

CAULMERT LIMITED

Engineering, Environmental & Planning

Consultancy Services

Willmott Partnership Homes Limited

Blackley, Moston & Collyhurst Housing Developments

**PHASE I AND PHASE II GEO-ENVIRONMENTAL REPORT
JURBY AVENUE, BLACKLEY**

Prepared by:

Caulmert Limited

8 St Georges Business Park
Altrincham Business Park,
Dairyhouse Lane,
Altrincham,
Cheshire,
WA14 5UA

Doc ref: 3025-CAU-XX-XX-RP-V-0306.A0-C1

APPROVAL RECORD

Client: Willmott Partnership Homes Limited

Site: Blackley, Moston & Collyhurst Housing Developments

Project Title: Phase I and Phase II Geo-environmental Report - Jurby Avenue, Blackley

Document Ref: 3025-CAU-XX-XX-RP-V-0306.A0-C1

Report Status: Final

Project Manager: Paul Clayden

Caulmert Limited: 8 St Georges Business Park, Altrincham Business Park, Dairyhouse Lane,
Altrincham, WA14 5UA

Tel: 0161 928 6886

Author	Paul Clayden	Date	April 2017
Reviewer	Paul Clayden / Alan Jones	Date	April 2017
Approved	Celia Pendlebury / Alan Jones	Date	April 2017

DISCLAIMER

This report has been prepared by Caulmert Limited with all reasonable skill, care and diligence in accordance with the instruction of the above named client and within the terms and conditions of the Contract with the Client.

The report is for the sole use of the above named Client and Caulmert Limited shall not be held responsible for any use of the report or its content for any purpose other than that for which it was prepared and provided to the Client.

Caulmert Limited accepts no responsibility of whatever nature to any third parties who may have been made aware of or have acted in the knowledge of the report or its contents.

No part of this document may be copied or reproduced without the prior written approval of Caulmert Limited.

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Details of Commission.....	1
1.2	Proposed Development	1
1.3	Limitations of this Study.....	1
1.4	Objectives of Report	2
1.5	Scope of Report.....	2
1.6	Previous Investigations	2
2	SITE LOCATION AND DESCRIPTION	3
2.1	Site Location and Description	3
2.2	Site History	4
2.3	Geology	7
2.4	Hydrogeology & Hydrology	7
2.5	Underground Utilities.....	8
2.6	Unexploded Ordnance Risk.....	8
2.7	Site Walkover Survey	8
3	INFORMATION FROM THIRD PARTIES	10
3.1	Regulatory Enquires	10
3.2	Environmental Database.....	10
4	PROPOSED DEVELOPMENT	13
5	GROUND INVESTIGATION	14
5.1	Previous Investigations	14
5.2	Current Ground Investigation	14
5.3	Geotechnical Laboratory Testing	15
5.4	Chemical Laboratory Testing.....	15
6	GROUND CONDITIONS.....	16
6.1	General Stratigraphy	16
6.2	Made Ground	16
6.3	Cohesive Superficial Deposits	16
6.4	Granular Horizons	18
6.5	Groundwater.....	18
6.6	Ground Gas	19
7	CONTAMINATION ASSESSMENT.....	20
7.1	Methodology for Contamination Risk Assessment.....	20

7.2	Comparison of Soils Results against Generic Assessment Criteria	21
7.3	Conceptual Site Model	21
8	RECOMMENDATIONS	24
8.1	Introduction	24
8.2	Groundwork	24
8.3	Foundations and Ground Floor Slabs	25
8.4	Coal Mining Risk	26
8.5	Pavement Design	26
8.6	Protection of Buried Concrete	26
8.7	Surface Water Disposal	27
8.8	Contamination	27
8.9	Ground Gas	28
8.10	Additional Ground Investigation	28
9	REFERENCES	29

Figures

Figure 1	Site Location Plan
Figure 2	Site Layout
Figure 3	Site History (Figures 3A – 3E)
Figure 4	Proposed Development Layout Plan
Figure 5	Conceptual Site Model

Appendices

Appendix 1	Photographs from Site Walkover Survey
Appendix 2	GroundSure Report
Appendix 3	CON29M Non-residential Coal Mining Report
Appendix 4	Express Preliminary UXO Risk Assessment
Appendix 5	Factual Ground Investigation Information
Appendix 6	Laboratory Test Results - Contamination
Appendix 7	Laboratory Test Results – Geotechnical

1 INTRODUCTION

1.1 Details of Commission

- 1.1.1 Caulmert Ltd were commissioned by Willmott Partnership Homes Limited. (“the Client”) to undertake a Phase I Desk Study and geo-environmental appraisal, along with a preliminary ground investigation at a site off Jurby Avenue, Blackley, Manchester (“the Site”).
- 1.1.2 The Site covers an area of 0.58 ha and is roughly square in shape, with a gentle drop to the south and west. The site is accessible off Jurby Avenue to the north. The Client is proposing to develop the Site as residential units comprising of one/two storey brick-built dwelling homes.
- 1.1.3 This report comprises the findings from a site walkover, desk based study using third party information from the following sources:
- i) A site walkover survey and photographs (Appendix 1);
 - ii) A review of a GroundSure report (Appendix 2), including geological and environmental data;
 - iii) A review of CON29M Non-Residential Coal Mining Report;
 - iv) A review of information obtained from online sources as referenced in section 8 (British Geological Survey, Environment Agency website and online historic maps).
- 1.1.4 A site location plan is provided as Figure 1. Additional information is provided in subsequent Figures and Appendices.

1.2 Proposed Development

- 1.2.1 Caulmert has been informed that the proposed development will consist of two one/two storey brick-built dwelling houses with private gardens, car parking and associated infrastructure. A layout of the proposed development is provided as Figure 3.

1.3 Limitations of this Study

- 1.3.1 This report is solely for the use of Willmott Partnership Homes Limited and should not be relied upon by third parties without prior written consent from Caulmert.
- 1.3.2 Information used within this report has been gathered from data sets compiled by third party organisations and purchased on behalf of Willmott Partnership Homes Limited. The validity and accuracy of this third-party information is outside the control of Caulmert.

- 1.3.3 Interpretation and recommendations contained within this report should not be assumed valid for adjacent areas of land or alternative land uses, and are based upon the proposed layout provided to Caulmert at the time of compiling this report.

1.4 Objectives of Report

The objective of this report is to complete an initial assessment of potential environmental and geotechnical liabilities given the Client's intention to purchase and develop the site. This report is also intended to support an application for planning authorization to the planning authority.

1.5 Scope of Report

- 1.5.1 The scope of works consisted of the following:

- A site walkover survey and on-site observations;
- A review of third party information as referenced;
- An assessment of potential sources of pollutants on the site and in the immediate surrounding area;
- Derivation of a preliminary conceptual site model identifying potential sources, pathways and receptors of contaminants;
- A preliminary assessment of ground conditions given the Site's planned development, its construction phase and its foundation requirements.
- Recommendations for further investigations (as necessary).

1.6 Previous Investigations

- 1.6.1 Caulmert has not undertaken any previous investigations on the site and is not aware of any investigations carried out by others.

2 SITE LOCATION AND DESCRIPTION

2.1 Site Location and Description

- 2.1.1 The Site is located off Jurby Avenue, approximately 5km north of Manchester city centre, Greater Manchester, at a national grid reference of SD 385550, 403525. The site location plan is presented as Figure 1.



Figure 1 - Site Location

- 2.1.2 The site is roughly square in shape, measuring approximately 65m x 65m, with an area of 0.58 ha. The site is accessible off Jurby Avenue to the north. The site is generally level and flat, with a gentle fall to the south and west.



Figure 2 - Site Layout Plan and Red Line Boundary

2.1.3 A summary of the Site and surrounding areas is presented in Table 2.1 below. The site's location and current layout are illustrated in Figures 1 and 2.

Table 2.1 – Site Description

Site Location		
National Grid Reference	SD 385550, 403525	
Site Area	0.58 ha	
Site Setting / Description	Current Land Use	The site is mostly grassed with scattered trees. An access road from Jurby Avenue extends into the northern site area (where previous houses demolished). Low fence posts separate the road from the grass.
	Surrounding Area	North: Jurby Avenue/Residential
		East: Grass field with mature trees
		South: Grass field with mature trees
		West: Grass field with mature trees

2.2 Site History

2.2.1 In compiling this desk study, historical maps Ordnance Survey (OS) dating from 1848 to 2014 were procured from online mapping and GroundSure were reviewed. A summary of the historical land uses is presented below.

The earliest OS maps show the site and vicinity to be undeveloped Greenfield. There is a "Reformatory" 100m west and steelworks 250m south with isolated farms. A number of issues and sinks were also present around the site.

Figure 3A – 1922 Map Extract - A sand pit is approximately 150m to the east of the site and more ground disturbance within 30m to the east.



Figure 3B – 1932 Map Extract - Residential developments have been constructed to the north, east and south of the site up to 150m of the site boundary.

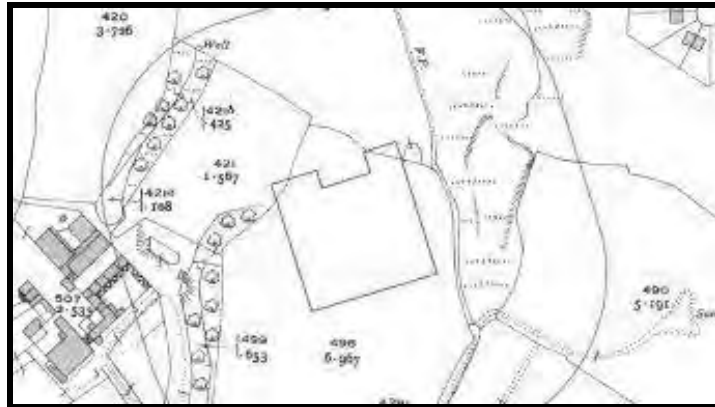


Figure 3C - 1951 Map Extract – A refuse heap is approximately 10m to the south east. A pond is next to the site to the north east.

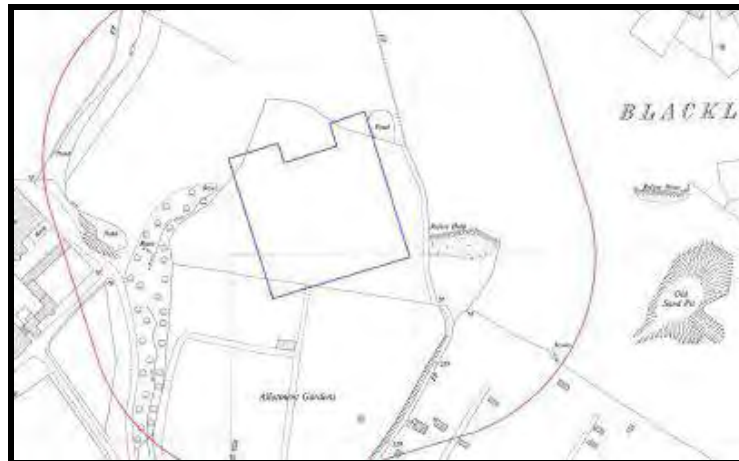


Figure 3D - 1963/64 Map Extract – Houses have been built on the northern and central part of the site in the form of three terraced blocks around a cul-de-sac access road. The former worked ground, sandpits and refuse pit are apparently restored and named “Plant Hill Park”.



No significant changes evident on subsequent maps up to 2010.

Figure 3E – 2014 Map Extract – Housing had been demolished, access road remained in place.



2.2.2 A summary of historical development, both on and off site, that could potentially impact upon the proposed development are presented in Tables 2.2 and 2.3 below.

Table 2.2 – Potentially Contaminative Past Uses

On-site History ¹	Map Date	
	From	To
Residential properties and access roads were constructed on site at some time between 1956 and 1966, but were demolished between 2010 and 2014.	1963	2010
Off-site History ²	Map Date	
	From	To
Sand pit 200m to the east of the site – possibly infilled with unknown material after 1956.	1848	1951
Backfilled sand pits – Refuse heap shown within approximately 10m of eastern site boundary.	1951	Present
Backfilled pond near NE site boundary.	1951	Present
Blackley Steel Works 300m to the south of the site.	1891	1906
Pike fold mills renamed as 'Engineering Works' by 1906.	1891	1923
Old Clay Pit 400m to the west of the site – possibly infilled with unknown material after 1923.	1906	1923

¹ On-site past uses refers to activities directly within the red-line site boundary.

² Off-site past uses refers to activities within 500 m of the red-line site boundary.

Allotments 200m to the south of the site and bordering the south of the site from 1966 to 1975.	1932	Present
Residential development increased in the surrounding area of the site from 1932. Dwellings were constructed immediately to the north of the site and on site by 1966.	1932	Present

- 2.2.3 This information indicates that the only contaminants expected on the site will be demolition rubble from the housing development, potentially including asbestos containing materials. There has been disturbed ground and a refuse pit under 50 metres to the east which may contain gas generating wastes.

2.3 Geology

- 2.3.1 Published geological maps indicate the site is underlain by the following geological conditions:

- Superficial Deposits – Glacial till (Devensian);
- Bedrock Deposits - Chester Pebble Beds (Early Triassic Epoch) which typically comprises sandstone, fine to coarse grained, commonly pebbly, with conglomerates and sporadic siltstones.

- 2.3.2 A major fault trending WNW – ESE is located approximately 40m south of the site, separating the Chester Pebble Beds from the Collyhurst Sandstone Formation.

- 2.3.3 The site is located within a Coal Mining Reporting area, but does not lie within a 'development high risk area'. A CON29M Coal Mining Report (refer to Appendix 3) was obtained from the Coal Authority which indicates the following:

- The property is not within a surface area that could be affected by past underground mining.
- There are no known coal mine entries within, or within 20 metres of, the boundary of the property.
- The property is not in an area where the Coal Authority has plans to grant a licence to remove coal using underground methods.

2.4 Hydrogeology & Hydrology

- 2.4.1 The nearest surface water feature is an unnamed tertiary river 55m west of the site which flows in a southerly direction. The river is culverted 106m south of the site.

2.4.2 The superficial deposits have been classed as a Secondary Aquifer – Undifferentiated.

2.4.3 The bedrock has been classified as a Principal Aquifer.

2.5 Underground Utilities

2.5.1 Based on the utility survey information provided by SEP Ltd (ref: S13903-U) there are several unidentified (UI) services located on site, possibly remnants from the former housing on the site. There is a UI within the footpath on the east and west side of the Jurby Avenue; the east one terminates at the end of the footpath; the one on the west extends to just beyond the south of the footpath in the grass covered area.

2.5.2 There are a further three traces recorded in the grass-covered areas of the site. One extends from the northeast corner along the eastern boundary and then diverts to the west and terminates just south of the end of the road. There is another UI trace to the south of the road which is orientated in an approximate east west direction. The third trace is to the west of the road and is orientated in a north-south direction, with a spur extending to the east which terminates next to the footpath.

2.5.3 A sewer, which drains to the south, is present along the approximate centre-line of Jurby Avenue that extends to a manhole cover located in the grass-covered area just south of the road / footpath. A spur extends to the east from the manhole which terminates in the grassed area; it was not possible to push the tracer sonde any further. Further to the east of this pipe a manhole cover is present which may have been connected at some point in the past.

2.5.4 Two fire hydrants are present in the north of the site within the footpaths on the east and west sides of Jurby Avenue. A trace/ detection of the buried pipes was not possible.

2.6 Unexploded Ordnance Risk

2.6.1 A preliminary UXO risk assessment (ref: EP4491-00 dated 9th March 2017) carried out by 1st Line Defence has not identified any significant risk of encountering items of UXO at the Site, which is considered to be minimal/low risk. It was recommended that no further action was required. A copy of the report is presented in Appendix 4.

2.7 Site Walkover Survey

2.7.1 A site walkover survey was completed by a Caulmert Engineer on 24th March 2017. A summary of the observations made during the site visit are presented in Table 2.3 below.

Table 2.3 – Summary of Observations from the Site Walkover Survey

Observations	Comments
Buildings and Structures	There are currently no buildings or structures on the site (see photograph 1).
Topography	The site is overall level with a gentle slope towards the south and west from an elevation of approx. 89m in the north east to 86m in the south west. To the south and west, the natural topography drops further away from the site (see photograph 3).
Site Access and Security	The former access road from Jurby Avenue is evident. A public footpath borders the eastern side of the site. Low fence posts are present along the road/grass boundary on the south and west sides. None present along the eastern side. The site is easily accessible to the public.
Site Surface	Grassed with some trees on the western side of the site.
Services	No overhead electrical wires are present at the site. A fire hydrant cover was observed in the pavement towards the north of the site on the eastern side of the road (see photograph 2). No other services were observed on site.
Vegetation	Low grass with isolated trees. Mature trees border the site and there are dense brambles to the west of the site.
Invasive Species	An ecological survey is recommended.
Surface Water Features	No surface water features were observed on or near to the site.
Potential Contaminative Sources (on site)	No potential sources of contamination were observed on site.
Potential Contaminative Sources (off site)	No potential sources of contamination were observed close to the site. New housing developments being constructed to the north.
Other Information	The natural topography falls to the south and west towards a valley feature.

3 INFORMATION FROM THIRD PARTIES

3.1 Regulatory Enquires

3.1.1 This section presents the results of enquiries to third parties including the Environment Agency, Local Authority (LA), British Geological Survey, and other Statutory Authorities' records, where relevant, which have been reviewed to determine potentially contaminative activities.

3.1.2 The Neighbourhood Officer – Environmental Protection Officer for Manchester City Council (Laura Miller) was contacted via email (dated 24th March 2017) to enquire whether there are any known or suspected contaminated land issues affecting the site or the proposed development. The response (sent via email dated 28th March 2017) is shown below:

'I have checked our records and can confirmed the following: Jurby Avenue - within 250m of two landfills (Tweedle Hill and Pike Fold Lane)'.

3.1.3 Other than the aforementioned landfill site, the correspondence confirms there are no further known issues regarding the site.

3.2 Environmental Database

3.2.1 A GroundSure Assessment report was procured (ref: HMD-3629120) and is presented as Appendix 2. The pertinent information is contained in table 3.1.

Table 3.1 – Summary of Environmental Information

Reference	Description
Artificial Geology	Possible made ground associated with historic residential properties.
Superficial Deposits	Glacial till (Devensian).
Solid Geology	Bedrock of Chester Pebble Beds.
Hydrology	The nearest surface water feature is an unnamed tertiary river 55m to the west of the site which flows in a southerly direction, the river becomes culverted 106m to the south of the site.
Hydrogeology	The superficial deposits have been classed as a Secondary Aquifer – Undifferentiated. The bedrock has been classified as a Principal Aquifer. The site is not located within a source protection zone. Soil is of high leaching potential.

Reference	Description
Groundwater Abstractions	There are seven groundwater abstraction licences held at three sites within 2km to the south west of the site boundary. All boreholes are source groundwater.
Discharge Consents	None recorded within 500m of site boundary.
Historical Borehole Records	None available in the surrounding area.
Flood Risk	The site does not lie within an area considered to be at risk of flooding from rivers and the sea.
Ecologically Sensitive Land uses	None recorded within 500m of the site boundary.
Mineral and Coal Extraction	The site is located within a Coal Mining Reporting area, see Section 2.3.2 of report. The property lies outside the Cheshire Brine Compensation District.
Radon Gas	The property is not in a Radon Affected Area and no radon protective measures are necessary.
Registered Waste Facilities	None recorded within 500m of the site boundary.
Recorded Pollution Incidents	None recorded within 500m of the site boundary.
Unexploded Ordnance (UXO)	An express preliminary UXO risk assessment report was obtained for the site from 1 st Line Defence (refer to Appendix 4), which indicates the following: There is minimal/low risk of encountering UXO at the site – no further action is required.
Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) Process Authorisations, Parts A and B (legislation governing certain industrial activities and their impact on the environment)	None recorded within 500m of the site boundary.
Water Industry Referrals (potentially harmful discharges to public sewers)	None recorded within 500m of the site boundary.
List 1/2 Dangerous Substances Inventory Sites	None recorded within 500m of the site boundary.
Records of Part A(2) and Part B Activities and Enforcements	Part B Permit is given to the unloading of petrol into storage at Blackley Service Station 462m to the south east of the site.
Radioactive Substances Act, 1993	None recorded within 500m of the site boundary.
Planning Hazardous Substance Consents/Enforcements	None recorded within 500m of the site boundary.
COMAH/NIHHS Sites (Dangerous or Hazardous Sites)	None recorded within 500m of the site boundary.

Reference	Description
EA Recorded Pollution Incidents (National Incident Recording System, List 1 & 2)	None recorded within 500m of the site boundary.
Part IIA EPA 1990 (sites determined as Contaminated Land)	None recorded within 500m of the site boundary.
Landfill and other Waste Sites EA landfill data EA historic landfills BGS/DoE non-operational landfill sites Local Authority landfill sites Waste treatment, transfer or disposal sites EA licenced waste sites	There are three historic landfill sites within 500m of the site boundary: 125m to the west of the site at 'Land at Tweedle Hill' 127m to the south west of the site at 'Land at Pike Fold Lane', and 459m to the south east at 'land off White Moss Road' No other information has been made available. There are eight local authority registered landfill sites recorded between 184m and 338m of the site
Potentially Contaminative Activities (list of commercial/industrial premises close to site)	- The closest significant potentially contaminative activities are recorded as: - Garage, 96m to the west of the site. - Automobile Engineering Works, 96m to the west of the site. - Electrical Substation, 363m to the east of the site. - Petrol Station, 455m to the south east of the site.
Designated Environmentally Sensitive Sites	- None recorded within 500m of the Site boundary.

4 PROPOSED DEVELOPMENT

4.1.1 It is proposed to construct 10 semi-detached bungalows on the site, an indicative layout is presented below:

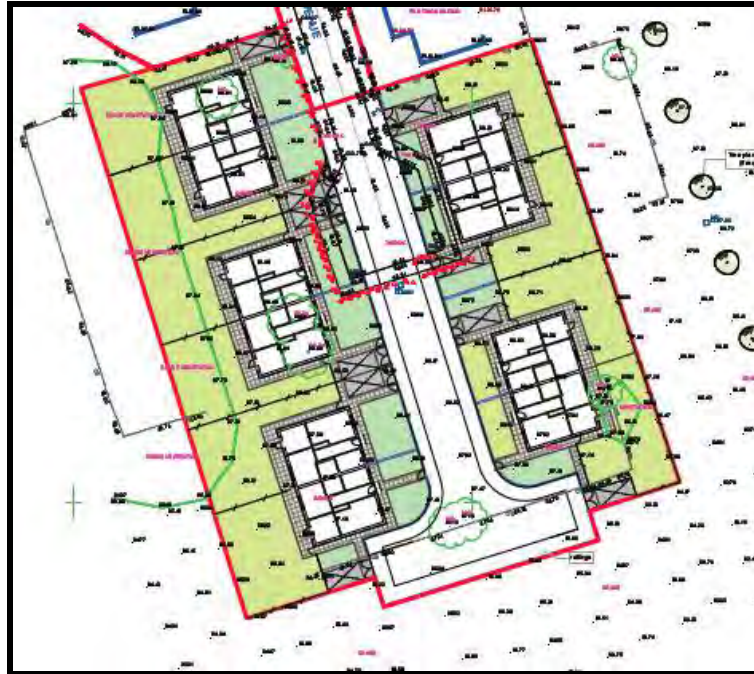


Figure 4 - Proposed Development Layout Plan

4.1.2 No construction details or structural loads have been received, therefore the recommendations in this report are based on the following assumptions:

- The buildings will be of traditional block, brick, or timber frame construction;
- The development will be at or near grade; no retaining walls or earthworks are therefore considered.
- Gardens will be provided to all properties.

5 GROUND INVESTIGATION

5.1 Previous Investigations

5.1.1 No information relating to previous ground investigations carried out at the site have been received.

5.2 Current Ground Investigation

5.2.1 An intrusive site investigation was completed on 10th March 2017, following the clearance of all proposed locations for underground utilities (by SEP) and unexploded ordnance (UXO). The ground investigation comprised:

- Five boreholes (WS1-6 to WS5-6) were advanced using the percussive “window sampler” drilling technique installed to depths of between 3.45m and 5.45m below ground level (bgl).
- In situ SPT tests at 1m intervals;
- Dynamic probing from the base of borehole WS1-6 from 4.00 to 6.00mbgl;
- One permanent gas and groundwater monitoring well installation (WS4-6);
- One groundwater falling head test (WS3-6).

5.2.2 The position of the exploratory holes are shown on Figure 5 below.



Figure 5. Exploratory Hole Location Plan

5.2.3 During their advancing, the cores derived from each borehole were continuously inspected for field indications of contamination, and logged by an experienced geo-environmental engineer. The boreholes logs are presented as Appendix 5.

5.2.4 Borehole WS4-6 in the approximate centre of the site was completed as a permanent groundwater monitoring well and monitored for gas and groundwater. The remaining boreholes were backfilled with arisings and made good.

5.3 Geotechnical Laboratory Testing

5.3.1 A suite of physical laboratory testing was undertaken on representative samples of soils to establish site specific geotechnical design parameters. The laboratory tests comprised:

- 5 no. moisture content test;
- 2 no. Atterberg limit tests;
- 1 no. particle size distribution (PSD) test.

5.3.2 Testing was scheduled by Caulmert and carried out at CCG and ELAB, who are UKAS accredited for a range of geotechnical tests. The laboratory physical testing results are presented in Appendix 7.

5.4 Chemical Laboratory Testing

5.4.1 Four soil samples collected from the site were submitted to an accredited environmental analytical laboratory, Concept Life Sciences Ltd, UK. (UKAS Testing Laboratory Reference No. 1549, December 2012). The Chain of Custody documentation is presented as Appendix 6.

Table 5.1 – Summary of Chemical Scheduled Laboratory Testing

Borehole Ref.	Depth (m)	Asbestos	CLEA Metals	PAH USEPA 16	SO ₄ (2:1)	SOM	TPH (C10-C35)	pH
WS1-6	0.10-0.30	Y	Y	Y			Y	Y
WS3-6	0.50-0.70	Y	Y	Y	Y	Y	Y	Y
WS5-6	0.15-0.30	Y	Y	Y			Y	Y
WS5-6	0.50				Y			Y

5.4.2 The soil samples were submitted for an analytical suite comprising pH, heavy metals (arsenic, cadmium, copper, chromium (total), mercury, nickel, lead, selenium, zinc, boron, beryllium, vanadium), pH, soil organic matter (SOM), asbestos fibres, poly-aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH) and water soluble sulphate.

5.4.3 Laboratory certification of the chemical analysis is provided in Appendix 6.

6 GROUND CONDITIONS

6.1 General Stratigraphy

- 6.1.1 The encountered stratigraphy comprised a surface layer of cohesive topsoil, overlying between 0.2m and 0.6m of made ground. The natural superficial deposits comprised generally cohesive glacial till, with localised sand horizons. No bedrock was encountered
- 6.1.2 A summary of the ground conditions encountered in each exploratory is presented in the table and discussed in more detail below.

Table 6.1 – Summary of Stratigraphy

Expl. Hole Ref	Depth of Stratum (m)				Ground water (m)	Comment
	Topsoil	Made Ground	Cohesive Glacial Till	Granular horizon		
WS1-6	0.10	0.10-0.60	0.60-2.10 2.70-4.00	2.10-2.70	2.10 1.85 after 50 min	Dynamic probing from 4.00-6.00m.
WS2-6	0.20	-	0.20-3.65	3.65-4.00	3.00 2.93 after 30 min	
WS3-6	0.05	0.05-1.00	1.00-4.00	-	Dry	
WS4-6	0.10	0.10-0.20	0.20-4.45	3.60-3.80	3.60 3.44 after 30 min	
WS5-6	0.15	0.15-0.30	0.30-2.15 2.50-2.70	2.15-2.50 2.70-5.45	2.70 Damp	

6.2 Made Ground

- 6.2.1 Reworked topsoil was present in all exploratory holes to depths of between 0.05m and 0.2m.
- 6.2.2 Made ground was encountered in all exploratory holes except for WS2-6, where it was encountered to depths of between 0.2m and 1.0m. It comprised a mixture of brick and concrete in a soft brown clay matrix, with pockets and horizons of black granular ash and clinker. The following horizons were recorded:

- WS1-6 a layer of crushed sandstone aggregate between 0.30-0.60m;
- WS4-6 a sand and gravel comprising ash and clinker between 0.10-0.20m;
- WS5-6 crushed bricks and concrete were present between 0.15-0.30m.

6.3 Cohesive Superficial Deposits

- 6.3.1 The Made Ground was underlain at all locations by brown mottled grey sandy slightly gravelly clay with occasional sand lenses. It was generally firm apart from in WS1-6, where it was soft between 0.6m and 1.2m, and WS4-6 where it was firm to stiff between 0.2m and 3.6m.

6.3.2 Five moisture content tests were carried out at depths of between 1.0m and 2.0m, recording values of between 16% and 18%.

6.3.3 Two Atterberg limit tests were carried out and the following results were recorded:

Table 6.2 – Summary of Atterberg Limit Testing and Volume Change Potential

Expl. Hole Ref	Depth (m)	w	LL	PL	Ip	NHBC VCP
WS2-6 B1	1.00-1.50	18	32	16	16	Low
WS5-6 B1	0.50-1.00	16	31	16	15	Low
NHBC VCP – NHBC Volume Change Potential						

6.3.4 The results are very uniform, with plastic limits of 16% and Liquid Limits between 31 and 32%. The samples are classified as Low plasticity Clay and have a low volume change potential, when compared to NHBC guidance.

6.3.5 Twenty one standard penetration tests (SPT) were carried out in the cohesive soils window sample boreholes at depths of between 1m and 5m; the recorded N values ranged between 8 and 21, averaging 11.8. The results are summarised by depth in the table below.

Table 6.3 – Summary of SPT N Values vs Depth

Commencement Depth	No. of tests	SPT 'N' value		
		Min.	Max.	Average
1.00	5	9	13	11
2.00	5	8	21	13
3.00	4	10	15	12
4.00	2	12	12	12

6.3.6 There was some variation in the recorded N values at each depth between each borehole location, with the maximum range of values recorded at 2.0m below ground level. However, overall the average for the range of values recorded is consistent, with average 'N' values ranging between 11 and 13 at all depths.

6.3.7 SPT 'N' values may be used to derive approximate values of mass shear strength (c). Based on a Plastic Index of 16 the conversion factor is approximately 6 (Stroud; CIRIA 143), resulting in the following mass shear strength values, which indicate the clay is in typically in a firm condition:

Table 6.4 – Summary of Approximate Values of Mass Shear Strength

Commencement Depth	SPT 'N' value range	Mass Undrained Shear strength (kPa)
1m	9 - 13	54 - 78
2m	8 - 21	48 - 126
3m	10 - 15	60 - 90

6.4 Granular Horizons

6.4.1 A number of discreet granular horizons were encountered within the glacial till, which typically comprised orange or brown typically silty, fine to medium sand:

- WS1-6 - 2.10 to 2.70m
- WS2-6 - 3.65 to 4.00
- WS4-6 - 3.60 to 3.80m
- WS5-6 - 2.15 to 5.45mBGL

6.4.2 Four SPT tests were carried out in the granular horizons, one at 4.0m in WS2-6, which recorded an SPT 'N' value of 17 (medium dense), and three in WS5-6 at 3.0m, 4.0m and 5.0m, which recorded 'N' values of 10, 10 and 11 respectively, indicative of loose to medium dense conditions.

6.4.3 One particle size distribution (PSD) was carried out on a sample of the granular soils; the following grain sizes were recorded:

Table 6.5 – Summary of PSD Grading Results

Hole Ref	Depth	Percentage		
		Clay/silt	Sand	Gravel
WS5-6	2.15-2.50	53	45	2

6.4.4 Dynamic probing was completed in borehole WS1-6 between 4.0 and 6.0mBGL. Between 4.0-5.0m the recorded blow counts were low, with typical values of 1 and 2 recorded. This trend continued for the first part of the run between 5.0 and 6.0m, with blow counts increasing to 6 from 5.60mBGL.

Table 6.6 – Summary of Dynamic Probing in WS1-6

Commencement Depth	Blow Count
	WS1-5
4.00	1,2,1,1,2,1,2,2,1,2
5.00	1,1,2,2,2,5,6,6,6,6

6.5 Groundwater

6.5.1 Groundwater strikes were recorded in two locations in the western part of the site. One was in WS1-6 at 2.10m in a sandy horizon within the Till which rose to 1.85mbgl after 45 minutes. Groundwater was also encountered in borehole WS2-6 at two horizons, 2.30mbgl in a sandy horizon and at 3.65mbgl in sand. It rose to 2.93mbgl after 60 minutes. A seepage was also recorded in borehole WS5-6 within sand strata at a depth of 2.70mbgl.

6.5.2 Groundwater monitoring was completed during the investigation. One groundwater monitoring standpipe was installed at WS4-6. The standpipe was dipped on 21st March 2017. The readings are presented below.

Table 6.7 – Groundwater Monitoring Results

Expl. Hole Ref	Field Records		Monitoring Records						
	'strike' depth (m)	Standing water (m)	standpipe depth (m)	Groundwater Depth (m)					
				21/03	30/03				
WS1-6	2.10	1.85	-	-	-				
WS2-6	2.30 / 3.65	2.93	-	-	-				
WS4-6	N/A	N/A	1.86	0.33	0.79				
WS5-6	2.70	None	-	-	-				

6.5.3 One infiltration test was carried out in borehole WS3-6 in cohesive soil. The infiltration test failed and, after an initial drop, the water remained at the same level after one hour and twenty minutes on test.

6.6 Ground Gas

6.6.1 Two rounds of ground gas monitoring were completed, with a summary of the results presented in the table below:

Table 6.8 – Summary of Gas Monitoring Results

Expl. Hole Ref	Round 1 21/03/17	Round 2 30/03/17	Round 3	Round 4	Round 5	Round 6
WS4-5						
O ₂ (%)	21.0	20.8	TBC	TBC	TBC	TBC
CO ₂ (%)	0.2	0.0	TBC	TBC	TBC	TBC
CH ₄ (%)	0.0	0.0	TBC	TBC	TBC	TBC
Flow (l/hr)	0.0	0.01	TBC	TBC	TBC	TBC

6.6.2 Low levels of carbon dioxide were encountered and no methane was recorded. There was a low flow recorded from the borehole during the second visit.

7 CONTAMINATION ASSESSMENT

7.1 Methodology for Contamination Risk Assessment

- 7.1.1 This section assesses the likely potential contamination to be present, and the risk it may pose to human health, the natural environment and the built environment.
- 7.1.2 In the United Kingdom, the legislative regime for identifying and dealing with contaminated land is set out in Part IIA of the Environmental Protection Act 1990. The Act, together with associated Regulations and Guidance (published separately for England, Wales, Scotland and Northern Ireland), describe the regulatory functions and actions aimed at identifying contaminated land, and defining the persons liable for voluntary or enforced remediation.
- 7.1.3 The methodology recommended for identifying contaminated land is outlined in the DEFRA / EA published guidance document, CLR11 “Model Procedures for the Management of Land Contamination” (2004). The methodology takes the form of the identification of potential contaminant sources, pathways and sensitive receptors and their likely predilection to be linked. Under the guidance, this is termed a “pollutant linkage”.
- 7.1.4 For there to be a potential risk from contamination, a complete-source-pathway-receptor pollutant linkage must exist, or potentially exist, during and after development of the site. Risk can be defined as the combination of the consequence of a harmful effect and the probability of its occurrence. Each aspect of the pollutant linkage is defined below:
- i) Source (contaminant): A substance that is in or under the land that has the potential to cause harm to the receptor.
 - ii) Pathway: The route(s) or means via which a receptor can be exposed to, or affected by, a contaminant.
 - iii) Receptor: The factor (person, built environment or ecosystems) that might adversely be affected by the source.
- 7.1.5 The potential sources, pathways and receptors for each site are encapsulated into a conceptual site model. A Conceptual Site Model (CSM) is the means by which the sources, pathways and receptors are systematically considered; and either discounted, or else earmarked as potentially valid and warranting further investigation.
- 7.1.6 In accordance with the approach advocated in CLR11, a conceptual site model has therefore been derived for the site using information obtained during the desk study and site walkover information reported earlier in this document, as well as the results from the ground investigation and the results from the chemical analysis of the samples collected.

- 7.1.7 The reported concentrations of contaminants in soils have been compared against GAC based on Category 4 screening levels (C4SLs) as published by the DEFRA, and where unavailable, against other suitable guidance as published by LQM/CIEH and other sources.
- 7.1.8 The reported concentrations of contaminants in groundwater have been compared against relevant Environmental Quality Standards (EQS) as published under the Water Framework Directive (2000/60/EC) (2014) and amended, or against other sources (such as Drinking Water Standards (DWS) as relevant. The Environmental Quality Standard (EQS) Freshwaters Specific Pollutants and Operational EQS. (Annual average concentrations AAC and maximum admissible concentrations MAC).

7.2 Comparison of Soils Results against Generic Assessment Criteria

- 7.2.1 Three samples of made ground were sent for analytical chemical testing. A table presenting the comparison of soil analytical results against generic assessment criteria (GAC) for residential uses is presented in Appendix 6.
- 7.2.2 The pH values of the soil samples was consistent and ranged between 8.2 and 8.3 which is moderately alkaline. The sulphate concentrations for both samples was less the method detection limit of 0.1g/l.
- 7.2.3 The Soil Organic Matter (SOM) concentration of one sample of made ground is 3.1%. To adopt a conservative approach, the results have been compared to assessment criteria derived for SOM of 2.5%.
- 7.2.4 The following contaminants were found to exceed their respective GAC threshold limits for residential (with plant uptake) land use assuming 2.5% SOM:
- 7.2.5 All three samples (WS1-6 at 16mg/kg, WS3-6 at 17mg/kg and WS5-6 at 22mg/kg) were submitted for analysis of total chromium. Their measured concentrations (16mg/kg, 17mg/kg and 28mg/kg) all exceed the screening criteria of 6mg/kg for the more toxic form of chromium, which is chromium (VI). This is a conservative approach and further analysis of chromium (VI) and (III) will enable a more representative assessment of risk to be made.
- 7.2.6 Asbestos (amosite) fibres were detected in sample WS1-6 at 0.10 to 0.30mbgl. The sample was subsequently scheduled for quantification, the results of which are <0.001%, which is below the 0.1% threshold at which it would be classified as hazardous waste.

7.3 Conceptual Site Model

The CSM derived following the desk study and site walkover reported in Sections 2 and 3 of this document is presented in Figure 3 with the details summarised in Table 7.1 below.

Table 7.1 – Summary of Potential Pollutant Linkages (Preliminary Conceptual Site Model)

Potential Source	Potential Contaminant	Potential Pathways	Potential Receptor	Pollutant Linkage Present	Comments
Made ground and demolition rubble (bricks, concrete, plaster, paints) associated with the former houses on the site at some time between 1956 and 1966, but were demolished between 2010 and 2014.	Metals, PAH, petroleum hydrocarbons,	Dermal contact with ground, Ingestion of soil/homegrown product, Inhalation of dust, Inhalation of vapours – indoor/outdoor.	Human Health – Site workers Future residents	Unlikely	Evidence of former structures on historical maps consistent with made ground encountered containing demolition rubble to depths of 1.0mbgl encountered locally from former houses. Elevated concentrations of Cr but further testing required.
	Asbestos	Inhalation of fibres	Human Health – Site workers, Future residents	Likely	Amosite asbestos fibres detected within the made ground deposits. The extent and nature of the asbestos contamination is not known, but further deposits may be present on site within the made ground.
Made ground and natural granular superficial deposits	Sulphate and pH	Direct contact.	Building materials durability	Unlikely	The recorded pH is slightly alkali and the recorded sulphate concentrations are all less than 0.1g/l. Semi-confined groundwater in sandy horizons in Till, not tested. No special requirements are considered necessary for buried concrete foundations.
Potential for gas producing material within the infilled sand pits and from historic landfill sites to the west of the site.	Methane, carbon dioxide	Accumulation of gasses in confined spaces.	Human Health – Future residents	To be confirmed	Several infilled pits and three registered historic landfill sites less than 500m from site boundary. The gas monitoring completed to date (two rounds at the time of writing this report) indicates that no methane is present and that low concentrations of carbon dioxide (maximum 0.2%) are present. Low flow rates have been measured. The underlying strata includes low permeability deposits of Till, and the landfill deposits are old, meaning that the gas generation potential is low. Risk potentially low pending completion of monitoring regime.

- 7.3.1 At this stage the CSM constitutes a preliminary or interim risk assessment which determines only the likelihood of a linkage being present. The preliminary CSM should be refined and revised as more site information is obtained.
- 7.3.2 The conclusions from the CSM are there is a potential risk of chromium in the made ground, although it is anticipated that further testing of chromium species will demonstrate no risk exists. However, asbestos has also been identified in the made ground. Provided that appropriate health and safety measures are implemented, such as the use of suitable PPE during construction, there should not be a risk. The potential for risks to future residential users should be mitigated through the use of geo-barriers and appropriate imported inert soil profiles. Further assessment may determine that chromium (III) is present, and therefore asbestos would be the only contaminant of concern based on the preliminary findings.
- 7.3.3 The identification of a potential pollutant linkage does not necessarily mean that there is a risk, or that the linkage is present, but that further investigation is required to establish whether or not that risk exists. Whereby a risk is identified and verified, the potential consequence of harmful effect and the likelihood of its occurrence should then be established in order to determine whether the risk is acceptable or unacceptable.
- 7.3.4 Table 7.1 assumes that the land uses will be residential, and is not valid for other land uses.

8 RECOMMENDATIONS

8.1 Introduction

- 8.1.1 The comments and recommendations presented below should be treated as preliminary and should be reviewed as additional development information becomes available.

8.2 Groundwork

- 8.2.1 The site is generally level with a slight fall towards the south and west. Based upon the current understanding of the proposed development, some minor earthworks and levelling may be necessary, particularly along the western boundary, where the ground level drops away to the west
- 8.2.2 Excavations will be carried out through a mixture of made ground and predominantly cohesive superficial soils. Granular soils are unlikely to be encountered in shallow excavations, below approximately 2m depth. All excavation should be achievable using conventional earthmoving plant.
- 8.2.3 It is possible that former foundations associated with the previous houses remain in the ground, which would represent buried obstructions to the development.
- 8.2.4 Relatively shallow excavations and trenches are likely to remain stable in the made ground and glacial till in the short term. It may be necessary to provide trench support or batter back the sides to a stable angle if manual entry is required or if excavations will be left open for prolonged periods.
- 8.2.5 Safe working conditions should be maintained for site workers, who should not enter excavations unless a careful assessment of the need for ground support has been carried out by a competent person and any necessary ground support has been installed.
- 8.2.6 Construction plant and stockpiles of materials must not be permitted close to the edges of open excavations.
- 8.2.7 Groundwater strikes during the investigation were recorded at depths of 2.10m and 2.70m in sandy bands within the Till, and at 3.65m in sand. On site monitoring in boreholes WS1-6 and WS2-6 recorded standing water levels at 1.85m and 2.93mbgl respectively. Subsequent monitoring of the installation in borehole WS4-6 recorded groundwater level at 0.33 and 0.79mbgl.
- 8.2.8 The granular horizons do not appear to be in continuity with each other, therefore it is likely that groundwater ingress from these horizons will be controlled with relative ease by

pumping from sumps, although it may take some time for the initial drawdown to occur. However there is a risk that inflows could result in washout or running sands and a risk of sidewalls being undermined.

- 8.2.9 The monitoring visits confirmed that the perched groundwater is semi-confined within the made ground and is probably not hydraulically connected across the site. Nevertheless, levels may have a rapid response to rainfall events. Potential seasonal groundwater variations should of course be taken into account when planning groundworks.

8.3 Foundations and Ground Floor Slabs

- 8.3.1 Based on the exploratory hole records, the proposed houses will be predominantly underlain by a thin surface layer of made ground over cohesive superficial deposits. Granular horizons were generally encountered beneath 2m depth and are unlikely to be encountered in shallow excavations.
- 8.3.2 The cohesive superficial deposits are considered to provide a suitable bearing formation for shallow traditional strip footings, however localised soft horizons may be encountered which may require over excavation to expose the underlying firm clay.
- 8.3.3 To take into account the various consistencies logged for the cohesive soils, it is recommended that the allowable bearing capacity of the soils for shallow strip footings up to 1m wide is limited to 100kPa. The formation should be extended through any soft clay until firm clay, with a minimum undrained shear strength of 50kPa is encountered.
- 8.3.4 The cohesive soils are classed as having a low volume change potential in accordance with NHBC guidelines.
- 8.3.5 Two small trees are to be felled in the western part of the site, and several on the eastern side (away from the footprint of the proposed dwellings). The depth of any foundations within the zone of influence of existing or proposed trees should be checked against NHBC guidelines, and adjusted accordingly, based on a low volume change potential.
- 8.3.6 Any excavations penetrating into granular soils are likely to result in groundwater inflow with the associated risk of sidewall collapse, however this is unlikely within the anticipated depth of the shallow foundations.
- 8.3.7 Suspended floor slabs are recommended due to the variable thickness of made ground, which extends to depths of 1m locally on the site.

8.4 Coal Mining Risk

8.4.1 The site is not considered to be at risk from past or future coal mining activities.

8.5 Pavement Design

8.5.1 No in situ or laboratory CBR tests have been carried out at the site. The formation of the road construction will be in made ground, which predominantly comprised granular construction debris in a soft clay matrix.

8.5.2 Guidance on the selection of equilibrium CBR values as provided in Table 5.1 of Interim Advice Note 73/06 (2009) from the DMRB, however this is not considered appropriate for made ground.

8.5.3 It is recommended that the design of roads and hardstanding are based on a CBR value of 2%, which will account for any variations in the made ground. However, it is likely that the subgrade CBR may be increased by excavating and re-compacting the granular made ground, subject to any regulatory approval on adoptable roads.

8.5.4 Any areas soft spots or unsuitable material at formation level should either be removed and replaced with suitable compacted granular material, or inspected by a competent person to assess treatment requirements.

8.5.5 In situ CBR tests are recommended at construction stage to confirm the design assumptions for CBR values.

8.6 Protection of Buried Concrete

8.6.1 Five soil samples were tested for pH and two for sulphate content (2:1 water soluble extraction). The testing results were as follows:

Table 8.2 – Assessment of Aggressive Chemical Environment for Concrete

	Made Ground	Natural Ground
pH (units)	8.2	8.2
Water soluble sulphate (SO ₄) (mg/l)	<100	<100

8.6.2 The results have been compared to the guidance contained in BRE Special Digest 1, Concrete in aggressive ground, 2005 [7]. Based on greenfield conditions and a static groundwater regime, the site is classed as follows:

Table 8.3 – Assessment of Concrete Classification

Design Sulphate class	DS-1
ACEC Class	AC-1

- 8.6.3 Concrete below ground must comply with the requirements of Parts D to F of Special Digest 1 [7], as appropriate.

8.7 Surface Water Disposal

- 8.7.1 One soil infiltration test has been carried out in borehole WS3-6 which was in the low permeability soils typically encountered across the site.
- 8.7.2 Infiltration drainage via soakaways is therefore considered unlikely to be suitable for the proposed development.

8.8 Contamination

- 8.8.1 For a proposed residential end use, it is recommended that allowances should be made for a capping layer of a minimum thickness of 600mm, of clean imported subsoil and topsoil in all proposed gardens and areas of soft landscaping that are underlain by reworked topsoil/made ground. This would ensure there are no valid pollutant linkages between soil-bound contamination and future residential users.
- 8.8.2 Of the three samples of made ground screened for the presence of asbestos, asbestos fibres were positively identified in one sample from WS1-6 at 0.10 to 0.30mbgl. This was identified as amosite and quantified as <0.001%, which is below the 0.1% threshold at which it would be classified as hazardous waste. It remains possible that asbestos containing materials may be present from elsewhere arising from the demolition of the former building on the site. The planned construction programme should incorporate provisions as recommended in the Control of Asbestos Regulations 2012 (CAR 2012) and CL:AIRE document CAR-SOIL 2012 *"Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials"*.
- 8.8.3 No sampling has been conducted for waste disposal purposes pending confirmation of a detailed design. However, it should be noted that the CL:AIRE Definition of Waste Code of Practice (DoW CoP) supports the sustainable and cost-effective development of land and this includes the potential reuse of both contaminated and uncontaminated materials either on their site of origin, but also between sites within a defined "cluster project". The application of the DoW CoP can provide an alternative to Environmental Permits or Waste Exemptions and reduce waste disposal costs. Should topsoil, made ground or natural ground at this site be identified as being potentially suitable for reuse (i.e. topsoil for gardens, or made ground for landscaped mounds for example) the material should be representatively sampled, analysed, interpreted and correctly used in accordance with the guidance provided in DoW CoP (2008).

8.9 Ground Gas

- 8.9.1 Radon - The property is not in a Radon Affected Area and no radon protective measures are necessary.
- 8.9.2 Ground gases - Two rounds of gas monitoring have been completed to date. The results so far suggest there are low concentrations of carbon dioxide, no methane, and low gas flow. However, given the presence of potential sources of ground gas in close proximity to site (former infilled sand pits and refuse heaps) and in the neighbourhood (three landfills within 500m), it is recommended that the complete monitoring regime comprising six visits, including at least one under low atmospheric pressure conditions, is completed. Once all the monitoring results are received, they are interpreted in accordance with BS8485:2015 *Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings*, and CIRIA C665:2007 *Assessing the risk posed by hazardous ground gases to buildings*.

8.10 Additional Ground Investigation

- 8.10.1 Further investigation works are not considered necessary in relation to foundation design.
- 8.10.2 Shallow groundwater is perched and semi-confined within low permeability horizons in the made ground. It is recommended that one sample is collected from the existing monitoring well (WS4-6) and submitted for analysis for chemical contaminants to confirm there are no water-borne contaminants in the made ground. The results will inform an amended conceptual site model, and if waterborne contaminants are identified, arrangements can be made to manage any liquid arisings during site development.
- 8.10.3 The completion of the gas monitoring programme is required as outlined in 8.9.2.
- 8.10.4 An ecological survey is recommended.

9 REFERENCES

- [1] DEFRA and Environment Agency (2004). *Model Procedures for the Management of Land Contamination*. R & D Publication CLR 11.
- [2] National House Builders Council, Environment Agency and Chartered Institute of Environmental Health (2008). *Guidance for the Safe Development of Housing on Land Affected by Contamination*. R & D Publication 66.
- [3] DETR Circular 01/2006 (2006). *Environmental Protection Act 1990 Part 2A. Contaminated Land*.
- [4] British Standard Institution (2001). *Code of Practice for Investigation of Potentially Contaminated Sites*. BS 10175:2001
- [4] British Standards Institution (2010): *Environmental Management – Environmental Assessment of Sites and Organisations* (EASO). BS ISO 14015:2010.
- [5] British Standards Institution (2013): *Code of practice for the investigation of potentially contaminated sites*. BS 10175:2011+A1:2013.
- [6] British Standards Institution (2015): *Code of practice for ground investigations*. BS 5930:2015.
- [7] Building Research Establishment (2005): *Concrete in aggressive ground*. BRE Special Digest 1. Third Edition.
- [8] Building Research Establishment (2007): *Radon: guidance on protective measures for new dwellings*. BRE Report BR211.
- [9] Department of Food and Rural Affairs (2012). *Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance*.
- [10] CIRIA (2007). *Assessing the risk posed by hazardous ground gases to buildings*. C665.
- [11] CIRIA (2009). *Unexploded ordnance (UXO) A guide for the construction industry*. C681.
- [12] UK Public General Acts (1991) Water Industry Act 1991. 1991 Chapter 56, The Stationary Office, 1991.
- [13] Environment Agency (2012) 'What's in your backyard?' Wiyby www.environmentagency.gov.uk/wiyby/

- [14] Groundsure Enviro Insight, Jurby Avenue, Manchester M9 6NG (Reference HMD-39629120). 10 Feb 2017.
- [15] Coal Authority, CON29M Non-residential Mining Report (Reference: 51001393520005). 6 March 2017.
- [16] 1st Line Defence, Express Preliminary UXO Risk Assessment (Reference EP4491-00) 9 March 2017.
- [17] CL:AIRE (2012): CAR-SOIL, *Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials*.
- [18] CL:AIRE (2008): *Definition of Waste: Development Industry Code of Practice* (September 2008).
- [19] BS8485:2015 - *Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings*.
- [20] CIRIA C665:2007 - *Assessing the risk posed by hazardous ground gases to buildings*.

APPENDICES

APPENDIX 1

Photographs from Site Walkover Survey



Project Name: Jurby Avenue	Project Number: 3025.06	Date: 24/02/17
Photograph Number: 1 (IMG 3)	Orientation (Direction Facing): South	
Description and Notes: Site entrance off Jurby Avenue. Wooden posts visible along foot path.		
Special Features or Observations: n/a		
Approximate Dimensions (where appropriate): n/a		



Project Name: Jurby Avenue	Project Number: 3025.06	Date: 24/02/17
Photograph Number: 2 (IMG 5)	Orientation (Direction Facing): South-east	
Description and Notes: Fire Hydrant seen in the foot path		
Special Features or Observations: n/a		
Approximate Dimensions (where appropriate): n/a		



Project Name: Jurby Avenue	Project Number: 3025.06	Date: 24/02/17
Photograph Number: 3 (IMG 12)	Orientation (Direction Facing): South-west	
Description and Notes: Localised littering.		
Special Features or Observations: n/a		
Approximate Dimensions (where appropriate): n/a		



Project Name: Jurby Avenue	Project Number: 3025.06	Date: 24/02/17
Photograph Number: 4 (IMG 14)	Orientation (Direction Facing): North	
Description and Notes: Brambles/bushes seen in the west of site. The ground level can also be seen to drop away towards the west (left of picture).		
Special Features or Observations: n/a		
Approximate Dimensions (where appropriate): n/a		

APPENDIX 2

GroundSure Report

Groundsure Enviro Insight

Address: JURBY AVENUE, MANCHESTER, M9 6NG

Date: 10 Feb 2017

Reference: HMD-3629120

Client: Caulmert Ltd

NW

N

NE

W

E



SW

S

SE

Aerial Photograph Capture date: 11-Jun-2015

Grid Reference: 385550,403525

Site Size: 0.58ha

Report Reference: HMD-3629120

Client Reference: 3025H

Contents Page

Contents Page	3
Overview of Findings	6
Using this report	10
1. Historical Land Use	11
1. Historical Industrial Sites	12
1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping	12
1.2 Additional Information – Historical Tank Database	14
1.3 Additional Information – Historical Energy Features Database	15
1.4 Additional Information – Historical Petrol and Fuel Site Database	15
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	15
1.6 Potentially Infilled Land	16
2. Environmental Permits, Incidents and Registers Map	19
2. Environmental Permits, Incidents and Registers	20
2.1 Industrial Sites Holding Licences and/or Authorisations	20
2.1.1 Records of historic IPC Authorisations within 500m of the study site	20
2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site	20
2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site	20
2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site	20
2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site	20
2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site	21
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	21
2.1.8 Records of Licensed Discharge Consents within 500m of the study site	21
2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site	21
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	21
2.2 Dangerous or Hazardous Sites	22
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents	22
2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site	22
2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site	22
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	22
3. Landfill and Other Waste Sites Map	23
3. Landfill and Other Waste Sites	24
3.1 Landfill Sites	24
3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site	24
3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site	24
3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site	25
3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site	26
3.2 Other Waste Sites	27
3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site	27
3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site	27
4. Current Land Use Map	29
4. Current Land Uses	30
4.1 Current Industrial Data	30
4.2 Petrol and Fuel Sites	30
4.3 National Grid High Voltage Underground Electricity Transmission Cables	30
4.4 National Grid High Pressure Gas Transmission Pipelines	31

5. Geology	32
5.1 Artificial Ground and Made Ground.....	32
5.2 Superficial Ground and Drift Geology	32
5.3 Bedrock and Solid Geology	32
6 Hydrogeology and Hydrology	33
6a. Aquifer Within Superficial Geology	33
6b. Aquifer Within Bedrock Geology and Abstraction Licenses	34
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses	35
6d. Hydrogeology – Source Protection Zones within confined aquifer	36
6e. Hydrology – Detailed River Network and River Quality	37
6.Hydrogeology and Hydrology	38
6.1 Aquifer within Superficial Deposits.....	38
6.2 Aquifer within Bedrock Deposits.....	38
6.3 Groundwater Abstraction Licences.....	39
6.4 Surface Water Abstraction Licences.....	40
6.5 Potable Water Abstraction Licences.....	40
6.6 Source Protection Zones.....	40
6.7 Source Protection Zones within Confined Aquifer.....	41
6.8 Groundwater Vulnerability and Soil Leaching Potential.....	41
6.9 River Quality.....	41
6.9.1 Biological Quality:.....	41
6.9.2 Chemical Quality:.....	42
6.10 Detailed River Network.....	42
6.11 Surface Water Features.....	43
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)	44
7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)	45
Map	45
7 Flooding	46
7.1 River and Coastal Zone 2 Flooding.....	46
7.2 River and Coastal Zone 3 Flooding.....	46
7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.....	46
7.4 Flood Defences.....	46
7.5 Areas benefiting from Flood Defences.....	46
7.6 Areas benefiting from Flood Storage.....	47
7.7 Groundwater Flooding Susceptibility Areas.....	47
7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.....	47
7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?.....	47
7.8 Groundwater Flooding Confidence Areas.....	47
8. Designated Environmentally Sensitive Sites Map	48
8. Designated Environmentally Sensitive Sites	49
8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:.....	49
8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:.....	49
8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:.....	49
8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:.....	49
8.5 Records of Ramsar sites within 2000m of the study site:.....	49
8.6 Records of Ancient Woodland within 2000m of the study site:	50
8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:.....	50
8.8 Records of World Heritage Sites within 2000m of the study site:.....	50
8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:	50

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:	51
8.11 Records of National Parks (NP) within 2000m of the study site:	51
8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:.....	51
8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:.....	51
8.14 Records of Green Belt land within 2000m of the study site:.....	51
9. Natural Hazards Findings	52
9.1 Detailed BGS GeoSure Data.....	52
9.1.1 Shrink Swell.....	52
9.1.2 Landslides.....	52
9.1.3 Soluble Rocks.....	52
9.1.4 Compressible Ground.....	53
9.1.5 Collapsible Rocks.....	53
9.1.6 Running Sand.....	53
9.2 Radon.....	53
9.2.1 Radon Affected Areas.....	53
9.2.2 Radon Protection.....	54
10. Mining	55
10.1 Coal Mining.....	55
10.2 Non-Coal Mining.....	55
10.3 Brine Affected Areas	55
Contact Details	56
Standard Terms and Conditions	58

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	0	4	23	71
1.2 Additional Information – Historical Tank Database	0	0	0	2
1.3 Additional Information – Historical Energy Features Database	0	0	0	8
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	0	0	2	8
1.6 Potentially Infilled Land	0	4	19	76

Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	0	0	0	1
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
2.1.8 Records of Licensed Discharge Consents	0	0	0	0
2.1.9 Records of Water Industry Referrals	0	0	0	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	0	0	0	0
2.2 Records of COMAH and NIHHS sites	0	0	0	0
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	0	0	0	0
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	0	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	2	1	3	4
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	8	8	0	3
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	0	0	0	0	0	5

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	0	0	2	Not searched
4.2 Records of Petrol and Fuel Sites	0	0	0	1
4.3 National Grid Underground Electricity Cables	0	0	0	0
4.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 5: Geology	
5.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
5.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 6: Hydrogeology and Hydrology				0-500m		
6.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?				Yes		
6.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?				Yes		
	On-site	0-50m	51-250	251-500	501-1000	1000-2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	4	3
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	1	0	0	1	Not searched	Not searched

Section 6: Hydrogeology and Hydrology	0-500m					
	On-site	0-50m	51-250	251-500	501-1000	1000-1500
6.9 Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site?	No	No	No	No	Yes	No
6.10 Detailed River Network entries within 500m of the site	0	0	5	2	Not searched	Not searched
6.11 Surface water features within 250m of the study site	No	No	Yes	Not searched	Not searched	Not searched

Section 7: Flooding						
7.1 Are there any Environment Agency Zone 2 floodplains within 250m of the study site?	No					
7.2 Are there any Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	No					
7.3 What is the Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site?	Very Low					
7.4 Are there any Flood Defences within 250m of the study site?	No					
7.5 Are there any areas benefiting from Flood Defences within 250m of the study site?	No					
7.6 Are there any areas used for Flood Storage within 250m of the study site?	No					
7.7 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Potential at Surface					
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Low					

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
8.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
8.5 Records of Ramsar sites	0	0	0	0	0	0
8.6 Records of Ancient Woodlands	0	0	0	0	2	0
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	2	2
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
8.11 Records of National Parks	0	0	0	0	0	0
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	1	0	0	0	0	0
8.14 Records of Green Belt land	0	0	0	0	0	2

Section 9: Natural Hazards

9.1 What is the maximum risk of natural ground subsidence?	Very Low
9.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Very Low
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	Very Low
9.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
9.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Negligible
9.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
9.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Very Low
9.2 Radon	
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary.

Section 10: Mining

10.1 Are there any coal mining areas within 75m of the study site?	Yes
10.2 Are there any Non-Coal Mining areas within 50m of the study site boundary?	No
10.3 Are there any brine affected areas within 75m of the study site?	No

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon..

10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

11. Contacts

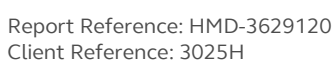
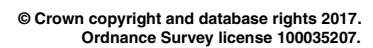
This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.



1. Historical Industrial Sites

1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 98

ID	Distance [m]	Direction	Use	Date
1AC	13	E	Refuse Heap	1956
2A	19	E	Unspecified Pit	1923
3A	22	E	Unspecified Ground Workings	1915
4	38	E	Unspecified Ground Workings	1938
5AF	101	E	Unspecified Ground Workings	1938
6B	126	E	Unspecified Pit	1956
7C	127	E	Refuse Heap	1956
8B	128	E	Sand Pit	1915
9B	128	E	Sand Pit	1933
10B	132	E	Sand Pit	1923
11B	132	E	Sand Pit	1938
12C	135	E	Sand Pit	1851
13AG	144	SW	Unspecified Ground Workings	1956
14AH	149	W	Unspecified Heap	1891
15D	204	NE	Rope Walk	1923
16D	209	NE	Unspecified Commercial/Industrial	1933
17D	209	NE	Rope Walk	1915
18E	211	W	Refuse Heap	1980
19E	211	W	Refuse Heap	1975
20E	211	W	Refuse Heap	1966
21F	215	S	Engraving Works	1915
22F	215	S	Steel Works	1906
23G	223	S	Engraving Works	1933
24D	230	NE	Rope Walk	1906
25G	232	S	Unspecified Ground Workings	1956
26	238	S	Steel Works	1891
27I	242	S	Engraving Works	1923
28AI	257	SW	Sand Pit	1851
29G	262	S	Unspecified Mills	1891
30	267	S	Engraving Works	1906

31H	288	SW	Unspecified Ground Workings	1966
32H	288	SW	Unspecified Ground Workings	1975
33H	288	SW	Unspecified Ground Workings	1980
34H	288	SW	Unspecified Ground Workings	1956
35H	288	SW	Unspecified Ground Workings	1988
36AJ	290	NE	Unspecified Heap	1906
37I	290	S	Unspecified Ground Workings	1906
38J	299	W	Police Station	1988
39J	299	W	Police Station	1975
40J	299	W	Police Station	1980
41K	302	SW	Old Clay Pit	1915
42K	302	SW	Old Clay Pit	1906
43K	302	SW	Unspecified Pit	1933
44AK	302	SE	Unspecified Ground Workings	1933
45K	305	SW	Unspecified Pit	1891
46K	305	SW	Old Clay Pit	1923
47L	307	NW	Refuse Heap	1975
48L	307	NW	Refuse Heap	1980
49L	307	NW	Refuse Heap	1966
50K	321	SW	Unspecified Pit	1938
51M	322	NW	Refuse Heap	1980
52M	322	NW	Refuse Heap	1966
53M	322	NW	Refuse Heap	1975
54AN	338	E	Unspecified Ground Workings	1956
55N	341	NW	Refuse Heap	1975
56N	341	NW	Refuse Heap	1980
57N	341	NW	Refuse Heap	1966
58O	345	W	Refuse Heap	1975
59O	345	W	Refuse Heap	1966
60O	345	W	Refuse Heap	1980
61AP	376	NW	Refuse Heap	1956
62P	412	S	Unspecified Works	1975
63P	412	S	Unspecified Works	1980
64P	412	S	Unspecified Mill	1988
65W	437	S	Unspecified Works	1975
66Q	437	SE	Disused Field Works	1915
67AQ	440	SE	Unspecified Heap	1915
68Q	441	SE	Unspecified Disused Works	1906
69Q	444	SE	Field Works	1933
70S	444	SW	Unspecified Mills	1938

71AX	445	SE	Field Works	1938
72R	446	SE	Unspecified Heap	1923
73R	446	SE	Unspecified Ground Workings	1906
74S	447	SW	Unspecified Mills	1915
75T	448	SE	Unspecified Disused Works	1923
76P	448	SW	Unspecified Works	1966
77AR	448	SW	Old Sand Pit	1906
78T	448	SE	Field Works	1891
79R	448	SE	Unspecified Heap	1933
80S	449	SW	Unspecified Mills	1956
81T	450	SE	Unspecified Works	1975
82T	454	SE	Bleach Works	1851
83S	454	SW	Unspecified Mills	1923
84AS	454	E	Unspecified Ground Workings	1906
85AT	455	SW	Unspecified Pit	1891
86U	460	E	Fire Station	1980
87U	460	E	Fire Station	1975
88U	460	E	Fire Station	1988
89AU	464	E	Brick Kiln	1851
90P	470	SW	Unspecified Mills	1933
91AW	476	W	Unspecified Ground Workings	1956
92	480	S	Unspecified Works	1988
93V	481	SE	Unspecified Ground Workings	1956
94V	483	SE	Unspecified Pit	1988
95V	483	SE	Unspecified Pit	1980
96V	484	SE	Unspecified Ground Workings	1975
97V	484	SE	Unspecified Ground Workings	1966
98AY	489	N	Unspecified Ground Workings	1975

1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary:

2

ID	Distance (m)	Direction	Use	Date
99W	465	S	Unspecified Tank	1951
100W	466	S	Unspecified Tank	1951

1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary:

8

ID	Distance (m)	Direction	Use	Date
101X	363	E	Electricity Substation	1988
102X	363	E	Electricity Substation	1981
103X	364	E	Electricity Substation	1995
104Y	433	SE	Electricity Substation	1951
105Y	434	SE	Electricity Substation	1951
106Y	440	SE	Electricity Substation	1988
107Y	440	SE	Electricity Substation	1981
108Y	441	SE	Electricity Substation	1995

1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary:

0

Database searched and no data found.

1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary:

10

ID	Distance (m)	Direction	Use	Date
109Z	96	W	Garage	1951
110Z	96	W	Automobile Engineering Works	1955
111AA	270	E	Garage	1995
112AA	297	E	Garage	1964
113AA	297	E	Garage	1963
114AB	449	SE	Garage	1995
115AB	449	SE	Garage	1988

116AB	449	SE	Garage	1981
117Q	450	SE	Garage	1964
118Q	452	SE	Garage	1964

1.6 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 99

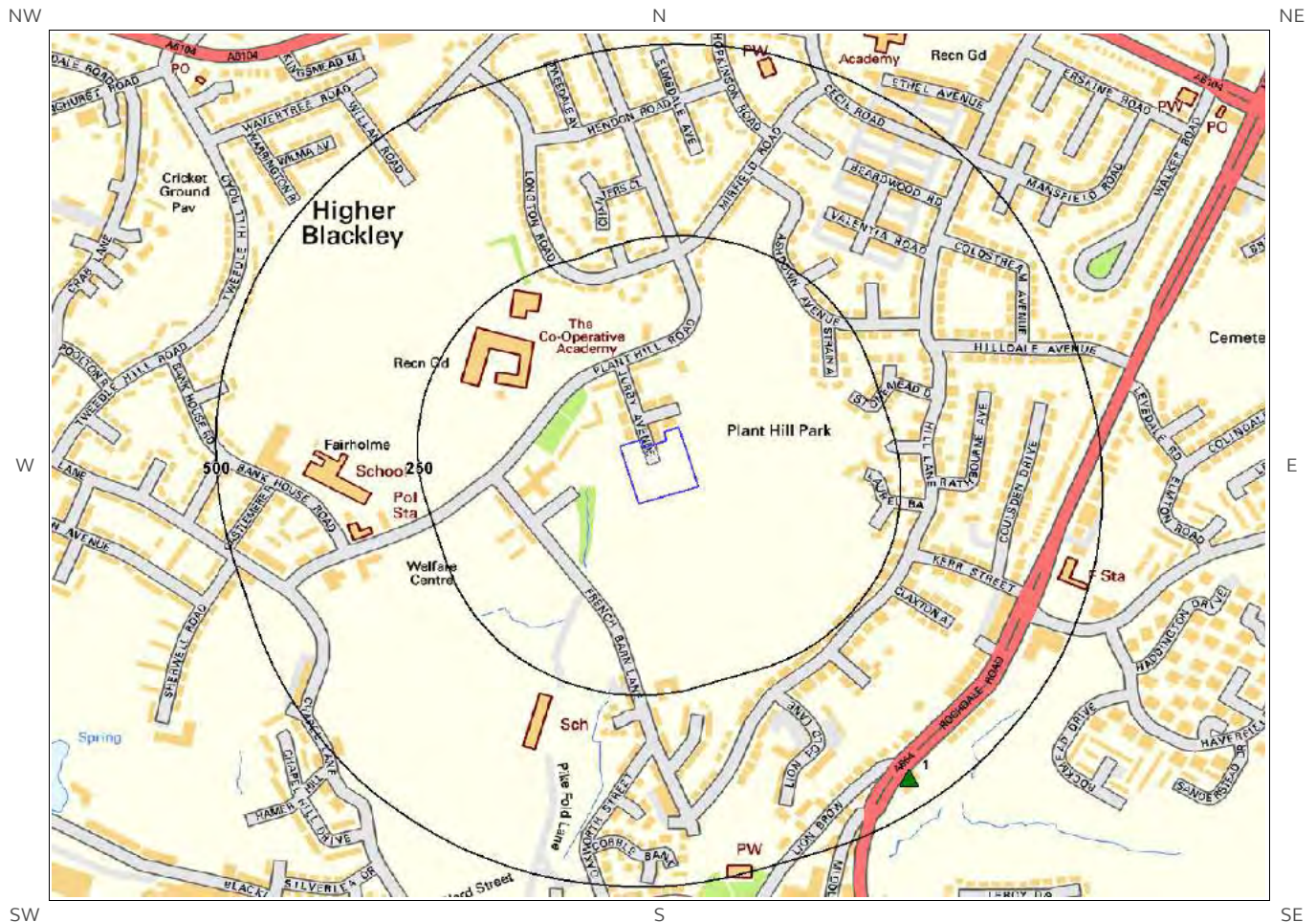
The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
119AC	13	E	Refuse Heap	1956
120A	19	E	Unspecified Pit	1923
121A	22	E	Unspecified Ground Workings	1915
122A	38	E	Unspecified Ground Workings	1938
123AD	72	W	Ponds	1891
124AD	72	W	Ponds	1923
125AE	83	W	Pond	1906
126AE	83	W	Pond	1915
127AE	83	W	Pond	1933
128AF	101	E	Unspecified Ground Workings	1938
129B	126	E	Unspecified Pit	1956
130C	127	E	Refuse Heap	1956
131B	128	E	Sand Pit	1933
132B	128	E	Sand Pit	1915
133B	132	E	Sand Pit	1923
134B	132	E	Sand Pit	1938
135C	135	E	Sand Pit	1851
136AG	144	SW	Unspecified Ground Workings	1956
137AH	149	W	Unspecified Heap	1891
138E	211	W	Refuse Heap	1975
139E	211	W	Refuse Heap	1966
140E	211	W	Refuse Heap	1980
141G	232	S	Unspecified Ground Workings	1956
142AI	257	SW	Sand Pit	1851
143H	288	SW	Unspecified Ground Workings	1980
144H	288	SW	Unspecified Ground Workings	1966
145H	288	SW	Unspecified Ground Workings	1975
146H	288	SW	Unspecified Ground Workings	1956

147H	288	SW	Unspecified Ground Workings	1988
148AJ	290	NE	Unspecified Heap	1906
149I	290	S	Unspecified Ground Workings	1906
150K	302	SW	Old Clay Pit	1915
151K	302	SW	Old Clay Pit	1906
152K	302	SW	Unspecified Pit	1933
153AK	302	SE	Unspecified Ground Workings	1933
154K	305	SW	Unspecified Pit	1891
155K	305	SW	Old Clay Pit	1923
156L	307	NW	Refuse Heap	1975
157L	307	NW	Refuse Heap	1966
158L	307	NW	Refuse Heap	1980
159AL	316	S	Reservoir	1891
160K	321	SW	Unspecified Pit	1938
161AL	322	S	Pond	1851
162M	322	NW	Refuse Heap	1975
163M	322	NW	Refuse Heap	1966
164M	322	NW	Refuse Heap	1980
165AM	336	SE	Pond	1915
166AM	338	SE	Pond	1966
167AM	338	SE	Pond	1956
168AM	338	SE	Pond	1975
169AN	338	E	Unspecified Ground Workings	1956
170N	341	NW	Refuse Heap	1975
171N	341	NW	Refuse Heap	1966
172N	341	NW	Refuse Heap	1980
173AM	344	SE	Pond	1923
174AM	344	SE	Pond	1906
175O	345	W	Refuse Heap	1975
176O	345	W	Refuse Heap	1966
177O	345	W	Refuse Heap	1980
178AM	351	SE	Pond	1891
179AO	357	N	Pond	1923
180AO	358	N	Pond	1891
181AL	364	S	Reservoir	1906
182AL	364	S	Reservoir	1915
183AO	366	N	Pond	1906
184AO	366	N	Pond	1915
185AP	376	NW	Refuse Heap	1956
186AL	377	S	Reservoir	1956
187AL	407	S	Reservoir	1923
188AL	421	S	Reservoir	1933
189AL	421	S	Reservoir	1938

190AQ	440	SE	Unspecified Heap	1915
191AQ	446	SE	Unspecified Heap	1923
192R	446	SE	Unspecified Ground Workings	1906
193AR	448	SW	Old Sand Pit	1906
194R	448	SE	Unspecified Heap	1933
195AS	454	E	Unspecified Ground Workings	1906
196AT	455	SW	Unspecified Pit	1891
197AU	464	E	Brick Kiln	1851
198AV	475	SE	Ponds	1966
199AV	475	SE	Reservoirs	1956
200AW	476	W	Unspecified Ground Workings	1956
201AV	477	SE	Ponds	1975
202AV	478	SE	Reservoirs	1915
203AV	480	SE	Reservoirs	1933
204V	481	SE	Unspecified Ground Workings	1956
205AX	481	SE	Reservoirs	1933
206AV	481	SE	Pond	1906
207AV	482	SE	Reservoirs	1938
208AV	482	SE	Reservoirs	1891
209V	483	SE	Unspecified Pit	1980
210V	483	SE	Unspecified Pit	1988
211AX	483	SE	Reservoirs	1938
212AV	484	SE	Reservoirs	1923
213V	484	SE	Unspecified Ground Workings	1975
214V	484	SE	Unspecified Ground Workings	1966
215AX	485	SE	Reservoirs	1923
216AY	489	N	Unspecified Ground Workings	1975
217T	498	SE	Pond	1938

2. Environmental Permits, Incidents and Registers Map



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.

- | | | |
|---|---|--|
|  Site Outline |  Recorded Pollution Incident |  RAS 3 & 4 Authorisations |
|  Dangerous Substances (List 1) |  Dangerous Substances (List 2) |  Part A(1) Authorised Processes and Historic IPC Authorisations |
|  Water Industry Referrals |  Licenced Discharge Consents |  Part A(2) and Part B Authorised Processes |
|  Red List Discharge Consents |  COMAH / NIHHS Sites |  Sites Determined as Contaminated Land |
| |  Hazardous Substance Consents and Enforcements | |

2. Environmental Permits, Incidents and Registers

2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

0

Database searched and no data found.

2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

1

The following Part A(2) and Part B Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details
1	462	SE	385857 403116	Address: Blackley Service Station, 976 Rochdale Road, Blackley, M9 7EP Process: Unloading of Petrol into Storage at Service Stations Status: Current Permit Permit Type: Part B Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified

2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

0

Database searched and no data found.

2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

0

Database searched and no data found.

2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site:

0

Database searched and no data found.

2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

0

Database searched and no data found.

2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

Database searched and no data found.

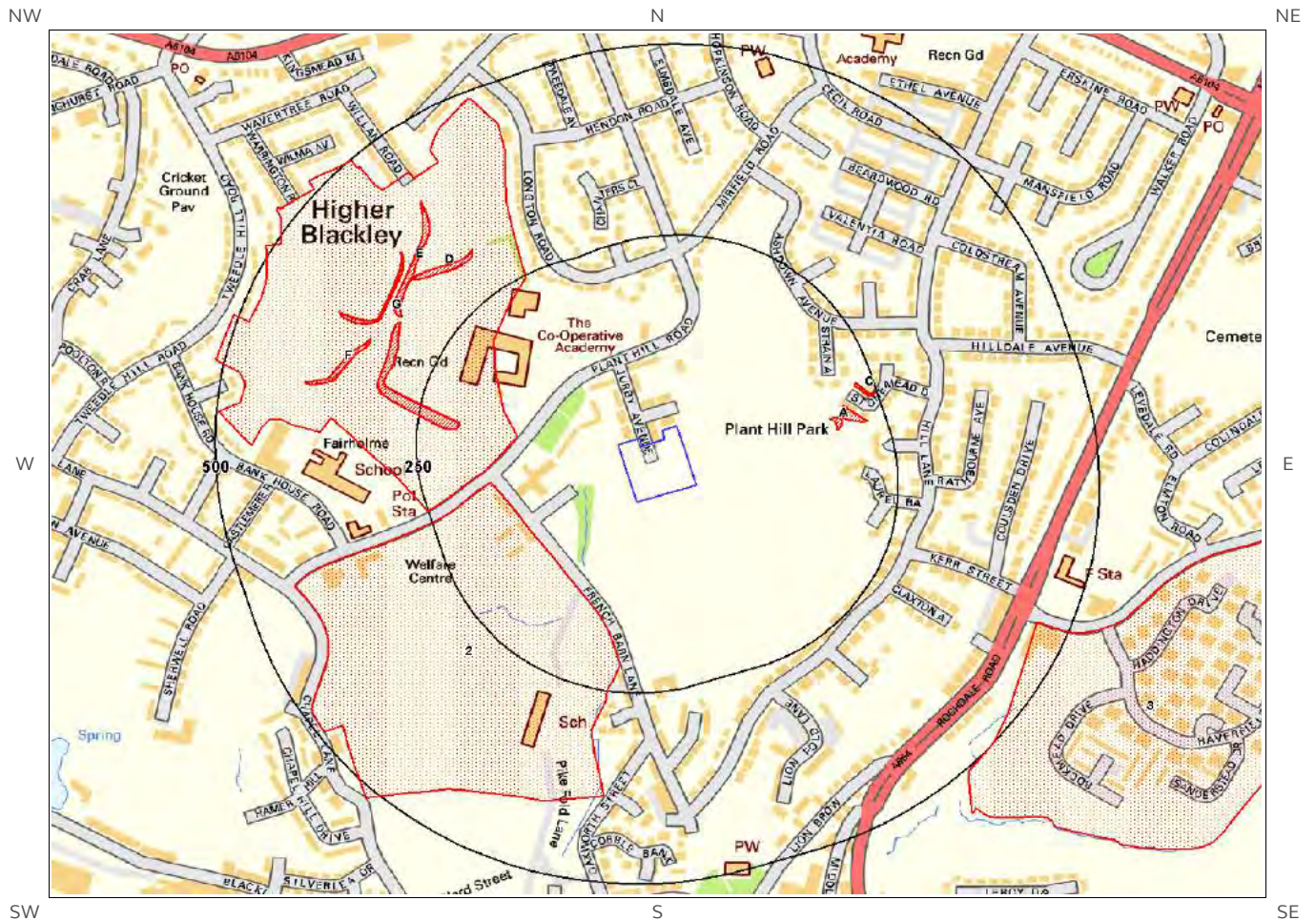
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site?

0

Database searched and no data found.

3. Landfill and Other Waste Sites Map



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.

- | | | | | | |
|---|--------------------------|---|----------------------------|---|---|
|  | Site Outline |  | EA/NRW Active Landfill |  | Historic and Planned Waste Sites |
|  | EA/NRW Historic Landfill |  | EA/NRW Licensed Waste Site |  | Local Authority/Historical Mapping Landfill Records |
|  | 250 |  | BGS / DoE Survey Landfill | | |
|  | 500 | | | | |
| | Search Buffers (m) | | | | |

3. Landfill and Other Waste Sites

3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

10

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details
1G	125	W	385200 403700	Site Address: Land at Tweedle Hill, Plant Hill Road, Higher Blackley, Manchester, Greater Manchester Waste Licence: - Site Reference: F002 Waste Type: - Environmental Permitting Regulations (Waste) Reference: - Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
2	127	SW	385300 403200	Site Address: Land at Pike Fold Lane, Higher Blackley, Manchester, Greater Manchester Waste Licence: - Site Reference: F043 Waste Type: - Environmental Permitting Regulations (Waste) Reference: - Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
3	459	SE	386200 403200	Site Address: Land off White Moss Road, White Moss Road, Blackley, Manchester, Greater Manchester Waste Licence: - Site Reference: F003 Waste Type: - Environmental Permitting Regulations (Waste) Reference: - Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -

ID	Distance (m)	Direction	NGR	Details	
Not shown	843	NE	386100 404300	Site Address: Land to the rear of Symond Road, Symond Road, Blackley, Manchester, Greater Manchester Waste Licence: - Site Reference: F026 Waste Type: - Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
Not shown	912	W	384400 403400	Site Address: Land at Riverdale Road, Riverdale Road, Crumpsall, Manchester, Greater Manchester Waste Licence: - Site Reference: F033 Waste Type: - Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
Not shown	989	S	385600 402200	Site Address: Land at Factory Lane, Blackley, Manchester, Greater Manchester Waste Licence: - Site Reference: F018 Waste Type: - Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
Not shown	1024	W	384200 403000	Site Address: South of Blackley New Road, Blackley New Road, Crumpsall, Manchester, Greater Manchester Waste Licence: - Site Reference: F017 Waste Type: - Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: Earl of Wilton First Recorded: - Last Recorded: -
Not shown	1232	N	385200 404800	Site Address: Land at Boothroyden Road, Boothroyden Road, Higher Blackley, Manchester, Greater Manchester Waste Licence: - Site Reference: F047 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
Not shown	1451	NW	384400 404600	Site Address: Land Off Heaton Park Road, Higher Blackley, Manchester, Greater Manchester Waste Licence: Yes Site Reference: F034, RD/LIC/133/77 Waste Type: Inert, Industrial Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 02-Jul-1979 Licence Surrendered: Licence Holder Address: 44 George Street, Manchester Operator: - Licence Holder: Wills Fabrics Limited First Recorded: 31-Dec-1947 Last Recorded: 31-Dec-1986
Not shown	1478	S	385900 402000	Site Address: Land at Bankfield Street, Blackley, Manchester, Greater Manchester Waste Licence: - Site Reference: F028 Waste Type: - Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -

3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

0

Database searched and no data found.

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

19

The following landfill records are represented as points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Site Address	Source	Data Type
16A	184	E	385774 403578	Refuse Tips	1964 mapping	Polygon
17A	185	E	385774 403578	Refuse Tips	1962 mapping	Polygon
18B	198	W	385208 403641	Refuse Tip	1964 mapping	Polygon
19B	199	W	385207 403641	Refuse Tip	1962 mapping	Polygon
20A	200	E	385793 403592	Refuse Tips	1964 mapping	Polygon
21A	200	E	385793 403592	Refuse Tips	1962 mapping	Polygon
22C	226	E	385805 403624	Refuse Tips	1964 mapping	Polygon
23C	226	E	385805 403623	Refuse Tips	1962 mapping	Polygon
24D	304	NW	385297 403787	Refuse Tip	1964 mapping	Polygon
25D	304	NW	385295 403786	Refuse Tip	1962 mapping	Polygon
26E	316	NW	385249 403795	Refuse Tip	1964 mapping	Polygon
27E	316	NW	385248 403794	Refuse Tip	1962 mapping	Polygon
28F	336	NW	385161 403660	Refuse Tip	1964 mapping	Polygon
29F	336	NW	385162 403660	Refuse Tip	1962 mapping	Polygon
30G	338	NW	385221 403757	Refuse Tip	1964 mapping	Polygon
31G	338	NW	385221 403756	Refuse Tip	1962 mapping	Polygon
Not shown	1108	W	384361 403060	Refuse Tip	1964 mapping	Polygon
Not shown	1108	W	384361 403060	Refuse Tip	1964 mapping	Polygon
Not shown	1475	NE	386810 404398	Refuse Tip	1962 mapping	Polygon

3.2 Other Waste Sites

3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

0

Database searched and no data found.

3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

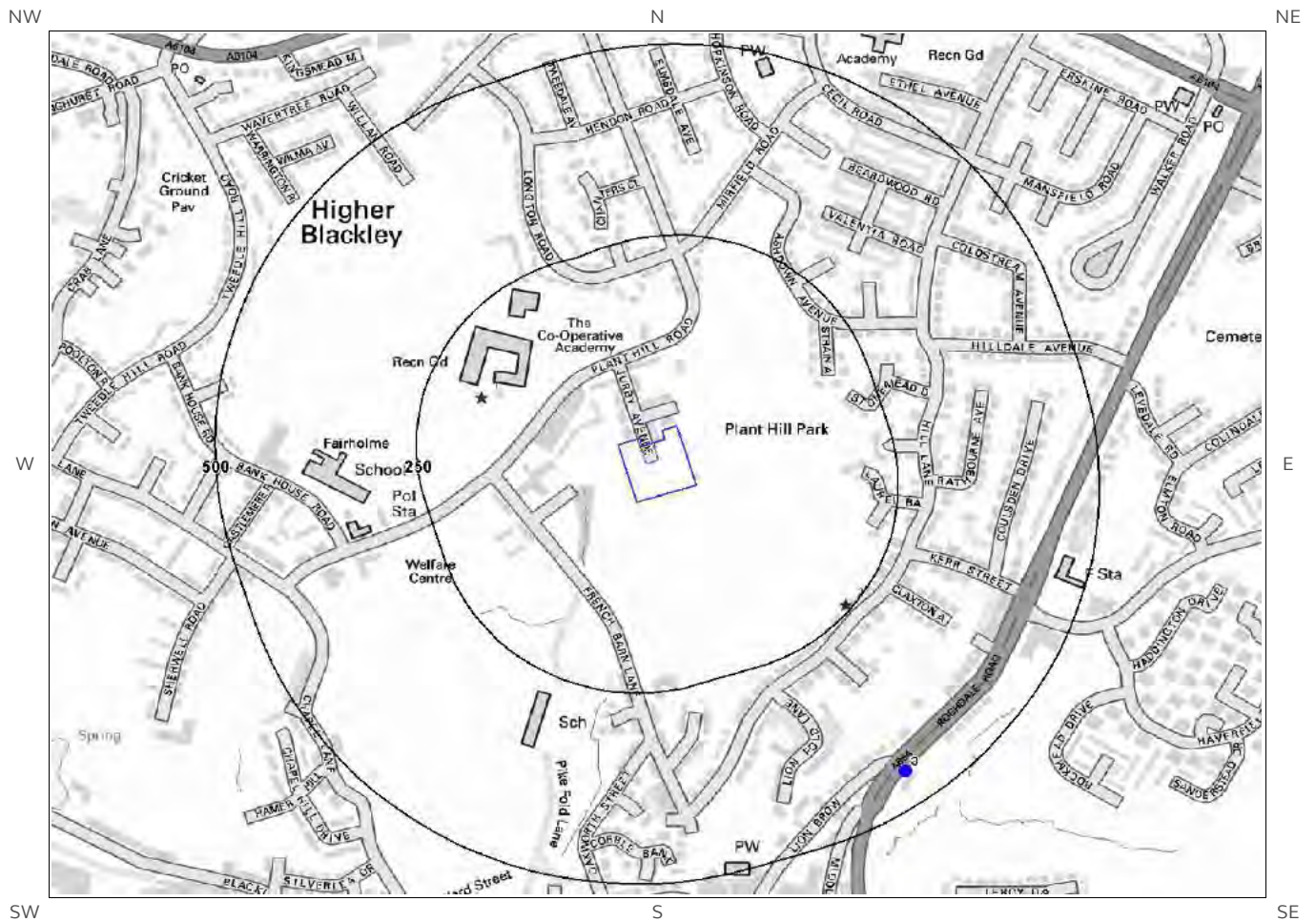
5

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details
Not shown	1324	NW	384940 404751	Site Address: - Type: Household, Commercial & Industrial Waste Landfill Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: DOT001 EPR reference: - Operator: The Director Dept Of Transport North West Construction Programme Division Waste Management licence No: 53662 Annual Tonnage: 0.001 Issue Date: 07/04/1995 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Landfill Site Between Rhodes & Higher Blackley Correspondence Address: Project Services And Operations, Room D4, Broadway, Broad Street, Birmingham, B15 1BL
Not shown	1324	NW	384940 404751	Site Address: - Type: Household, Commercial & Industrial Waste Landfill Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: DOT001 EPR reference: - Operator: The Director Dept Of Transport North West Construction Programme Division Waste Management licence No: 53662 Annual Tonnage: 0.001 Issue Date: 07/04/1995 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Closure Site Name: Landfill Site Between Rhodes & Higher Blackley Correspondence Address: Project Services And Operations, Room D4, Broadway, Broad Street, Birmingham, B15 1BL
Not shown	1324	NW	384940 404751	Site Address: - Type: Household, Commercial & Industrial Waste Landfill Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: DOT001 EPR reference: EA/EPR/BP3496CZ/A001 Operator: The Director Dept Of Transport North West Construction Programme Division Waste Management licence No: 53662 Annual Tonnage: 0.001 Issue Date: 07/04/1995 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Closure Site Name: Landfill Site Between Rhodes & Higher Blackley Correspondence Address: -

ID	Distance (m)	Direction	NGR	Details
Not shown	1469	NE	386920 404160	Site Address: Oldham Wastewater Treatment Works, The Causeway Off Gateway Crescent, Chadderton, Oldham, Lancashire, OL9 9XD Type: Biological Treatment Facility Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: OLD017 EPR reference: EA/EPR/SP3992CK/A001 Operator: United Utilities Water Plc Waste Management licence No: 50524 Annual Tonnage: 163000.0 Issue Date: 03/01/2008 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: To PPC Site Name: Oldham Wastewater Treatment Works Correspondence Address: -
Not shown	1469	NE	386920 404160	Site Address: Oldham Wastewater Treatment Works, The Causeway Off Gateway Crescent, Chadderton, Oldham, Lancashire, OL9 9XD Type: - Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: OLD017 EPR reference: - Operator: United Utilities Water Plc Waste Management licence No: 50524 Annual Tonnage: 0.0 Issue Date: 03/01/2008 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: IPPC Site Name: Oldham Wastewater Treatment Works Correspondence Address: Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington, Cheshire, WA5 3LP

4. Current Land Use Map



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



4. Current Land Uses

4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site:

2

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	181	W	Electricity Sub Station	385329 403613	Electricity Sub Station, M9	Electrical Features	Infrastructure and Facilities
2	242	SE	D P S Remedials Ltd	385781 403342	D P S Remedials Ltd, 77, Hill Lane, Manchester, M9 6PF	Construction Completion Services	Construction Services

4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site:

1

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

ID	Distance (m)	Direction	NGR	Company	Address	LPG	Status
3	455	SE	385856 403124	Texaco	Blackley Service Station, 976, Rochdale Road, Blackley, Manchester, Lancashire, M9 7EP	No	Open

4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site:

0

Database searched and no data found.

4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.

5. Geology

5.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

5.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
TILLD	TILL, DEVENSIAN	DIAMICTON
GFSD	GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN	SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]
TILLD	TILL, DEVENSIAN	DIAMICTON

5.3 Bedrock and Solid Geology

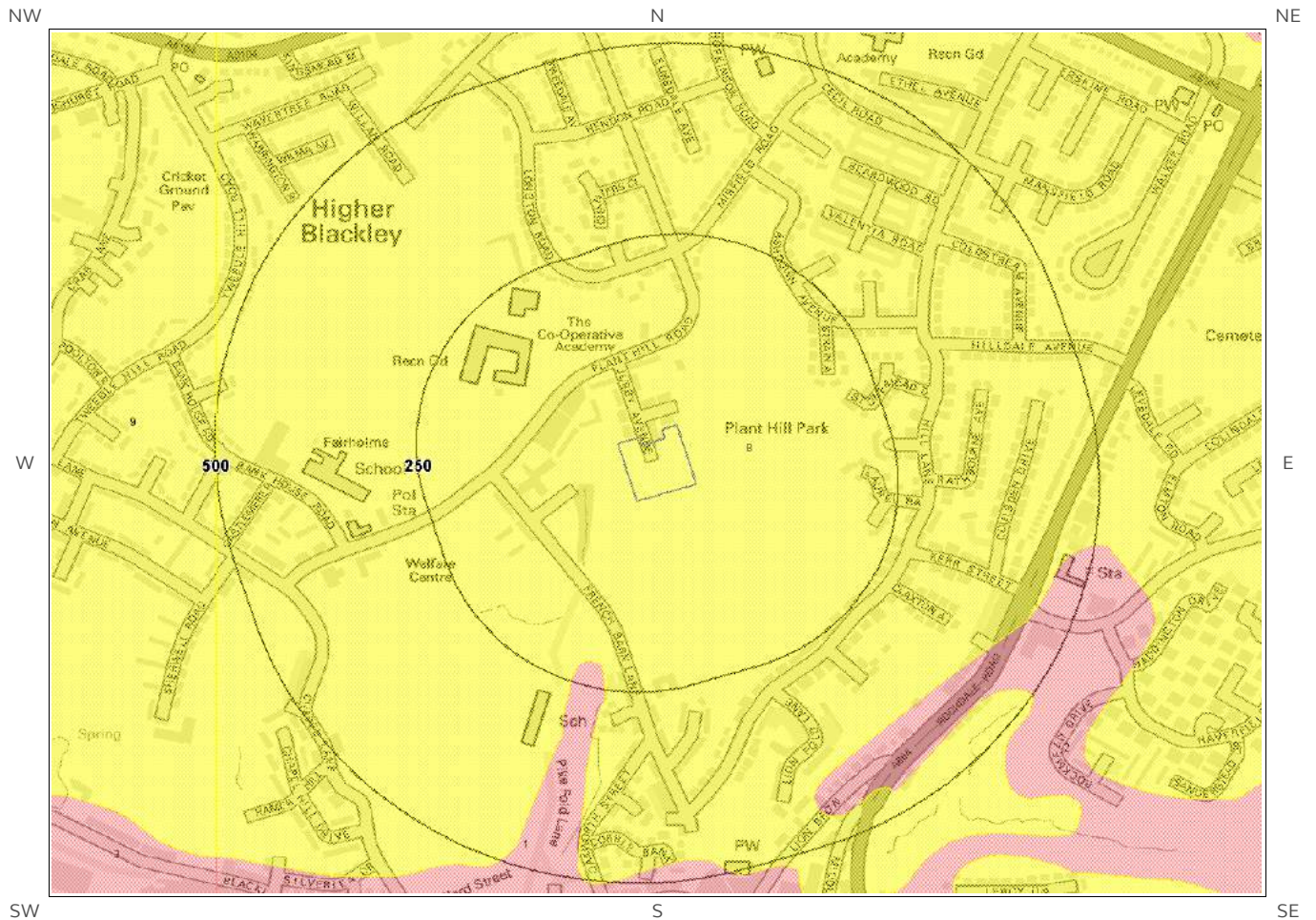
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
CPB-SDST	CHESTER PEBBLE BEDS FORMATION	SANDSTONE
CS-SDST	COLLYHURST SANDSTONE FORMATION	SANDSTONE

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

6a. Aquifer Within Superficial Geology

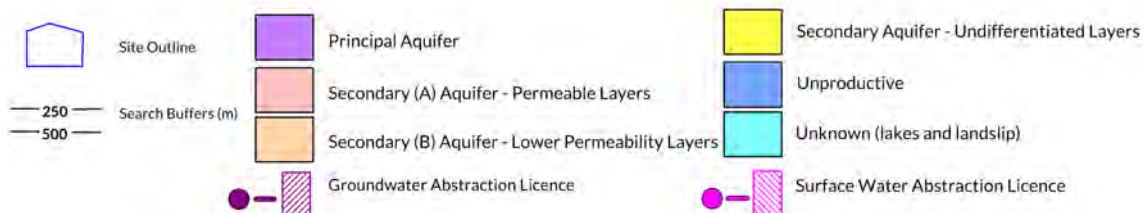


© Crown copyright and database rights 2017
Ordnance Survey license 100035207.

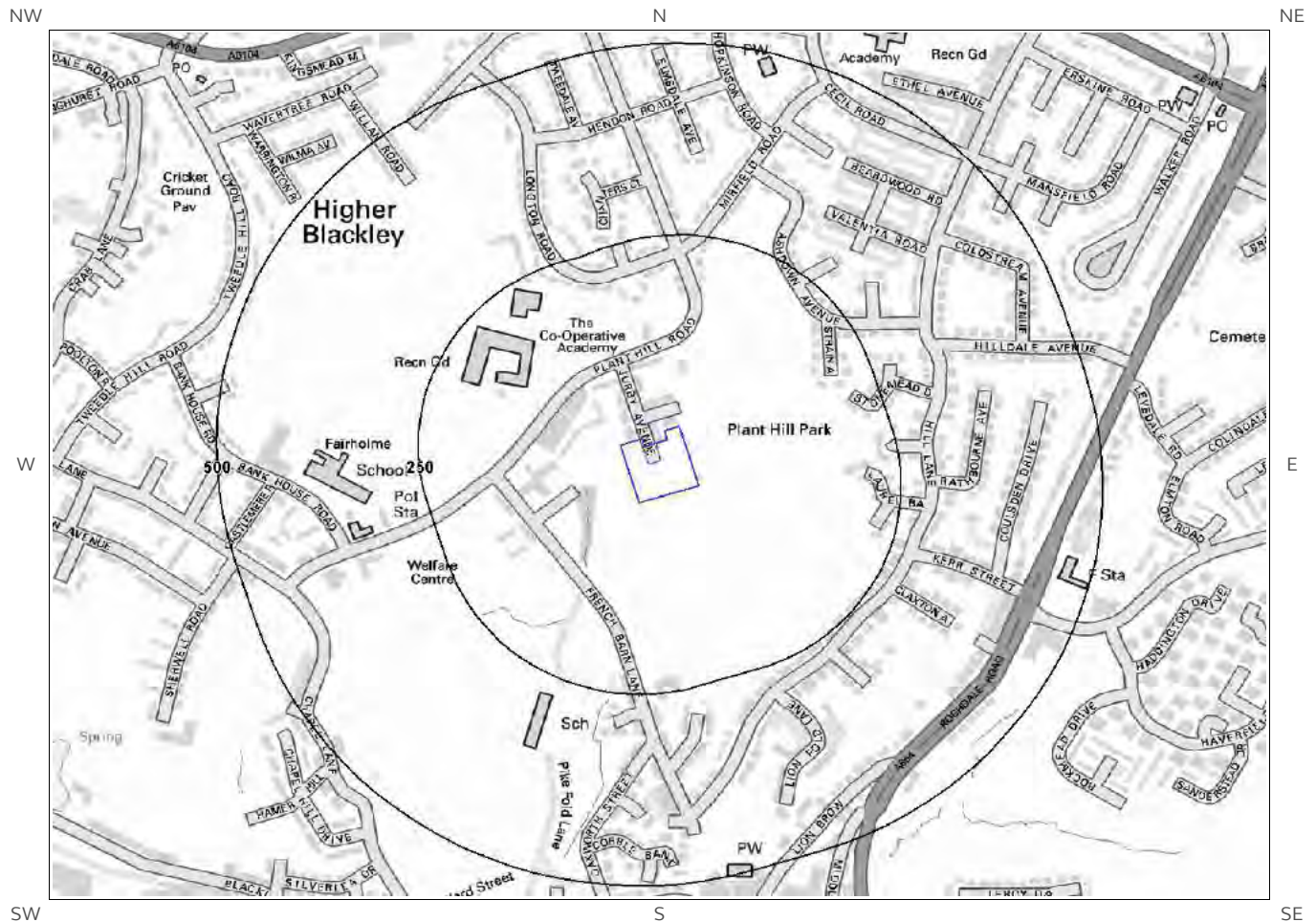
6b. Aquifer Within Bedrock Geology and Abstraction Licenses



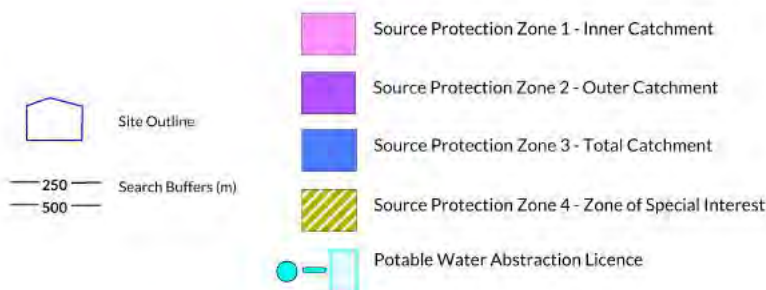
© Crown copyright and database rights 2017
Ordnance Survey license 100035207.



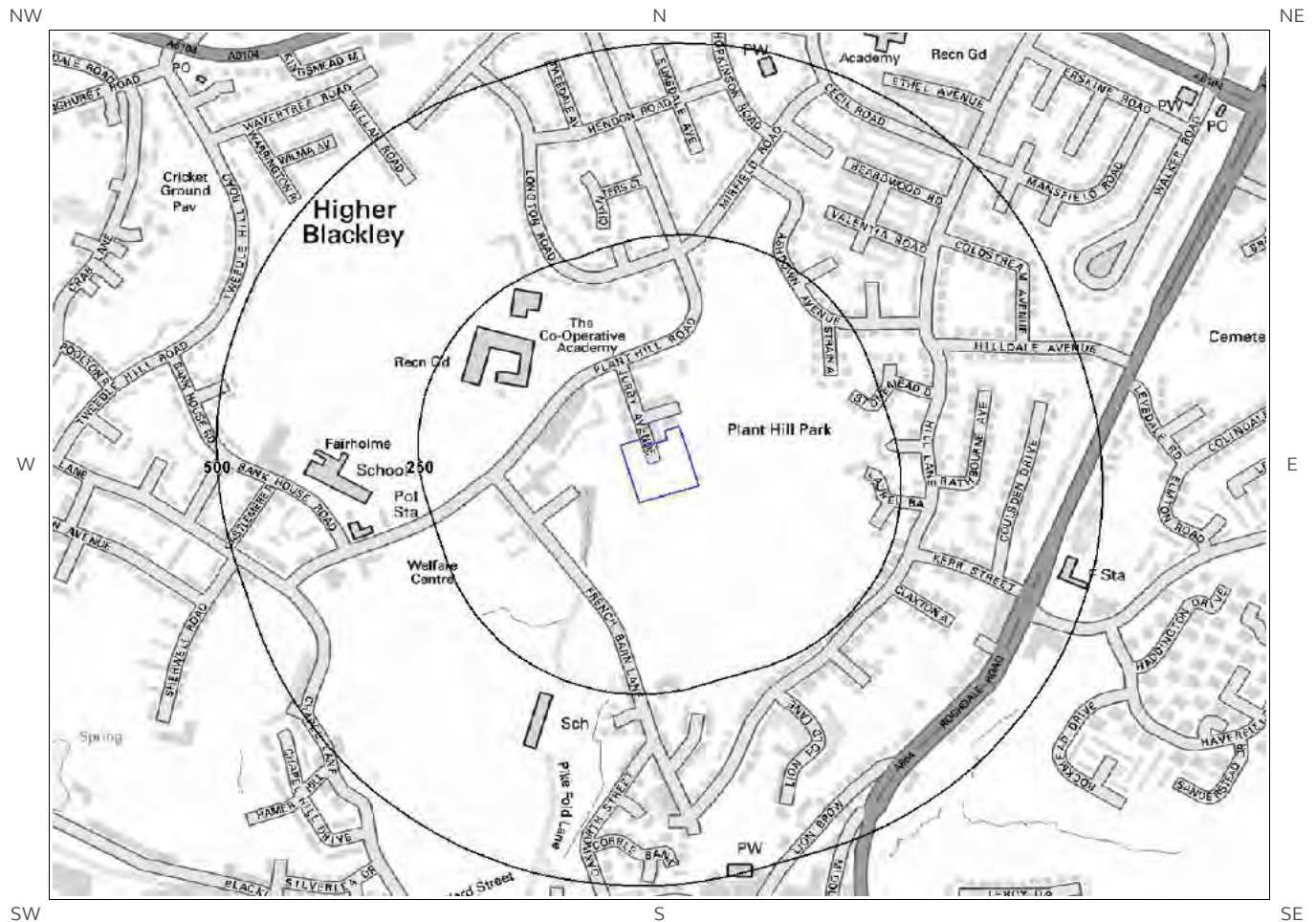
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



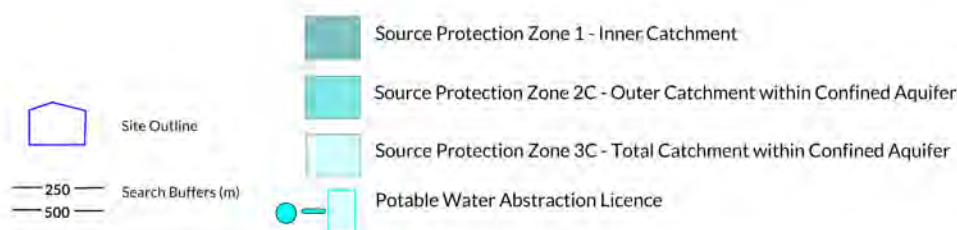
© Crown copyright and database rights 2017
Ordnance Survey license 100035207.



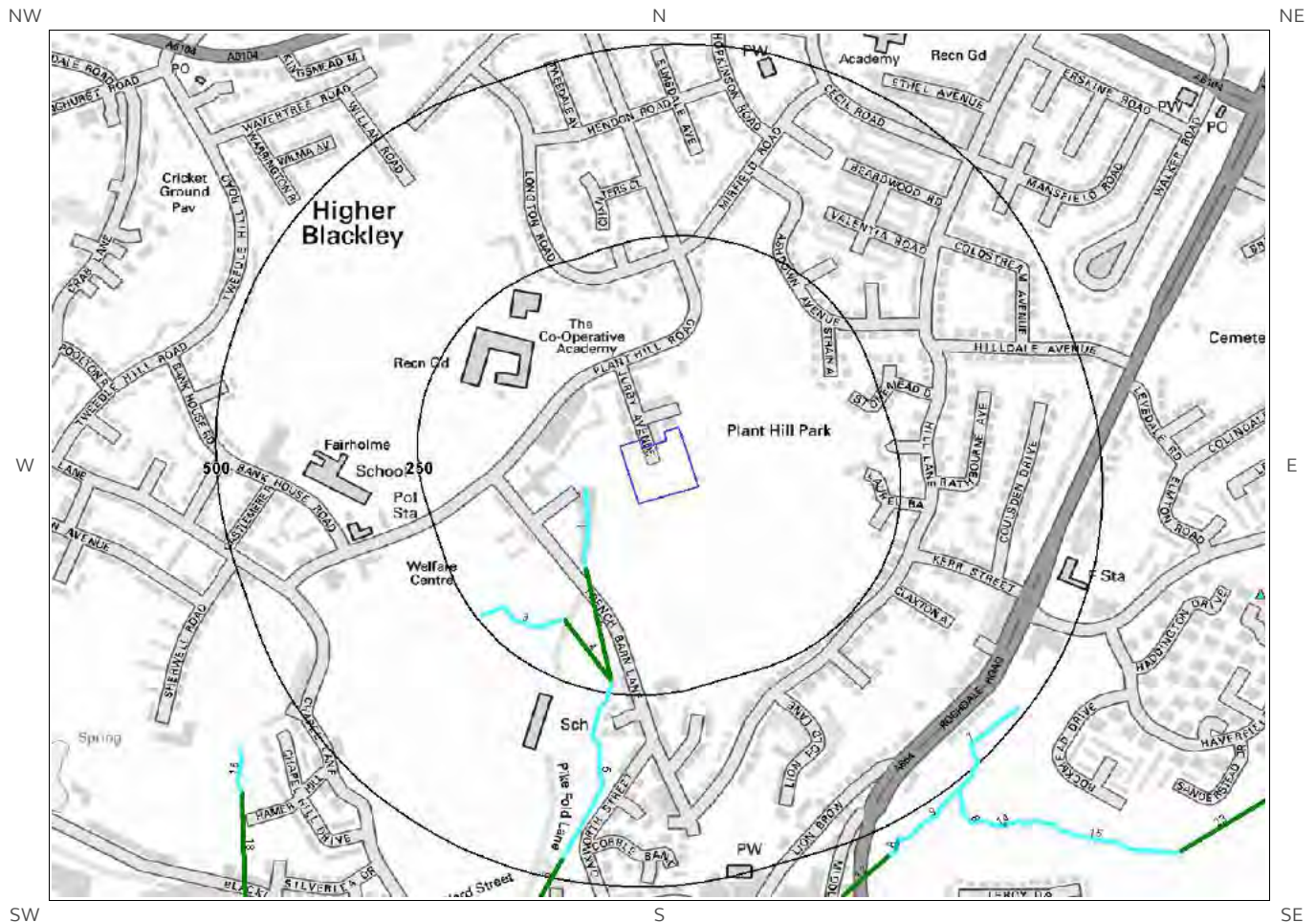
6d. Hydrogeology – Source Protection Zones within confined aquifer



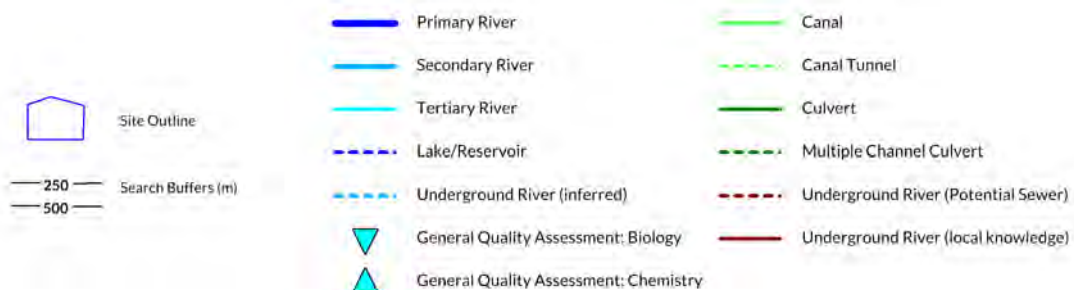
© Crown copyright and database rights 2017
Ordnance Survey license 100035207.



6e. Hydrology – Detailed River Network and River Quality



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



6. Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? **Yes**

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
8	0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
1	216	S	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
2	394	SE	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
9	499	W	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

6.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property? **Yes**

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers
5	101	SW	Secondary B	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers
6	424	NE	Secondary B	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers
2	499	SW	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers

ID	Distance (m)	Direction	Designation	Description
7	499	W	Secondary B	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers

6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details
Not shown	778	SW	385000 402900	Status: Historical Licence No: 2569005012 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Ground Water - North West Region Point: "borehole At Blackley, Manchester" Data Type: Point Name: AVECIA LTD Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: CW0414 Original Start Date: 23/5/1994 Expiry Date: - Issue No: 101 Version Start Date: 1/7/1999 Version End Date:
Not shown	778	SW	385000 402900	Status: Historical Licence No: 2569005012 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Ground Water - North West Region Point: Borehole At Blackley, Manchester Data Type: Point Name: AVECIA LTD Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: CW0414 Original Start Date: 23/5/1994 Expiry Date: - Issue No: 101 Version Start Date: 1/7/1999 Version End Date:
Not shown	823	SW	384890 402950	Status: Historical Licence No: 2569005044 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Ground Water - North West Region Point: "2 Boreholes At Blackley, Manchester" Data Type: Point Name: BELDEN (UK) LTD Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 22/1/1966 Expiry Date: - Issue No: 103 Version Start Date: 16/11/2001 Version End Date:
Not shown	823	SW	384890 402950	Status: Historical Licence No: 2569005044 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Ground Water - North West Region Point: 2 Boreholes At Blackley, Manchester Data Type: Point Name: BT Cables Limited Annual Volume (m³): 477271 Max Daily Volume (m³): 1363 Original Application No: NPS/WR/011237 Original Start Date: 22/1/1966 Expiry Date: - Issue No: 105 Version Start Date: 9/10/2012 Version End Date:
Not shown	1034	SW	384610 402990	Status: Historical Licence No: 2569005044 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Ground Water - North West Region Point: 2 Boreholes At Blackley, Manchester \$121 Data Type: Point Name: BELDEN (UK) LTD Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 22/1/1966 Expiry Date: - Issue No: 103 Version Start Date: 16/11/2001 Version End Date:

ID	Distance (m)	Direction	NGR	Details
Not shown	1034	SW	384610 402990	Status: Historical Licence No: 2569005044 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Ground Water - North West Region Point: "2 Boreholes At Blackley, Manchester \$121" Data Type: Point Name: BELDEN (UK) LTD Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 22/1/1966 Expiry Date: - Issue No: 103 Version Start Date: 16/11/2001 Version End Date:
Not shown	1034	SW	384610 402990	Status: Historical Licence No: 2569005044 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Ground Water - North West Region Point: Boreholes X 2 At Blackley Manchester Data Type: Point Name: BT Cables Limited Annual Volume (m³): 477271 Max Daily Volume (m³): 1363 Original Application No: NPS/WR/011237 Original Start Date: 22/1/1966 Expiry Date: - Issue No: 105 Version Start Date: 9/10/2012 Version End Date:

6.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? No

Database searched and no data found.

6.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site? No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site? Yes

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Major Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.
314	S	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.

6.9 River Quality

Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site? Yes

6.9.1 Biological Quality:

Database searched and no data found.

6.9.2 Chemical Quality:

Chemical quality data is based on the General Quality Assessment Headline Indicators scheme (GQAHI). In England, each chemical sample is measured for ammonia and dissolved oxygen. In Wales, the samples are measured for biological oxygen demand (BOD), ammonia and dissolved oxygen. The results are graded from A ('Very Good') to F ('Bad').

The following Chemical Quality records are shown on the Hydrology Map (6e):

ID	Distance (m)	Direction	NGR	River Quality Grade	Chemical Quality Grade				
					2005	2006	2007	2008	2009
33B	710	E	386293 403356	River Name: Whitsundale Beck Reach: Hoods Bottom Beck River Swale End/Start of Stretch: Start of Stretch NGR	A	A	A	A	A
34B	710	E	386293 403356	River Name: Whitsundale Beck Reach: White Mossy Hill Hoods Bottom Beck End/Start of Stretch: End of Stretch NGR	A	A	A	A	A

6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? Yes

The following Detailed River Network records are represented on the Hydrology Map (6e):

ID	Distance (m)	Direction	Details	
1	55	W	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
2	106	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
3	177	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
4	177	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
5	234	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
6	472	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
7	476	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined

6.11 Surface Water Features

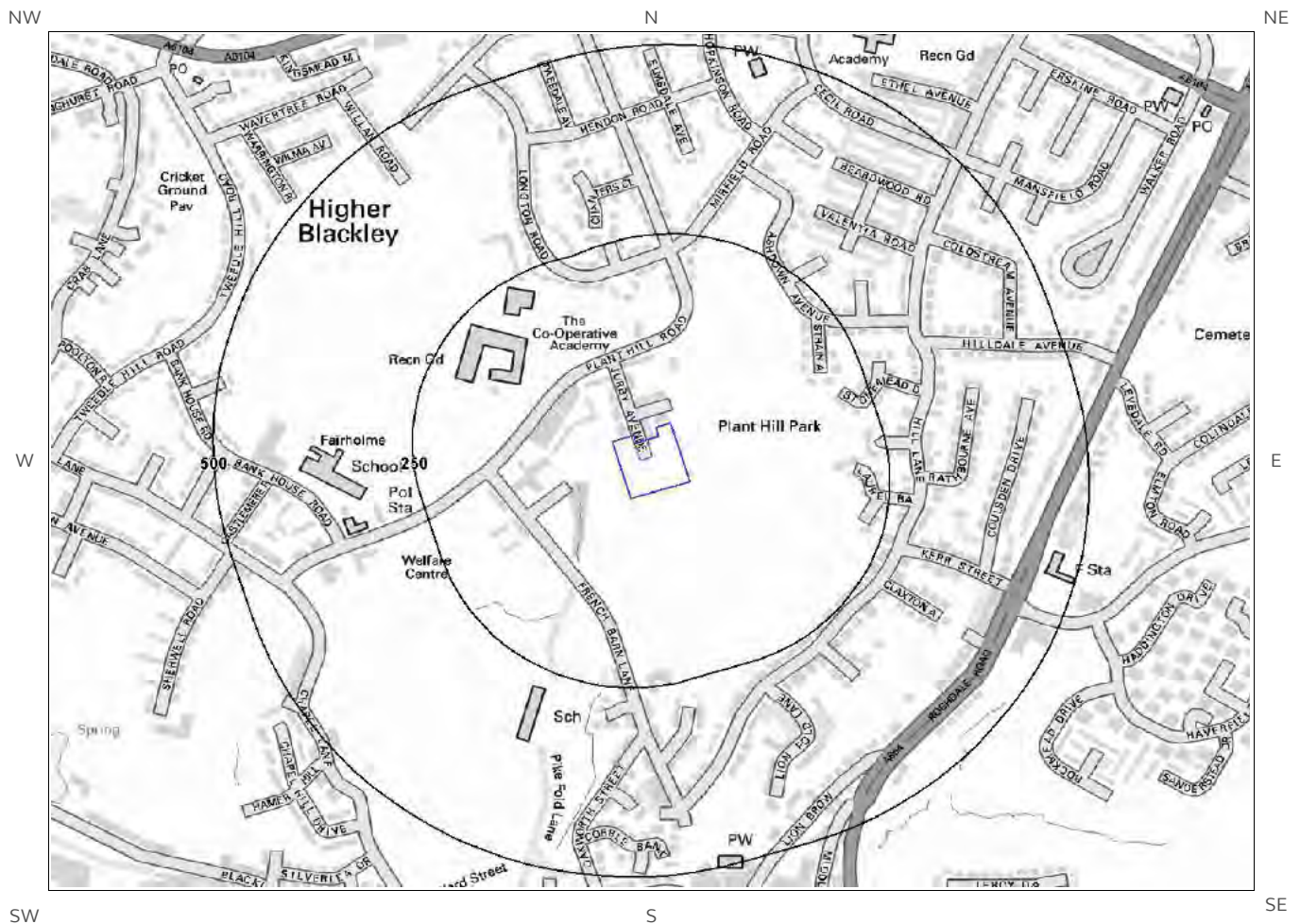
Are there any surface water features within 250m of the study site?

Yes

The following surface water records are not represented on mapping:

Distance (m)	Direction
55	W
177	SW
228	SW
239	S

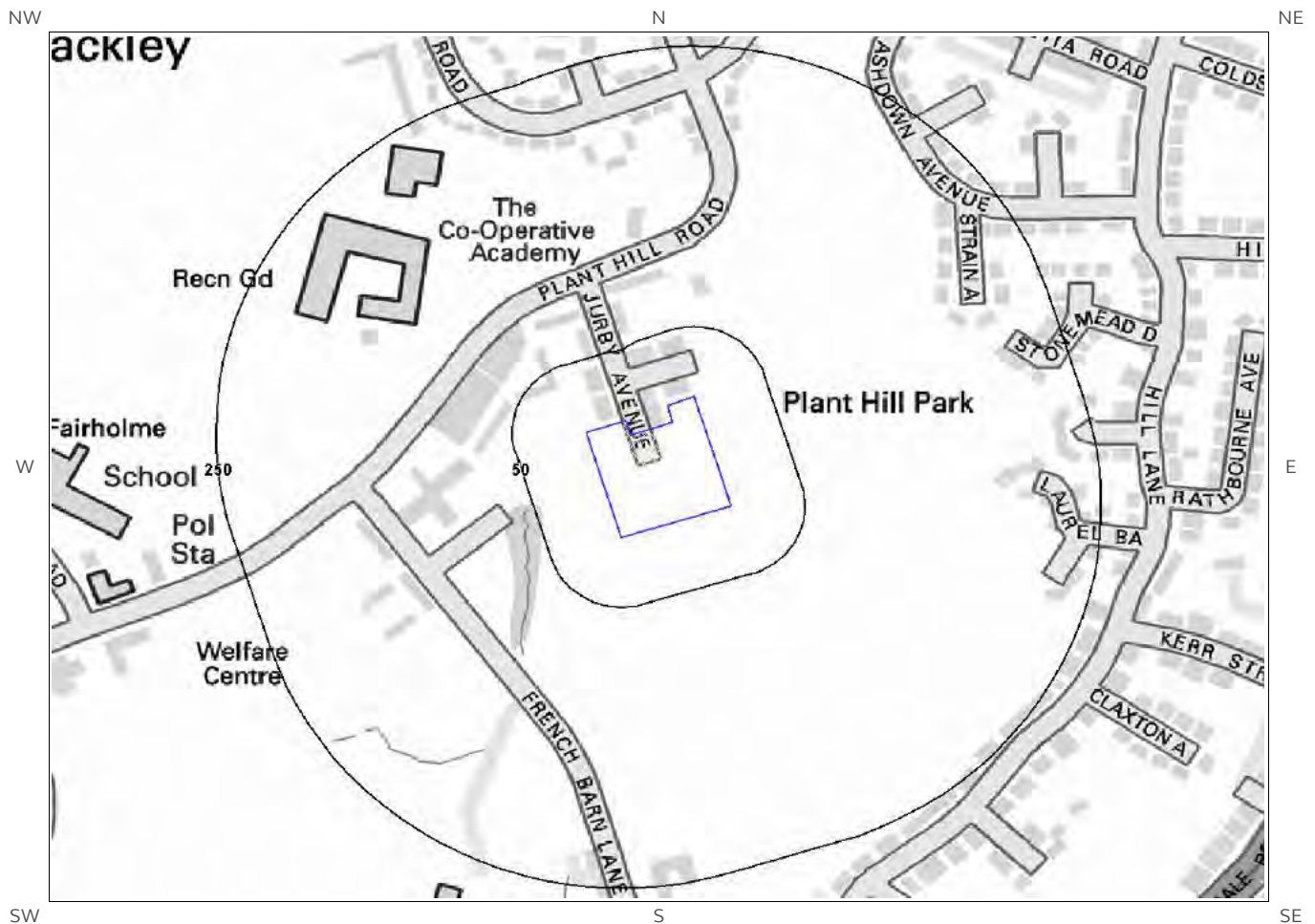
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



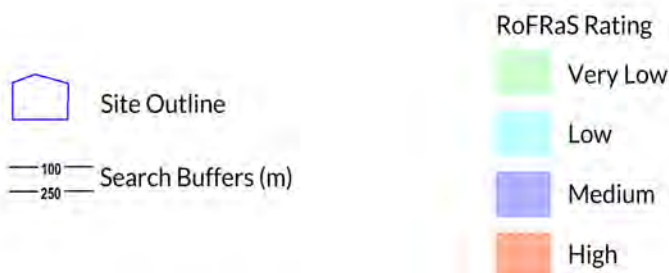
© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



7 Flooding

7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 2 floodplain? No

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 3 floodplain? No

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite? Very Low

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? No
Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

7.6 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site?

No

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes

Does this relate to Clearwater Flooding or Superficial Deposits Flooding?

Clearwater Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Potential at Surface

Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

7.8 Groundwater Flooding Confidence Areas

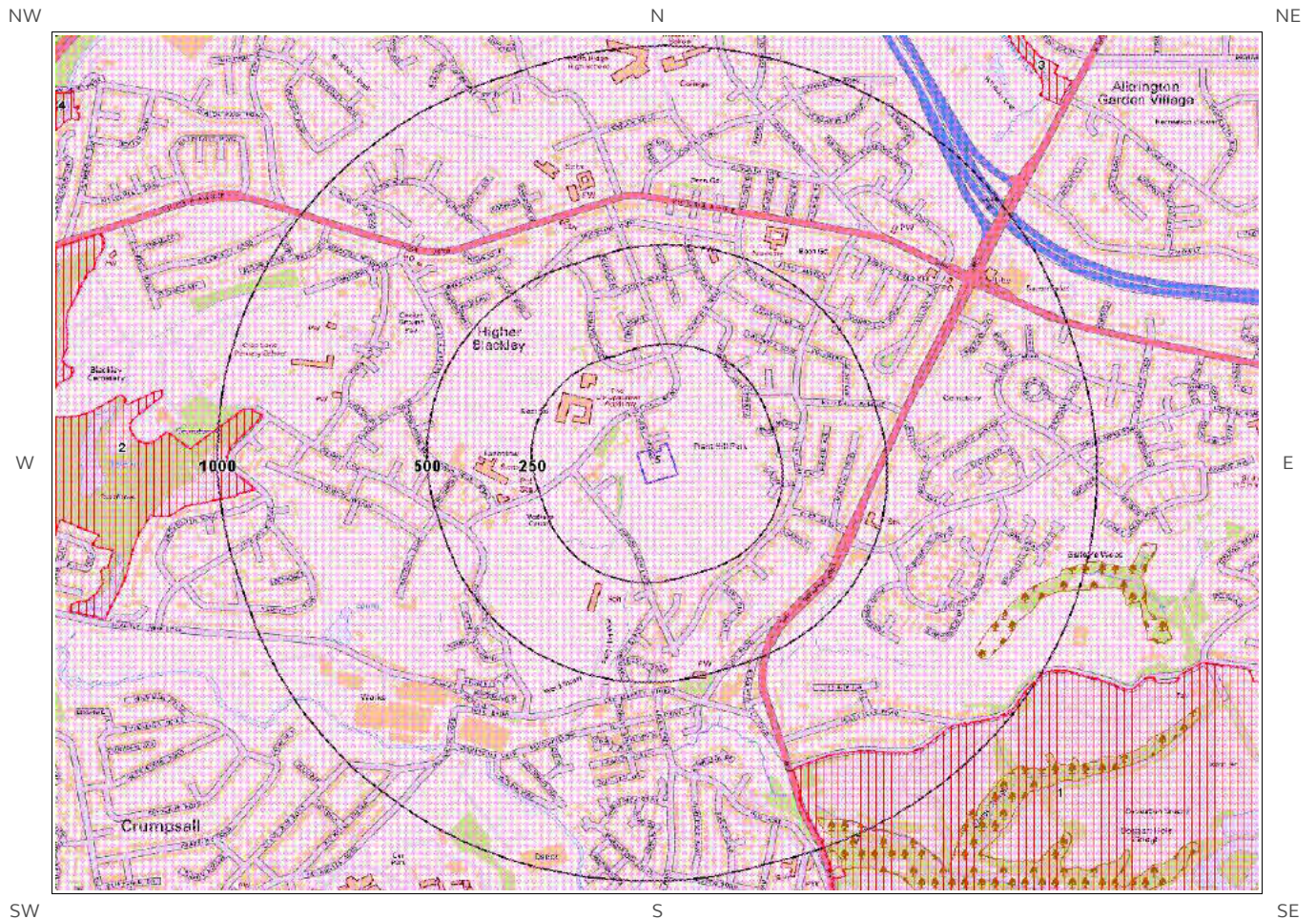
What is the British Geological Survey confidence rating in this result?

Low

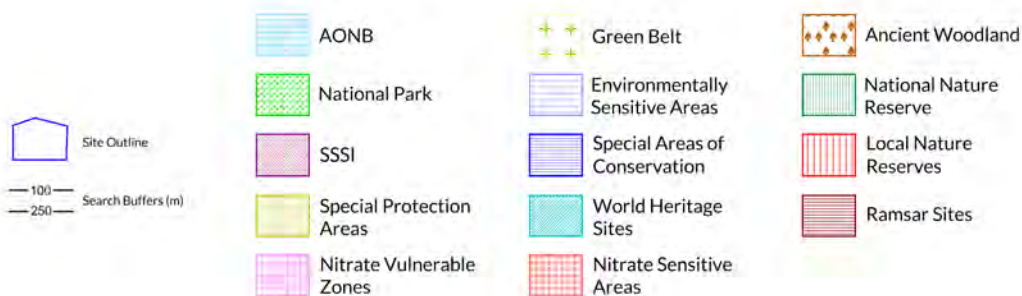
Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

8. Designated Environmentally Sensitive Sites Map



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site? Yes

8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

0

Database searched and no data found.

8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

8.6 Records of Ancient Woodland within 2000m of the study site:

2

The following records of Designated Ancient Woodland provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	Ancient Woodland Name	Data Source
6	833	SE	UNKNOWN	Ancient and Semi-Natural Woodland
7	924	S	UNKNOWN	Ancient and Semi-Natural Woodland

8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

4

The following Local Nature Reserve (LNR) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	LNR Name	Data Source
1	789	SE	Boggart Hole Clough	Natural England
2	900	W	Blackley Forest	Natural England
3	1248	NE	Alkrington Woods	Natural England
4	1531	W	Blackley Forest	Natural England

8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

8.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

1

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NVZ Name	Data Source
5	0	On Site	Existing	DEFRA

8.14 Records of Green Belt land within 2000m of the study site:

2

Green Belt data contains Ordnance Survey data © Crown copyright and database right [2015].

ID	Distance	Direction	Green Belt Name	Local Authority Name
8	1711	W	Liverpool, Manchester and West Yorks Greenbelt	Manchester District (B)
Not shown	1713	NW	Liverpool, Manchester and West Yorks Greenbelt	Bury District (B)

9. Natural Hazards Findings

9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a **Groundsure Geo Insight**, available from our **website**. The following information has been found:

9.1.1 Shrink Swell

What is the maximum Shrink-Swell* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.

9.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

9.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This indicates an automatically generated 50m buffer and site.

9.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

9.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

9.1.6 Running Sand

What is the maximum Running Sand** hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

9.2 Radon

9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

* This indicates an automatically generated 50m buffer and site.

9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing

ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

10. Mining

10.1 Coal Mining

Are there any coal mining areas within 75m of the study site? Yes

The following coal mining information provided by the Coal Authority is not represented on Mapping:

Distance (m)	Direction	Details
0	On Site	The study site is located within the specified search distance of an identified mining area. Further details concerning this can be obtained from the Coal Authority Helpline on 0845 762 6848.

10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary? No

Database searched and no data found.

10.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? No

Guidance: No Guidance Required.

Contact Details

Groundsure Helpline
Telephone: 08444 159 000
info@groundsure.com

British Geological Survey Enquiries
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:
Web: www.bgs.ac.uk

BGS Geological Hazards Reports and general geological enquiries:
enquiries@bgs.ac.uk

Environment Agency
National Customer Contact Centre, PO Box 544
Rotherham, S60 1BY
Tel: 03708 506 506
Web: www.environment-agency.gov.uk
Email: enquiries@environment-agency.gov.uk

Public Health England
Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe
Email: enquiries@phe.gov.uk
Main switchboard: 020 7654 8000

The Coal Authority
200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey
Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

Local Authority
Authority: Manchester City Council
Phone: 0161 234 5000
Web: <http://www.manchester.gov.uk/>
Address: Town Hall, Albert Square, Manchester, M60 2LA

Gemapping PLC
Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444



Acknowledgements: Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, Natural England who retain the Copyright and Intellectual Property Rights for the data.

PointX © Database Right/Copyright, Thomson Directories Limited © Copyright Link Interchange Network Limited © Database Right/Copyright and Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028].

This report has been prepared in accordance with the Groundsure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
<https://www.groundsure.com/terms-and-conditions-sept-2016>



NW N NE



SW S SE

Aerial Photograph Capture date: 11-Jun-2015
Grid Reference: 385550,403525
Site Size: 0.58ha

Contents Page

Overview of Findings.....	5
1 Geology.....	8
1.1 Artificial Ground Map.....	8
1 Geology.....	9
1.1 Artificial Ground.....	9
1.1.1 Artificial/ Made Ground.....	9
1.1.2 Permeability of Artificial Ground.....	9
1.2 Superficial Deposits and Landslips Map.....	10
1.2 Superficial Deposits and Landslips.....	11
1.2.1 Superficial Deposits/ Drift Geology.....	11
1.2.2 Permeability of Superficial Ground.....	11
1.2.3 Landslip.....	11
1.2.4 Landslip Permeability.....	11
1.3 Bedrock and Faults Map.....	12
1.3 Bedrock, Solid Geology & Faults.....	13
1.3.1 Bedrock/ Solid Geology.....	13
1.3.2 Permeability of Bedrock Ground.....	13
1.3.3 Faults.....	13
1.4 Radon Data.....	14
1.4.1 Radon Affected Areas.....	14
1.4.2 Radon Protection.....	14
2 Ground Workings Map.....	15
2 Ground Workings.....	16
2.1 Historical Surface Ground Working Features derived from Historical Mapping.....	16
2.2 Historical Underground Working Features derived from Historical Mapping.....	17
2.3 Current Ground Workings.....	17
3 Mining, Extraction & Natural Cavities Map.....	19
3 Mining, Extraction & Natural Cavities.....	20
3.1 Historical Mining.....	20
3.2 Coal Mining.....	20
3.3 Johnson Poole and Bloomer.....	20
3.4 Non-Coal Mining.....	20
3.5 Non-Coal Mining Cavities.....	21
3.6 Natural Cavities.....	21
3.7 Brine Extraction.....	21
3.8 Gypsum Extraction.....	21
3.9 Tin Mining.....	21
3.10 Clay Mining.....	22
4 Natural Ground Subsidence.....	23
4.1 Shrink-Swell Clay Map.....	23
4.2 Landslides Map.....	24
4.3 Ground Dissolution Soluble Rocks Map.....	25
4.4 Compressible Deposits Map.....	26
4.5 Collapsible Deposits Map.....	27
4.6 Running Sand Map.....	28
4 Natural Ground Subsidence.....	29
4.1 Shrink-Swell Clays.....	29
4.2 Landslides.....	29
4.3 Ground Dissolution of Soluble Rocks.....	29