

COAL MINING RISK ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT OAKENROD ROCHDALE OL11 5EU

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Client: Hallmark Developments Ltd
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Revision	Date	Reason
0	Feb 2024	Original to support planning application.
1	Sept 2024	Update re CA consultation.

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1 Introduction & Site Overview.

T. J. Booth Associates have been appointed Hallmark Developments Ltd to undertake a Coal Mining Risk Assessment (CMRA) to land at Oakenrod, Rochdale.

The Site comprises a piece of land formerly used for Oakenrod School, and Oakenrod Mill. It is bound by Bury Road to the north, Bridgefield Street to the northeast, and the River Roch to the south.

The proposal is for the construction of a residential housing development, comprising 52No. detached & semi-detached dwellings with associated access road.

Previous reports have been undertaken in support of the application which have provided limited levels of assessment with regard to coal mining legacy at the Site:

- Phase I Geoenvironmental Desk Study Report (dated April 2022) from Earth Environmental & Geotechnical Ltd.
- Phase II Geoenvironmental Site Assessment (August 2023, prepared by E3P).

As part of the planning application and consultation process, the Coal Authority have provided a consultation dated 14 November 2023, indicating a Substantive Concern and recommended refusal based on the information given to date (refer to sects 1.1 & 1.2 below for further details).

The revision 0 version of this report was subsequently submitted, and further consultation (August 2024) & discussion was undertaken with Coal Authority engineers. As part of the August 2024 consultation, the Coal Authority revised some of the information on underground mining contained within the Consultants Coal Mining Report.

The information was further reused to inform of coal mining risk to the Application Site.

The purpose of the report is to assess the potential coal mining legacy local to the proposed residential development, and to put forward recommendations based on current best practice for approval by the LPA/Coal Authority.

1.1 Earth Environmental & Geotechnical Ltd - Phase I Geoenvironmental Desk Study.

A phase 1 geo-environmental desk study was undertaken in April 2022, ref No. A4743/22, and was submitted in support of the planning application.

The report recommended that a Coal Mining Risk Assessment should be undertaken.

The Coal Authority subsequently objected to the planning application.

1.2 E3P - Phase II Geoenvironmental Site Assessment.

A phase 2 geo-environmental assessment was undertaken in August 2023, ref No. 16-932-R1-1 (version 1), and was submitted in support of the planning application.

The report noted that the Application Site was not situated within a Coal Authority reporting area, and that further assessment was not required.

The Coal Authority subsequently objected to, and recommended refusal of the planning application, due to insufficient and inadequate information submitted.

T J Booth Associates also note an updated E3P geo-environmental assessment was undertaken in November 2023, ref No. 16-932-R1-2 (version 2). The report concluded and recommended the same as the version1 report above. It is understood that the Coal Authority have not reviewed this report.

2 Environmental Database Search.

2.1 Historic Maps.

Date	Notable features
1844	The nearest coal mining features are the Pinfold Colliery and Sparth Bottoms Colliery approximately 250-300m south respectively. Coal shafts are noted.
1891-1960s	Area developed with commercial/industrial mills etc, and Rochdale Brick Works. However, there are no coal mining features noted on historic maps for the local area.

2.2 BGS Geology.

Superficial Geology:	The Site is primarily underlain by glaciofluvial sand & gravel to the northwest and west, alluvial deposits to the south and southwest, and area of no cover to the northeast corner adjacent the Site entrance.
Bedrock Geology:	The Site is underlain by Westphalian Coal Measures, generally undifferentiated mudstone & sandstone, nominally 5 degrees southwest. The closest coal seam up dip of the Site is the Arley coal seam.
Coal Entries:	Coal entries to the south of the local area around the former Pinfold Colliery and Sparth Bottoms Colliery indicate the Arley coal seam is located at a depth of 324 feet (approx 100m), although faulting separates the associated shafts and the Application Site.

2.3 BGS Borehole Records.

One borehole record, ref: SD81SE14 (Appendix) is relevant for the Application Site and records the Arley seam at depth to the southwest of the area, essentially fixing the seam at depth to this side of the area.

The borehole noted the following stratigraphy:

BH SD81SE14 0.0 - 18.0m made ground.
 18.0 - 45.00m Coal Measures.
 45.0 - 45.60m Arley coal seam.

The ground level at the borehole is estimated to be around 120.00maOD, placing the seam at a depth of 75maOD.

2.4 TJBA Borehole Records 2019.

TJBA have undertaken boreholes in the local area, up-dip of the Site, and have records to prove the seam depth to datum - refer to Arthur Street Borehole in the Appendix (closest up-dip of the Application Site).

The borehole was undertaken in 2019 on land adjacent to 1 Arthur Street, Rochdale, under Coal Authority permits, to prove the depth of the Arley coal seam for development proposals.

The ground level at the borehole was 138.50maOD, and drilling recorded a loss of flush and backfilled workings associated with the Arley coal seam at between 17.80-18.40m deep (120.70-120.10maOD).

Other boreholes undertaken by TJBA in the area local to Arthur Street have also identified workings in the Arley at similar depths.

2.5 Ian Farmer Associates BH Records 2001.

TJBA have records of previous boreholes undertaken c2001 by Ian Farmer Associates, prior to our involvement in the Site.

Three boreholes were undertaken BHs1-3 (northeast to southwest respectively), as well as various trial holes. The boreholes were shallow but proved bedrock beneath the Site as the following depths:

BH1	0.0 - 3.80m	made ground.
	3.8 - 4.68m	mudstone bedrock.
BH2	0.0 - 1.50m	made ground.
	1.5 - 2.50m	mudstone bedrock.
BH3	0.0 - 1.50m	made ground.
	1.5 - 3.00m	clay.
	3.0 - 3.50m	mudstone bedrock.

BHs1-3 as well as trial holes THs4&5 are Appended.

2.6 Coal Authority.**2.6.1 Consultant's Report (April 2023 with August/September 2024 addendum).**

Past Recorded Mining.	The report notes past underground mining in the Arley coal seam with the following references: - Approximately 20m northeast of the Application Site (offsite), CA ref: 3XNT, dip/direction 5° southwest, suggested at shallow depth. - Onsite/below the Application Site, CA ref: 3XOI, dip/direction 5° southwest, suggested at shallow depth. **UPDATE SEPT 2024: THE GEOLOGICAL DIP OF THE ABOVE SEAMS HAS BEEN AMENDED TO 5 DEGREES, REFER TO COAL AUTHORITY CONSULTATION IN SECTION BELOW.**
Unrecorded Probable/Potential Shallow Underground Workings:	None noted. The lack of probable workings beneath the Site are in contrast to the above noted 'recorded workings' suggested at shallow depth.
Spine Roadways.	None noted.
Mine Shafts, Pits, Adits/Entries:	None recorded within influencing distance of the Application Site.
Past/Present/Future Surface Mining/Opencast:	None recorded.
Coal Mining Subsidence:	None noted.
Mine Gas:	None noted.
Hazards Relating to Coal Mining:	None noted.

2.6.2 Online Interactive Map.

Past Recorded Underground Mining.	Not used since Coal Authority Consultation & Consultants Coal Mining Report update.
Unrecorded Probable/Potential Shallow Underground Workings:	There are no probable shallow workings at the Application Site or within the local area. The only probable workings are around immediately downstream of the Arley coal seam to the northeast around the Arthur Street/Spotland Road area approx 380m northeast.

	The lack of probable workings beneath the Site are in contrast to the above noted 'recorded workings' suggested at shallow depth.
Mine Shafts, Pits, Adits/Entries:	None recorded within influencing distance of the Application Site.
Development High Risk Area:	There are Development High Risk Areas associated with specific underground workings, although the only working beneath the Site is noted to the southwest side.

2.6.3 Coal Authority Consultation.

The submission of the revision 0 version of this report, and subsequent consultation with the Coal Authority, led to the Coal Authority revising the dip information for the local area to 5 degrees in accordance with BGS maps, and the following addendum to the Past Underground Mining section of the Coal Authority Consultants report:

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	ARLEY	Coal	3XNT	23	North-East	5.0	South-West	120	1849
unnamed	ARLEY	Coal	3XOI	29	Beneath Property	5.0	South-West	120	1849

2.6.4 Abandonment Plans.

Abandonment Plan ref: NW1177 (Appendix) was obtained for the area, which indicated workings in the Arley seam but had no seam date and depth info attached.

3 Identification & Assessment of Site-Specific Coal Mining Risks.

Source Of Risk.	Comment.	Development Risk.	
Recorded Workings.	There are 'Development High Risk Areas' associated with past underground workings beneath the Site and in the local area.	RISK NOTED IN COAL AUTHORITY DATA	FURTHER ASSESSMENT
Probable Shallow Workings.	No 'probable' workings in the local area although the above workings are suggested to be shallow.	LOW RISK	NO FURTHER ASSESSMENT
Opencast Workings.	No past or future opencast workings noted locally.	LOW RISK	NO FURTHER ASSESSMENT
Coal Pits/Shfts/Adits.	No pits/shafts/adits noted within influencing distance of the Site.	LOW RISK	NO FURTHER ASSESSMENT
Mine Gas or subsidence.	No evidence of local events.	LOW RISK	NO FURTHER ASSESSMENT

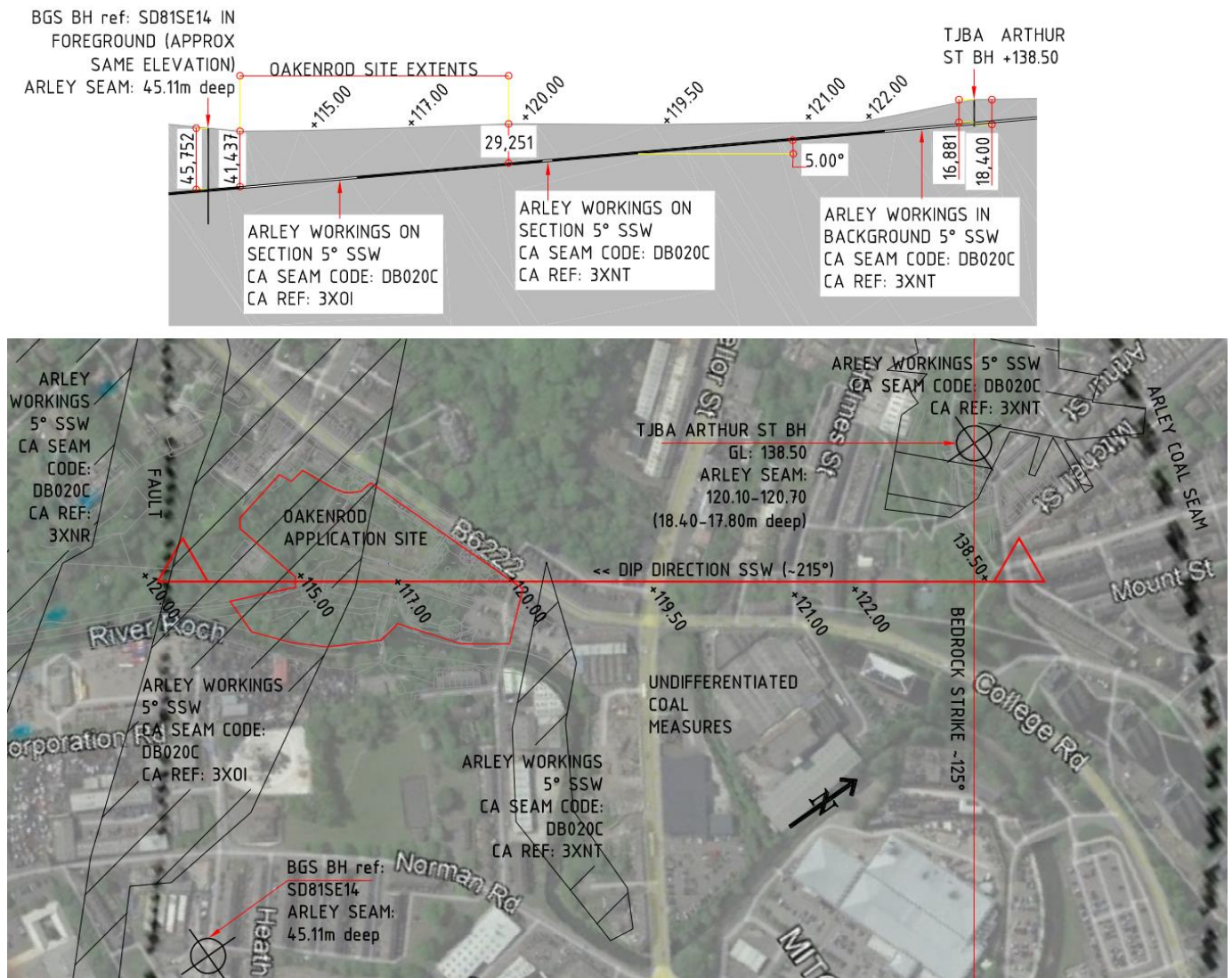
4 Mitigation Strategy Proposed.

To mitigate the risk attributed to the 'Development High Risk Area' associated with workings & the potential shallow seam beneath the Application Site, the following information has been cross referenced to create a geological plan & section of the local area:

- BGS map & Arley subcropping positions;
- Topographic data held by TJBA for multiple sites in the local area;

- Past site investigations in the local area undertaken by TJBA, and the verified depth of the Arley coal seam in a known up-dip location;
- BGS borehole data (SD81SE14), and the verified depth of the Arley coal seam in a known down-dip location;
- BGS & Coal Authority data on the recorded strike/dip direction & angle in stratigraphy across the area.

Refer to plan & section below:



The section was obtained from known strike dip direction information, and the corresponding topography plotted. Given known positions to maOD of the Arley seam up dip of the Site in a TJBA borehole, the 5 degrees geological dip attributed to the area by the Coal Authority was then used to plot the seam on section.

This has been checked against the known depth of the Arley seam (45m) in BGS BH SD81SE14 at the corresponding topographic level, and the depth of the plotted seam aligns with the 5 degree dip suggested by the Coal Authority, and the TJBA obtained Arley seam position up dip of the Application Site.

The scale section then gives depth estimates to the Arley seam across the Application Site, which range from >29m deep to the northeast boundary, and around 41m deep to the southwest.

Given the estimated seam depths >c30m associated with the Application Site, the risk noted in section 3 (Identification & Assessment of Site-Specific Coal Mining Risks) is considered to be mitigated.

5 Further Mitigation.

Ciria C758 retains estimation of void migration as a means of mitigation.

Figure 5.4 'Type and estimation of void migration', details potential type of void migration mechanisms from rectangular (best case) to conical (worst-case), and for certain rock types where bulking factors arrest the upward

migration of voids. It particularly notes the bulking factors for typical ranges of Coal Measures (which are made up of both mudstone & sandstone), and the range thorough percentage of bulking factors from 30-50% (ie, more mudstone dominated to more sandstone dominated).

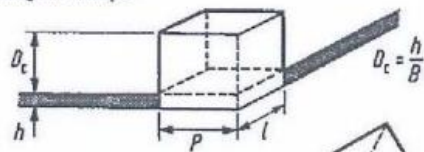
Given the Application Site is underlain by general undifferentiated Coal Measures, it can be assumed that as a conservative estimate, the Coal Measures have a bulking factor of 30%.

Working depths in the Arley seam are considered to be at worst case a 1.5m void space, (which is the maximum noted in the local borough, & obtained from numerous coal investigations on the same seam (seam depth estimated by both BH SD81SE14, and the TJBA Arthur Street backfilled workings were 600mm).

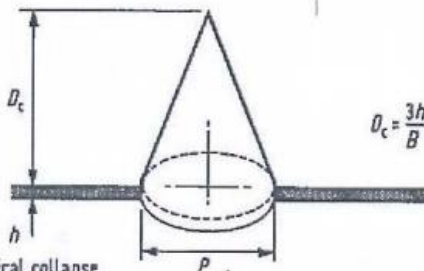
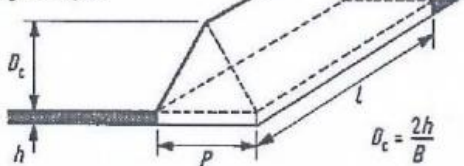
Given the above conservative parameters of 30% & a void space of 1.5m, the potential migration for a worst-case conical collapse can be given as:

$$\text{Conservative conical collapse } D_c = 3h/B = 3 \times 1.5 / 0.3 = 15\text{m}$$

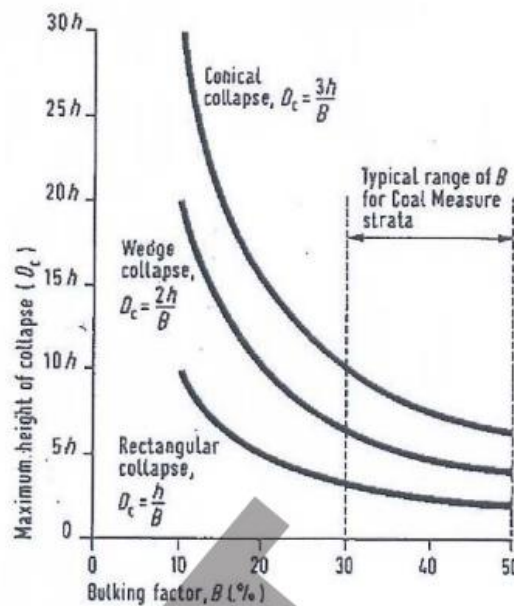
Rectangular collapse



Wedge collapse



(a) Diagram showing notation relating to maximum height of collapse and geometry



(b) Postulated variation in maximum height of collapse for different modes of failure and bulking factors

The depth to the Arley seam is estimated at approximately 29m.

The depth to bedrock on the worst-case part of the Site as measured in the Ian Farmer Associates BH is 1.5m.

The depth of competent bedrock is thus $= 29 - 1.5 = 27.5\text{m}$

Considering the thickness of competent bedrock beneath the Application Site, the worst case conservative conical collapse estimate of 15m would be arrested before it breaches the top of the bedrock, which indicates the Application Site will be safe from the potential effect of coal mining legacy.

6 Conclusions & Recommendations.

Development at the Application Site is considered safe from coal mining legacy issues.

No further assessment or investigation is proposed.

This report should be approved by the Coal Authority prior to development.

Signed.....  .

D.S. Slattery BSc (Hons).

T J Booth Associates.

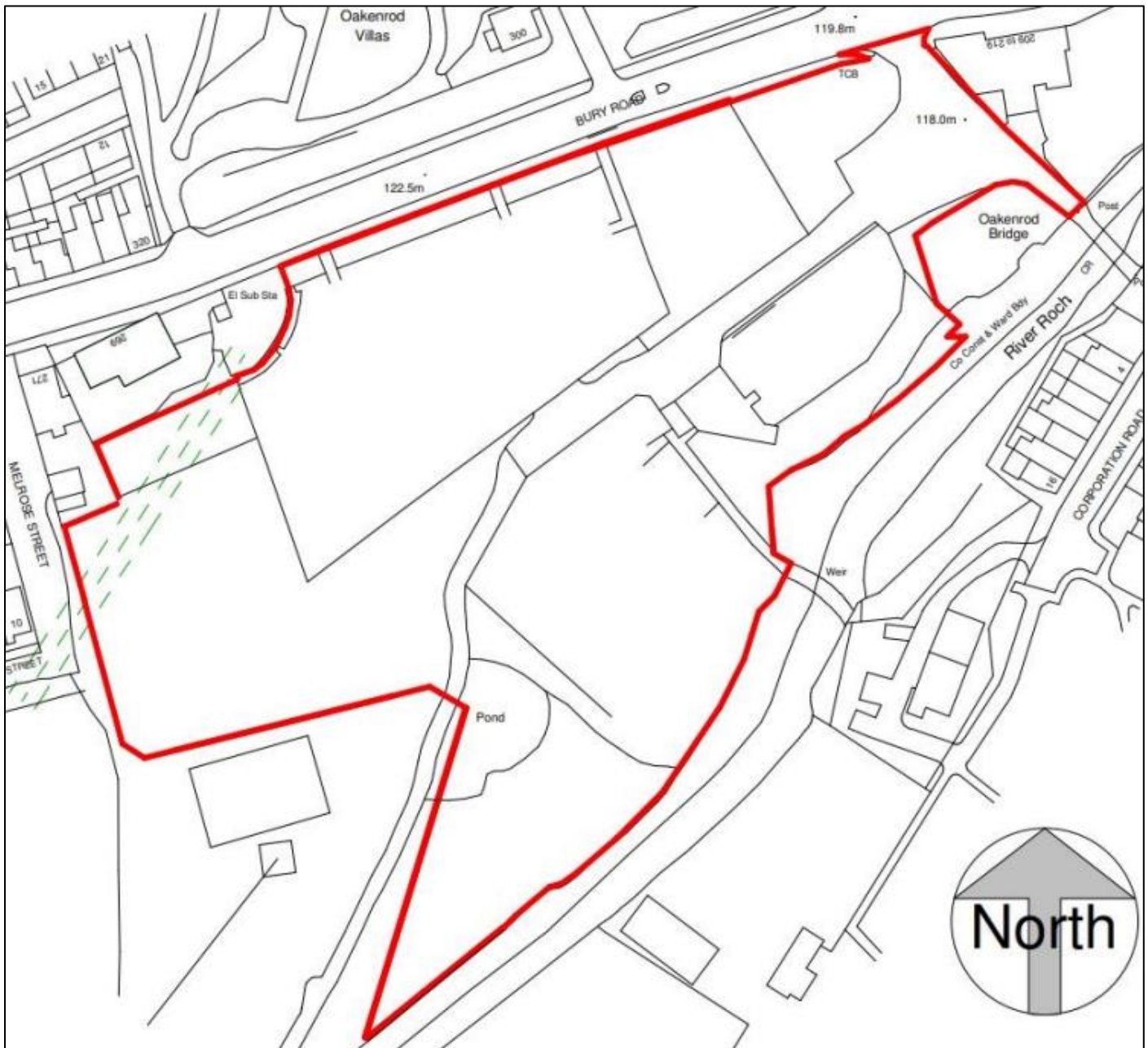
Authorised...  .

T J Booth BSc (Hons), C. Eng. C. Env.

T J Booth Associates.

7 Appendix.

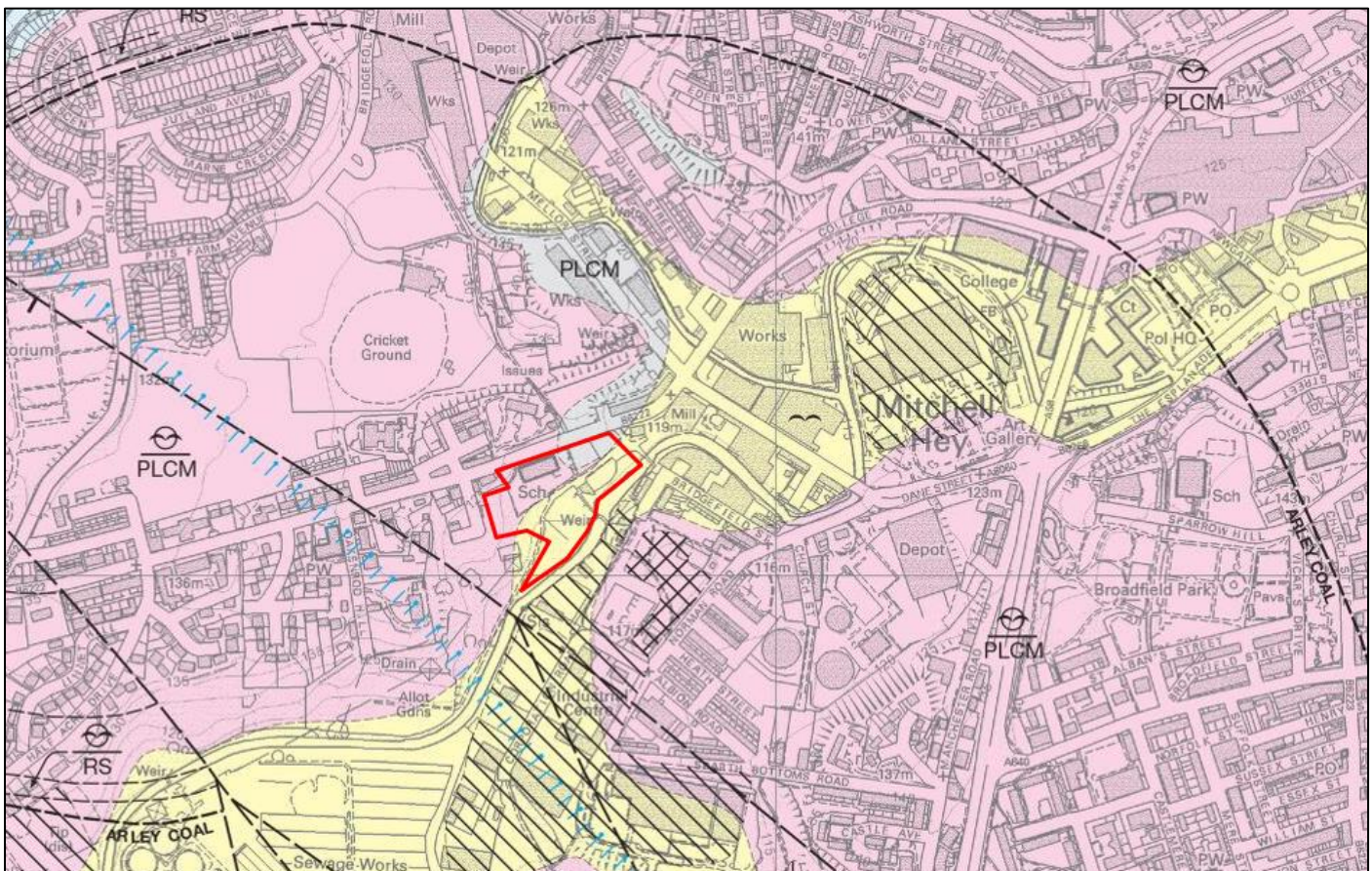
7.1 Location Plan.



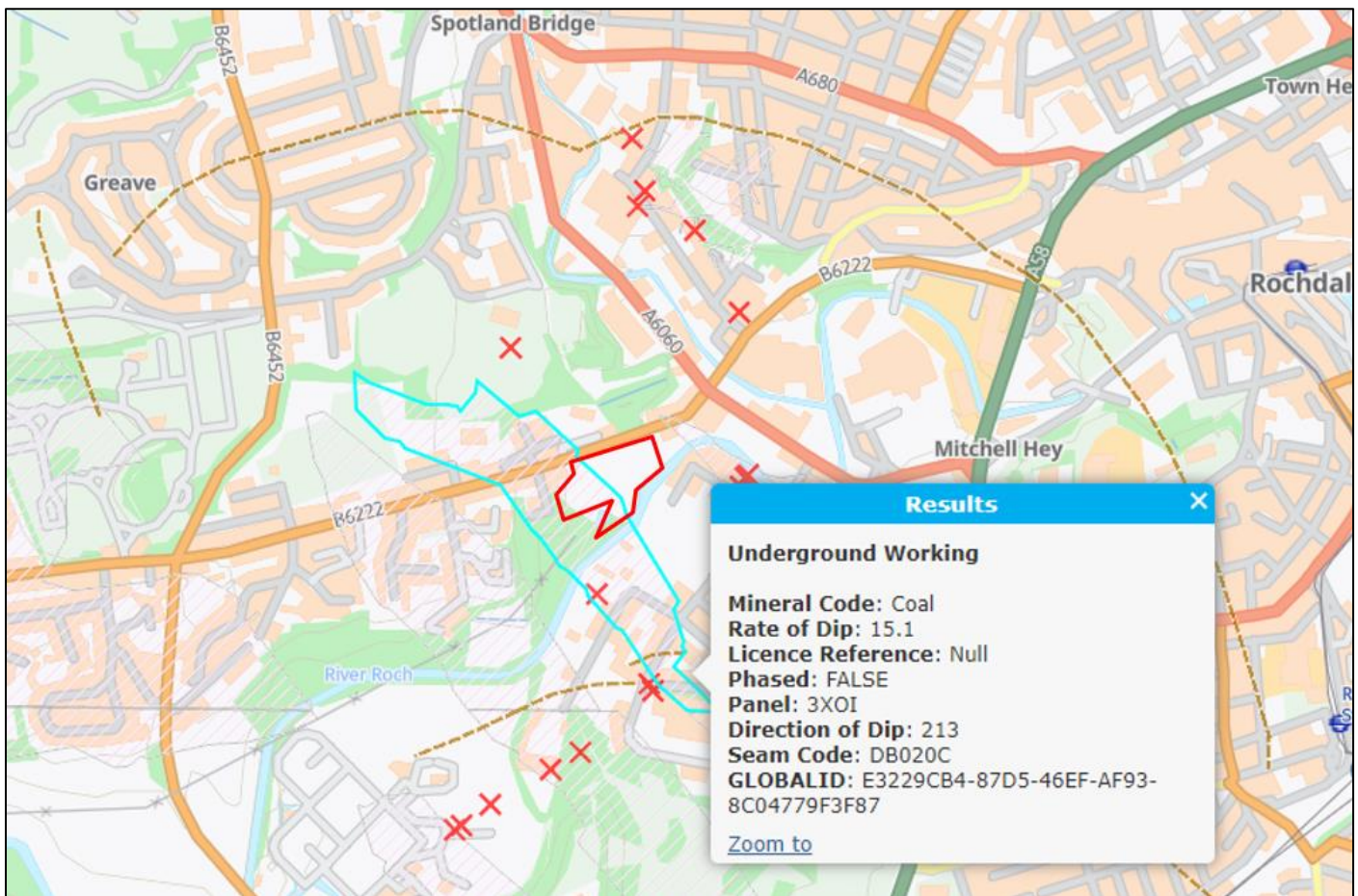
7.2 Proposed Plans.



7.3 BGS Solid & Drift Geology.



7.4 Coal Authority Interactive Map.



7.5 Coal Authority Report (April 2023).



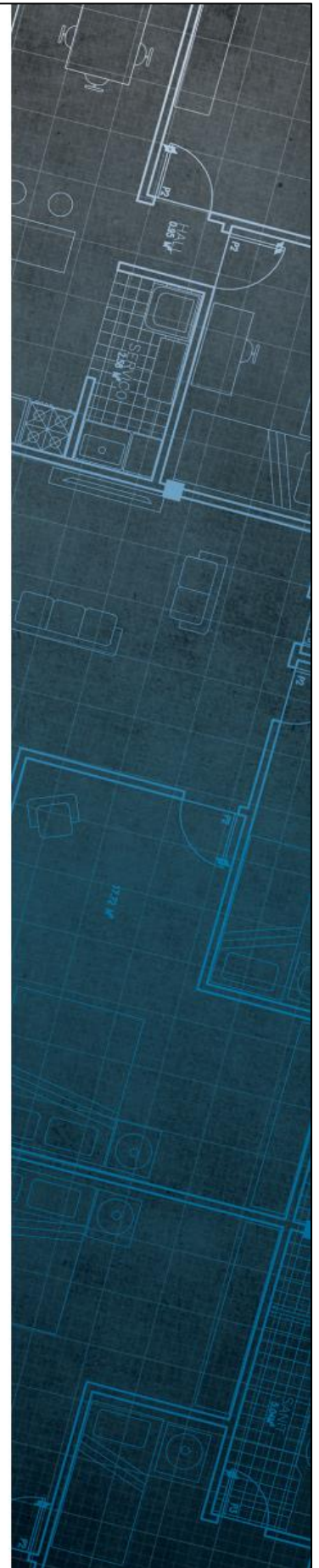
The Coal
Authority

Consultants Coal Mining Report

Btg Plastics Ltd
Corporation Road
Rochdale
OL11 4HJ

Date of enquiry: 14 April 2023
Date enquiry received: 14 April 2023
Issue date: 14 April 2023

Our reference: 51003349766001
Your reference: A4743



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

Earth Environmental & Geotechnical Ltd

Enquiry address

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Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	ARLEY	Coal	3XOI	14	Beneath Property	15.1	South-West	120	1849
unnamed	ARLEY	Coal	3XNT	21	North-East	15.1	South-West	120	1849

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	388412-001	388714 412922		Coal	

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

NW1178	NW162	16820
PO0	115	NW1177

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

No outcrops recorded.

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.



Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Future development

If development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply specialist engineering practice required for former mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or coal mines without first obtaining the permission of the Coal Authority.

MINE GAS: Please note, if there are no recorded instances of mine gas within 500m of the enquiry boundary, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded. Developers should be aware that the investigation of coal seams, mine workings or mine entries may have the potential to generate and/or displace underground gases. Associated risks both to the development site and any neighbouring land or properties should be fully considered when undertaking any ground works. The need for effective measures to prevent gases migrating onto any land or into any properties, either during investigation or remediation work, or after development must also be assessed and properly addressed. In these instances, the Coal Authority recommends that a more detailed Gas Risk Assessment is undertaken by a competent assessor.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission. Please note, if there are no recorded instances of mine gas reported, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

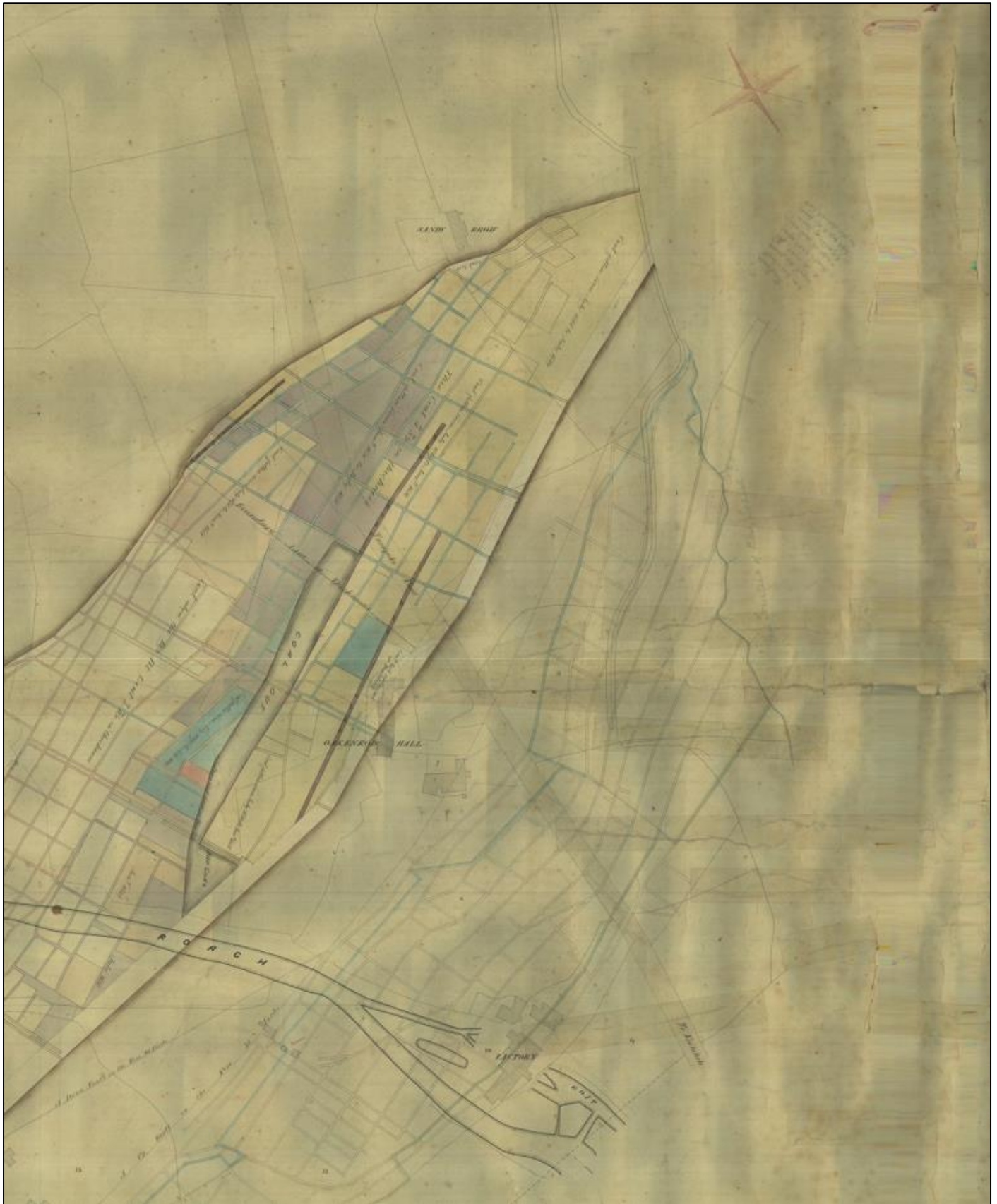
Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

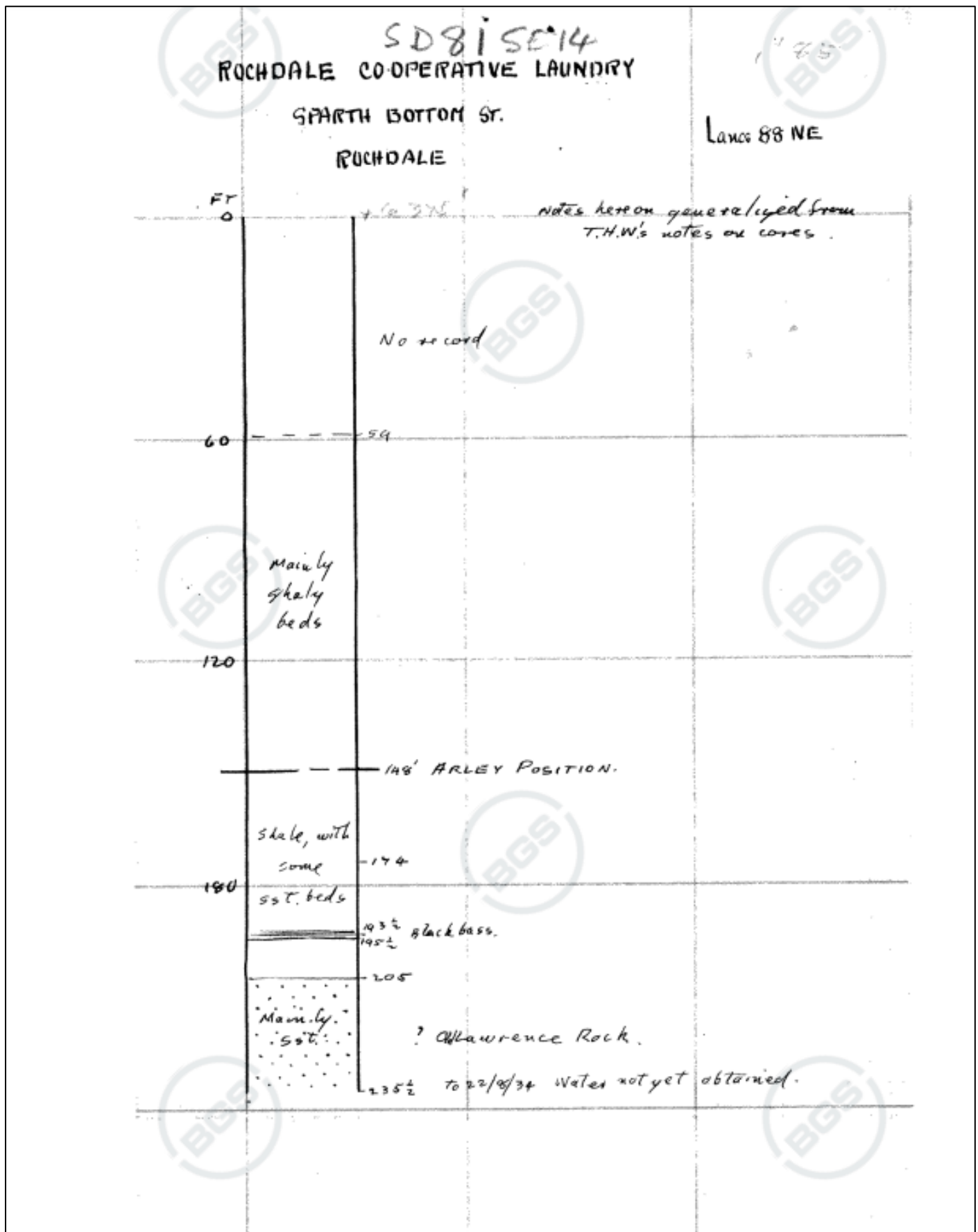
Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land

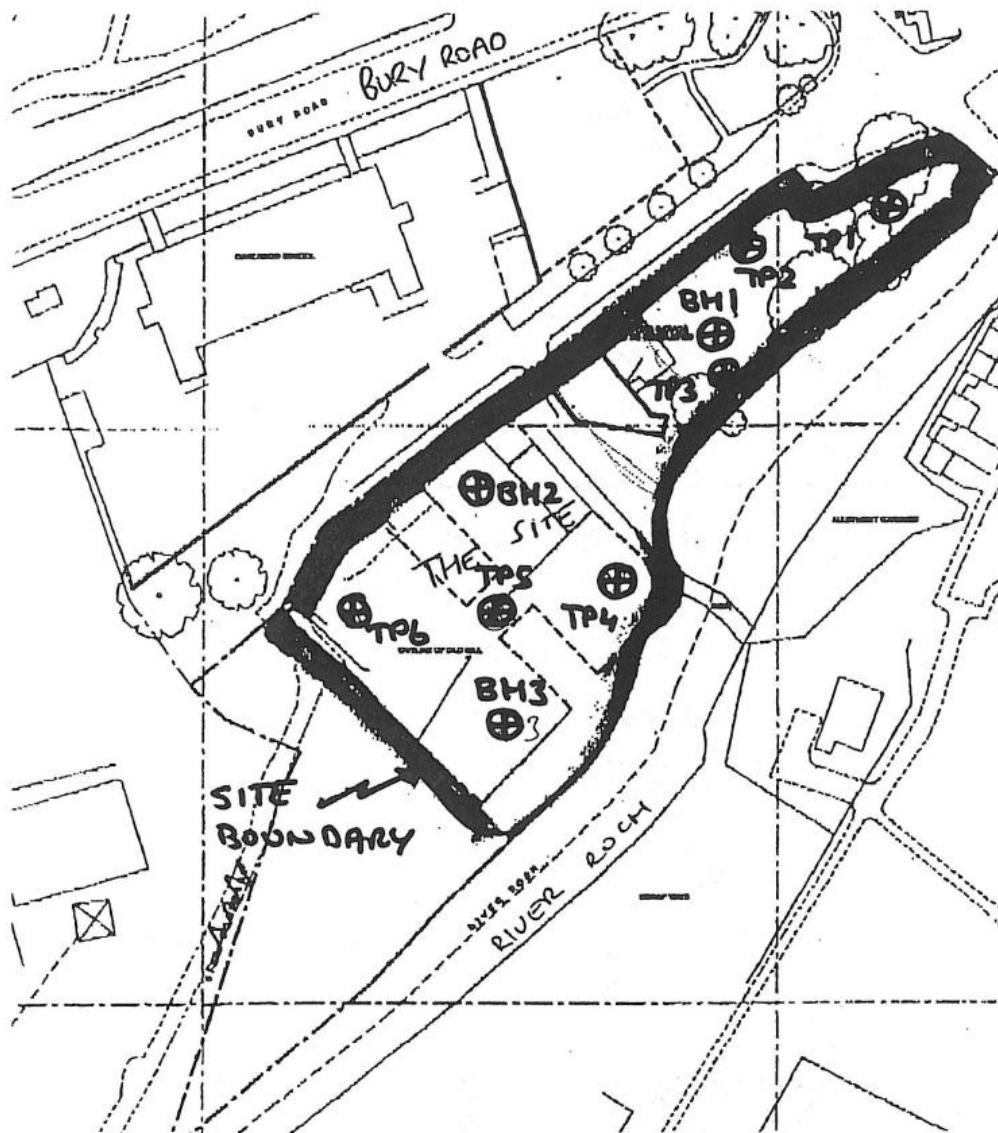
Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

7.6 Coal Authority Arley Seam Abandonment Plan.

7.7 BGS Borehole Logs – SD81SE14.



7.9 Ian Farmer Associates Borehole Logs – Application Site c2001.



PROJECT:
Bridgefield Street, Rochdale

DRAWING No. 4019-2

SCALE: NTS

TITLE
Exploratory Hole Location Plan

IAN FARMER ASSOCIATES
Geotechnical and Environmental Investigations

IAN FARMER ASSOCIATES

Geotechnical and Environmental Investigations

Site
Bridgfield Street, Rochdale

Borehole
Number
BH2

Boring Method
Cable Percussion

Diameter
150mm cased to 2.50m

Ground Level (mOD)

Client
Owen Ellis Partnership

Job
Number
4019

Location

Dates
07/12/2001-
10/12/2001

Engineer
Fleming Smith Associates Ltd

Sheet
1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Instr
0.00-1.20	B					(1.50)	Grass over MADE GROUND : Black, gravelly sandy CLAY. Gravel is angular and subangular, fine to coarse of sandstone, mudstone, brick and porcelain tiles. Cobbles present and organic plant material. (Rootlets).		Water
1.50-1.95	SPT N=33	1.50	Dry	3,6/7,8,8,10		1.50	Grey MUDSTONE recovered as angular to subangular, fine to coarse gravel and stiff clay.		
1.50	D					(1.00)			
1.50-1.95	B								
2.50-2.66	SPT 10/15	2.50	Dry	25,40/10		2.50	Complete at 2.50m		

Remarks
Water standing at 0.50m at start of shift. 10/12/2001. Sealed at 1.50m.
Standpipe installed. Slotted pipe in gravel filter from 1.00m to 2.50m.
Chiselling from 2.20m to 2.50m for 1 hour.

Scale
(approx)

Logger
By
JB

Figure No.
4019 BH2

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IAN FARMER ASSOCIATES

Geotechnical and Environmental Investigations

Site
Bridgefield Street, Rochdale

Borehole
Number
BH1

Boring Method
Cable Percussion

Diameter
150mm cased to 4.50m

Ground Level (mOD)

Client
Owen Ellis Partnership

Job
Number
4019

Location

Dates
07/12/2001

Engineer
Fleming Smith Associates Ltd.

Sheet
1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Instr
0.00-1.20	B						MADE GROUND : Soft to firm, black, gravelly, sandy CLAY. Gravel is angular and subangular, fine to coarse of sandstone, mudstone, brick and fabric. Cobbles present.		Water
1.50-1.95 1.50-1.95	SPT N=2 B	1.50	Dry	1/1..1		(3.80)			
2.50-2.95 2.50-2.95	SPT N=8 B	2.50	Dry	1,1/1,4,2,1					
3.50-3.95 3.50-3.95	SPT N=10 B	3.00	Dry	1,2/2,2,2,4		3.80			
4.00	D			Water strike(1) at 3.80m, rose to 2.40m in 20 mins, sealed at 4.00m.		(0.88)	Grey occasionally dark brown, MUDSTONE, recovered as angular and subangular, fine to coarse gravel		
4.50-4.68	SPT 25*/75 50/100	4.50	Dry	25/35,15		4.68			
							Complete at 4.68m		

Remarks

Standpipe installed. Slotted pipe in gravel filter from 1.00m to 4.00m. Bentonite fill from 4.00m to 4.50m. Chiselling from 4.20m to 4.50m for 1 hour. Excavating from 0.00m to 1.20m for 1 hour.

Scale
(approx)

Logged
By

1:50

JB

Figure No.
4019 BH1

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IAN FARMER ASSOCIATES

Geotechnical and Environmental Investigations

Boring Method
Cable Percussion

Diameter
150mm cased to 3.30m

Ground Level (mOD)

Site
Bridgefield Street, Rochdale

Client
Owen Ellis Partnership

Borehole
Number
BH3

Job
Number
4019

Location

Dates

Engineer

Fleming Smith Associates Ltd.

Sheet
1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Instr
0.00-1.20	B					(1.50)	MADE GROUND : Dark grey and brown, mottled sandy, gravelly CLAY. Gravel is angular and rounded, fine to coarse of sandstone, mudstone, brick, quartz and feldspar. Cobbles and boulders present.		
1.50-1.95	SPT N=9	1.50	Dry	1,1/2,2,2,3		1.50	Soft to firm, grey brown, slightly sandy, slightly gravelly CLAY. Gravel is angular and subangular, fine to coarse of mudstone and sandstone.		
1.50-1.95	B					(1.50)			
2.00	D								
2.50-2.95	SPT N=9	2.50	Dry	1,1/1,2,2,4		3.00	Grey MUDSTONE recovered as angular and subangular, fine to coarse gravel.		
2.50-2.95	B					(0.50)			
3.00	D					3.50	Complete at 3.50m		
3.30-3.50	SPT 25*/95 50/100	3.30	Dry	18,7/35,15					

Remarks
Standpipe installed. Slotted pipe in gravel filter from 1.00m to 3.30m.
Chiselling from 3.00m to 3.30m for 1 hour. Excavating from 0.00m to 1.20m for 1 hour.

Scale (approx) Logger By

1:50

Figure No.
4019.BH3

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IAN FARMER ASSOCIATES

Geotechnical and Environmental Investigations

Excavation Method
JCB 3CX

Dimensions
2.20m x 0.80m x 3.40m

Ground Level (mOD)

Site

Bridgefield Street, Rochdale

Trial Pit
Number
TP4

Client

Owen Ellis Partnership

Job
Number
4019

Location

Dates

13/12/2001

Engineer

Fleming Smith Associates Ltd.

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.20	D					MADE GROUND : Brown, slightly gravelly fine to coarse SAND. Gravel is subangular and subrounded, fine to coarse.	
0.20	D				(0.90)		
					0.90	Brown, sandy, clayey subrounded and rounded, fine to coarse GRAVEL of mudstone.	
1.40	D						
1.40	D				(1.60)		
2.10	B						
					2.50	Weak to moderately weak, grey slightly weathered MUDSTONE. (Undisturbed)	
2.80	D						
2.80	D				(0.90)		
3.30	B						
					3.40	Complete at 3.40m	
Plan						Remarks	
						Pit stability good. No water encountered.	

Scale (approx)

1:25

Logged By

IJ

Figure No.

4019.TP4

IAN FARMER ASSOCIATES

Geotechnical and Environmental Investigations

Excavation Method
JCB 3CX

Dimensions
3.00m x 0.80m x 2.90m

Ground Level (mOD)

Site
Bridgefield Street, Rochdale

Client
Owen Ellis Partnership

Trial Pit
Number
TP5

Job
Number
4019

Location

Dates
13/12/2001

Engineer
Fleming Smith Associates Ltd.

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.20	D				(0.35)	MADE GROUND : Dark brown, gravelly fine to coarse SAND. Gravelly is angular and subangular, fine to coarse of brick. At 0.20m : concrete slab present.	
0.20	D				0.35	MADE GROUND : Soft to firm, slightly gravelly, sandy CLAY. Gravel is angular to subangular, fine to coarse including brick.	
					(0.60)	Between 0.70m and 0.90m : clay pipe.	
1.00	D				0.95	Firm brown, slightly gravelly, sandy CLAY. Gravel is angular and subangular, fine to medium of sandstone.	
1.00	D						
					(1.55)		
1.80	B						
					2.50	Weak, moderately weak, grey, slightly weathered MUDSTONE. (Undisturbed)	
					(0.40)		
2.80	D				2.90		
2.80	D						
2.90	B					Complete at 2.90m	

Plan

Remarks

Pit stability good.
No water encountered.

Scale (approx)

Logged By

Figure No.

1:25

IJ

4019.TP5

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