical Work – Grouting; and,
- CIRIA C514 Grouting for Ground Engineering.

An intrusive and geophysical investigation was undertaken to assess the risk from historic coal mining activity within the commercial development. The investigations resulted in the following constraints associated with historic coal mining across the site:

- **Moderate / High** risk of unrecorded shallow mine workings;
- **Moderate** risk of unrecorded mine entries; and,
- **Low** risk associated with the unrecorded opencast coal workings.

Hazards associated with the drilling of relic coal workings stand to have severe consequences both during, e.g. initiation of collapses or forced migration of mine gases to nearby properties, and after, e.g. preferential pathways for the migration of mine gases, the works are completed and it is therefore recommended that reference is made to British Drilling Association's Code of Safety Drilling Practice.

This document comprises Version 2 of the Specification for Stabilisation of Shallow Mineworkings, which has been updated to reflect updates to the drainage proposals proposed for the site.



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1.1. Proposed Development

Under current proposals the development will comprise the partial demolition of the existing college buildings in the east of the site, with construction of the new proposed 4 No. storey college building in the north, a water tank and small ancillary building in the centre, and a substation in the northwest of the site. The remainder of the site will comprise car parking and soft landscaped areas, as presented in Appendix A.

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Throughout this document the term "Engineer" shall refer to the authorised representative of Tier. The term "Contractor" shall refer to the specialist Contractor tendering for the location and treatment of shallow workings and/or mine shafts, if encountered.



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2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview.

Site name	Hopwood Hall College
Site address	Hopwood Hall College, Rochdale Campus, St Mary's Gate, Rochdale OL12 6RY. A site location plan is included as Drawing No. TE1880-TE-00-XX-DR-GE-001-V01 within Appendix A.
National Grid Reference (NGR)	389299 413363
Approximate site area	1.75 ha
Site shape	The site is approximately triangular in shape
Current land use on the site	The site currently comprises a college with a building of several storeys (including a basement/undercroft) present in the east of the site, and an asphalt surfaced car park across the majority of the remainder of the site and a drop off lane present along the northern and western boundaries. It is understood that an interceptor is present in the northeastern corner of the car park/drop off lane. Metal fencing around 2m height is present at the northern and western extent of the car park, with a brick retaining wall of between approx. 1.00m and 2.00m height present at the northern boundary of the drop off lane, marking the site boundary with College Road. A second brick retaining wall is present at the south of the car park, separating the car park from the river embankment which lies approx. 1.00m to 2.00m below the car park. No cracks or visible signs of stress were visible on either of the retaining walls. Limited soft landscaped areas are present, including a small, sloped grass verge in the northwest of the site, a grassed embankment between the car park/college buildings and the river in the south of the site, and as a grassed terraced area to the northeast of the building, which steps down to the basement floor level. The basement/undercroft area is accessible from the car park and is understood to comprise storage, waste disposal areas (bins/skips) and a plant room. The plant room contains the heating infrastructure for the building, including 2 no. oil tanks, both of which are understood to no longer be used with one understood to have been emptied via tanker (but not decommissioned) in the past couple of years. These oil tanks are present within a separate concrete bunded room, only accessible via locked ladder access. From the limited viewpoint accessible during the walkover, no spills or leakages were observed. An electric substation is present in the northeast of the site, to the northwest of the existing college building. Underground services are known to be present beneath the site, including electricity, gas, water and drainage. There is limited surface water drainage around the car park area, observed only to be present at the car park boundaries. Vehicular access for deliveries and disabled parking is present from College Road close to the centre north of the site, leading to the drop off lane, a small parking area and the basement/undercroft access. An access road for the main car park is present in the northwest of the site, with a smaller car park present to the west of this access road. This smaller car park is understood to be let out and was not accessible during the ground investigation. During college opening hours, pedestrian access is freely available. A hedge of approximately 1m height is present surrounding the northeastern soft landscaped area, with limited shrubs present elsewhere around site. Mature trees are present in the far northwest of the site, surrounding the smaller car park (it is understood that development is to be undertaken in this area). It should be noted that the car park in the northwest of the site and the terraced soft landscaping in the east of the site was not accessible during the walkover and are unlikely to be accessible for any ground investigation.
Surrounding land uses	The site is set within a mixed commercial and residential area, with Rochdale Town centre located approximately 500m northeast of the site.
General topography and ground levels	The main car park area of the site is generally level at around 119m AOD. However, College Road to the north of the site lies between approx. the same level as the site in the northeast (120m AOD) rising to around 1.0m higher than the site in the northwest (120m AOD), separated from the site by a brick retaining wall. Similarly, in the south of the site the highest level of the grassed banks of the River Roch lies between 0.5m to 1.00m below the car park level at around 118m AOD, separated by a brick retaining wall. Site levels between the existing building and St. Mary's Gate also vary, with grassed terraces leading from road level (120m AOD) in the northeast to 116m AOD in the centre east and back up to 120m AOD in the southeast. Again, a brick and concrete retaining wall was present at the site boundary (this area was not accessible during the walkover).



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3. GROUND CONDITIONS SUMMARY

Hardstanding

Hardstanding comprising asphalt was encountered in the car park, access road, and footpaths across the site to depths between 0.05m and 0.35m bgl. A concrete slab was encountered across the footprint of the former building which occupied the present-day car park, comprising thicknesses between 0.21m and 0.47m.

Made Ground

Made Ground has been reported to a maximum depth of 6.50m bgl and was found to be thickest towards the southwest and central west of the site within the former infilled watercourse. Made Ground was found to comprise both granular and cohesive deposits, with a layer of suspected Pulverised Fuel Ash (PFA) identified across the site, thickest beneath the former building footprint within the present-day car park area.

Other anthropogenic materials encountered within the Made Ground include brick, concrete, sandstone, limestone, clinker/slag, plastic, metal, glass, timber, and occasional rebar.

Superficial Deposits

The Made Ground was found to be underlain by superficial deposits in some instances, comprising Alluvium (clay) and Glaciofluvial Deposits (silty sand).

Bedrock

The Made Ground and superficial deposits were found to be underlain at depths between 3.30m and 6.50m bgl by bedrock of the Pennine Lower Coal Measures, found to comprise mudstone with interbedded sandstone and siltstone.

Coal

Coal was reported at depths between 6m and 40m bgl within rotary boreholes, with evidence of probable workings within the Arley Mine seam. Specific coal seams encountered include:

- RH101: 30.30m to 30.80m bgl (0.50m thick, hard coal)
- CP104/RH102: 34.20m to 34.40m bgl (0.20m thick, possible coal/shale)
- RH103: 16.80m to 17.00m bgl (0.20m thick, coal flash), 29.00m to 29.30m bgl (0.20m thick, hard coal)

3.1. Coal Seams Encountered

A summary of the encountered intact coal seams encountered during all the known investigations for the site is given in Table 3.1.



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Table 3-1 Summary of Observed Coal Seams

Borehole ID	Depth of Top Coal Seam (m AOD)	Depth of Base Coal Seam (m AOD)	Thickness (m)	Observations/ Descriptions
RH101	89.22	88.72	0.5	Hard COAL
RH102 / CP104	85.44	85.24	0.2	Possible COAL / SHALE
RH103C	102.42	102.22	0.2	COAL Flash
RH103C	90.22	89.92	0.3	Hard COAL

3.2. Evidence of Potential Shallow Mineworkings

A summary of the evidence of potential shallow mineworkings is presented in Table 3.2

Table 3-2 Summary of Evidenced of Mineworkings

Borehole ID	Depth of Evidence (m AOD)	Observations / Drillers Notes
RH101	114.72-114.82	60% Flush return
RH101	110.52	Loss of flush
RH101	113.17-11.67	No flush return
RH101	105.20-101.22	Between no flush return and 10% flush return
RH101	85.02-84.52	Lost flush
RH101	99.72-99.52	Weak flush
RH103C	111.33-11.53	No recovery
RH103C	110.53-104.53	50% to 60% flush returns
RH103C	84.52-83.42	Lost flush. Easy drilling
RH102/CP104	110.64-103.14	50% flush return
RH103	113.22-112.98	Brownish grey, GRAVEL of sandstone(within bedrock) Lost flush)
RH103	112.72-112.71	Loss of flush. Core barrel stuck and loss of drill bit (possible cast iron obstruction)
RH103A	113.22-112.72	Loss of flush, drilling rods dropped by 0.50m bgl, core barrel sticking on possible cast iron. (Possible void)

3.3. Unrecorded Mine Entries

During investigations, no unrecorded mine shafts have been identified. However, due to the outcropping coal seam and the history of coal mining in the wider area, it is considered that there is a moderate risk of unrecorded shafts being present within the site boundary, as such:

- The developer should be aware of the risk of unrecorded shafts being present and be aware that any shaft found could result in construction delays, treatment (infilling and capping) and/or modifications to the intended layout.
- Inspections of all attenuation and service excavations should be undertaken where possible.



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3.4. Coal Mining Risk Assessment Summary

Historical unrecorded underground coal workings are potentially present based on evidence described within Table 3.2. The abandonment plans that relate to workings within the Arley Mine Seam indicate that the workings have been mined predominantly by the room and pillar method over 200 hundred years ago. When assessing the impact of risk associated with underground workings, it has been assumed that with the overburden pressure and the weakness of pillars formed from coal, that pillar failures in mines of this age are likely to have occurred by present times.

CIRIA Special Publication 32 (1984) and CIRIA C758D outlines that voids relating to coal extraction are unlikely to migrate more than 10 times seam thickness in bedrock. Whilst this 'rule of thumb' may be considered over-cautious in most circumstances, given the near impossibility in gathering enough data for numerical modeling techniques, it has been decided that it provides a reasonable assurance against surface subsidence at the site. When applying this method, the seam thickness has only been compared to bedrock cover. This assessment is designed to be conservative as an initial screen and may be revised with the findings of an exploratory investigation.

Table 3.2 above details the potential evidence for potential unrecorded mineworkings underlying the site. When these depths are compared against the expected depths of the Arley Mine Seam presented on drawing TE1880-TE-00-XX-DR-GE-016-V01 within Appendix A and Figure 8.1, it appears that in multiple locations the depths are similar. This indicates further that the evidence encountered is representative of mineworkings. Furthermore, the solid coal recovered was not as anticipated, implying the coal could have historically been removed.

Due to the nature of different types of evidence encountered (voids, loss of flush and weak strata) it is presumed that some of the encountered workings are collapsed whilst some are still intact. The presence of collapsed workings is expected given the workings are likely from pre 1820 (>200 years old). It is considered that the risk of unacceptable differential settlement is high in these areas.

As detailed in Table 3.2 above, there have been multiple observations within RH101, RH102, RH103, RH103A and RH103C indicate it is likely/possible, that there are shallow mineworkings present underlying the site. Due to the high risk associated with shallow mineworkings from crown hole collapse and large differential settlements, a precautionary approach must be undertaken if the presence of shallow mineworkings cannot be categorically ruled out. Taking into account the similar depth that the features were observed in the boreholes, the varying thickness and depth that coal was encountered in each borehole, the suspected metal obstruction within the bedrock, the void/drop in drill rods, the loss of flush, the areas of no recovery and very poor recovery, the similarity with assumed coal depths and evidence of workings, the highly fractured nature of this rock horizon and the shallow recorded coal seams, it is considered more likely than not that there are shallow unrecorded mineworkings present underlying the site.

As a precautionary measurement to avoid unacceptable total and differential settlements affecting the proposed development, it is therefore recommended that the building footprint, substation, sprinkler and attenuation tanks are stabilised by a series of drilling and grouting. These stabilisation works will be outlined in a Specification for the Stabilisation of Shallow Mineworkings document and submitted to the Coal Authority for approval for the necessary permit.

Local geological thickening, faulting and folding cannot be discounted so a risk remains of additional unrecorded coal seams underlying the site and therefore further potential unrecorded workings.



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4. SCOPE OF WORKS

4.1. Coal Authority Permits

Tier will be responsible for obtaining the relevant Coal Authority permit(s) for the proposed stabilisation works. Reference should be made to the previous permit obtained by Tier (Ref. 29084).

4.2. Excavation Inspections

Efforts should be made to inspect foundation and attenuation excavations by a suitably qualified geotechnical engineer to review any evidence for any unrecorded mine entries.

4.3. Grouting Operations

As detailed above, the key elements for consideration as part of the grouting operations are:

- The site lies within the Lancashire Coalfield;
- The geology dip angles generally vary between 3° and 4° due to folding and possibly secondary faulting;
- **Moderate / High** risk of unrecorded shallow mine workings;
- **Moderate** risk of unrecorded mine entries; and,
- **Low** risk associated with the unrecorded opencast coal workings.
- Proof bulk filling/grouting is required on 6m primary and possible off-set 6m secondary grid and tertiary grid (subject to drilling records and grout takes) under the building footprint and a 6m primary and possible off-set 6m secondary line and tertiary lines (subject to drilling records and grout takes) under attenuation. Full extent on grouting is on Tier Drawing TE1880-TE-00-XX-RP-GE-024-V06.

Preliminaries

The contractor is to submit site specific Health and Safety Plan, Risk Assessments and Operation Method Statements for the Grouting Operations, including all temporary works details for approval by Tier and the Developer.

Tier will be acting as the designer for grouting works.

Grouting Operations - Shallow Mine Workings (Coal)

The grouting operations will comprise bulk grouting beneath the proposed building footprints, external yard areas, energy entre, substation and service/utility corridors and are to be undertaken in accordance with the Grouting Specification (Section 5 of this document). At this stage, it is envisaged that the Grouting Programme will broadly comprise:

- Mobilisation to site.
- Installation of safety measures.
- Drilling and proof grouting on a Primary Grid of 6m, under building footprint and primary grid/line of 6m under attenuation.
- Drilling and grouting of Secondary Grid/ line dependent on findings of Primary Grid.



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- Drilling and grouting of a Tertiary Grid dependent on findings of Secondary Grid. This is likely to be localised where grout takes have been excessive, unable to maintain grout pressures and/or uncertainty remains.
- Validation of grouting operations, including testing of the grout.
- Demobilisation from site.

A total of approximately 108 No. proof grouting primary drill and grout holes are proposed for the development as shown on Tier Drawing Ref TE1880-TE-00-XX-RP-GE-024-V06 within Appendix A.

The primary holes will be drilled on a primary 6m grid under building footprint and substation, sprinkler tank and attenuation tank. Secondary centre holes will be drilled offset to the primary holes. Drilling and grouting of a tertiary grid may also be required, dependent on findings of the secondary grid. The tertiary grid is likely to be localised where grout takes have been excessive, unable to maintain grout pressures and/or uncertainty remains. The specific determination of what constitutes as excessive will be determined by the engineer. Tier will be responsible for determining if additional holes are required.

Proof drilling and grouting to between approximately 10m and 20m is considered sufficient, however this depth will be confirmed following the completion of the first drilled holes to verify that representative features (workings and or seam) have been encountered. The depth of drilling is likely to increase southwards through the site. As the works progress a review will be undertaken to assess reducing the depth of grouting to shallower depths if possible.

Casing is likely to be required in order to achieve sufficient socket into the bedrock deposits encountered at depths of between of 4m and 7m bgl to ensure that the pressurised grout is injected into the correct strata and not say, into the Made Ground.

The lower limit on the main grouting operations has been set at 20.0m below ground level. However, if a phased programme of works is undertaken within each unit, a reduction in grouting depth may be achievable depending on the findings of the stabilisation works. Tier will be responsible for determining if a reduction of depth is allowable.

Grout compositions and mixes have been designed in order to maintain a sufficient viscosity to infill voids (*bulk grouting*) and limit the potential for progressive collapses to occur within the workings with the strength characteristics of the grout mix a secondary consideration.

Grout will be injected in a bottom-up, ascending stage fashion from the base of the drill hole using a tremie pipe and employing the use of a packer (*if required*) to maintain sufficient injection pressures across each stage. Stages shall initially be set at 1.0m lengths to be increased, up to 2.5m lengths, at the discretion of the Engineer and subject to the findings of the initial drill hole. However, a top-down grouting system may be more favourable.

Grout pressures shall generally be low with an upper limit of the overburden pressure up to a maximum limit of 200kN/m².

Completion of the on-site grouting operations shall be confirmed once all primary drill holes (and any secondary and tertiary drill/grout holes) have been successfully drilled and grouted together with validation drill holes and a complete pack of drill and grout records have been supplied to the Engineer for approval. Completion of the contract shall be confirmed once the Contractor has submitted their Completion Report to the Engineer and approval of the works has been confirmed.



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Grouting Operations - Mine Entries

No recorded mine entries are shown to be present within the Site boundary. Due to the shallow coal potentially present underlying the site, it is considered possible that unrecorded entries may be present within the Site area that this report pertains too. If a suspected mine entry is encountered, the Engineer should be consulted to fully appraise the Health and Safety risk.

An investigation to determine the depth of the mine entry will be undertaken once a mine entry is discovered. If it is determined to be shallow (<5.5m depth) then it can be dug out and removed and replaced with suitable engineered site won granular deposits. If the mine entry is deeper, it will be drilled and proof grouted and then a suitably designed shaft cap will be placed above it.

Actions required if and where a mine entry is identified are included within the specification. If or where evidence of a mine entry is encountered, e.g. backfill, voiding or loose ground from shallow depths, the Contractor shall cease operations and inform the Engineer immediately.

4.4. Reporting

Once completed, the contractor is to submit a completion report for the stabilisation works, including copies of all records detailed in Section 5.6 of the Grouting Specification, and a Warranty for the works completed, exact details to be confirmed with successful Contractor during the appointment process.

4.5. Risk Assessments, Method Statements and Insurance Details

The contractor will be required to supply site specific risk assessments, method statements and insurance details for the stabilisation works.

Recommendations and supporting information provided herein are indicative and the contractor should satisfy themselves of the provision of suitable health and safety measures within their method statements.

Mine Gases

The relic shallow coal mine workings serve as potential repositories for mine gases to accumulate. Low levels of carbon dioxide, methane, carbon monoxide and low levels of oxygen were encountered during ground gas monitoring at the Site. The mining of coal deposits and subsequent abandoning of the workings may have given rise to the accumulation of carbon dioxide, carbon monoxide, methane and hydrogen sulphide. Notwithstanding the potential presence of mine gases within the workings, the use of water flush within the probe holes and subsequent grout injection will result in only limited displacement of these gases and therefore the risk presented to adjacent sites is considered to be **Low**.

The close monitoring of mine gases at the drill site should be undertaken as a matter of course and in accordance with the regulations with the Contractor making allowance for this within their Health and Safety Plan, Risk Assessments and Operation Method Statements. If and where evidence of elevated concentrations of mine gas are recorded at the drill/grout positions, then off-site mitigation/measurement may be considered at the discretion of the Engineer.

Current ground gas regime has been assessed by Tier as part of the recent ground investigation works. Results of that monitoring indicate that, in its current state, the site is currently assessed as CS1 – very low risk scenario for which ground gas protection measures are required.

Existing monitoring well infrastructure shall be maintained, fenced off and protected, wherever possible, to allow gas monitoring during and post grouting. If this is not feasible additional wells will be installed surrounding the grouting site. The extent of monitoring required and risk is greatly reduced due to the very low risk currently attributed to the site.



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If wells proposed to be maintained are damaged, the Engineer should be informed immediately.

Utility Mapping

The client is to provide relevant public utility suppliers service plans and/or a scan of the site utilities prior to commencement of any intrusive works.

Thereafter, the Contractor is to allow for confirming that the site is free from live services in the location of the exploratory holes or otherwise by use of appropriate equipment, such as CAT and genny, GPR or other appropriate surveys.

4.6. United Utilities

United Utilities should be contacted, and grouting operations should be discussed with them due to the water main that traverses the site, adjacent to the proposed grouting area. Risk and Method statements should be provided and include measures as to how grouting operations will avoid any UU infrastructure (angles boreholes etc).



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5. SPECIFICATION

5.1. Preliminaries

- 5.1.1. In this Specification the term "Engineer" shall refer to the authorised representative of Tier. The term "Contractor" shall refer to the specialist Contractor tendering for the location and treatment of shallow workings and/or mine entries, if encountered.
- 5.1.2. All work shall be carried out strictly in accordance with the "Treatment of Disused Mine Shafts and Adits" as issued by the NCB and CIRIA C758 "Construction over abandoned mine workings".
- 5.1.3. Before submitting their tender, the Contractor shall visit the site. The tender shall include any costs likely to be incurred in gaining access to the site with plant and materials including removing fencing and reinstating same at the completion of the work.
- 5.1.4. The Contractor shall note in their tender the necessity for removal of overhead wires or any other items likely to increase the cost of the work.
- 5.1.5. Any points not so noted and itemised, or cost details not included shall be deemed to be covered in the tender figure.
- 5.1.6. The Contractor shall comply in all respects with local bye-laws with particular regard to noise, smoke and parking for off-loading, etc.
- 5.1.7. The Contractor shall state in their tender the type and number of machines and drilling rigs he intends to use on site and their method of operation.
- 5.1.8. The conditions likely to be met on site shall be determined by the Contractor and it shall be their responsibility to provide suitable plant to cope with the ground conditions and changes in level. The cost of standing time caused by failure or inadequacy of plant shall not be recoverable under the contract.
- 5.1.9. At the time of tendering, the Contractor shall clearly state in detail, including size and amounts, the working or storage areas, water, power, access, labour or any other items he will require to be provided.
- 5.1.10. Any item not so noted shall be assumed to be covered in the tender figure.
- 5.1.11. The Contractor shall state in their tender the amount of notice he requires before beginning work. Any costs incurred by delays in beginning operations shall be borne by the Contractor.
- 5.1.12. Sufficient insurance cover against damage to persons or property shall be arranged by the Contractor and dated prior to the commencement on site by the Contractor and shall be maintained to cover the full period of the Contractor's legal liability.
- 5.1.13. The Contractor shall provide and erect adequate fencing around all excavations and shafts if they have been located. If deemed necessary by the Engineer, the Contractor shall provide a watchman together with all necessary equipment and accommodation on site.



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- 5.1.14. The Contractor shall carry out the works in a safe and competent manner and shall comply with the appropriate safety Regulations applicable to the site and nature of the ground encountered.
- 5.1.15. All safety procedures relevant to mine workings are to be adhered to and reference made to precautions to be taken as referred in Coal Authority document "The Treatment of Disused Mine Shafts and Adits".
- 5.1.16. Mine entries may potentially be encountered within the development. If encountered, the Contractor shall be responsible for arranging, where necessary, for a Coal Authority Surveyor to visit the site to determine that a disused mine entry has been located and that it has been securely fenced and to make the necessary tests for noxious gases.
- 5.1.17. The Contractor must allow a sum in their tender to cover the full cost of any standing involved while waiting for the Coal Authority to visit the site to determine that a mine entry has been found, and to test for noxious gases.
- 5.1.18. The contractor shall include for the provision of noxious gas detection equipment and equipment required on site to comply with the Coal Authority safety requirements (and permit requirements) for the duration of the contract.
- 5.1.19. The Contractor will be provided with all information available concerning services under the site. In some cases it may be necessary, at the discretion of the Contractor, to begin boring or excavations with a hand excavation to a depth of 1.20 metres, to avoid service or drainage runs. Any damage to such services or drains under the site shall be the responsibility of the Contractor and he shall ensure at the time of tendering that, should precautions be necessary, they are included in the tender.
- 5.1.20. The intrusive investigation indicates a moderate likelihood of mine entries on site within the development area. If encountered, the Contractor must be prepared to have to remove obstructions including old foundations when searching for mine entries and a rate must be included in the tender for clearing any such obstructions.
- 5.1.21. The Contractor shall provide the Engineer with two copies of a boring record detailing items required by the Engineer, for every hole bored, as the work proceeds. He shall also give the Engineer or Clerk of Works sufficient notice to enable them to check and agree the length of penetration of each hole bored.
- 5.1.22. No conditions requested by the Contractor with their tender shall override any clause in this Specification.
- 5.1.23. Should a Contractor require modification to any clause he shall apply in writing to the Engineer before submitting their tender.
- 5.1.24. On completion of the work the Contractor shall remove from site all unwanted materials and plant.
- 5.1.25. The Contractor shall dispose of all excavated material to the satisfaction of the Engineer and to a suitably licensed disposal facility. The Contractor shall be responsible for backfilling boreholes and excavations on completion of the work. The site when vacated shall be in a similar condition to its condition before commencement of work.
- 5.1.26. The Contractor shall be responsible for all setting out and location of the existing mine entries/workings as per the development layout contained within Appendix A.
- 5.1.27. Unrecorded mine entries are likely to be present based on the ground investigation. However, if encountered the Contractor shall submit with their tender details of the method he proposes to adopt to locate the disused mine shafts and/or adits. Once mine



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entries are located the Coal Authority will be informed and an agreed upon method of making them safe will be confirmed before any work takes place.

- 5.1.28. Tier are to provide supervision during the grouting works, with attendance based on work load and programme.
- 5.1.29. A plan will be available to the Contractor showing the extent of the grouting within the commercial development on the site to be treated (TE1880-TE-00-XX-DW-GE-024-V04 in Appendix A). The Contractor shall ensure that the proposed treatment works will be adequate in terms of the proposed development.
- 5.1.30. The Contractor shall be responsible for removing from the site all effluent, unused or waste material arising from grouting operations to a suitably licensed disposal facility.
- 5.1.31. Nothing in this specification should be taken as an instruction to adopt working methods which contravene the CDM Regulations, and all contractor/sub-contractors, etc, are responsible for ensuring safe procedures which comply with the Regulations.

5.2. Materials

- 5.2.1. Test Certificates for materials showing compliance with the British Standard along with source of manufacture should be forwarded to the Engineer for record purposes before orders are placed.
- 5.2.2. The use of materials or techniques not covered by the British Standard or excluded from the specification clauses will not be permitted unless by prior written agreement with the Engineer.
- 5.2.3. Water shall be from an agreed upon source. Ideally mains supplied or other source approved by the Engineer.
- 5.2.4. Sand shall generally comply with BS EN 12620:2013 and be of a grading suitable for use in the Contractor's plant and approved by the Engineer.
- 5.2.5. Pea gravel shall comply with BS EN 12620:2013, grading and chemical testing approved by the Engineer.
- 5.2.6. Bulk material, excluding mixing water, shall be paid for by weight, except that there shall be no payment for the excess weight if the moisture content exceeds 10% by weight of the dried material as determined in accordance with BS 1881.
- 5.2.7. Pulverised Fuel Ash (PFA) for use in grouts shall comply with BS EN 450-1:2005 (+A1:2007). Its source of supply shall be to the approval of the Engineer, and certificates of compliance with BS EN 450-1:2005 (+A1:2007) shall be provided by the Contractor to the Engineer for all the material used.
- 5.2.8. Portland cement/PFA grout shall comply with the requirements of BS EN 197-1:2011.
- 5.2.9. Proprietary grouts shall be of a type approved for the purpose by the Manufacturer and the Engineer and used strictly in accordance with the Manufacturer's instructions. The constituent materials including catalysts, additives and admixtures shall be notified to the Engineer immediately upon request.
- 5.2.10. Cement for sand and cement grouts shall be Sulphate Resisting Portland Cement to of BS EN 197-4:2011; cement for use with PFA shall be Ordinary Portland Cement (OPC) to BS EN 197-1:2011.



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- 5.2.11. Sand and cement grouts shall be made with an approved super-plasticiser. Sand grading shall be determined by the Contractor to achieve the required performance.
- 5.2.12. Materials shall be stored so as to prevent contamination and deterioration. Cement shall be kept in a dry location and the delivery sequence recorded to ensure that cement is used in rotation.
- 5.2.13. If and where end tipping is deemed a viable and safe methodology for the filling of open voids, e.g. mine shafts, the selection and use of granular bulk filling materials shall be subject to the approval of the Engineer.

5.3. Grouting Plant

- 5.3.1. The Contractor shall submit to the Engineer, for comment, details of the proposed method of mixing, batching and pumping of grout to the injection points, together with the means of monitoring grouting pressures and the quantities injected.
- 5.3.2. The materials shall be introduced into the mixer via approved weight batching equipment. Bearing in mind the low strength requirements, volume batching may be acceptable on occasion, with the approval of the Engineer.
- 5.3.3. The grout mixer shall be capable of producing a homogeneous mix, all particles being thoroughly wetted without segregation occurring.
- 5.3.4. Any grout which has started to gel shall be discarded; the addition of extra water or the "working up" of gelled grout shall not be permitted.

5.4. Grout Mixes

- 5.4.1. Before work commences, the Contractor shall confirm to the Engineer a selection of grout mixes likely to prove satisfactory for the conditions. Alternatively, the Engineer may specify the mixes. The Contractor shall prepare cubes, of an agreed size, representative of the mixes agreed, and he shall arrange for them to be tested by crushing at 14 and 28 days in accordance with BS 1881. The testing shall be carried out by an independent laboratory if directed by the Engineer. Where time permits, the results of the tests shall be furnished to the Engineer prior to commencement of grouting operations.
- 5.4.2. The following mixes (proportions by weight) are listed for general guidance:

- I. **Primary grouting positions or perimeter curtain wall grouting: cavities less than 500 mm high:**
- Cement : PFA = 1:10
 - Cement : PFA : Sand = 1:10:2 (sand can be added where grout consumption or spread should be limited).
 - The cement content should not be less than 75kg/m³ in dry or unsaturated conditions. In waterlogged workings, the minimum cement content may be raised to 100kg/m³ to allow for dilution effects.
- II. **Primary grouting positions, perimeter curtain wall or mine entry grouting: for large or interconnecting cavities exceeding 500 mm high** (a pea gravel infilling is recommended to limit grout travel within the area of consolidation)



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- Cement : PFA : Sand = 1:6:1
- The cement content should not be less than 100kg/m³ in dry or unsaturated conditions. In waterlogged workings, the minimum cement content may be raised to 125kg/m³. Admixtures, such as bentonite, may be incorporated to limit the spread of the grouting during injection.
- The grout is injected while pea gravel is fed simultaneously through a hopper, to form a cone of side slope greater than 35 degrees.

III. Secondary and tertiary grouting positions or infill grouting

- Cement: PFA = 1:10 to 1:12
- The cement content should not be less than 50kg/m³ of mixed volume in dry or unsaturated conditions. In waterlogged workings, the minimum cement content may be raised to 75kg/m³.

5.4.3. The design, adjustment and installation of grouts shall be the sole responsibility of the Contractor who shall nevertheless satisfy the Engineer that the mix proportions are in accordance with this Specification, or with the approved variations, and meet the minimum strength and flow requirements of this Specification.

5.4.4. If PFA is not able to be sourced, sand can be used as the component of the grout mix. Ideally use of sand will be limited to working within voids greater than 0.5m thickness. Where sand is proposed in small voids/ broken ground, additional and increased testing using PFA:Cement only mixtures is required. Sand used should be fine grained and grains should be rounded. Grading certificates should be provided by the contractor.

5.5. Grout Properties and Testing

5.5.1. Water to cement and PFA ratios shall generally be in the range 0.40 to 0.45 (including the moisture in the aggregates), the mixes envisaged should produce pump able grout with lucidity readings of 300mm to 600mm when measured in a meter of the 'Concrete' type.

5.5.2. High bleed grouts shall be avoided and the bleed capacity shall be limited to 5% maximum.

5.5.3. Bleed capacity shall be measured in a clear plastic or glass graduated cylinder which has an internal diameter not less than 50 mm, with a volume of approximately 1,000ml. After placing the grout, a cover shall be placed over the cylinder to avoid evaporation. Bleed capacity shall be read at hourly intervals. For neat cement grout, readings shall continue for not less than 3 hours, and for not less than 6 hours for fly ash/cement grouts.

5.5.4. The mixes shall produce cubes with crushing strengths of **not less than 1.0N/mm² (1MPa) at 28 days.**

5.5.5. The actual proportions to be used initially for the various grouts shall be determined by the responsibility of the Contractor who shall nevertheless satisfy the Engineer that the mix proportions are in accordance with this Specification, or with the approved variations, and meet the minimum strength and flow requirements of this Specification, according to the conditions met in drilling and the results of any cube testing or trial grouting carried out before work commences.



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- 5.5.6. Grout viscosity at the time of injection shall be such as to achieve full penetration of all voids encountered, subject to achieving a satisfactory gel with minimum bleeding and shrinkage within three hours of injection.
- 5.5.7. The Contractor shall check the lucidity of the grout on site during operations by means of a flow meter. Bleed capacity after 2 hours shall be monitored by means of a graduated beaker. For strength testing, the Contractor shall make sets of six test cubes of an agreed size and taken from the grouting, at surface positions, when directed by the Engineer. The cubes shall be marked, handled, stored and tested in accordance with BS 1881 to confirm the projected 14 and 28 day strengths of the grout.
- 5.5.8. If the Engineer considers the results of the tests indicate that a change of mix proportions is required, the Contractor shall make such modifications as the Engineer may direct. If required by the Engineer, the testing shall be carried out by an independent laboratory which shall provide certified records of the results. The contract shall specify the extent of testing and allow a provisional sum for such.

5.6. Drilling and Grouting Procedures

Drill Procedures

- 5.6.1. All holes, including any which strike mineral pillars, to be used for the injection of grout, shall be drilled by rotary or rotary percussive techniques down to a minimum of the pavement of the old workings. The drilling system and flushing medium to be used shall be approved by the Engineer. The minimum diameter of holes shall be 50mm unless otherwise specified by the Engineer. When it is impracticable to drill at the minimum diameter for the full depth, the diameter of the holes shall be increased in the upper lengths.
- 5.6.2. The holes shall be cased through superficial deposits down to the rock-head, and if directed by the Engineer, down through the rock strata. The holes shall be kept open until grout injection into the workings and rock is complete.
- 5.6.3. Where a hole proves abortive because it becomes obstructed, or because of the Contractor's failure to progress the hole, it shall be re-drilled at a larger diameter and re-cased, or a new hole drilled and cased at the contractor's expense.

Grouting Procedures

- 5.6.4. The Contractor shall stabilise by grouting all worked seams, voids and cavities as directed by the Engineer. The maximum drill depth anticipated is 40m with a review during the works to potentially reduce the depth as the data set is enhanced and made clearer. Liaisons with Coal Authority will be undertaken to agree this reduction if it arises.
- 5.6.5. The Contractor shall be responsible for ensuring that the grouting has completely stabilised all voids, broken ground, cavities, worked seams, adits or shafts, encountered in the boreholes.
- 5.6.6. Immediately prior to grouting each hole, the contractor shall check that it is unobstructed to the required depth to receive the tubing or pipes for grout. Obstructions shall be dealt with as described above.
- 5.6.7. Grout shall be tremied into position down each hole via an approved T-connection and flexible tubing, or series of steel tubes, placed to the base of the hole or to such other depth as specified by the Engineer. Provision shall be made for monitoring the pressure of the grout and the quantity being delivered in the line.



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- 5.6.8. The grout shall be injected at the approved rates until either a limiting pressure of 10kN/m² per m overburden or a maximum of 200kN/m² is reached, or grout appears near the point of injection, when the hole shall be deemed complete. If one of these criteria is reached quickly, the grout tube or pipes shall be lifted to check that a local obstruction is not preventing the flow of the grout into the strata.
- 5.6.9. Grout shall be injected using a grout tube carried below rock head level. The Contractor shall seal the tube against the surrounding ground as necessary to develop the required pressures, with a bentonite slurry.
- 5.6.10. If pressure is not achieved or grout has not appeared at the point of injection after 15 tonnes of grout materials have been placed, the grout tube or pipe shall be removed from the hole and injection suspended. After a period of at least 12 hours, up to a further 10 tonnes of materials shall be injected. If there is still no result, injection shall again be suspended for at least 12 hours and the process shall be repeated with further quantities of 5 tonnes. **If the hole is still accepting grout after a total of 50 tonnes of materials have been injected without any sign of the hole being completed, the Contractor shall consult the Engineer to determine whether the injection is to be continued or other measures such as secondary or test holes are required.**
- 5.6.11. When holes have been cased through rock, grout injection shall continue at gauge pressures to be approved by the Engineer, subject to the maximum of 10kN/m² per m of overburden with an upper limit of 200kN/m² whatever the depth, as the casing is withdrawn.
- 5.6.12. Care shall be taken to ensure that uplift pressures are not allowed to develop under any adjacent infrastructure, including United Utilities services, during grout injections. Where there is the potential for any nearby infrastructure to be affected by the grouting operations, the Contractor shall employ special supervision, and unless otherwise specified by the Engineer, shall monitor ground levels by precise levelling at intervals, both prior to and during operations. best practices for the location of sub-surface structures will be implemented where possible, including but not limited to utility surveys, monitoring of manholes and drains and careful setting out of locations.

Primary and Secondary Holes

- 5.6.13. Primary grout holes shall be positioned on no less than a 6m by 6m square grid under the building footprint and 12m by 12m under external hardstanding, energy centre and substation, with secondary grout holes adopted at an offset 6m by 6m or 12m by 12m square grid, subject to the levels of grout take within the primary grout holes the requirement for which is to be at the discretion of the Engineer.
- 5.6.14. If grout takes within the secondary holes are excessive or there any doubt, tertiary holes will be drilled as specified by the Engineer(Tier).

Reporting / Certification

- 5.6.15. Logs and grout records should be provided to Tier within 3 No. days of drilling or grouting.
- 5.6.16. The Contractor shall issue a Certificate and Warranty (exact requirements to be confirmed to successful Contractor) upon completion of the treatment work itemising:
- I. the depth and position of each hole drilled.
 - II. the condition of seams, shafts or cavities encountered.



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- III. the quantity and type of grout injected, measured as tonnes of dry material.
- IV. the quantity and type of other filling material used.
- V. any information related to underground workings bearing on future building development on the site, and stating the site is stabilised and fit for the proposed development, subject to suitable foundation design.
- VI. Tier to provide a Completion Report in addition to Factual Remedial Works Report from the Contractor.

In Situ Testing

- 5.7.1. The Contractor should consider the need to test the consolidated ground for permeability and strength.
- 5.7.2. Permeability by grout acceptance testing should be checked by drilling test holes and injecting grout at pressures appropriate to the depth, all in accordance with the requirements for infill grouting. The Engineer will advise upon test positions. If the quantities of grout accepted are excessive, further holes should be drilled and grouted.
- 5.7.3. After testing, holes shall be completed in accordance with the requirements for grouting infill holes.
- 5.7.4. Where deemed appropriate, the strength of consolidated ground shall be tested by taking sample cores either in newly drilled and cased holes or in re-drilled existing holes. When the samples have been taken, the hole shall be filled up with grout injected in accordance with the requirements for infill grouting.

5.7. Records

- 5.8.1. The Contractor should prepare and keep available for inspection, site plans showing the positions and surface levels of all holes, and sections through the rows of holes to show the results of the Works, inclusive of the Daily Drilling Records (see below), together with the total amounts of grout injected. All levels should be given with reference to a datum to be determined.
- 5.8.2. Daily drilling records should be provided for each hole and should preferably contain the following information:
 - I. Job title and location
 - II. Hole reference number
 - III. Date
 - IV. Contractor's name
 - V. Plant in use, crew members and hours worked
 - VI. Method of boring or drilling, flushing medium and type of drill bit used
 - VII. Type, diameter and depth of casing used.
 - VIII. Diameter and depth of hole at the beginning and end of each working day or shift.
 - IX. Loss of any flushing medium during drilling
 - X. Standing time, with reason, or time lost overcoming obstructions
 - XI. Details of underground services located
 - XII. Details of any settlement or ground heave
 - XIII. Daily and cumulative length drilled
 - XIV. Depth to each major change of stratum
 - XV. Description, with identification, of the stratum and whether it is intact or broken
 - XVI. Depths at which groundwater is encountered



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- XVII. Depths at which any samples are taken
- XVIII. Details of any voids or suspended workings
- XIX. Details of any emissions of gas, water etc
- XX. Depth of completed hole

5.8.3. Daily grouting records should be provided for each hole and should preferably contain the following information:

- I. Job title and location
- II. Hole reference number
- III. Date
- IV. Contractor's name
- V. Plant in use, crew members, and hours worked
- VI. Details of type of injection and grout-line dimensions (e.g. tremie injection through 25 mm diameter line)
- VII. Type of grout mix and volumetric quantity injected
- VIII. Grout pressures recorded, with the corresponding depths
- IX. Details of casing abandoned.

5.8.4. Logs and grout records should be provided to Tier within 3 No. days of drilling or grouting.

5.8.5. The Contractor will be required to provide a Warranty for the remedial works undertaken. The exact warranty terms and requirements will be confirmed with the successful Contractor prior to commencement of the works.



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**SPECIFICATION FOR THE STABILISATION OF
SHALLOW MINeworkINGS, HOPWOOD HALL
COLLEGE, ROCHDALE**

Report No : TE1880-TE-00-XX-RP-GE-005-V02

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7. GLOSSARY OF TERMS

ACEC	Aggressive Chemical Environment for Concrete (classification)
aOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
BRE	Building Research Establishment
CBR	California Bearing Ratio (test)
COMAH	Control of Major Accident Hazards (regulations)
Designated location	Site (and the ecosystem on that site) protected under national or international legislation. A potential ecological receptor to be considered as part of the assessment of land contamination. Example designated locations include SSSIs (q.v.), SACs (q.v.), national nature reserves, Ramsar sites and bird special protection areas.
DQA	Data Quality Assessment
DQO	Data Quality Objective
DQRA	Detailed Quantitative Risk Assessment
DWS	Drinking Water Standard
EQS	Environmental Quality Standard
GAC	Generic Assessment Criterion
GQA	General Quality Assessment (Environment Agency)
GSV	Gas Screening Value
HCV	Health Criteria Value
IPPC	Integrated Pollution Prevention and Control (regulations)
K _{ow}	Octanol-water partition coefficient
LEL	Lower Explosive Limit
LL	Liquid Limit
LoD	Limit of Detection (analytical)
LoQ	Limit of Quantification (analytical)
Mean Value Test	Statistical test (described in the CIEH Guidance) to estimate the mean value of a normally distributed population of data at a given level of confidence. Normally for contaminated land assessment, the 95th percentile (referred to as the 95%UCL or US95) is applied as a reasonable but conservative estimate of the mean concentration for comparison with the relevant assessment criteria.
Maximum Value Test	Statistical test (described in the CIEH Guidance) to identify whether an elevated concentration within a normally distributed data set forms part of the underlying population from which it has been sampled or whether it is an outlier (such as a localised area of contamination) that merits further consideration.
MC	Moisture Content
NGR	National Grid Reference
NIHHS	Notification of Installations Handling Hazardous Substances (regulations)
OS	Ordnance Survey
PI	Plasticity Index
PID	Photoionisation Detector
PL	Plastic Limit
ppm	Parts per million
ppmv	Parts per million by volume
QA	Quality Assurance
QC	Quality Control
SAC	Special Area of Conservation
SOM	Soil Organic Matter



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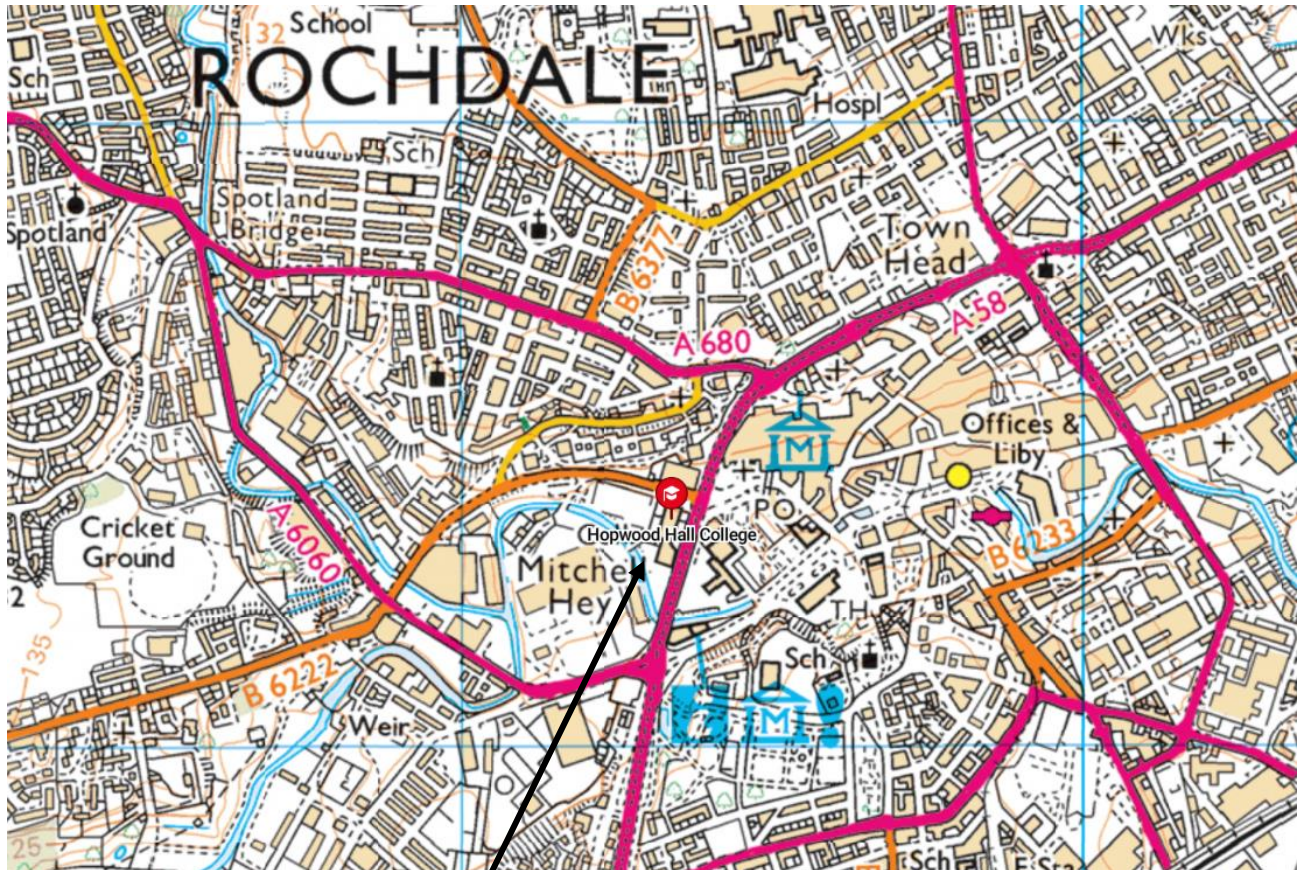
SPT	Standard Penetration Test
SPZ	Source Protection Zone
SSAC	Site-Specific Assessment Criterion
SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compound
TEF	Toxicity Equivalent Factor
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
US95	95 th percentile estimate of the true mean value of a data population (also known as 95%UCL).
VOC	Volatile Organic Compound

APPENDIX A - DRAWINGS



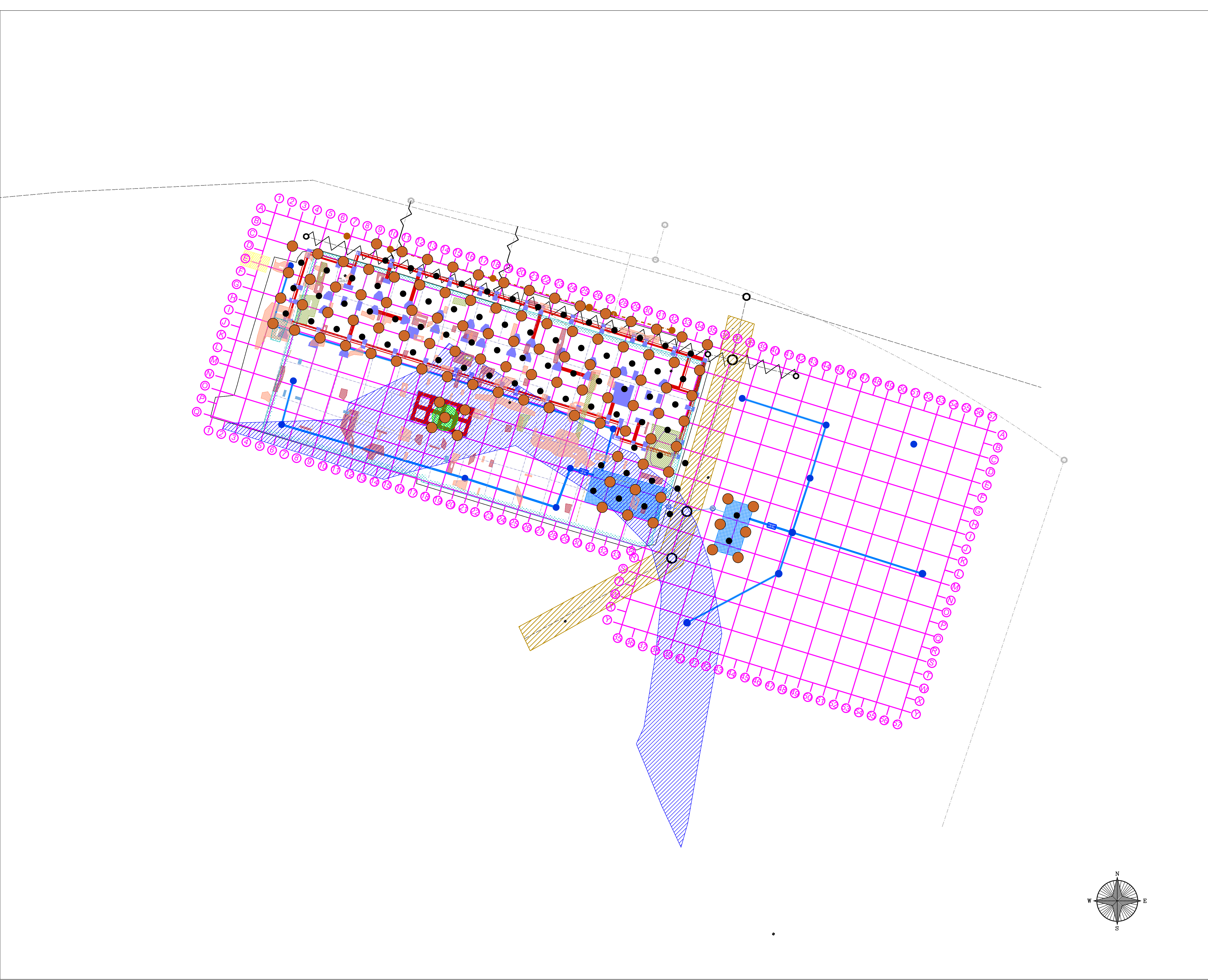
Contract Number:	TE1880
Contract:	Hopwood Hall College, Rochdale
Client:	Wilmott Dixon Construction

Site Location Plan



Site

Scale	NTS	
Drawn by	SE	Approved AR
Drawing Number	TE1880-TE-00-XX-DR-GE-001-V01	



DO NOT SCALE

TIER

CONSULT GROUP

NOTES

Primary Borehole Location

Secondary Borehole Location

Drainage Key

Proposed Surface Water Drainage

Proposed Foul Sewer Drainage

Existing Surface Water Drainage

Existing Foul Sewer Drainage

Surface Water Flow Control Chamber

Bypass Separator Interceptor

Cellular Attenuation Tank

Easements

Existing Surface Water Sewer to be abandoned subject to Approval from LUJ

Existing Foul Water Sewer to be abandoned subject to Approval from LUJ

Structures Key

Pile Caps

Ground Beams

LV Room and Substation

Sprinkler Tank

Geotechnics Key

Boreholes, Geotechnics, Nov 2021

Record Position Of Former River

Roch Route & Weir

GPR Survey Boundary

GPR Detection Line - Likely Related To a Buried Service or Remnant Linear Feature

GPR Detection Line - Interpreted as a Reinforced Concrete Slab Join. Depth Shows Approximate Slab Depth

A. GPR Detected Anomaly

B. GPR Detected Anomaly

C. GPR Detected Anomaly

D. GPR Detected Anomaly

E. GPR Detected Anomaly

F. GPR Detected Anomaly

P1	11.02.2025	CS	ISSUED FOR INFORMATION	AP	AP
REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS: INFORMATION

TIER

CONSULT GROUP

Tier Environmental Ltd.

Unit 5 Office Village

Sandpiper Court

Chester Business Park

Chester | CH4 9QZ

t: 01925 818 388

CLIENT: WILLMOTT DIXON CONSTRUCTION

PROJECT: HOPWOOD HALL COLLEGE ROCHDALE

TITLE: GROUTING PLAN

SCALE: 1:100	CHECKED: AP	APPROVED: AP
CAD FILE: -	DESIGN/DRAWN: CS	DATE: 11.02.2025
PROJECT No: TE1880	DRAWING No: TE1880-TE-00-XX-DR-GE-026-V06	REV: P6