



EARTH ENVIRONMENTAL
& GEOTECHNICAL

Phase I GeoEnvironmental Desk Study

Oakenrod

Rochdale

April 2022

On behalf of

Hallmark Prospect Ltd

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**OAKENROD
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FOR
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CONTENTS

1.0	INTRODUCTION	1
	Appointment	1
	Objective	2
	Scope	2
2.0	SITE LOCATION AND DESCRIPTION	3
	Site Utility Services.....	4
3.0	ENVIRONMENTAL SETTING	5
	Geology	5
	Ground Workings	5
	Mining and Other Underground Workings.....	5
	Radon Potential.....	6
	Hydrogeology and Hydrology	6
	Landfill & Waste Management Activity	7
	Industrial Land Use Information	8
	Environmental Permits, Incidents and Registers.....	9
	Environmentally Sensitive Sites	10
	Ecology.....	10
	Archaeology	10
	Potential Flood Risks.....	11
	Previous Site Investigations	11
4.0	SITE HISTORY	12
5.0	WALKOVER SURVEY.....	18
6.0	PRELIMINARY CONTAMINATION RISK ASSESSMENT	20
	Introduction.....	20
	Potential Sources	21
	Potential Receptors	21
	Potential Pathways.....	21
7.0	GEOTECHNICAL HAZARDS ASSOCIATED WITH THE DEVELOPMENT	24
8.0	CONCLUSIONS & RECOMMENDATIONS.....	26
	Conclusions.....	26
	Recommendations	26

FIGURES

Figure 1	Proposed Development Plan
Figure 2	Site Location Plan
Figure 3	Site Photograph
Figure 4	OS Map Extract: 1851
Figure 5	OS Map Extract: 1908-1909
Figure 6	OS Map Extract: 1954-1956
Figure 7	OS Map Extract: 1984-1989
Figure 8	OS Map Extract: 1992
Figure 9	OS Map Extract: 2005
Figure 10	OS Map Extract: 2021
Figure 11	Site Features Plan
Figure 12	Site Walkover Photo Locations

TABLES

Table 1	Environmental Permits, Incidents and Registers within 500m of the Site
Table 2	Summary of Site History
Table 3	Consequence, Probability and Risk
Table 4	Estimation of Level of Risk by Comparison of Consequence and Probability
Table 5	Preliminary Conceptual Model
Table 6	Summary of Geotechnical Hazards

APPENDICES

Appendix 1	Groundsure Reports
Appendix 2	Site Photographs
Appendix 3	Site Walkover Notes
Appendix 4	Report Limitations

1.0 INTRODUCTION

Appointment

- 1.1 Earth Environmental & Geotechnical Ltd has been commissioned by Hallmark Prospect Ltd (the Client) to undertake a Phase I GeoEnvironmental Desk Study for the proposed development on land referred to as "Oakrenrod" in Rochdale.
- 1.2 It is understood that the Client wishes to construct residential dwellings with associated driveways, access roads and soft landscaping.
- 1.3 Vehicle access will be gained from Bury Road to the northeast of the site.
- 1.4 A proposed development plan for the site is shown in Figure 1 below.

Figure 1: Proposed Development Plan



Objective

- 1.5 The purpose of the Desk Study is to collate available geological and environmental data for the site (and its environment) and provide a preliminary geotechnical and geo-environmental appraisal, with a site-specific conceptual model. This enables a preliminary assessment of geo-environmental risks to be undertaken and, if necessary, provides information for the design of a Phase 2 Ground Investigation.

Scope

- 1.6 The Phase I Environmental Desk Study comprises of a site reconnaissance visit and a review of the following information sources, some of which was provided by the client.
- British Geological Survey online maps.
 - Google Earth imagery.
 - Environment Agency online mapping data.
 - Historical Ordnance Survey maps.
 - The site and surrounding areas environmental, geological and mining data presented in the site specific GroundSure Reports (Appendix 1).
 - Coal Authority Interactive Viewer.
 - Rochdale Borough Council Planning Portal.

2.0 SITE LOCATION AND DESCRIPTION

- 2.1 The site is on land known as Oakenrod, Rochdale approximately 1.2km from Rochdale town centre. The approximate National Grid Reference for the centre of the site is SD 88731 13108 (X: 388731, 413108) with the closest postcode being OL11 4HJ.
- 2.2 The site is an irregular shaped parcel of land with current access via Bury Road to the northeast of the site. The maximum dimensions of the proposed site are 310m northeast to southwest and 130m northwest to southeast. The site occupies an area of approximately 2.61 hectares.
- 2.3 The site is currently predominately vacant land with a vacant substation and pylon.
- 2.4 The site is currently accessed from Bury Road to the northeast of the site.
- 2.5 The general surrounding area comprises predominantly of commercial/industrial land use to the east and southeast, and residential dwellings to the west and northwest of the site and agricultural fields to the west. The River Roch runs along the eastern edge of the site boundary, running northeast to southwest. Rochdale Wastewater Treatment Works is located to the immediate southwest of the site. Mandale park is located to the southwest of the site.
- 2.6 A location plan is shown below as Figure 2, together with a recent site photograph as Figure 3 (overleaf).

Figure 2: Site Location Plan



Figure 3: Site Photograph



Site Utility Services

- 2.7 Site service plans have been obtained for the site on behalf of the client. The status of all services should be checked prior to any development (including site investigation) commencing.

3.0 ENVIRONMENTAL SETTING

- 3.1 The geology of the site is covered by British Geological Survey (BGS) online data and the site specific GroundSure Enviro+Geo Insight report (Appendix 1).
- 3.2 Environmental conditions are covered by Environment Agency (EA) and British Geological Survey (BGS) online data, and the site specific GroundSure Enviro+Geo Insight report (Appendix 1).

Geology

- 3.3 The BGS states that the site is not underlain by artificial deposits.
- 3.4 The site is underlain by superficial deposits of Alluvium, comprising clay, silt, sand and gravel to the west and northwest of the site. Glaciofluvial deposits also cross onto the eastern side of the site, comprising Devensian sand and gravel.
- 3.5 The solid geology beneath the site is shown to be the Pennine Lower Coal Measures Formation, comprising mudstone, siltstone, coal seams and sandstone.
- 3.6 There are 8 records of linear features within 500m of the site boundary. The closest record refers to an onsite fault described as normal fault.
- 3.7 There is 1 record of a landslide within 500m of the site. This record refers to landslide deposits located 365m south of the site.
- 3.8 There are 14 borehole records identified within 250m of the site. The closest record refers to the onsite borehole that is confidential.
- 3.9 The site is in an area where the hazard rating is negligible to low about running sands, very low to low regarding landslides, negligible to very low with regard to shrink swell, negligible to moderate with regard to compressible deposits, negligible to very low with regard to collapsible deposits, and negligible with regard to dissolution of soluble rocks.

Ground Workings

- 3.10 There are 65 records of historical surface ground working features identified within 250m of the site boundary. The closest records refer to an on-site pond dated 1949, refuse heaps dated 1928, 1938 and 1949, and an unspecified heap dated 1908.
- 3.11 According to the BGS, there are 10 records of a British Pit within 500m of the site. The closest record refers to the "Oaken House Sand Pit" described as a ceased status sand pit located 41m northwest of the site.

Mining and Other Underground Workings

- 3.12 Reference to the Coal Authority Interactive viewer shows the site is located within an identified coal mining area and partially within a Development High Risk Area.
- 3.13 There are no records for non-coal mining areas located within 1km of the site.

- 3.14 There are no areas of brine extraction, gypsum extraction, tin mining or clay mining on the site.
- 3.15 There are no records of natural cavities within 500m of the site.
- 3.16 There are no records for non-coal cavities identified within 1km of the site.
- 3.17 There are 2 records for historical underground working features identified within 1km of the site. The closest record refers to a tunnel located 659m southwest of the site, dated 1968.

Radon Potential

- 3.18 The property is not located in a Radon Affected Area, as less than 1% of the properties are above the Action Level. Therefore, no radon protection measures are necessary.

Hydrogeology and Hydrology

- 3.19 The superficial deposits are classified by the Environment Agency (EA) as a Secondary A. The Alluvium Sheet Deposits comprising clay, silt and gravel have an intergranular flow type and a high to very low permeability. The Glaciofluvial deposits of sand and gravel an intergranular flow type and a very high to high permeability. The BGS states the following:

***Secondary A** 'Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.'*

- 3.20 The Pennine Lower Coal Measures Formation is classified by the Environment Agency (EA) as a Secondary A Aquifer with a fracture flow type and a moderate to low permeability. The BGS states the following:

***Secondary A** 'Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.'*

- 3.21 The groundwater vulnerability and soil leaching potential of the site has been classified as a high vulnerability. The BGS states:

'High vulnerability - Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.'

- 3.22 There are 5 ground water abstraction licence records within 2km of the site. The closest record refers to a historical ground water source at Borehole at Premises, Spotland, Rochdale, Alexander Drew & Sons Ltd, located 337m north of the site.
- 3.23 There are 14 surface water abstraction licence records within 2km of the site. The closest record refers to an active surface water, non-tidal source at the river Roch at Rochdale Weir for Transport for Greater Manchester located 1.09km west of the site.
- 3.24 There are no potable water abstraction licence records within 2km of the site.

- 3.25 The site is not located within 500m of a Source Protection Zone or Source Protection Zone within a confined aquifer.
- 3.26 There are 9 water network entries within 250m of the site. The closest record refers to an Inland River, not influenced by normal tidal action, on ground surface, located 5m southeast of the site.
- 3.27 There are 6 surface water features identified within 250m of the site.
- 3.28 There is 1 record of a Water Framework Directive (WDF) surface water body located on site. The record refers to River Roch (Spodden to Irwell) in the Irwell catchment. The water body was a 'Fail' chemical rating and moderate ecological rating in 2019.
- 3.29 There is 1 record of a Water Framework Directive (WDF) groundwater body located on-site. The record refers to North Manchester Carboniferous Aquifers which were a poor chemical rating in 2019.

Landfill & Waste Management Activity

- 3.30 There are no records for current Environment Agency/Natural Resource Wales landfill records within 500m of the site.
- 3.31 There are 4 records of historic Environment Agency/Natural Resource Wales landfill sites within 500m of the site. The closest record refers to a historical landfill located 69m north of the site.
- 3.32 There is 1 record of a BGS/DoE non-operational landfill sites within 500m of the site. The record refers to a landfill located 421m southeast of the site.
- 3.33 There is 1 record of a historical landfill from the Local Authority and Historical Mapping records within 500m of the site. The record refers to a landfill located 464m southeast of the site.
- 3.34 There are 36 records of a waste treatment, transfer or disposal site within 500m of the site. The closest record refers to 262-266 Bury Road, Rochdale OL11 4EE, with a treating waste exemption, not on a farm located 10m north of the site.
- 3.35 There are 6 records of historical waste sites within 500m of the site. The closest record refers to a scrap yard located 9m southeast of the site dated 1990.
- 3.36 There are 14 records of current Environment Agency/Natural Resources Wales licensed waste sites within 500m of the site. The closest record refers to a metal recycling site located 39m southeast of the site dated 2003.

Industrial Land Use Information

- 3.37 There are 318 records of potentially contaminative historical land uses identified within 500m of the site. There are 10 on site records referring to: a woollen mill dated 1851, an unspecified mill dated 1890 – 1908, 1928 – 38, and 1949, an unspecified heap dated 1908, refuse heaps dated 1928 - 1938, and 1949, and unspecified works dated 1975.
- 3.38 There are 53 records of current potentially contaminative land uses identified within 250m of the site. The closest record refers to an electricity pylon located on site.
- 3.39 There are 138 records of historical tanks identified within 500m of the site. The records refer to 3 on site unspecified tanks dated 1890, and 1910 – 1930.
- 3.40 There are 44 records of historical energy features identified within 500m of the site. The closest record refers to an electricity substation, located 3m north of the site, dated 1987 - 1995.
- 3.41 There are 2 records for current petrol or fuel sites within 500m of the site. The closest record refers to an obsolete garage located 169m northwest of the site.
- 3.42 There are no records of historical petrol or fuel sites within 500m of the site.
- 3.43 There is 12 historical garage and motor vehicle repair site record identified within 500m of the site. The closest record refers to a garage located 78m northeast of the site, dated 1959 - 1978.
- 3.44 There are no National Grid high voltage underground electricity transmission cables within 500m of the site.
- 3.45 There are no National Grid high-pressure gas transmission pipelines within 500m of the site.
- 3.46 There are no historical railway and tunnel features identified within 250m of the site.
- 3.47 There are 12 historical railway lines identified within 250m of the site. The closest record refers to railway sidings located 50m northeast of the site dated 1890.
- 3.48 There are no current active railway line records identified within 250m of the site.
- 3.49 There are no underground railway lines or tunnels identified within 250m of the site.
- 3.50 The site is not within 500m of the route of the High Speed 2 rail project.
- 3.51 The site is not within 500m of the route of the Crossrail 1 rail project.
- 3.52 There is 1 record of historical military land use within 500m of the site. This record shows a national shell factory located 436m north of the site, where the date of operation was listed circa WWI era.

Environmental Permits, Incidents and Registers

- 3.53 The Groundsure Report includes records of environmental permits, incidents and registers within 500m of the site, which are summarised in Table 1 overleaf

Table 1: Environmental Permits, Incidents and Registers within 500m of the Site

Permit/Incident/Register	Number
Historical Licensed Industrial Activities (IPC)	0
Part A (1) and IPPC Authorised Activities	2
Pollutant Release to Surface Waters (Red List)	0
List 1 Dangerous Substances Inventory Sites	0
List 2 Dangerous Substances Inventory Sites	0
Part A (2) and Part B Activities and Enforcements	7
Category 3 or 4 Radioactive Substance Authorisations	0
Licensed Discharge Consents	16
Planning Hazardous Substance Consents and Enforcements	2
Dangerous or Hazardous (COMAH and NIHHS) Sites	2
Sites Determined as Contaminated Land under Part 2A EPA 1990	1
Regulated Explosive Sites	0
Pollutant Release to Public Sewer	5
Substantiated Pollution Incidents	17
Pollution Inventory Substances, Wastes and Radioactive Wastes	0

- 3.54 There are 2 records of Part A (1) and IPPC authorised activities within 500m of the site. The closest record refers to processes including coating, printing and textiles; pre-treating by washing etc, undertaken by Alexander Drew Ltd located 465m north of the site.
- 3.55 There are 7 records of Part (2) and Part B Activities and Enforcements within 500m of the site. The closest record refers to a historical Part B Permit for the use of bulk cement located 69m southeast of the site.
- 3.56 There are 16 records of Licensed Discharges to Controlled Waters within 500m of the site. The closest record refers to Sewage Discharges – sewer storm overflow – water company, located 12m southeast of the site.
- 3.57 There are 2 records of Planning Hazardous Substance Consents and Enforcements within 500m of the site. The closest record refers to application for consent to store hazardous substances at Dane Street depot located 310m southeast of the south.
- 3.58 There are 2 records of Dangerous or Hazardous (COMAH and NIHHS) sites within 500m of the site. The closest record refers to a historical COMAH site listed by National Grid Gas Plc located 241m southeast of the site.

- 3.59 There is 1 record of Sites Determined as Contaminated Land under Part 2A EPA 1990 within 500m of the site. The record refers to the Sandy Brow former landfill site with under the category “potential contaminated land – revoked” in Spotland Rochdale, located 81m north of the site dated 2013.
- 3.60 There are 5 records of Pollutant Release to Public Sewer within 500m of the site. The closest record refers to United Springs Ltd, Mandale Park, Norman Road, Rochdale, Lancashire, OL11 4HP, located 284m southeast of the site.
- 3.61 There are 17 records of Substantiated Pollution Incidents within 500m of the site. The closest record refers to inert materials and wastes found on site in 2002. The incident was a category 3 impact (minor) on land and a category 4 impact (no impact) on water and air.

Environmentally Sensitive Sites

- 3.62 There is 1 record of Greenbelt land within 2km of the site. The record refers to Merseyside and Greater Manchester green belt located 1.5km north of the site.
- 3.63 There are 4 records of Sites of Special Scientific Interest within 2km of the site. The closest record refers to the Rochdale Canal SSSI located 1.5km southeast of the site.
- 3.64 There is 1 record of Local Nature Reserves within 2km of the site.
- 3.65 There are no other Environmentally Sensitive Sites located within 2km of the site.

Ecology

- 3.66 An ecological assessment of the site falls outside the brief of this report. Where considered necessary, advice should be sought from an ecological specialist in this respect.
- 3.67 The site is classified as Urban Land. More details can be found in Appendix 1.
- 3.68 Deciduous woodland, as recorded on the Priority Habitat Inventory, is present on site.

Archaeology

- 3.69 An archaeological assessment falls outside the brief of this report. Where considered necessary, advice should be sought from an archaeological specialist in this respect.
- 3.70 There is 1 record of Listed Buildings within 250m of the site. The record refers to the Grade II listed building Oakenrod Hall, Bamford, Rochdale, OL11 located 41m west of the site.
- 3.71 Historic mapping from 1928 of site shows roman coins found on site with discovery dated 1804.
- 3.72 There are no records of World Heritage Sites or Scheduled Ancient Monuments with 250m of the site.

Potential Flood Risks

- 3.73 Detailed assessment of flood risks is outside the scope of this report. However, the site does lie within 50m of an Environment Agency Zone 2 or Zone 3 floodplain. The record is located on site as a Zone 2 and 3 (Fluvial/Tidal Models).
- 3.74 There are 13 records of risk of flooding from rivers and sea (RoFRaS) within 50m of the site.
- 3.75 There are 8 records of historical flood events within 250m of the site. The closest record refers to the flooding event “Roch”, recorded as other flood cause, located 87m southeast of site dated 28.01.1995 – 29.01.2995.
- 3.76 There is 1 record of flood defences located within 250m of the site. The record is located 96m east of site.
- 3.77 There are 2 records of areas benefitting from flood defences within 250m of the site. The closest record refers to an area benefitting from flood defences 20m southeast of the site.
- 3.78 There are no records of areas used for flood storage within 250m of the site.
- 3.79 The highest risk of surface water flooding occurring on-site is 1 in 30 year, 0.30m – 1.00m.
- 3.80 The highest risk of groundwater flooding occurring on-site is **Moderate**. However, this risk is present across the eastern side of entire site. Most of the site is recorded as having a **Low** risk of groundwater flooding.

Previous Site Investigations

- 3.81 Earth Environmental & Geotechnical Ltd are not aware of any previous site investigations carried out for the site.

4.0 SITE HISTORY

- 4.1 The historical development of the site has been determined by reference historical plans and Google Earth imagery. The reviewed historical plans comprise only readily available records and may be limited; however, the information available to date indicates that additional searches are unlikely to add to our understanding of the site. The earliest available historical mapping covering the site dates to 1851.
- 4.2 The site history is summarised in Table 2, below, followed by selected extracts from maps and aerial photographs.

Table 2: Summary of Site History

Date	On-Site History	Surrounding Land Use History
1851 1:1,056 1851 1:10,560	Oakenrod (Woollen) Mill is located on site with tenters to the north of the site. There are several drains, chimney and a reservoir. The mill is powered by water from the river.	The site is predominantly occupied by the woollen mill. A main road (Bury New Road) is located adjacent to the northern boundary of the site. The river Roch runs along the eastern boundary of the site supplying the mill. Residential buildings are located to the northeast of the site.
1890 1:2,500 1890-1891 1:10,560 1892 1:500	No significant change.	Gas works located 240m southwest of site. Heap located 55m southwest of site. Standard Mill located 10m southwest of site. Brimrod Mill located 95m southwest of site. Mitchell Hey Mills located 155m northeast of site.
1908-1909 1:10,560 1910 1:2,500 1928 1:10,560 1930 1:2,500	Land raising earthworks evident on the southern sector of the site. Roman coins found AD 1804. Mill annotated as cotton waste.	Heap now listed as brickworks. Residential buildings located adjacent to southwest boundary of site along Melrose Street. Iron works located 200m northeast of site. Standard Mill and Brimrod Mill located to southwest of site now listed as mills.
1954-1956 1:10,560 1957-1959 1:2,000 1958-1959 1:2,000 1967-1968 1:10,560	Electrical pylons located on south boundary of site. Oakenrod mill now listed as mill and works.	Brickworks to southwest of site no longer listed. Iron works to northeast of site now listed as works. Gasworks to southwest of site now listed as works. Mitchell Hey Mill to northeast of site now listed as mill.

Date	On-Site History	Surrounding Land Use History
1975-1980 1:1,250	No significant change.	No significant change.
1984-1989 1:1,250 1990-1992 1:1,250 1992/3-1995 1:1,250 2003 1:1,250	Mill structures removed.	No significant change.

Figure 4: OS Map Extract 1851

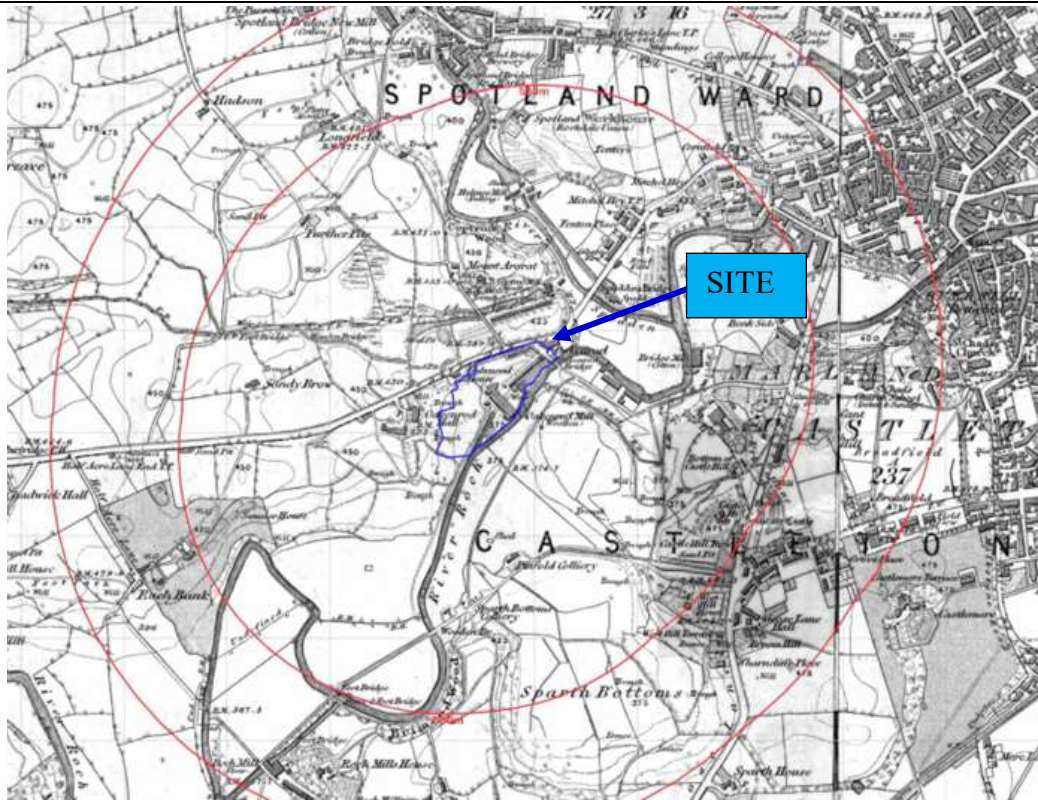


Figure 5: OS Map Extract 1908-09

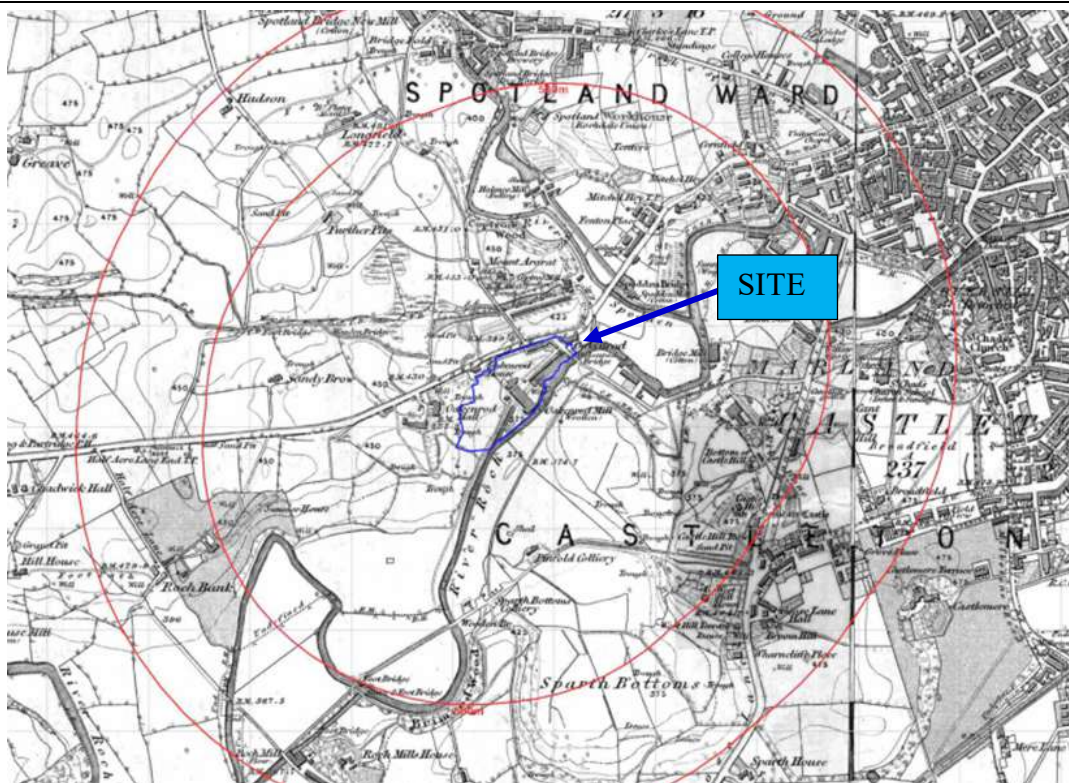


Figure 6: OS Map Extract 1954-1956

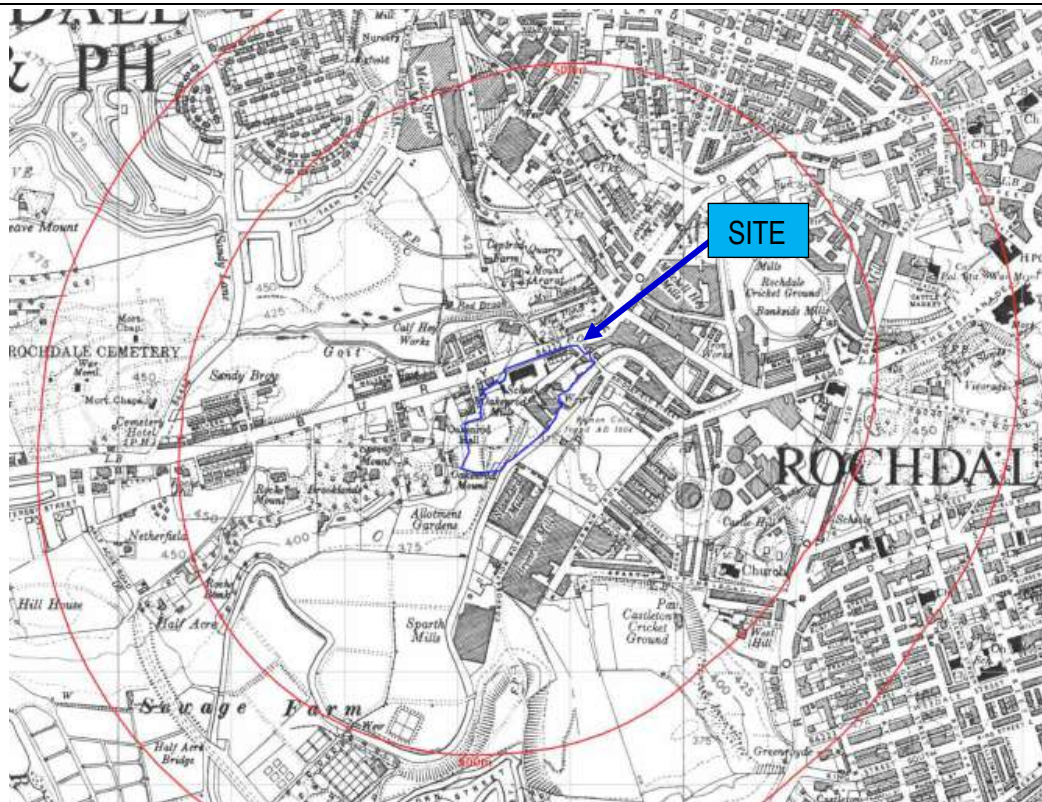


Figure 7: OS Map Extract 1984-1989

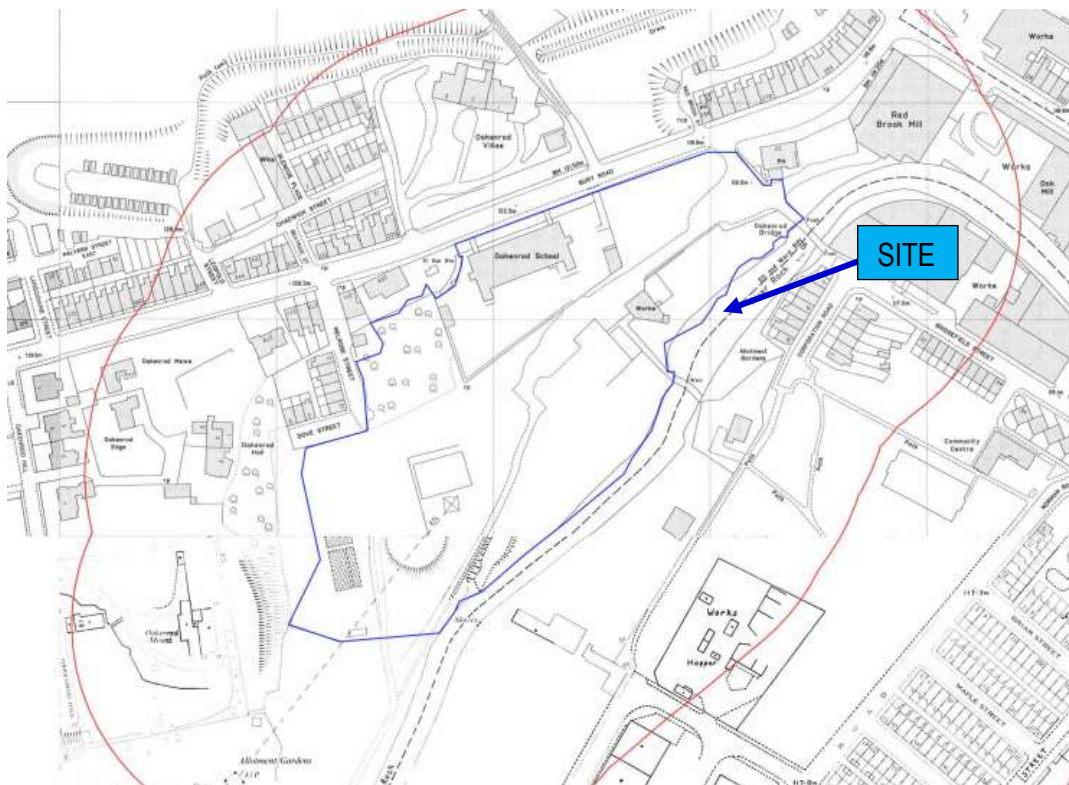


Figure 8 OS Map Extract 1992

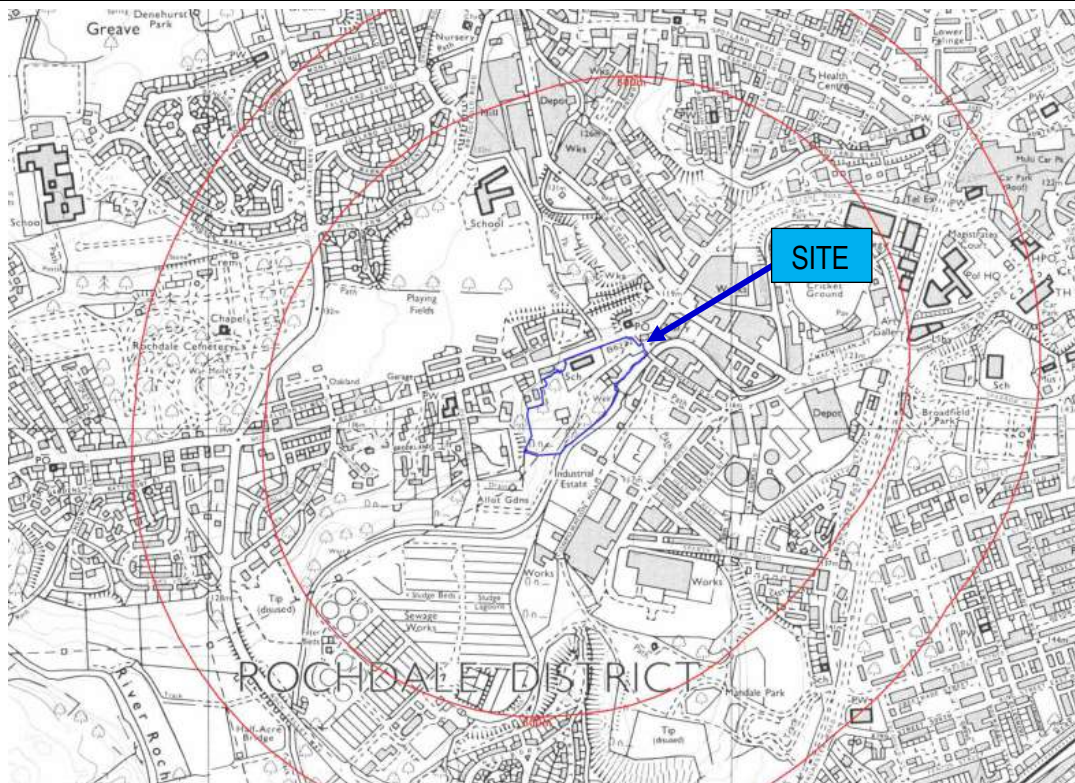


Figure 9 Aerial Plan 2005



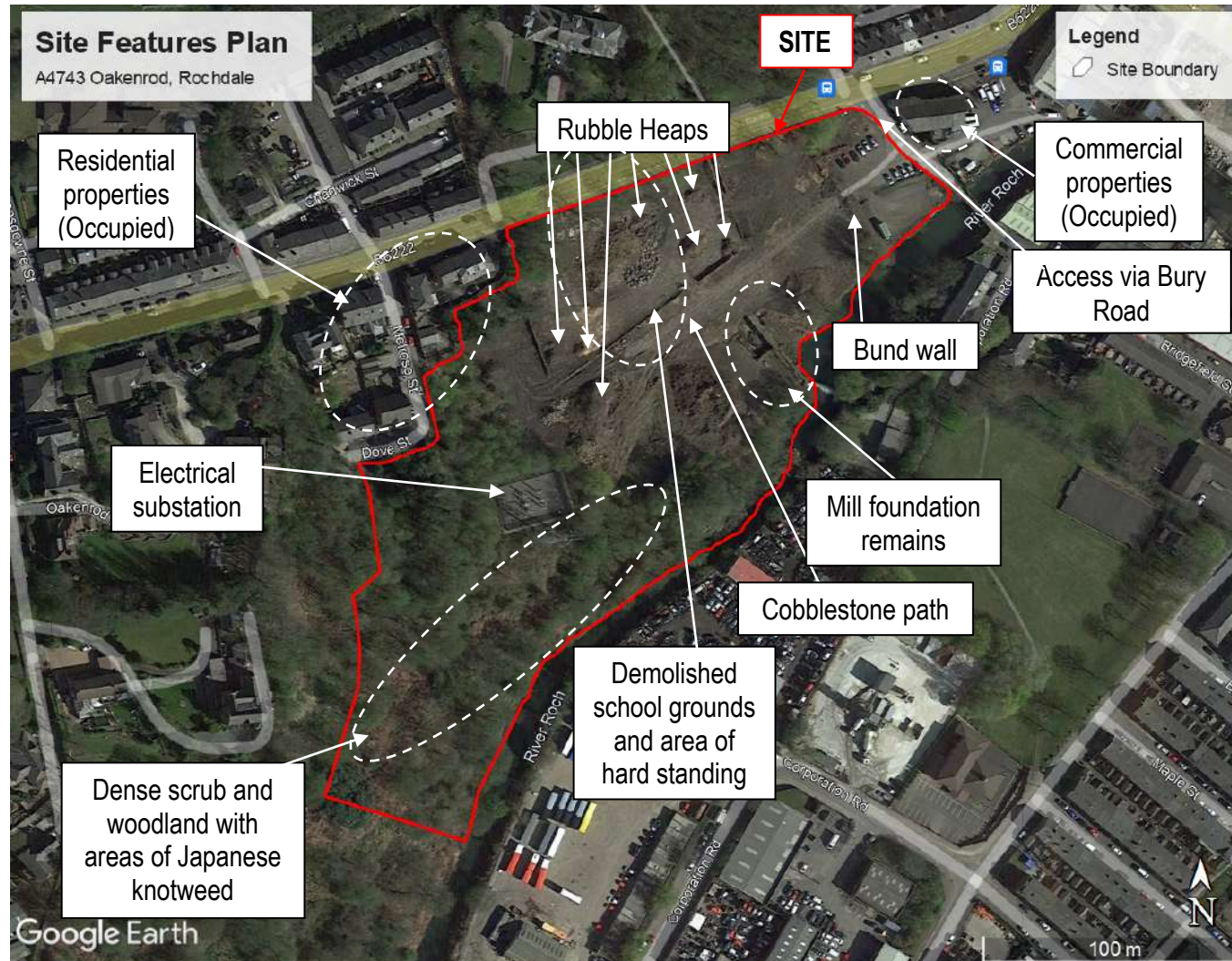
Figure 10 Aerial Plan 2021



5.0 WALKOVER SURVEY

- 5.1 A walkover survey was completed on 8th April 2022. The photographs and notes from this survey are appended to this report as Appendix 2 and Appendix 3 respectively.
- 5.2 The site is currently accessed via a carpark track off Bury Road to the northwest of the site.
- 5.3 The site is currently occupied by a demolished school and associated grounds, an electrical pylon with substation to the southwest of the site.
- 5.4 The south of the site is covered by dense scrub and woodland with large areas of sprouting Japanese Knotweed.
- 5.5 The site topography is predominantly slightly southeast sloping towards the River Roch. Two level areas are occupied by the electrical substation to the southwest and the old school grounds to the north of the site.
- 5.6 Overhead electrical transmission lines cross southwest off site running from electrical substation located on site.
- 5.7 Two manholes are present to the north and northwest of the demolished school grounds. A yellow cable cover, likely electrical, is exposed within the northwest corner of demolished school walls.
- 5.8 Demolished school grounds situation on concrete hardstanding. There are seven rubble piles across the site, five situated within the demolished school boundary, one to the northeast of the site on the river embankment, and a heap located in the centre of the site. A raised bund wall runs from the adjoining northwest embankment to northeast of the site.
- 5.9 Brick building remains and foundations lie to the southwest of the site, near the west site boundary.
- 5.10 Car tyre pile located on south of site adjacent to electrical substation.
- 5.11 Mill structure foundations are situated to the east of the site, bordering the River Roch.
- 5.12 The site is demarcated by a mixture of hardstanding, brick walls, rubble heaps, a cobble path, dense scrub vegetation and woodland.
- 5.13 Residential properties are situated to the northwest of the site on Melrose Street. Commercial properties are situated to the northeast of the site across the car park. An industrial park is situated to the southeast of the site, which is separated from the site by the river Roch running from the northeast boundary towards the southwest.
- 5.14 A site features plan is presented as Figure 11 overleaf.

Figure 11: Site Features Plan



6.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

Introduction

- 6.1 The following paragraphs outline a Preliminary Risk Assessment (PRA) for the site based on the above desk study information as defined by DEFRA and the EA Model Procedures for the Management of Land Contamination, CLR11⁽²⁰⁰⁴⁾.
- 6.2 Table 5 provides a Preliminary Conceptual Model (PCM) which considers the source-pathway-receptor linkages present alongside the likelihood, severity and risk level as defined within Table 3 and Table 4 below. The assessment of probability, a modified risk table, and certain consequence definitions are based on CIRIA C552 and CLR11.
- 6.3 Table 5 considers whether a pollution linkage is potentially present and provides a preliminary qualitative assessment of risk based on the information currently available. Where a possible linkage is identified, it does not necessarily mean that a significant risk exists but indicates that further information is required through appropriate site investigation to substantiate the conceptual model.
- 6.4 The PCM/PRA is based on a proposed residential end use.

Table 3: Consequence, Probability and Risk

Probability	Consequence,	Risk
High Likelihood- There is a pollution linkage and an event either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution	Very High – acute risk to the human health likely to result in significant harm. Risk of severe or irreversible effect on ground/surface water quality. Catastrophic damage to buildings / property.	Very High – there is a high potential that the source-pathway-receptor scenarios may give rise to harm to human health, or the environment and remedial action is likely to be required.
Likely – there is a pollution linkage, and all the elements are present, which means that it is probable an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	High – Severe or irreversible effect on human health. Temporary severe or irreversible effect on ground/surface water quality. Reduction of water quality rendering groundwater or surface water unfit to drink and/or substantial adverse impact on groundwater dependant environmental receptors.	High – it is likely that the source-pathway-receptor scenarios may give rise to an impact on human health or the environment, which may require remediation and/or control measures to mitigate risks
Low likelihood– there is a pollutant linkage and circumstances are possible for an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term	Moderate – Long term or short-term moderate effect on human health. Moderate effect on ground/surface water quality, reversible with time. Reduced reliability of a supply at a groundwater or surface water abstraction source	Moderate – it is possible that the source-pathway-receptor scenarios may give rise to an impact on human health or the environment, however it is either relatively unlikely that such would be severe, or if any harm were to occur it is more likely that harm would be mild.
Unlikely – there is a pollution linkage, but circumstances are such that it is doubtful that an event would occur even in the very long term.	Low – Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.) Slight effect on ground/surface water quality, reversible with time. Marginal reduced reliability of a supply at a groundwater or surface water abstraction source.	Low – it is possible that harm could arise at the source, however it is likely that this would at worst be mild.
		Very Low – it is unlikely that the source-pathway-receptor scenarios will give rise to an impact on human health or the environment.

Table 4: Estimation of Level of Risk by Comparison of Consequence and Probability

		Consequence			
		High	Moderate	Low	Very low
Probability	High Likelihood	Very High	High risk	Moderate risk	Moderate to low risk
	Likely	High risk	Moderate risk	Moderate to low risk	Low risk
	Low Likelihood	Moderate risk	Moderate to low risk	Low risk	Very low risk
	Unlikely	Moderate to low risk	Low risk	Very low risk	Very low risk

Potential Sources

- 6.5 Historically the site was predominately comprised of a cotton/woollen mill works until the late 20th century. An electricity substation was established on the site in the 1950's.
- 6.6 A school was built at the start of the 20th century.
- 6.7 There is therefore potential for the presence of contamination on the site or within the immediate area.

Potential Receptors

- 6.8 The following receptors have been considered for the construction and operational stages of the proposed redevelopment.
- Current site users;
 - Adjacent land users;
 - Future land users;
 - Construction workers during site development works;
 - Surface water and Groundwater within the underlying aquifer

Potential Pathways

- 6.9 The following pathways have been considered for the construction and operational stages of the proposed redevelopment.
- Dermal contact, ingestion, inhalation pathways of potentially contaminated soils;
 - Downward vertical migration of leachate to surface waters and shallow groundwater;
 - Vertical or lateral migration of ground gas.

Table 5: Preliminary Conceptual Model

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
Potential soil contamination E.g., Heavy Metals, PAH, TPH, BTEX and ground gases.	Dermal contact, ingestion and inhalation of soils dust	Current Site Users	Unlikely	Moderate	Low	The site is currently mostly unused vacant hardstanding. The risk is therefore considered to be LOW .
		Adjacent land users	Unlikely	Moderate	Low	Residential properties are located to the northwest of the site. Commercial properties are located to the northeast of the site. Usual dust control measures should be implemented as part of good site working practices during construction to reduce dust generation. Therefore, the risk is considered LOW .
		Future land users	Unlikely	Moderate	Low	The proposed development consists of constructing a new residential development. The risk to future site users via direct exposure is MODERATE . This assessment is based on the potential for contamination to be present beneath the site.
		Construction Workers	Low Likelihood	Moderate	Moderate to Low	Construction workers may be exposed to potentially contaminated soils during construction works, however exposure duration will be short-term only. There were two recorded pollution incidents on site however there is low potential these incidents will affect workers. The risk to construction workers is therefore considered MODERATE to LOW . Appropriate health and safety measures (in line with CDM and other relevant health and safety guidance) will reduce the risk to LOW .
	Downward vertical migration of leachate to shallow groundwater	Groundwater within the Underlying Aquifer	Low Likelihood	Moderate	Moderate to Low	The underlying superficial soils are anticipated to be intergranular with a high to very low permeability. There are no abstraction licences close by to the site. The groundwater vulnerability and soil leaching potential of the site is high vulnerability. The risk to groundwater is therefore considered to be MODERATE to LOW .
	Lateral migration in surface waters	Surface water	Low Likelihood	Moderate	Moderate to Low	There are 6 surface water features located nearby; the closest is a river located on site. Therefore, the perceived risk to surface waters is MODERATE to LOW .
	Vertical or lateral migration of ground gas	Current Site Users	Unlikely	Moderate	Low	The site is currently mostly unused vacant hardstanding. Due to the sites historical industrial use, likely potential for Made Ground is anticipated. The site is not located in a radon affected area. The risk

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
						to current site users from ground gas is therefore considered MODERATE .
		Adjacent land users	Unlikely	Moderate	Low	Residential properties are located to the northwest of the site. Commercial properties are located to the northeast of the site. There is likely potential for areas of Made Ground. There is no potential for radon gas. The risk to adjacent site users from ground gas is therefore considered LOW .
		Future land users	Unlikely	Moderate	Low	The proposed development consists of constructing a new residential development. There is no potential for radon gas and therefore the risk is considered LOW .
		Construction Workers	Low Likelihood	Moderate	Moderate to Low	Construction workers may be exposed to ground gas/depleted oxygen conditions in confined spaces and excavations; however, the duration will be short term. The risk to construction workers from ground gas is considered MODERATE to LOW .
Asbestos Containing Material (ACM)		Current Site Users	Low Likelihood	Moderate	Moderate to Low	The site is currently predominantly unused vacant hardstanding. Due to the sites historical industrial, asbestos may be present in small areas of the site, albeit unlikely. Asbestos is only harmful when disturbed. The risk to current site users is MODERATE to LOW .
		Adjacent land users	Low Likelihood	Moderate	Moderate to Low	Residential properties are located to the northwest of the site. Commercial properties are located to the northeast of the site. Asbestos may be present in small areas of the site, albeit unlikely. Disturbance of soil during the construction phase may allow fibres to become airborne. Dust control measures (dampening down) should be implemented as part of good site working practices. Therefore, the risk is considered MODERATE to LOW .
		Future land users	Low Likelihood	Moderate	Moderate to Low	The proposed development consists of constructing a new residential development. The risk is therefore considered MODERATE to LOW . A contamination assessment of the existing on-site soils would be required to determine the level of risk and necessary mitigation measures.
		Construction Workers	Low Likelihood	Moderate	Moderate to Low	Construction workers may be exposed to potential asbestos in Made Ground soils. However, this potential area is very small. The risk is considered MODERATE to LOW . A contamination assessment of the existing on-site soils would be required to determine the level of risk and necessary mitigation measures.

7.0 GEOTECHNICAL HAZARDS ASSOCIATED WITH THE DEVELOPMENT

7.1 In addition to the environmental hazards there are also geotechnical hazards associated with the stability of the ground including load bearing capacity, slope stability and effects of ground mining activities. Local Authorities follow NPPF (2012) which requires that a site is suitable for its new use considering of ground conditions and land instability, including from natural hazards to former activities such as mining. A summary of the geotechnical considerations is provided below in Table 6.

Table 6: Summary of Geotechnical Hazards

Geohazards:	
Highly Compressible Ground	Negligible to moderate risk.
Collapsible Soils	Negligible to Very low risk.
Swelling Clay	Negligible to Very low risk.
Running Sand	Very low to low risk.
Ground Dissolution	Negligible risk.
Landslip	Very low risk.
Mining & Quarrying	The site is located within a Coal Authority Mining Reporting Area and partially within a Development High Risk Area.
Geotechnical Design Considerations	
Site Clearance	There are seven rubble heaps located on site, concrete hardstanding from a historic school and a bund wall that will require clearance.
Trees	Multiple mature trees are present, predominantly located in the small woodland to the southwest of the site and around the perimeter of the site boundary.
Existing Buildings/Obstructions	The site is currently predominantly vacant hardstanding and unused land, however historic mill foundations, several brick walls, and a cobble path will require removal.
Foundations	The depth and type of proposed foundations would depend on the ground conditions present on site. There are no artificial deposit records underlying the site and the underlying ground will be made up of superficial deposits of alluvium, glaciofluvial deposits and Devensian sand and gravel. Bedrock depth has not been identified. Due to the presence of weak alluvium and areas of infilled ground shallow foundations are not anticipated.

Geotechnical Design Considerations	
Floor Slabs	Again, an intrusive geotechnical investigation is recommended prior to any construction works to discover the most suitable floor slab design for the on-site ground conditions.
Groundwater	Exact groundwater conditions are not known at this stage. For more detailed knowledge of the groundwater regime, an intrusive geotechnical investigation would be required. However, it is recorded that the site is underlain by Secondary A aquifers. The highest risk of groundwater flooding on site is recorded as high.
Earthworks	Due to the slight southeast sloping topography of the site and the final proposed floor levels, it is expected that earthworks will be necessary for the proposed development plan.
Slopes	No steeply dipping slopes were observed on site.
Retaining Walls	There are no retaining walls present on site due to the relative flat topography of the site. Retaining walls are unlikely to be required unless large excavations occur.
Chemically aggressive ground conditions	Chemically aggressive ground conditions are not expected at this site. However, an intrusive geotechnical investigation would be necessary to confirm this.

8.0 CONCLUSIONS & RECOMMENDATIONS

Conclusions

- 8.1 The proposed development of the site is the proposed construction of residential dwellings with associated driveways, access roads and soft landscaping.
- 8.2 The site was historically predominantly a cotton/woollen mill with an electricity substation. There is also historic evidence of a school being on site.
- 8.3 The site is underlain by superficial deposits of alluvium, comprising clay, silt, sand and gravel to the west and northwest of the site. Glaciofluvial deposits also cross onto the eastern side of the site, comprising Devensian sand and gravel. The solid geology beneath the site is shown to be the Pennine Lower Coal Measures Formation, comprising mudstone, siltstone and sandstone of Langsettian Sub-age (Secondary A Aquifer).
- 8.4 The property is not located in a Radon Affected Area, as less than 1% of the properties are above the Action Level.
- 8.5 The site is located within a Coal Mining Reporting Area and partially within a Development High Risk Area.
- 8.6 Given the potential contaminative land uses, the overall risk from soil contamination to end users is concluded to be **MODERATE**.
- 8.7 The underlying superficial soils are anticipated to be intergranular with a high to very low permeability. There are no abstraction licences close by to the site. The groundwater vulnerability and soil leaching potential of the site is high vulnerability. The risk to controlled water is therefore considered to be **MODERATE** to **LOW**.
- 8.8 The risk from ground gas to end users and construction workers is **MODERATE** due to the likelihood of areas of Made Ground.
- 8.9 The site is partially located within a Zone 2 or Zone 3 floodplain. The highest risk of groundwater flooding is **MODERATE**.
- 8.10 Weak alluvium is present on part of the site together with infilled reservoirs and drains. Shallow foundations are therefore not anticipated to be feasible.

Recommendations

- 8.11 An intrusive investigation should be undertaken to ensure the most up to date geotechnical parameters for the design of foundations, floor slabs and pavement construction for the proposed new structures and surrounding area are gained.
- 8.12 As part of the geotechnical investigation, it is recommended that samples of soil are recovered for contamination testing and to confirm whether there are still any potential risks.
- 8.13 As part of the site investigation ground gas monitoring should also be implemented.

- 8.14 A Coal Mining Risk Assessment will need to be developed for the site, together with a Flood Risk Assessment.
- 8.15 An invasive plant survey is recommended as part of an ecological survey of the site.

APPENDIX 1

GROUNDSURE REPORTS

APPENDIX 2

SITE PHOTOGRAPHS

Earth Environmental & Geotechnical Ltd Tel: 0161 975 6088 Email: info@earthenvironmental.co.uk Web: www.earthenvironmental.co.uk	SITE PHOTOGRAPHS 
Job No.: A4743/22	Site: Oakenrod, Rochdale
Plate 1 Viewing northeast showing the site access off Bury Road to the northeast of the site. Note bund wall running from northwest to northeast of site.	Plate 2 Viewing southwest showing the cobblestone road and school ground remains.
	
Date: 8th April 2022	Date: 8th April 2022
Plate 3 Viewing west/northwest of the site showing historic school walls, rubble heaps and northwest boundary.	Plate 4 Viewing east showing historic mill building foundations to the northeast of site and eastern side of site.
	
Date: 8th April 2022	Date: 8th April 2022

Earth Environmental & Geotechnical Ltd Tel: 0161 975 6088 Email: info@earthenvironmental.co.uk Web: www.earthenvironmental.co.uk	SITE PHOTOGRAPHS 
Job No.: A4743/22	Site: Oakenrod, Rochdale
Plate 5 Viewing northeast showing southwest of historic school grounds with concrete hardstanding and rubble heaps.	Plate 6 Viewing southeast showing eastern side of the site. Note existing standing water mature trees along the eastern boundary.
	
Date: 8th April 2022	Date: 8th April 2022
Plate 7 Viewing west showing brick building foundations to western boundary of the site. Note mature trees and dead Japanese knotweed.	Plate 8 Viewing northeast showing east site boundary. Note mature trees, river Roch running northeast to southeast along eastern boundary, and dense scrub with thick dead Japanese knotweed.
	
Date: 8th April 2022	Date: 8th April 2022

Earth Environmental & Geotechnical Ltd Tel: 0161 975 6088 Email: info@earthenvironmental.co.uk Web: www.earthenvironmental.co.uk	SITE PHOTOGRAPHS 
Job No.: A4743/22	Site: Oakenrod, Rochdale
Plate 9 Viewing northeast showing the north-eastern boundary of site. Note the River Roch along northeast boundary, dead Japanese knotweed and Oakenrod bridge to very most northeast corner of site.	Plate 10 Viewing southeast showing south-eastern boundary of site. Note low lying wetland adjacent to River Roch.
	
Date: 8th April 2022	Date: 8th April 2022

Figure 12: Site Walkover Photo Locations



APPENDIX 3

SITE WALKOVER NOTES

WALK OVER SURVEY REPORT

Site: Oakenrod, Rochdale

Date: 8th April 2022

Job No: A4743/22

Undertaken By: Luke Glover

Purpose of Site Walkover:

- 1) Provide further information for the Desk Study Report;
- 2) Identify potential contamination sources, pathways and receptors;
- 3) Identify geotechnical features and potential geohazards;
- 4) Determine locations for exploratory boreholes.

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Site Setting	Description required for: Town/Country/Suburb Setting Industrial/Residential/Retail Usage Current Site use (if undertaking security and access to the site)		Town/Suburb Setting Surrounding areas are predominantly residential with some industrial land use located to the east and southeast of the site. Note Industrial land is separated from site via the River Roch. The site is currently predominantly occupied by vacant hardstanding from historic school, historic mill foundations, with an electrical substation and woodland to the south of the site.
Evidence of Past Activities	Are there: Any relevant street names in area? Features or relics which indicate past history?	Yes/No Yes/No	The site is located to the south of Bury Road Historic school building concrete hardstanding and historic mill foundations adjacent to river Roch.
Geographic Setting	Description required for: Low lying flood plain/dry valley/rolling hills etc.		The site is low lying and lies on a flood plain.
Ground Conditions	Is there any evidence of: Mining, Mine entries Subsidence Landslip/slope erosion Former investigation works	Yes/No Yes/No Yes/No Yes/No	N/A

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Topography	Description required for: Are there apparent differences between site and surrounding area? (If yes describe the presence of retaining walls, and slopes). Is there evidence of Made Ground / Fill on site?	Yes/No Yes/No	The site slightly slopes down to the southeast. There is evidence of a demolished school ground in the northwest corner of the site and a historic mill foundation located to the northeast of site.
Site Boundaries and Neighbours	Description required for: Type of boundary demarcation (if any) on each side of site, usage of adjacent land and name of industrial/commercial occupiers. Note any adjacent features such as water course and other potentially environmentally sensitive uses (residential, school, infirmary, SSSI etc)		There are no distinguished demarcation features on site apart from river Roch running along northeast boundary to southeast. Adjacent land use includes residential usage to the northeast of the site and commercial usage to the northwest of the site. Residential properties located to the northeast of the site.
Vegetation	Are there any vegetation/trees on or close to site (if yes describe locations, type, maturity, etc) Is there any evidence of poor health / distress?	Yes/No Yes/No	Vegetation is located across and around the outside of the site. Dense scrub and some woodland lie to the southeast and south of the site with evidence of dead Japanese knotweed. There are multiple mature trees on the site as well as shrubs along site boundaries.
Ground Surface	Are there areas of hardstanding and estimate the split between hard and soft cover? (If yes describe locations, types and conditions). Is there any evidence of any spillages or staining?	Yes/No Yes/No	60% of the site is covered with vegetated made ground, with 20% hardstanding on the north-western part of the site and the remaining 20% is vegetated and soft cover to the southwest and southeast of the site. None visible on the site walkover.

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Site Drainage	Are there any drain covers / soakaways (if yes describe locations)	Yes /No	None visible on the site walkover.
	Are there any outfalls/water courses on site (note the condition of water courses in open water courses. discolouration, odour, eutrophication, oily sheen, gas bubbling water, clear or cloudy)	Yes /No	N/A
	Where a watercourse runs alongside or crosses a site are there any differences in visible water quality upstream and downstream of the site?	Yes /No	N/A
Electrical Equipment	Are there any electricity sub stations on or adjacent to the site? Are there any electrical transformers, capacitors, pylons etc on site?	Yes/ No	An electrical substation and pylon are in the south centre of the site.
Buildings	Is there any evidence of asbestos construction materials e.g., roofing, insulation materials.	Yes /No	None visible on the site walkover. However, there are remains of historic mill buildings on the site and may contain ACMs.
	Do any buildings have basements?	Yes /No	None visible on the site walkover, however the historic school building on the site is could potentially have a basement.
	Do any buildings have a boiler room (if yes, describe fuel type and storage arrangements)?	Yes /No	None visible on the site walkover.

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Landfilling	Is there any evidence of gas protection measures (gas membrane, gravel-filled trenches, venting pipes, etc)?	Yes /No	N/A
Process Air Emissions	Point Source: Are there any stacks / vents / cooling towers / abatement equipment? Fugitive Source: is there any stockpiled material / windblown dust / vapour process?	Yes /No Yes/ No	N/A Several rubble heaps located around site, mainly to north west of site.
Storage of fuels & Chemicals	Are there any drums / containers (if yes, describe quantity, full /empty, stored on hard standing / soft landscaping, bunding)? Are there any above ground fuel tanks (if yes, describe locations, volumes, how many, bunding, used / disused, condition?) Is there any evidence of underground fuel tanks (fuel pumps, covers, vent pipes, how many and how large, fill point, used / disused, and condition)?	Yes /No Yes /No Yes /No	N/A N/A N/A
Accidents	In the event of a large spillage would runoff affect any vulnerable watercourse/culverts? Are emergency procedures / equipment in place?	Yes/ No Yes /No	River Roch runs from northeast to southeast boundary of site, spillage event would adversely effect watercourse.

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Waste	Are there any waste skips present on site?	Yes /No	N/A
	Are waste storage facilities adequate?	Yes/ No	N/A
	Is there any litter/fly tipped material?	Yes /No	N/A
Atmospheric	Are there any fumes, odours originating from site or affecting site from neighbouring sites?	Yes /No	
Access / Further Investigations	If a Phase 2 Investigation is likely to be required, describe any access problems including headroom where relevant, services, overhead cables, restricted access areas, confined spaces, trafficked areas, etc that are likely to affect investigation scope/techniques. Identify possible site office and storage locations. Identify possible water supply		Machinery required on site must be able to traverse bund wall for access. Ground is soft and will likely be churned up during site investigation with large plant machinery. Overhead cables cross west off the site but will not affect machinery on site. One yellow cable casing was observed on site with no obvious pathway – care must be taken when breaking ground. Hardstanding to the northwest of the site on historic school grounds where there is evidence of a previous building. N/A
Site Environs	Are there any local features that could have a harmful influence e.g., landfill, industrial processes, railway land?	Yes/ No	Rubble heaps may contain landfill and or materials from industrial processes.
	Are there any sensitive water features/courses near to the site?	Yes/ No	River Roch runs along eastern site boundary.
Local Knowledge / Anecdotal Evidence			N/A
Site Dimensions	Describe shape of Site in plan and measure dimensions.		The maximum dimensions of the proposed site are 310m northeast to southwest and 130m northwest to southeast. The site occupies an area of approximately 2.66 hectares.

APPENDIX 4

REPORT LIMITATIONS

LIMITATIONS

This contract was completed by Earth Environmental & Geotechnical Ltd based on a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget and staff resources allocated to the project.

Other than that, expressly contained in the above paragraph, Earth Environmental & Geotechnical Ltd provides no other representation or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Earth Environmental & Geotechnical Ltd.

If a third party relies on this report, it does so wholly at its own and sole risk and Earth Environmental & Geotechnical Ltd disclaims any liability to such parties.

It is Earth Environmental & Geotechnical Ltd understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was an important factor in determining the scope and level of the services. Should the purpose for which the report is used, or the proposed use of the site change, this report will no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without Earth Environmental & Geotechnical Ltd review and advice shall be at the client's sole and own risk.

The report was written in 2022 and should be read considering any subsequent changes in legislation, statutory requirements and industry best practices. Ground conditions can also change over time and further investigations, or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of Earth Environmental & Geotechnical Ltd. In the absence of such written advice of Earth Environmental & Geotechnical Ltd, reliance on the report in the future shall be at the client's own and sole risk. Should Earth Environmental & Geotechnical Ltd be requested to review the report in the future, Earth Environmental & Geotechnical Ltd shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between Earth Environmental & Geotechnical Ltd and the client.

The observations and conclusions described in this report are based solely upon the services that were provided pursuant to the agreement between the client and Earth Environmental & Geotechnical Ltd. Earth Environmental & Geotechnical Ltd has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report.

Earth Environmental & Geotechnical Ltd is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, Earth Environmental & Geotechnical Ltd did not seek to evaluate the presence on or off the site of electromagnetic fields, lead paint, radon gas or other radioactive materials.

The services are based upon Earth Environmental & Geotechnical Ltd observations of existing physical conditions at the site gained from a walkover survey of the site together with Earth Environmental & Geotechnical Ltd interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst Earth Environmental & Geotechnical Ltd have no reason to doubt the accuracy and that it has been provided in full of those it was requested from, the items relied on have not been verified.

No responsibility can be accepted for errors within third party items presented in this report. Further Earth Environmental & Geotechnical Ltd was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Earth Environmental & Geotechnical Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to Earth Environmental & Geotechnical Ltd and including the doing of any independent investigation of the information provided to Earth Environmental & Geotechnical Ltd save as otherwise provided in the terms of the contract between the client and Earth Environmental & Geotechnical Ltd.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and Earth Environmental & Geotechnical Ltd] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site.