

PHASE I ENVIRONMENTAL AUDIT.
Caldershaw Centre, Ings Lane, Rochdale.

Client:	Iqbal Enterprises.
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1. INTRODUCTION.

T. J. Booth Associates have been appointed by Iqbal Enterprises to undertake a Phase I Environmental Audit to the above Site and surrounding area to support Town & Country Planning requirements for development.

The report will provide a desk based study to assess the potential for contamination at the Site, and will assess the effects on potential receptors. Data gathered from various sources will be accessed including information on historic and current maps, landfill activity, industrial activity, geological and mining hazards, and flooding etc.

Recommendations in line with current best practice (CIRIA/CLEA/LQM/NHBC) shall be put forward at the end of the report.

The Site comprises commercial brownfield land on the urban edge of Caldershaw, Rochdale. The developments Site is currently disused land, generally levelled with a slope to the S boundary.

The Phase I report will form part of a planning application to Rochdale MBC.

2. PROPOSED DEVELOPMENT.

The proposed development is for the construction of 11 industrial/commercial units which are proposed nominally to the W and S boundaries, and will share a common yard and site entrance area to the centre (refer to proposed plans in appendix).

The slope to the S perimeter will be re-profiled and the wall to the E rebuilt. The Site will be covered with concrete to the units & yard, with PCC pavements to the perimeter.

3. MAP REVIEW.

3.1. Historic Maps.

An historic map pack was obtained at nominally 1:2500 and 1:10000 scale of the Site and the surrounding area. They were reviewed and tabulated below.

Date	On Site	Off Site / Surrounding Area
c1850	The Site generally field for the most part with structures noted to the East & west sides.	To the WNW is a tenters field, reservoirs to the SW & S. Embankment/slope noted to the S side of the Site. There are building structures to the SE. There is a colliery approx. 400m W. Caldershaw Brook is culverted to the S of the Site. Brookside Mill 150-200m N. Brotherod Cotton Mill approx. 200m E. Clod Cotton Mill 250m E. Spotland Cotton & Woolen Mills 300m E.

c1890	No change.	Caldershaw Mills noted to the NW of the Site (labelled wrong on map, is in fact Caldershaw House). Caldershaw Mills to the SE of the Site with tanks & associated raised bund reservoir. Tanks are adjacent the perimeter of the development Site. Old shaft noted 250-300m W.
c1910	No change.	Caldershaw Mill to the SE noted as dying & finishing. Tanks to the S perimeter of development Site are noted as filter tanks. Asbestos & India Rubber Works 500m E. Caldershaw Brook to the E culverted with made ground now indicated.
c1930	Caldershaw Mill Expanded to N & NW side of the development Site. Tanks & chimneys noted on Site.	Caldershaw Mill expanded to N of Site.
c1960s	Chimneys demolished, mill expanded further on to development Site.	Housing estate erected approx. 150m S & 150m E on now demolished Brothorod Mill Site. Brookside Mill to N demolished. Former Clod & Spotland Mills now just indicated as Works 350E.
c1980s-90s	Further development of Mills on Site.	Caldershaw Mill expanded to the WNW of the Site, replacing Caldershaw House.

3.2. Present Day Maps.

Present day mapping data comprises digital mapping data, topographical survey data, and OS maps.

3.2.1. Site Boundaries, Outlines of Structures and Building Lines.

The present day Caldershaw Centre is split in to different industrial units. The proposed development is to the S side of the Centre, with the old mill reservoir to the SW, Ings Lane access road to the E, and commercial premises to the S and E. The Site is currently a vacant and unused plot of land.

3.2.2. Ground Contours, Natural Drainage Features and Water Courses.

The development Site is relatively flat at a height of nominally 152.5m aOD. There is a slope to the S side of the Site with the adjoining commercial land in the order of nominally 4m. The reservoir to the SW of the Site is fed by Caldershaw Brook which is then culverted under the area S of the Site. The raised bund wall reservoir to the S has now been removed. Drainage from the Site is too the S & W with the natural contours of the land lowest to the S of the Site in the approx. position of the culverted watercourse. The local area is also served by man-made sewerage and piped services.

3.2.3. Indication of Obstructions below Ground.

Historical mapping data indicates that there is an old/disused coal shaft nominally 250-300m W, which indicates a potential for worked coal seams at depth.

3.3. Geological Maps.

The local solid geology was reviewed using BGS Rochdale Sheet 76 (1:10650 edition) map (refer to appendix for maps).

The mapping data indicated that the Site lay on Milnrow Sandstone of the Carboniferous Lower Coal Measures. Undifferentiated sandstones/mudstones outcrop nominally 50m W & 100m E. The Upper Mountain Mine Coal Seam outcrops nominally 450m W, and the region has a stratigraphic dip in the order of approximately 5-10° S.

The drift geology under the Site was noted as being glacial till for much of the local area with some alluvium in the Spodden Valley bottom 300mE.

4. ENVIRONMENTAL DATA SEARCH.

4.1. BGS Borehole Data.

The British Geological Survey has records of boreholes for England & Wales. A number of records were found to the W of Caldershaw Mills. The closest of these indicated up to 7m sand and gravel in the Caldershaw Brook vicinity with 5m of boulder clay found to the estate N of the Mill.

4.2. Environment Agency Data.

The Environment Agency maintains various environmental datasets for England and Wales such as flooding, landfill, and pollution data.

4.2.1. Flooding.

In a search on the development Site, the EA flood mapping data indicated that the Site is not within a flood zone area (refer to EA map in appendix).

4.2.2. Landfill.

In a search on the development Site, the EA landfill mapping data indicated that the Site is not within 250m of a landfill site (refer to EA map in appendix).

4.3. Coal Authority Report.

4.3.1. Mining.

The Coal Authority report indicated that the site is not within the zone of likely physical influence of past or present underground workings. The site is also not within the area for which licences have, or are in the process of being granted; although reserves of coal do exist in the area. Past, present, and future open cast mining is not an issue in the area.

4.3.2. Mine Adits, Shafts, and Entries.

There are no known mine entries exist within the site, or within 20m of the site boundaries.

4.3.3. Mining Geology and Subsidence.

No evidence of any damage has been noted in the area due to lines of weakness or faults occurring as a result of mining activity. No subsidence issues have been noted in the area.

4.3.4. Hazards and Mine Gas.

There have been no records of mine gas or hazards pertaining to the site.

4.4. UK Radon Maps.

UK Radon Maps indicate that the Site is within an area where less than 1% of homes are above the radon action level.

5. FIELDWORK.

5.1. Site Reconnaissance.

A Site reconnaissance/investigation was undertaken on the 23rd August 2013. The weather was overcast but dry.

5.1.1. Records and Details of Existing Structures.

The Site was accessed by an entrance gate to the E side of the Caldershaw Centre off Ings Lane access road.

The E side of the Site comprised a concrete yard which is currently used as a car park to the Eurotyre depot. There was a tank to the NW corner of the yard situated on concrete. There was also some storage of tyres, a container and a prefabricated office block.

The S side of the Caldershaw Centre comprised a generally flat made ground (building rubble including brick, stone, conc, macadam, with occasional metal & plastics etc). The ground was vegetated with weeds/shrubs. The site sloped down to the adjacent landscaping & timber yards to the S. There were occasional areas of minor tipping on Site.

The landscaping & timber yards to the S comprised two storage bays which were used for composts.

Himalayan Balsam was noted to the SW corner adjacent the reservoir.

5.1.2. Water Levels, Directions of Flow and Rates in Rivers.

Caldershaw Brook flows in to the reservoir to the SW. The reservoir has a sluice/culvert outflow which flow under the Adjoining yards to the S.

5.1.3. Records of Adjacent Properties.

Timber yard and landscaping to the S. Other factories/works to the E across Ings Lane access road and to the N.

Reservoir to the SW comprised a concrete wall and bund dam.

5.1.4. Records of Old Mine or Quarry Workings.

None noted.

5.1.5. Records of any Obvious or Immediate Hazards to Health or Safety.

None noted.

5.1.6. Records of Areas of Discoloured Soil, Polluted Water, Vegetation, and Significant Odours.

A putrid odour was noted to the SE corner of the Site adjacent the landscaping yard. However it is thought that the source of the odour was from the compost stores adjacent to the Site in the landscaping yard.

5.1.7. Records of Relevant Ground Levels, Ground Water Levels, Positions of Wells and Springs.

The Site was generally flat with a steep slope in the order of approx. 4m to the S boundary/perimeter. The E boundary had a retaining wall above the adjacent Site nominally 3-4m high.

6. DISCUSSION FROM THE DESK STUDY AND FIELDWORK.

6.1. Preliminary Conceptual Model.

6.1.1. Introduction.

The development Site is on the rural edge of Caldershaw, Rochdale. It is surrounded generally by a commercial premises and some green space, with some residential development in the local area.

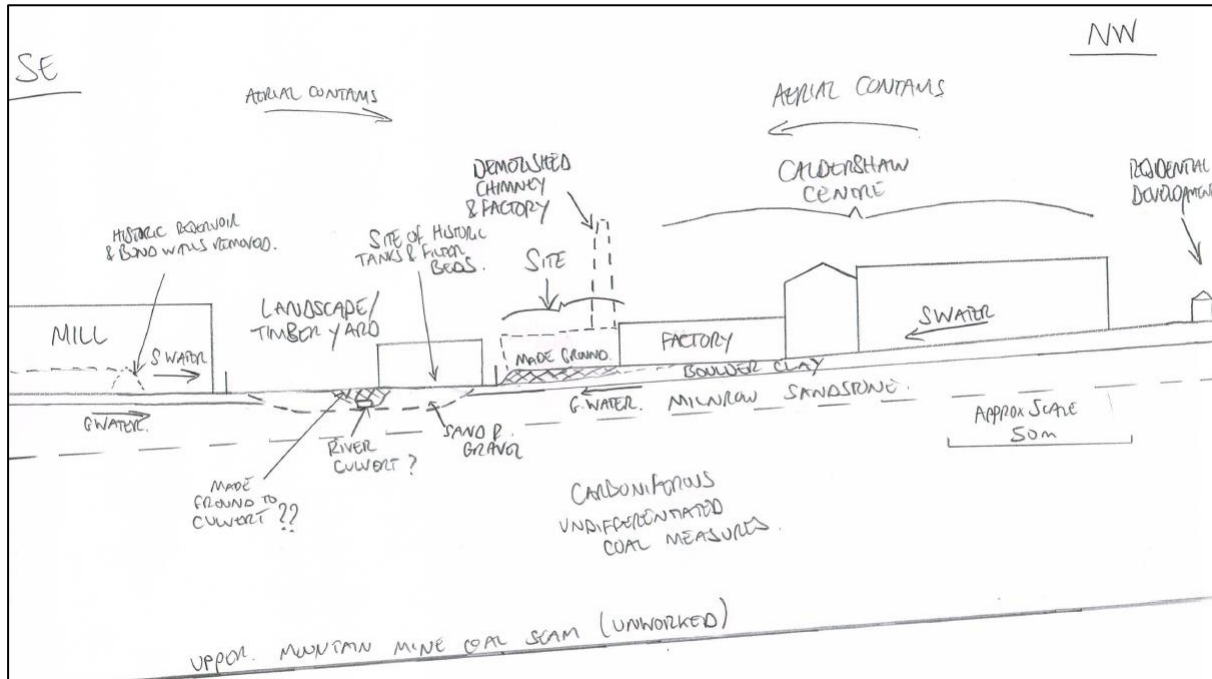
The local area has seen a significant amount of industry in the past due to its location on the Caldershaw Brook, and formed part of the Caldershaw Mills complex which was a dying & finishing mill historically, with cotton & woollen mills in the local area. The majority of the mills in the area have been demolished or modernised/rebuilt.

The Site itself has comprised part of the mill historically as well as housing chimneys and storage tanks. Filter beds have been noted historically to the S of the Site boundary. The Site comprises made ground built up both recently and historically.

Although in a coal mining area, the coal authority report indicated that no seams have been worked beneath the Site. Landfill sites are not an issue in the local area as none are within the standard 250m buffer zone of the Site.

Although there is a reservoir adjacent to the SW corner of the Site, the ground on Site is approx. 4m higher than the adjacent commercial premises to the S. The reservoir to the S of the Site was shown on historical maps to have raised bund banks and so is not thought to be infilled when removed.

6.1.2. Local Conceptual Model.



6.1.3. Potential Contaminants.

Potential minor contaminants include possible furnace ash in made ground (most likely used to build up levels historically but not encountered on Site reconnaissance) which generally contain heavy metals and PAHs as well as contaminants usually associated with building rubble such as sulphates and asbestos fibre or ACMs.

6.1.4. Potential Pathways.

Potential pathways at the Site include:

Ingestion of contaminated plant matter.

Ingestion of soils either via plants, or by children playing.

Ground water pathways.

Surface water pathways.

Ground gas migration and inhalation.

Inhalation of dust.

Dermal contact with contaminated soil/water.

Ingestion of contaminated water.

6.1.5. Potential Receptors.

Receptors include construction workers, potential future residents, plant matter.

6.1.6. Potential Pollutant Linkages.

Below is a tabulated form of the conceptual model.

	Source	Pathway	Receptor
1	On site surface soils.	Direct ingestion, aerial ingestion, dermal contact, drinking water.	Site construction operatives & future workers.
2	Subsoils.	Contact with potential hazards.	Site buildings.
3	Ground gas from coal measures.	Diffusion through soil, aerial inhalation.	Future workers. Site buildings.
4	Ground gas from waste or landfill sites.	Diffusion through soil, aerial inhalation.	Future workers. Site buildings.
5	Contaminated ground and surface water.	Permeation through soils into excavations / basements, dermal contact & ingestion.	Site construction operatives & future workers.
6	Aerial contaminants, settled dust, fumes, from local industrial processes.	Dermal contact & aerial inhalation.	All site users.

7. CONCLUSIONS.

7.1. Preliminary Contaminant Risk Assessment.

The Site will be a commercial development and contaminant hazards will be assessed where appropriate against common/established criteria.

Regarding potential pollutant linkage 1 & 2, there is a potential risk of minor contamination to on Site soil from made ground which is likely to contain furnace ash as well as the noted demolition rubble. These have the potential to contribute minor contamination of heavy metals, PAHs, and inorganic/sulphates & asbestos etc.

Regarding potential pollutant linkage 3, ground gas from coal seams is not thought to pose a risk to the Site. The Coal Authority report indicated that coal had not been worked beneath the Site and no ground gas issues from coal mining had been noted in the local area.

Ground gas sources such as waste & landfill sites in potential pollutant linkage 4 are not considered to pose a risk. No landfill Sites were noted within the 250m buffer of Site Boundaries. However, made ground which the Site generally comprises could potentially pose a minor risk.

Regarding potential pollutant linkage 5, surface/ground water is not considered to present a risk to the Site or development. There were no potentially contaminative uses noted on Site reconnaissance.

Potential pollutant linkage 6 is considered to pose a risk. Although present legislation regarding the release of aerial contaminants is regulated and licensed, past releases would have been unregulated. Any contamination from historic aerial pathways would now be recorded in potential pollutant linkage 1 as shallow ground contamination.

8. RECOMMENDATIONS.

There is the potential for on-site made ground to comprise contaminants; however, the proposed development is for commercial development with warehouse units to the perimeter of the Site with the central area to be a concrete hardstanding yard.

There is no reason why any shallow low level contaminated material can not remain below permanent hardstanding areas such as the concrete yard and building areas where it will not be accessible, thus cutting off any pathway to receptors.

It is recommended however that as part of the development boreholes/trial pits should be undertaken to the Site to better understand the geotechnical conditions of made ground. As part of the Site investigations a soil sampling regime should be undertaken to ascertain whether or not made ground to the Site is contaminated for excavation and tipping purposes.

There are no landfill Sites in the area, so ground gas from these is not considered an issue. Likewise, although coal seams have been noted at depth beneath the Site, the Coal Authority report indicated that the Site is not within the likely zone of physical influence suggesting they are unworked local to the Site, and thus do not pose a gas risk. There is however a potential for minor ground gas from made ground and infilled basements etc.

In lieu of a gas testing regime and dependant on site investigation results at this stage it is recommended that any development unit should comprise class 2 gas protective measures such as:

- a) Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft) with at least 1200g DPM9. All joints and penetrations sealed.
- b) Beam & block or pre-cast concrete slab and minimum 2000g DPM/reinforced gas membrane. All joints and penetrations sealed.
- c) Possibly underfloor venting or pressurisation in combination with a) or b) depending on use.

Signed.....

D.S.Slattery BSc (Hons).

T J Booth Associates.

Authorised.....

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

T J Booth Associates.

9. REFERENCES.

- NHBC. 2007. Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present.
- CIRIA. Report C665.
- CIRIA. Report 130.
- BS:10175.
- BRE 414. 2001. Protective Measures for Housing on Gas Contaminated Land.

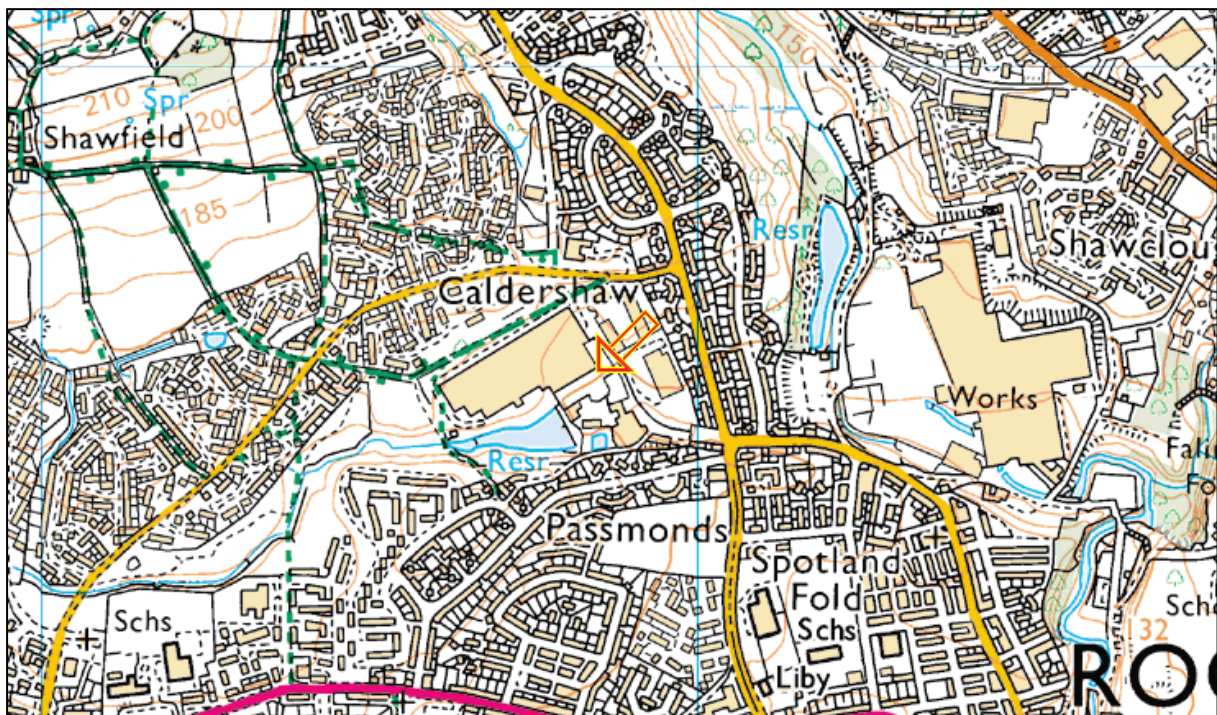
10. APPENDIX A: PHOTOGRAPHS & FIGURES.

10.1. Photographs.

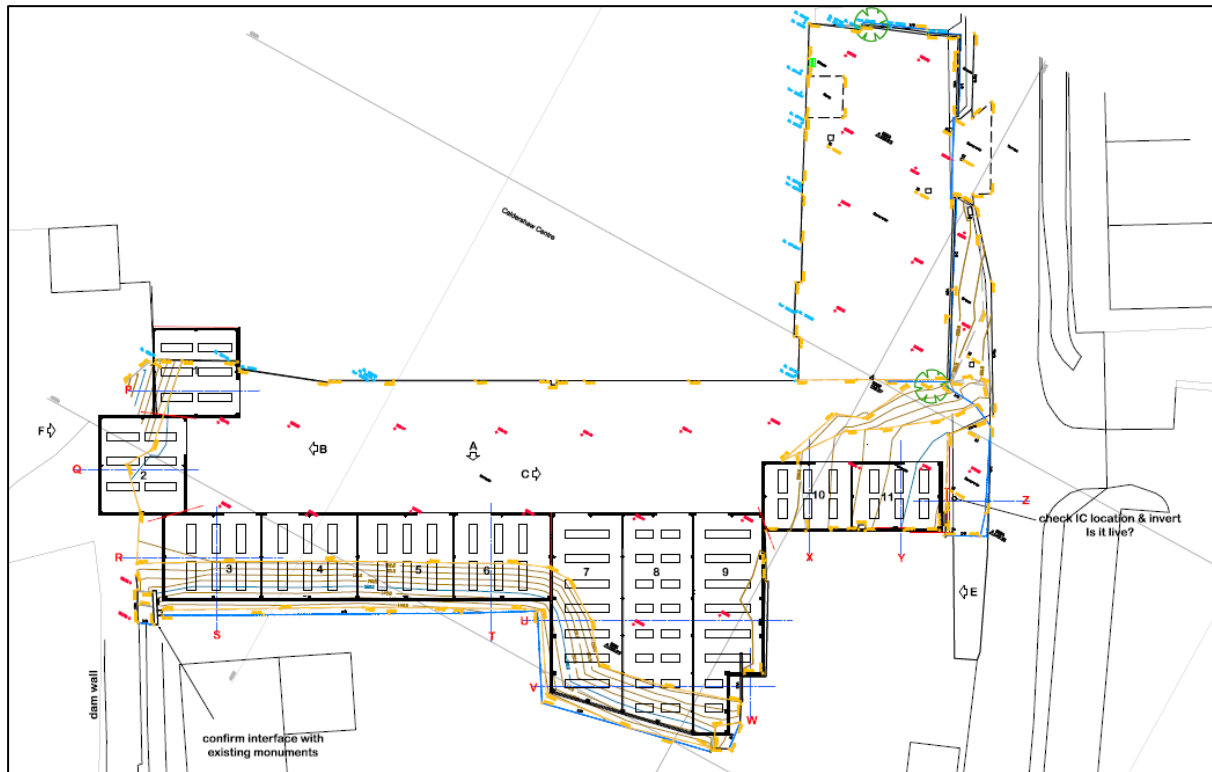




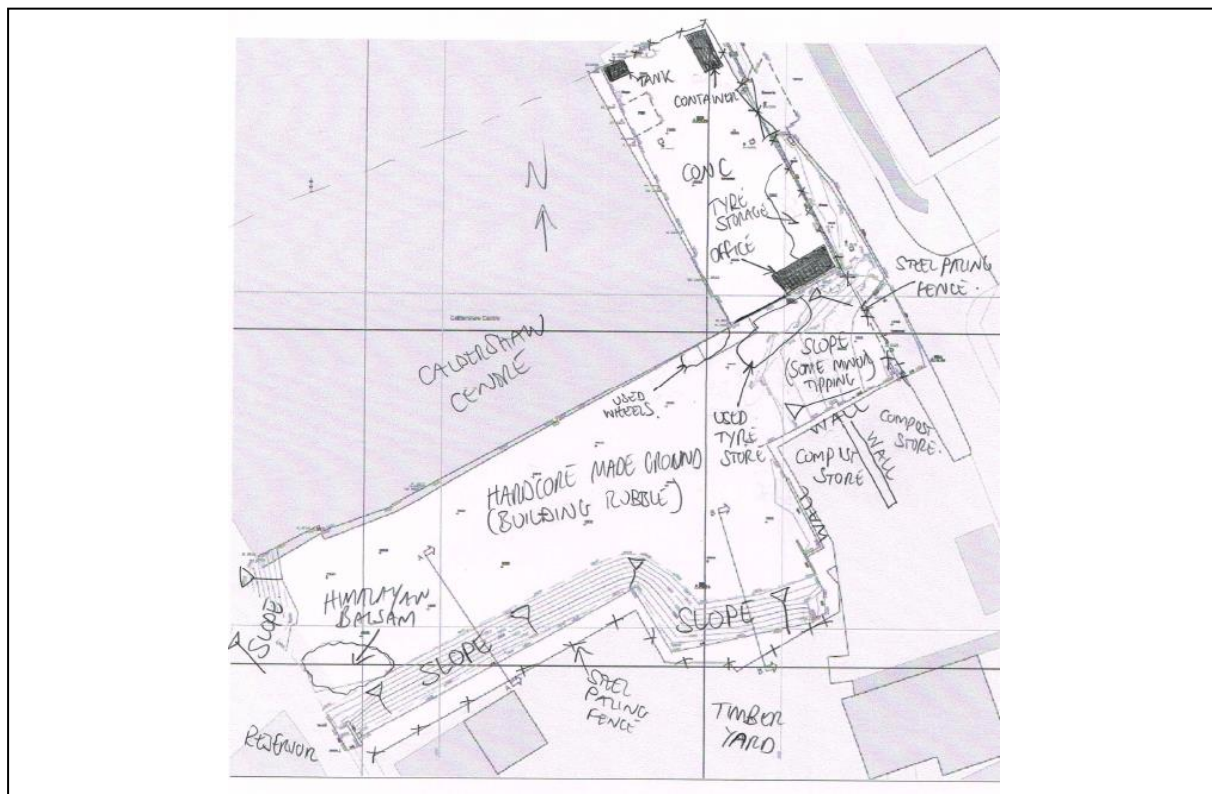
10.2. Location Plan.



10.3. Proposed Site Plan.



10.4. Existing Site Plan/Site Sketch.



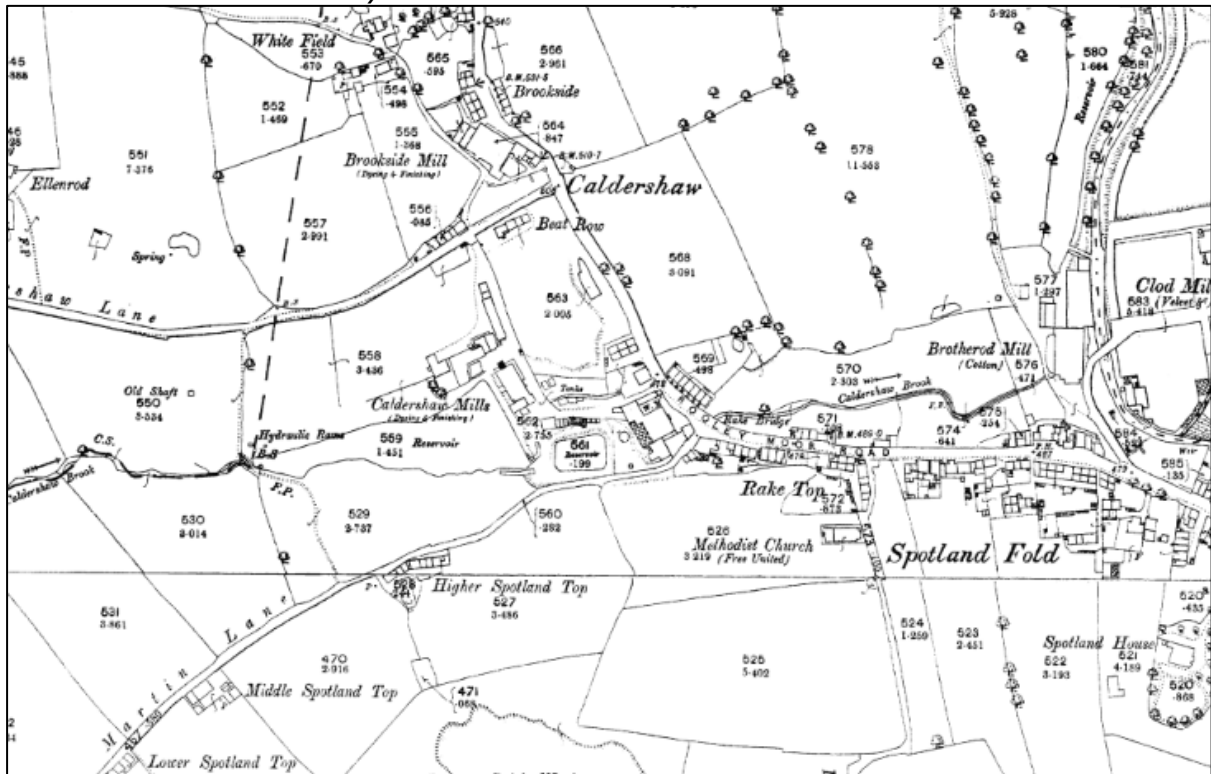
11. APPENDIX B: MAPS.

11.1. Historic Maps.

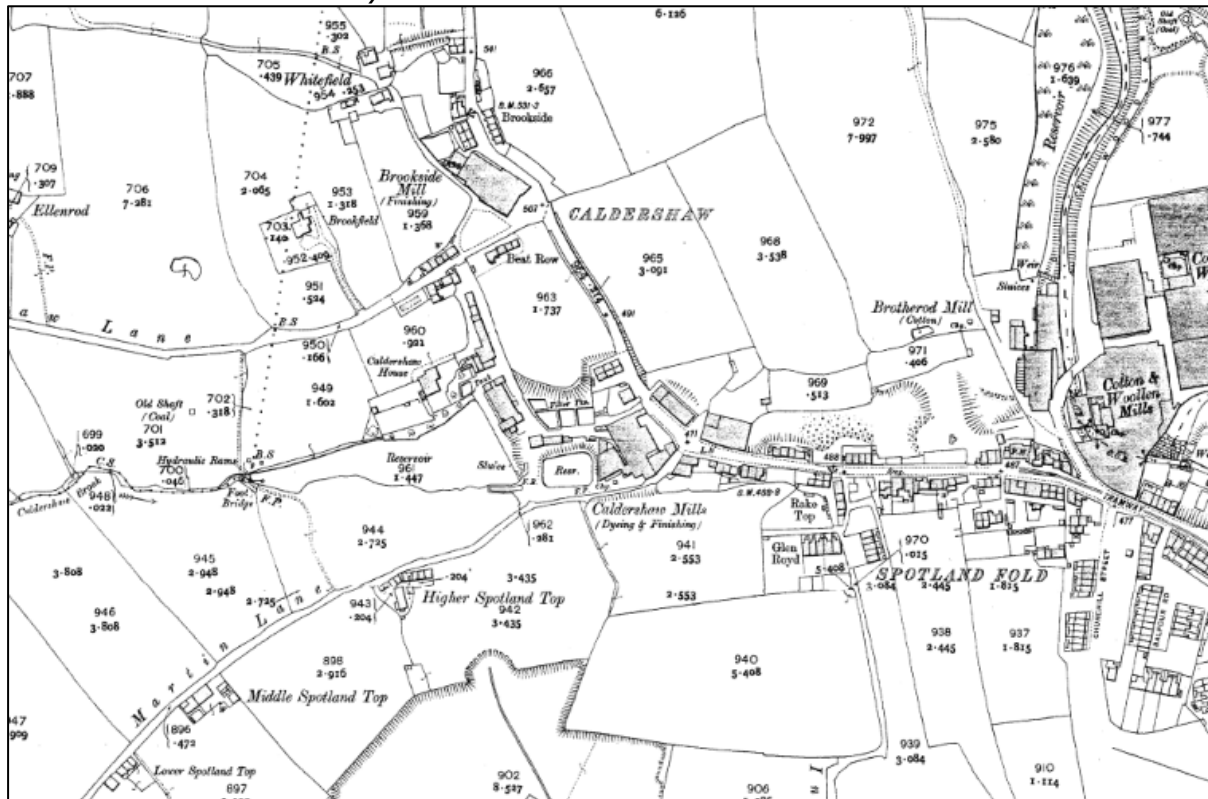
11.1.1.1. Ordnance Survey c1850.



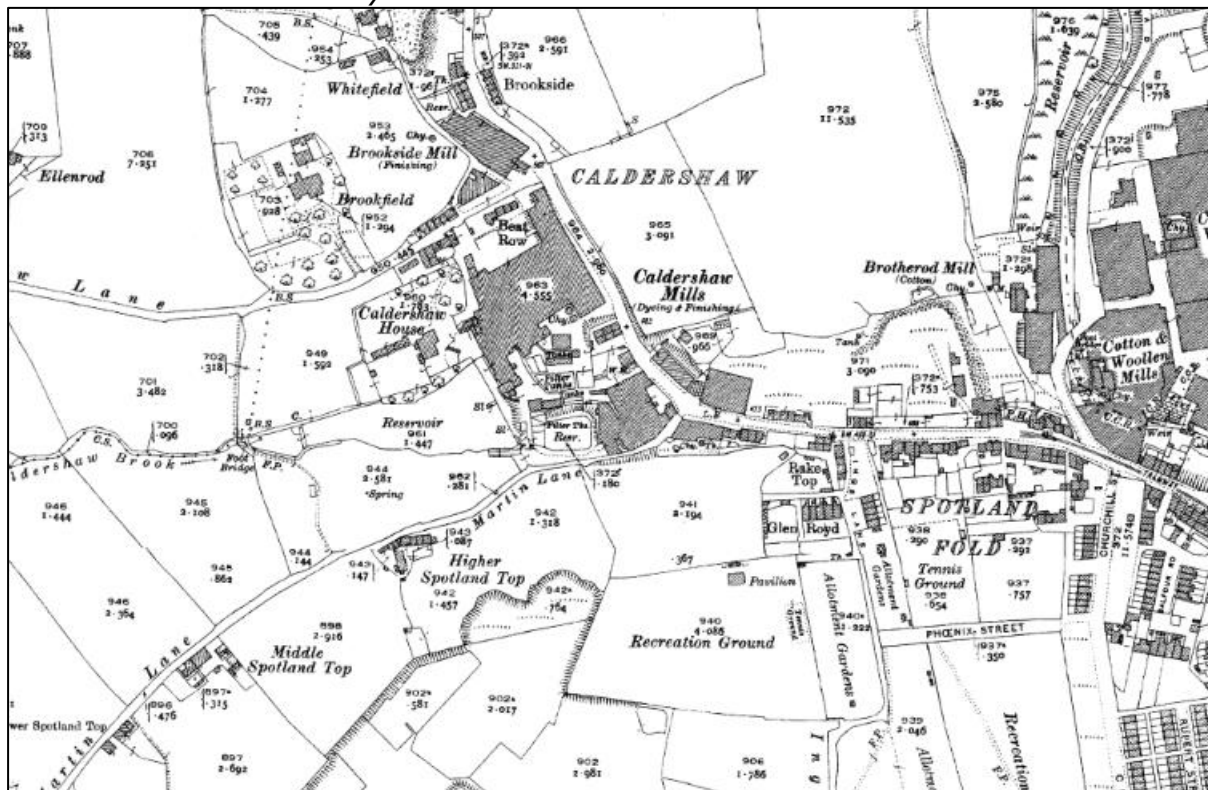
11.1.1.2. Ordnance Survey c1890.



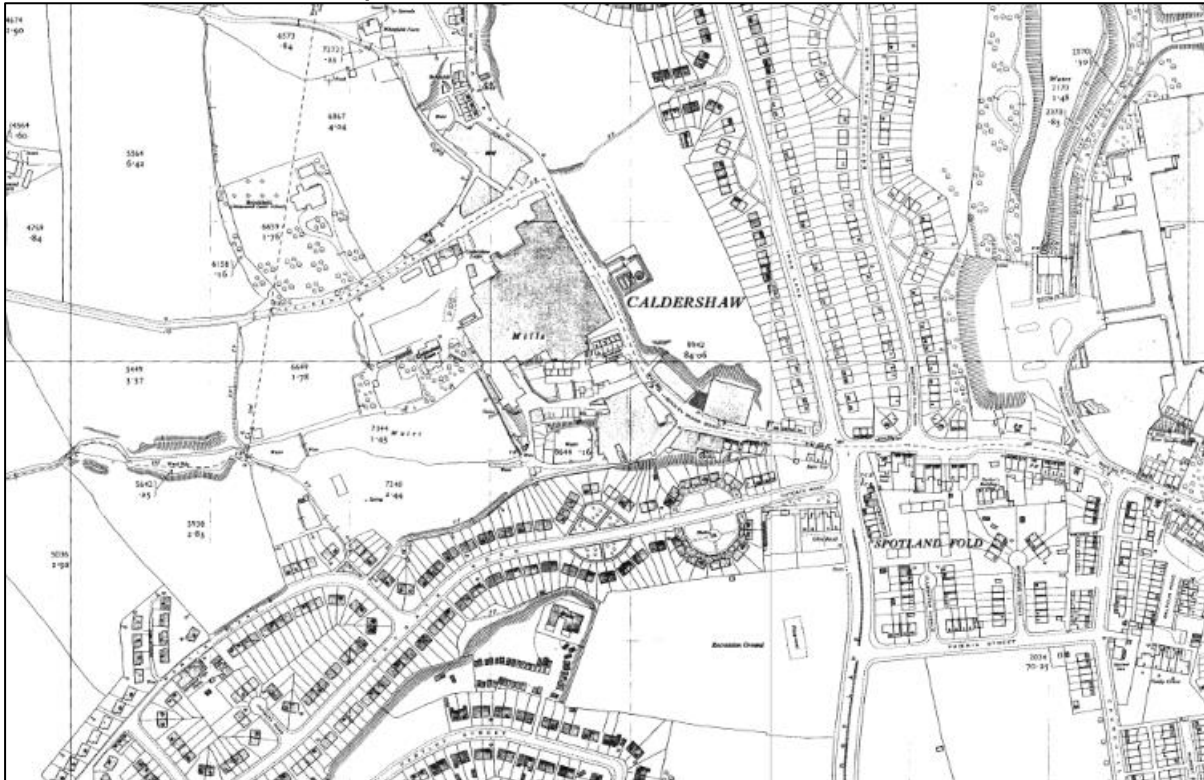
11.1.1.3. Ordnance Survey c1910.



11.1.1.4. Ordnance Survey c1930s.



11.1.1.5. Ordnance Survey c1960s.



11.1.1.6. Ordnance Survey c1980-90s.

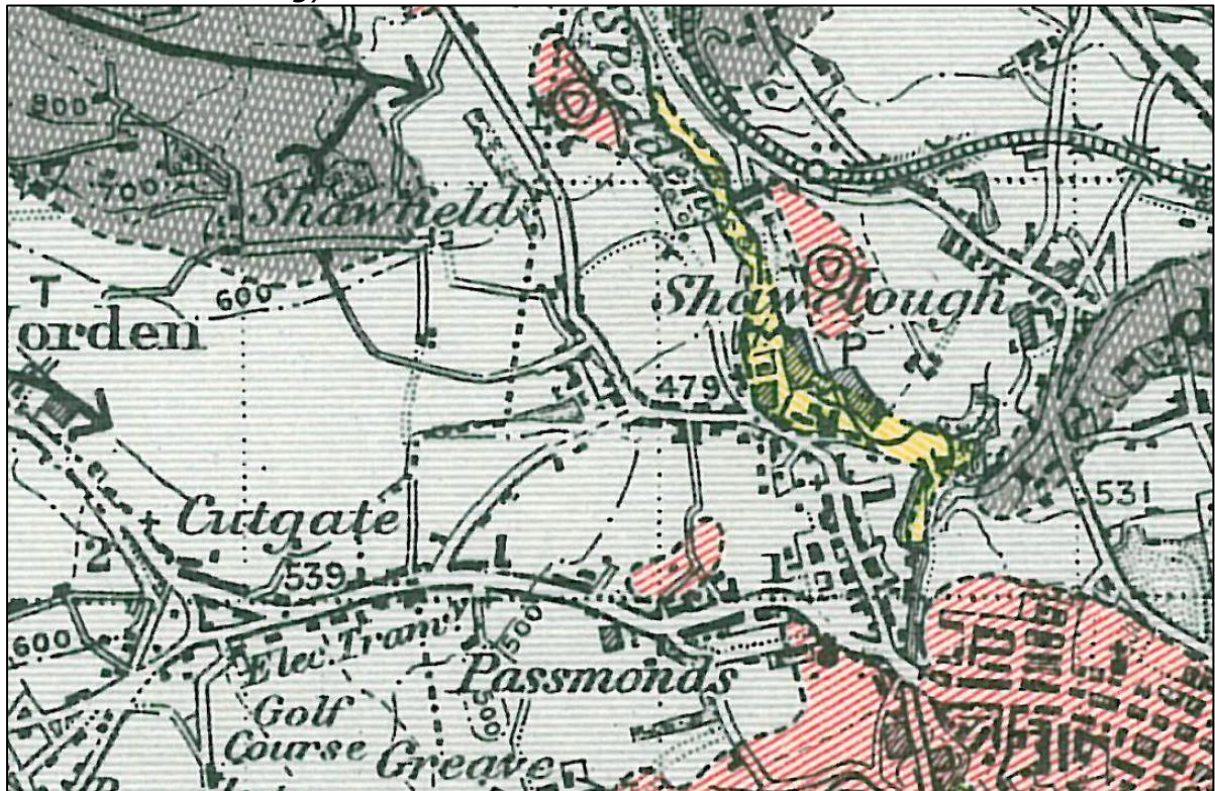


11.2. Geological Maps.

11.2.1.1. Solid Geology.



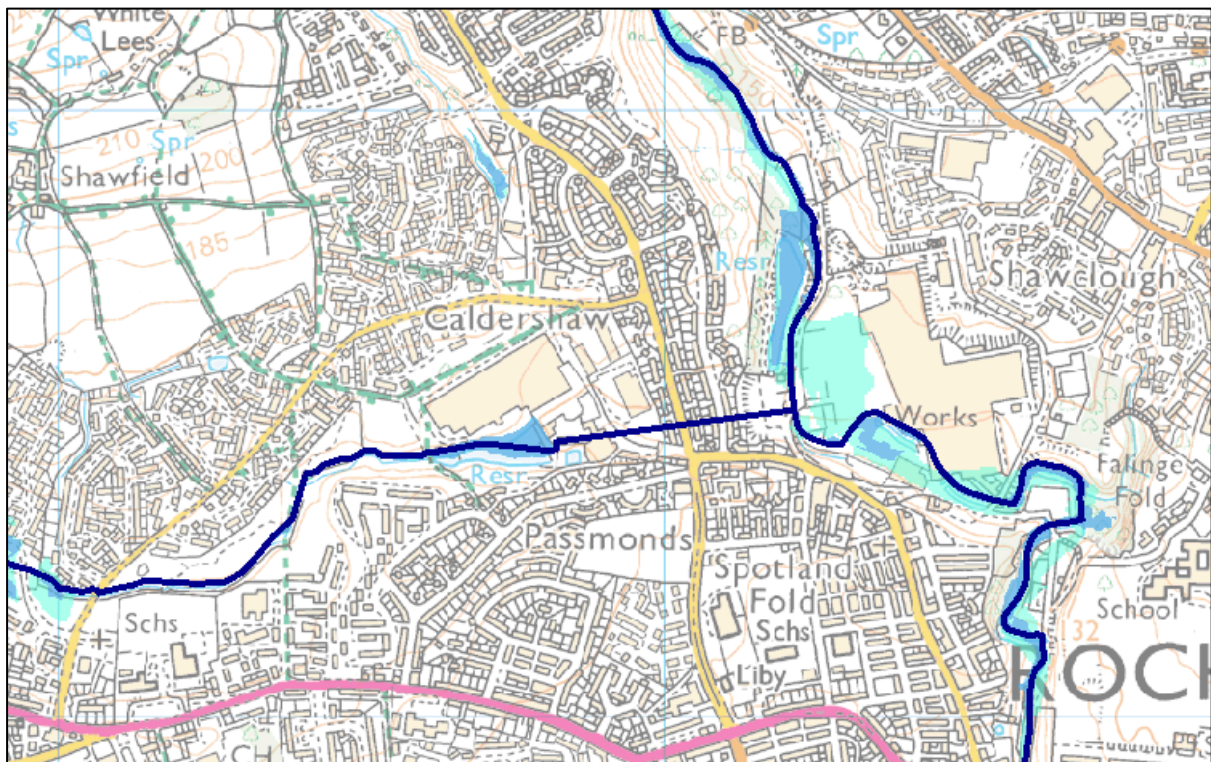
11.2.1.2. Drift Geology.



11.3.Environment Agency Landfill Map.



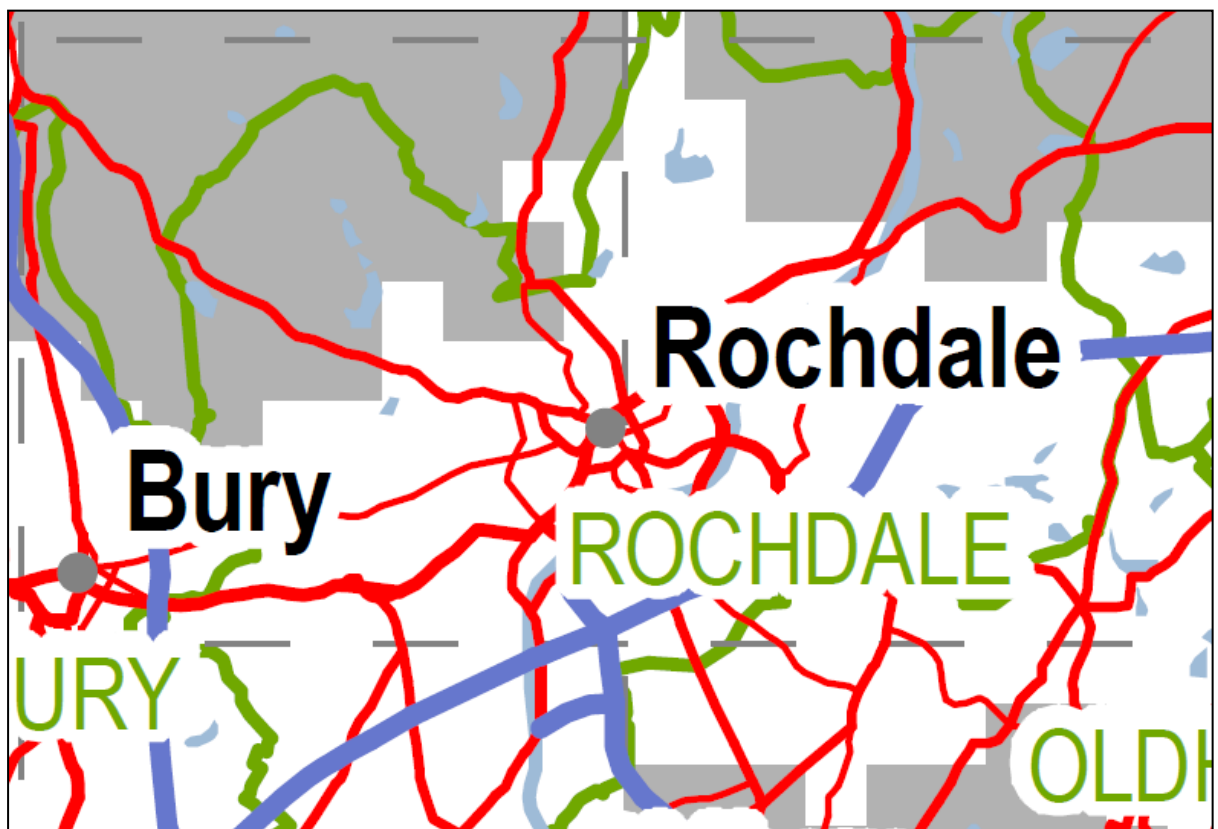
11.4.Environment Agency Flood Map.



11.5. Coal Authority Report Map.



11.6. Radon Map.



12. APPENDIX C: ENVIRONMENTAL DATABASES & REPORTS.



Issued by:
The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG
Website: www.groundstability.com Phone: 0845 762 6848 DX 716176 MANSFIELD 5

LANDMARK INFORMATION GROUP LIMITED SOWTON INDUSTRIAL ESTATE ABBEY COURT UNIT 5/7 EAGLE WAY EXETER DEVON EX2 7HY	Our reference: 51000363123001 Your reference: 48630242 Date of your enquiry: 23 August 2013 Date we received your enquiry: 23 August 2013 Date of issue: 23 August 2013
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This report is for the property described in the address below and the attached plan.

Non-Residential Coal Authority Mining Report

CALDERSHAW CENTRE, INGS LANE, ROCHDALE , GREATER MANCHESTER,

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	See comments below
Brine Compensation District	No

Information from the Coal Authority

Underground coal mining

Past
According to the records in our possession, the property is not within the zone of likely physical influence on the surface from past underground workings.

Present
The property is not in the likely zone of influence of any present underground coal workings.

Future
The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.
The property is not in an area for which a licence has been granted to remove or otherwise work coal using underground methods.
The property is not in an area that is likely to be affected at the surface from any planned future workings.
However, reserves of coal exist in the local area which could be worked at some time in the future.
No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries
There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

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 Non-Residential Coal Authority Mining Report - 51000363123001 Page 1 of 4 —

13. APPENDIX D: TABLES.

13.1. CIRIA SP 78, TABLE 15, Contaminant Hazards Related to End Use.

	Targets and associated hazards ¹						
	1	2	3	4	5	6	7
	Site works	Water resources	Buildings and services	Buildings and services	Garden amenities	Allotments, agriculture	Plant growing
Critical Contamination ²	Harm to workers ³	Leachate pollution ⁴	Fire and explosion	Corrosion or expansion damage ⁴	Harm to children ⁵	Crop uptake of contaminant ⁴	Phyto-toxicity ⁴
Arsenic	○	○			●	○	
Cadmium		○			●	● ¹⁵	
Lead		○		○ ¹¹	●	● ¹⁵	
Cyanide	○	●			● ¹⁴		
PAH ⁶	●		○		●		○
Phenols	●	●		●	●		○
Copper		○		○ ¹¹	○		● ¹⁵
Nickel		○		○ ¹¹			● ¹⁵
Zinc		○		○ ¹¹			● ¹⁵
Sulphate		●		● ¹²	●		○
Sulphide		○		●			
Chloride		○		●			○
Mineral oils	● ⁸	○	○	●	○		
Ammoniumion				●			
Methane	○ ⁹		● ⁹				○
Sulphur			●	○ ¹³			
Combustibles	○		● ⁷				
Oily, tarry substances	●	○	○	●			○
Asbestos	●	○ ¹⁰					
Radioactive materials	●	○			○	○	
Soluble metals		●		○	○		
pH	○	●		●		●	●
Solvents and organics	○	○	○				
Boron		○					○
Expansives				○ ¹⁷			

● Listed contamination hazards (from BS, DD 175 1988, and ICRL Note 59/83 2nd edition 1987).
 ○ Non-listed contamination hazards.

Notes. 1. Combinations of hazards may need investigation.
 2. Local factors may involve other contaminants.
 3. Workers at risk from contact, inhalation, explosion, fire and ground pH.
 4. Soil pH affects incidence of these hazards.
 5. Children at risk from inhalation, ingestion and contact.
 6. PAH polynuclear aromatic hydrocarbons.
 7. Combustibles include coal, oils, tars, refuse, rubber, etc Determine calorific value, loss on ignition, ash and volatile contents, total organic carbon.
 8. Mineral oils are industrial hygiene problem, with or without PCB contamination.
 9. Continuous on-site monitoring.
 10. Hazard if run-off carries friable asbestos into streams.
 11. Electrolytic action if free metal present.
 12. Total and soluble sulphate (See also Section 1 1.4.4).
 13. Corrosion induced by sulphur consuming bacteria.
 14. Free cyanide.
 15. Total and 'plant-available' metals.
 16. Total, 'plant-available' and 'zinc equivalent' values.
 17. Expansives include: blast-furnace and steel slags, mining spoils and pyritic materials. Determine: total sulphur and acid soluble sulphate, calcite, and calcium as CaO.

13.2.CLR 8, Table2.1.

Table 2.1 Potential inorganic contaminants for the assessment of industrial land and their receptors

Contaminants ^{a, b}	Receptors			
	Humans	Water	Vegetation and the ecosystem	Construction materials
Metals				
Barium		✓		
Beryllium	✓	✓	✓	
Cadmium	✓	✓	✓	
Chromium	✓	✓		
Copper		✓	✓	
Lead	✓	✓	✓	
Mercury	✓	✓	✓	
Nickel	✓	✓	✓	
Vanadium	✓	✓		
Zinc		✓	✓	
Semi-metals and non-metals				
Arsenic	✓	✓		
Boron		✓	✓	
Selenium	✓	✓	✓	
Sulphur	✓		✓	✓
Inorganic chemicals				
Cyanide (complex)	✓	✓	✓	✓
Cyanide (free) ^c	✓	✓	✓	
Nitrate		✓		
Sulphate		✓	✓	✓
Sulphide		✓	✓	✓
Other				
Asbestos	✓			
pH (acidity/alkalinity)	✓	✓	✓	✓

Notes

^a The list should not be regarded as a comprehensive list that should be taken into account in any particular site investigation. Some contaminants will be of no importance on certain types of site, while some sites may be contaminated by elevated concentrations of particular substances, which may not be selected because of their infrequent occurrence generally.

^b For references to synonyms of substances refer to Appendix C.

^c Free cyanide is broadly equivalent to "easily liberatable cyanide", which covers compounds that can release hydrogen cyanide at pH 4 and 100°C (see paragraph B.15 in Appendix B).

13.3.CLR 8, Table2.2.

Table 2.2 Potential organic contaminants for the assessment of industrial land and their receptors

Contaminants ^{a, b}	Receptors			
	Humans	Water	Vegetation and the ecosystem	Construction materials
Acetone	✓	✓		
Oil/fuel hydrocarbons	✓	✓	✓	✓ ^c
<i>Aromatic Hydrocarbons</i>				
Benzene	✓	✓	✓	✓ ^c
Chlorophenols	✓	✓	✓	✓ ^c
Ethylbenzene	✓	✓	✓	✓ ^c
Phenol	✓	✓	✓	✓ ^c
Toluene	✓	✓	✓	✓ ^c
<i>o</i> -Xylene	✓	✓	✓	✓ ^c
<i>m,p</i> -Xylene	✓	✓	✓	✓ ^c
Polycyclic Aromatic Hydrocarbons	✓	✓		
<i>Chlorinated Aliphatic Hydrocarbons</i> ^d				
Chloroform	✓	✓	✓	
Carbon tetrachloride	✓	✓	✓	✓ ^c
Vinyl chloride	✓	✓		
1,2-Dichloroethane	✓	✓	✓	✓ ^c
1,1,1-Trichloroethane	✓	✓	✓	✓ ^c
Trichloroethene	✓	✓	✓	✓ ^c
Tetrachloroethene	✓	✓	✓	✓ ^c
Hexachlorobuta-1,3-diene	✓	✓	✓	
Hexachlorocyclohexanes	✓	✓	✓	
Dieldrin	✓	✓	✓	
<i>Chlorinated Aromatic Hydrocarbons</i>				
Chlorobenzenes	✓	✓	✓	
Chlorotoluenes	✓	✓	✓	
Pentachlorophenol	✓	✓	✓	
Polychlorinated biphenyls ^e	✓	✓	✓	
Dioxins and furans ^f	✓	✓	✓	
<i>Organometallics</i>				
Organolead compounds	✓		✓	
Organotin compounds	✓	✓		

Notes

^a The list should not be regarded as a comprehensive list that should be taken into account in any particular site investigation. Some contaminants will be of no importance on certain types of site, while some sites may be contaminated by elevated concentrations of particular substances, which may not be selected because of their infrequent occurrence generally.

^b For references to synonyms of substances refer to Appendix C.

^c The impact of chlorinated hydrocarbons and other organic substances is probably limited to concentrations in the free phase.

^d Some chlorinated aliphatic hydrocarbons are considered to be of secondary importance (see paragraphs B.16 and B.17 in Appendix B) and are therefore excluded because they are less toxic, highly volatile or have limited industrial use. However, some highly volatile substances may be significant due to their solubility and are not excluded on grounds of volatility alone.

^e There are 209 polychlorinated biphenyl (PCB) congeners, the significance of which can be expressed using toxic equivalency factors (TEFs) relative to the best-characterised member of the group.

^f There are 210 possible isomers of chlorinated dioxins and furans, of which the most studied and most toxic representative of the group is 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD). Other dioxins and furans could be expressed in terms of TEFs relative to 2,3,7,8-TCDD.

13.4. CIRIA (Report 659) Wilson and Card Classification.

Characteristic Situation (CIRIA Report 149)	Risk Classification	GSV (CH ₄ or CO ₂) (l/hr) ¹	Additional factors	Typical source of generation
1	Very low risk	<0.07	Typically methane ≤1%v/v and/or carbon dioxide ≤5%v/v. Otherwise consider increase to Situation 2	Natural soils with low organic content. "Typical" Made Ground
2	Low risk	<0.7	Borehole flow rate not to exceed 70l/hr. Otherwise consider increase to Situation 3	Natural soil, high peat/organic content. "Typical" Made Ground
3	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
4	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures	Mineworking susceptible to flooding, completed landfill (WMP 26B criteria)
5	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
6	Very high risk	>70		Recent landfill site
Notes: 1. Gas screening value: litres of gas/hour is calculated by multiplying the gas concentration (%) by the measured borehole flow rate (l/hr); 2. Site characterisation should be based on gas monitoring of concentrations and borehole flow rates for the minimum periods as defined within CIRIA Report 659; 3. Source of gas and generation potential/performance must be identified; 4. Soil gas investigation to be in accordance with guidance contained within CIRIA Report 659; 5. If there is no detectable flow, use the limit of detection of the instrument; 6. The boundaries between the Partners in Technology classifications do not fit exactly with the boundaries for the above classification.				

13.5. CIRIA (Report 659) Wilson and Card Protective Measures.

Characteristic Situation (From Table 11.1)	Residential building (Not low-rise traditional housing) ¹		Commercial /industrial development	
	Number of levels of protection	Typical scope of protective measures	Number of levels of protection	Typical scope of protective measures
1	None	No special precautions	None	No special precautions
2	2	a) Reinforced concrete cast in situ floor slab (suspended, nonsuspended or raft) with at least 1200g DPM9 and underfloor venting b) Beam and block or pre-cast concrete and 2000 g DPM/reinforced gas membrane and underfloor venting. All joints and penetrations sealed. 1 to 2	1 to 2	a) Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft) with at least 1200g DPM9 b) Beam and block or pre cast concrete slab and minimum 2000g DPM/reinforced gas membrane c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on us All joints and penetrations sealed.
3	2	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space.	1 to 2	All types of floor slab as above. All joints and penetrations sealed. Minimum 2000g/reinforced gas proof membrane and passively ventilated underfloor sub-space or positively pressurised underfloor sub-space
4	3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated underfloor subspace or positively pressurised underfloor sub-space, oversite capping or blinding and in ground venting layer.	2 to 3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility.
5	4	Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and ventilated or positively pressurised underfloor sub-space, oversite capping and in ground venting layer and in ground venting wells or barriers.	3 to 4	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility. In ground venting wells or barriers.