

ENVIRONMENT

Wilson Bowden Developments Ltd &
David Wilson Homes Ltd
Plot W Kingsway Business Park
Rochdale

Phase 1 and 2 Geo-Environmental
Assessment

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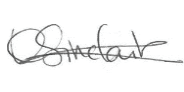
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EXECUTIVE SUMMARY

Executive Summary	
Site Address	Plot W Kingsway Business Park, James Kerne Avenue, Rochdale, OL16 4PR (nearest post code)
Proposed Development	The proposed development at this stage is likely to comprise either a small commercial/light industrial development or residential properties with an estimated 78 units predominantly of 3 or 4 bedrooms including gardens, landscaping and associated infrastructure.
Current Site Use and Site History	The site comprised a derelict farm in the north west area (Silverhill Farm) with grasslands across the rest of the site. No significant changes have occurred throughout the mapped history of the site.
Published Ground Conditions	The site is directly underlain by Hummocky (moundy) Glacial Deposits overlying bedrock of the Pennine Lower Coal Measures Formation (PLCMF). Both geologies are classified as Secondary A Aquifers.
Site Investigation	The ground investigation comprised three cable percussive boreholes to a maximum depth of 15.45m bgl with well installations, six dynamic sample boreholes with well installations, twenty one trial pits, soil chemical and geotechnical laboratory analysis, and six rounds of gas monitoring.
Ground Conditions Encountered	Ground conditions encountered were consistent with published conditions comprising very soft organic Topsoil over predominantly cohesive Hummocky Glacial Deposits (a Secondary A Aquifer). Made Ground was encountered within six out of twenty-four locations, generally within the north west of the site where Silver Hill Farm is located, with thicknesses ranging between 0.5m and >1.30m. The Made Ground was variable in composition but commonly included brick and concrete, including some boulders and occasionally plastic and wood. During subsequent monitoring, groundwater was recorded between 0.59m bgl and 4.22m bgl. It is considered that there is not a significant and consistent groundwater flow regime at the site. Groundwater is likely to accumulate and flow within granular pockets in a variety of directions.
Geotechnical Review	For residential development, Controlled Modulus Columns (CMCs) may be a viable option but may not provide a significant cost saving over driven piles, which is likely to present the most economical solution at the site. However, noise and vibrational effects on nearby developments associated with their installation need to be considered before adopting this solution. In addition, the possibility of relic foundations/slabs within the Made Ground cannot be discounted, as they have been observed as part of this investigation in the Silverhill Farm area. A suspended slab would be required in the Silverhill Farm area of the site due to NHBC requirements where Made Ground thicknesses exceed 600mm. Outside of this area it is possible that a ground bearing floor slab could be used for residential properties for loads of up to 10kPa, with less than 25mm settlement, subject to removal of topsoil and construction on a proof rolled granular layer. However, the gas protection requirement (to be confirmed) need to be considered for the adopted solution. For a small commercial / light industrial development, a vibro solution may be a viable option following improvement of the surface to facilitate the use of shallow spread footings. Ground improvement and/or reengineering of the near surface soils may be viable which would facilitate a ground bearing slab. Treatment of the top 2.0m of soils may facilitate a ground bearing slab of up to 30kPa. Otherwise, a fully suspended slab would be required with loads transferred to pile caps.

	Groundwater is likely to be a seasonal issue with excavations likely to require dewatering during late autumn through to spring. However, this will be highly dependent upon precipitation totals in the local areas. If excavations are undertaken during wetter periods then groundwater level control, such as dewatering at well points or slit trenches may need to be incorporated. Design Sulphate Class DS-3 and ACEC Class AC-3 for soils and groundwater should be considered.
Environmental Review	Six rounds of ground gas monitoring have been completed to date. The results have indicated gas concentrations commensurate with a CS1 / CS2 across the majority of the site. However, significantly elevated carbon dioxide and notably, methane concentrations as well as positive flows which are commensurate with a CS4 / NHBC Red situation have been recorded in a localised area in the east of the site associated with highly organic deposits in the area. Asbestos and marginally elevated TPH and PAH have been recorded in the Made Ground in the vicinity of the former farm buildings which are indicated to represent a risk to human health. If the Made Ground is to remain on site as part of the proposed development, a clean capping layer and marker membrane is required in garden areas to sever the pathway to future site users. Alternatively, removal of the localised Made Ground from the site would remove the source and the requirement for a capping layer/ marker membrane in gardens. No significant risk to controlled waters has been identified.
Waste Classification	Made Ground around Silverhill Farm may be classified as hazardous for waste disposal purposes. Otherwise, materials are likely to be classified as Non-Hazardous.
Recommendations	If development is to occur in the vicinity of BH03 and DS202 then the organic material should be excavated. It is recommended that CS2 / Amber 1 gas protection is installed across the site. A remediation strategy will be required to inform mitigation requirements. For a piling solution, a working platform should be designed in accordance with BRE470. A specialist piling/ ground improvement contractor should be consulted to further assess the most economical and suitable piling solution.
This summary should be read in conjunction with BWB's full report (ref. KPW-BWB-ZZ-XX-RP-GE-0001_Ph1&2) and reflects an assessment of the site based on information received by BWB at the time of production.	

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1. INTRODUCTION

Instruction

- 1.1 BWB Consulting (BWB) was instructed by Wilson Bowden Developments Ltd & David Wilson Homes Ltd (the Client) to carry out a Phase 1 and 2 Geo-Environmental Assessment for the site at Plot W Kingsway Business Park, Rochdale. Details of the project brief are included in BWB proposal reference 190805/01/01/NTE2554/KES/RTR.
- 1.2 The proposed development at this stage is likely to comprise either a small commercial/light industrial development or residential properties with an estimated 78 units predominantly of 3 and 4 bedrooms including gardens, landscaping and associated infrastructure. Current development plans are included as **Appendix 1**.

Objectives

- 1.3 This report has been completed to present pertinent information into the environmental risks and liabilities associated with the site. It has been completed to fulfil the requirements of a preliminary risk assessment in accordance with BS 10175:2011+A2:2017 '*Investigation of potentially contaminated sites, code of practice*' and CLR11 '*Model Procedures for the Management of Land Contamination*'.
- 1.4 The report has also been prepared with reference to land contamination technical guidance available through <https://www.gov.uk/government/collections/land-contamination-technical-guidance>.
- 1.5 The objectives of the desk study elements of the report are to:
- Assess historical activities at the site with respect to their potential impact on the site environment;
 - Characterise the environmental setting of the site, identify migration pathways and vulnerable receptors for contamination originating at the site, focusing on potential soil and groundwater liabilities;
 - Assess historical and current surrounding land use in relation to known or potential off-site contamination issues that may impact the site; and
 - Develop a preliminary Conceptual Site Model (CSM).
- 1.6 The objectives of the phase 2 ground investigation sections of the report are to:
- Assess the prevailing ground and groundwater conditions across the site;
 - Assess the potential presence and extent of contamination in shallow soil and groundwater beneath the site;
 - Assess the significance and magnitude of the observed contamination through comparison of analytical data to appropriate published assessment criteria;
 - Assess the strength properties of the soil beneath the site to enable foundation assessment;
 - Assess the ground gas regime beneath the site; and

- Update the preliminary Conceptual Site Model.

Scope of Work

1.7 The Desk Study Scope of Work included:

- Site walkover (photographs presented as **Appendix 2**);
- A review of the following information:
 - o Groundsure report, reference HMD-214-6443776 and HMD-214-6443777 (**Appendix 3**);
 - o Historical Ordnance Survey Mapping (**Appendix 4**);
 - o Historical aerial photographs (Google Earth) and other imagery;
 - o British Geological Survey (BGS) 1:50 000 Scale, 'Manchester', Sheet 85, Bedrock and Superficial, (2011);
 - o BGS online geological maps and exploratory hole records (www.bgs.ac.uk);
 - o MAGIC website (www.natureonthemap.naturalengland.org.uk/magicmap);
 - o Coal Authority Interactive Map Viewer (<http://mapapps2.bgs.ac.uk/coalauthority/home.html>);
 - o Coal Authority Consultants Coal Mining Report, reference HMD-214-6443779 (**Appendix 5**); and
 - o Regional unexploded bomb risk maps.
- Production of a Geo-Environmental Assessment (this report), concluding in a qualitative assessment of the risks from contamination and ground-related constraints which may impact on the site.

1.8 The intrusive ground investigation was completed between 2nd and 10th October 2019 and comprised the following scope of work:

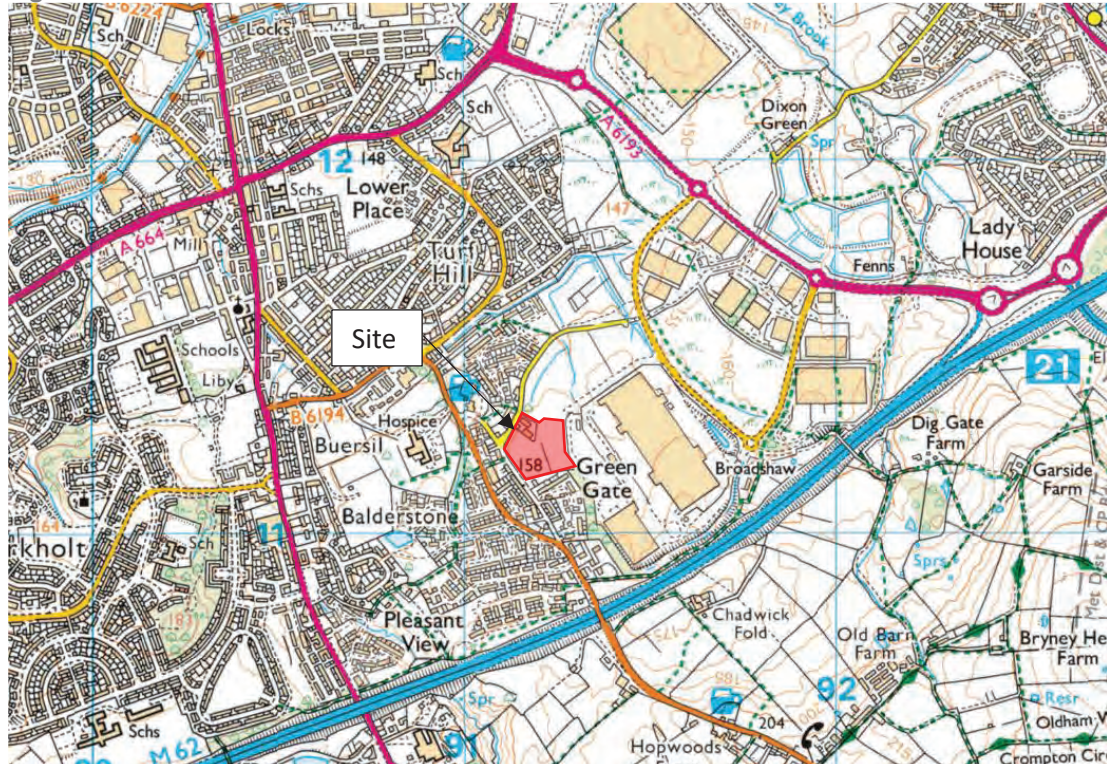
- Non-intrusive survey of excavation locations for underground utilities;
- Survey of coordinates and levels for each excavation location;
- Three cable percussive boreholes;
- Twenty one machine excavated trial pits;
- Chemical analysis of soils;
- Geotechnical testing of soil;
- Six post-investigation ground gas and groundwater monitoring visits; and
- Preparation of this report.

2. THE SITE

Site Location

- 2.1 The site is located at Plot W Kingsway Business Park, in Rochdale, centred at National Grid Reference 391216,411245. The approximate location of the site is shown below in **Figure 2-1**.

Figure 2-1: Site Location Plan



Site Description

- 2.2 The site comprises an area of approximately 2.26 hectares largely comprising boggy grassland with the derelict Silverhill Farm located in the north east of the site. The
- 2.3 The current layout of the site is shown on **Drawing 1**. Photographs from the walkover are presented in **Appendix 2**.
- 2.4 The grassland covered approximately 80% of the site and are separated into two areas by a small fence line. The site boundary is formed by hedge lines. Silverhill Farm is present in the north western area of the site and comprises several small derelict stone farm structures. The buildings were sealed with boarding and were not access during the walkover.

Site Surroundings

- 2.5 The surrounding land uses at the time of the walkover survey are summarised in **Table 2-1**.

Table 2-1: Surrounding Land Use

Surrounding Land Use	
North	Grassland associated with Plot J on Kingsway Business Park.
East	Large Asda distribution facility.
South	Residential Properties.
West	Residential Properties

- 2.6 An aerial photograph representative of the site and surroundings, dated 26th March 2012, is presented below as **Figure 2-2**.

Figure 2-2: Aerial Photograph



3. ANTICIPATED GROUND CONDITIONS

- 3.1 The anticipated ground conditions for the site and controlled waters vulnerability is discussed within **Table 3-1**.

Table 3-1: Summary of Anticipated Ground Conditions

Anticipated Ground Conditions	
Geology	Information published by the BGS indicates that the site is directly underlain by Hummocky (moundy) Glacial Deposits, Devensian - Diamicton. Bedrock geology beneath the glacial deposits is indicated to comprise Pennine Lower Coal Measures Formation (PLCMF) - mudstone, siltstone and sandstone. The BGS Lexicon database describes the PLCMF bedrock as Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part.
Hydrogeology	The Environment Agency (EA) classifies the Hummocky Glacial Formation and the PLCMF bedrock as a Secondary A Aquifers. These are 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. There are seven groundwater abstraction licenses listed within 500m with the closest listed approximately 220m north east. All entries are historical entries related to farming uses. There are no discharge consents to groundwater indicated in close proximity to the site. The site is not indicated to be within, or within close proximity to, an EA groundwater Source Protection Zone.
Surface Waters	Unnamed tributaries are listed approximately 40m north of the site flowing in a northerly direction. There are no surface water discharge consents within 1km of the site. The site is not in an EA flood risk area.
Ground Gas & Radon	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level. Shallow organic deposits within glacial deposits and potential Made Ground associated with the farm both represent potential sources of ground gas.
Mining and Mineral Extraction	The site is located within a Coal Authority reporting area. A Coal Authority Consultants Mining Report has been obtained for the site (Appendix 5) and indicates that no recorded mining has been undertaken beneath the site and there are no significant mining features, including mine entries, within close proximity to the site.
Environmental Sensitivity	There are no environmentally sensitive sites listed within close proximity to the site.
Unexploded Ordnance	Low risk; no further action required.

4. SITE HISTORY

- 4.1 Historical Ordnance Survey (OS) mapping for the site area has been reviewed. These maps and plans date from 1851 to 2019. The historical plans reviewed are provided in **Appendix 4**. The key points of the historical development of the site and surrounding area are summarised below. All distances quoted are approximate.

On Site

- 4.2 Silver Hill Farm is present on site in the north western area from 1851 mapping, with the rest of the site apparently utilised for agricultural purposes. The farm gradually expands over time with some small additional buildings present. Electricity pylons cross the south eastern corner of the site from 1955 plans up until the 1992 plans. No further significant changes to the site were noted.

Off Site

- 4.3 The surrounding land uses are predominantly agricultural on the earliest plans with a Wheelwright Works present immediately west of site on the 1891 plan. Several small drains and watercourses are present along the surrounding field boundaries.
- 4.4 1994 plans indicated that a residential development is mapped 100m west of site, a tank (probably water storage) is present immediately north of Silver Hill Farm, and a Works is mapped 20m west. By 2003, residential premises are present immediately north west, west and south of the site. The 2019 plans indicated two large industrial style buildings 200m east and south east.

5. REGULATORY SETTING

Permits Consents and Authorisations

- 5.1 A full listing of permits, consents and authorisations including discharge consents, pollution incidences and other environmental information, is included in the Groundsure report, presented in **Appendix 3**.
- 5.2 No significant features have been identified which are considered likely to have had a detrimental impact on the site.

Landfilling and Waste Management

- 5.3 A full listing of EA, BGS and Local Authority recorded landfills are provided in the Groundsure report presented in **Appendix 3**.
- 5.4 No significant facilities have been identified which are considered likely to have had a detrimental impact on the site.

6. PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

Introduction

- 6.1 The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.
- 6.2 Three impact potentials exist for any given site, all of which need to be considered in a risk assessment, which are:
- The site impacting upon itself;
 - The site impacting on its surroundings; and
 - The surroundings impacting on the site.
- 6.3 The following sections discuss all the identified potential on and off-site sources, pathways and receptors in the context of the proposed development and plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or controlled waters from the data gained from the desk study.
- 6.4 The assessment is qualitative and aimed to determine all likely pollutant linkages, with consideration of significance and allowing for uncertainties.
- 6.5 **Sources (S):** These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks).
- 6.6 **Pathways (P):** A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.
- 6.7 **Receptors (R):** Receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by contaminant(s).

Conceptual Site Model

- 6.8 Consideration has been given to the likely sources, pathways and receptors which may be present, based on the information in the previous sections. These are presented in **Table 6-1** and **Table 6-2** and further information about the risk classification scheme is included within **Appendix 6**, with reference to CIRIA C552 '*Contaminated land risk assessment - a guide to good practice*'.
- 6.9 A tabulated version of the Preliminary CSM based on the desk study and site observations is presented in **Table 6-3**.

Table 6-1: Potential Sources of Contamination

Location	Potential Source	Contaminants of Potential Concern (CoPC)
On-site	MADE GROUND associated with the former Silverhill Farm.	- Heavy metals - Inorganics, such as cyanides, sulphates and nitrates - pH - Asbestos Containing Materials (ACMs) - Volatile organic compounds (VOCs) - Petroleum hydrocarbons - Methane, carbon dioxide
	FARM MACHINERY associated with Silverhill Farm	Fuel hydrocarbons
Off-site	Contamination associated with neighbouring works	- Heavy metals - Inorganics, such as cyanides, sulphates and nitrates - Petroleum hydrocarbons - Methane, carbon dioxide

Table 6-2: Relevant Potential Pathways and Receptors

Receptors	Pathways
Human Health: - Future site users (residential) - Neighbouring public (residential) - Intrusive maintenance workers	- Dermal contact with soil or dust - Incidental ingestion of soil and/or dust - Inhalation of dust and/or fibres - Ingestion of contaminated vegetables and/or soil attached to vegetables - Migration and accumulation of ground gas in enclosed spaces leading to inhalation or explosion
Controlled Waters: - Groundwater (Secondary A Aquifer) - Unnamed tributaries	- Leaching of soil contaminants - Vertical and lateral migration
Property: - Underground utilities - Building structures	Direct Contact

Table 6-3: Preliminary Conceptual Site Model

Source	Pathway	Receptor	Con	Prob	Risk
On-site sources as detailed in Table 6-1.	Dermal contact with, and incidental ingestion of soil and/or dust.	Future site users (residential)	Md	UI	L
	Inhalation of dust and/or fibres.	Intrusive maintenance workers	Md	UI	L
	Ingestion of contaminated vegetables and/or soil attached to vegetables.	Future site users (residential)	Md	UI	L
	Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane).	Future site users (residential)	Md	Lw	M/L
	Leaching and permeation through soil profile.	Groundwater: Underlying Secondary A Aquifer	Md	UI	L
	Vertical and lateral migration of contaminants.		Md	UI	L
	Lateral migration of contaminated groundwater.	Unnamed Tributaries	Mi	UI	VL
	Direct contact.	Water utility pipes	Md	UI	L
		Buried structures/ foundations.	Md	Lw	M/L
Off-site sources as detailed in Table 6-1.	Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane).	Future site users (residential)	Md	Lw	M/L
	Lateral migration of contaminated groundwater.	Groundwater: Underlying Secondary A Aquifer	Md	UI	L

7. GROUND INVESTIGATION WORKS

Scope of Investigation

- 7.1 Intrusive ground investigation works were undertaken between 2nd and 10th October 2019.
- 7.2 The site investigation works were carried out in general accordance with BS 5930:2015 '*Code of Practice for Ground Investigations*' and BS 10175:2011+A2:2017 '*Investigation of Potentially Contaminated Sites Code of Practice*'.
- 7.3 The site works comprised the following works:
- Clearance of investigation locations by a specialist buried services tracing company;
 - Collection of coordinates and elevations of exploratory hole locations;
 - Three cable percussive boreholes (BH01 to BH03) to a maximum depth of 15.45m bgl with in-situ testing and installation of gas and groundwater monitoring wells;
 - Twenty one machine excavated trial pits (TP01 to TP20 and TP16B) to a maximum depth of 4.0m bgl (TP01, TP08, TP14 and TP17);
 - Collection of representative soil samples for environmental analysis at a UKAS and MCERTS accredited laboratory;
 - Collection of undisturbed and disturbed soil samples for geotechnical analysis at a UKAS accredited laboratory;
 - Undertaking Hand Shear Vane (HSV) testing in suitable cohesive soils;
 - A return visit on 11th November 2019 to drill and install Six dynamic sampling and hand excavated boreholes to a maximum depth of 3.0m bgl;
 - Six post-investigation gas and groundwater level monitoring visits.
- 7.4 An exploratory hole location plan is presented as **Drawing 1**. Engineering logs are presented as **Appendix 7**. The standard penetration testing (SPT) hammer calibration certificates and driller's logs are presented in **Appendix 8**. The post-investigation gas and groundwater monitoring data is presented as **Appendix 9**.

Exploratory Hole Location Rationale

- 7.5 The exploratory hole locations were chosen based on the findings of the Phase 1 Geo-environmental Assessment, as summarised in **Table 7:1**.

Table 7-1: Exploratory Hole Location Rationale

Location	Reason
BH01 and TP01 to TP05	Targeting potential contamination associated with Silver Hill Farm
DS201 to DS206	Ground gas impact delineation.
BH02, BH03, TP06 to TP20, and TP16B	Site coverage

In-situ Testing

Strength Testing

- 7.6 In-situ soil strength testing comprising SPTs were undertaken in the cable percussive boreholes. SPT 'N' values are included on the exploratory hole logs (**Appendix 7**).
- 7.7 HSV tests were undertaken within trial pits where cohesive soils were encountered. The results of these tests are included on the exploratory hole logs (**Appendix 7**).

Chemical Testing

- 7.8 Chemical analysis was scheduled primarily targeting the Made Ground in the Silver Hill Farm area of the site but also providing site wide background concentrations in natural deposits. The soil samples collected for environmental purposes were sent to i2 Analytical Ltd (UKAS and MCERTS accredited) for chemical analysis. The soil analysis undertaken was as follows:
- Eight BWB Standard Suite: arsenic, barium, beryllium, water soluble boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water soluble sulphate (2:1 extract), total phenols, total cyanide, free cyanide, complex cyanide, fraction of organic carbon, pH, Polycyclic Aromatic Hydrocarbons (PAHs) (United States Environmental Protection Agency priority 16 compounds) and Total Petroleum Hydrocarbons (TPH) C₆-C₁₀ and C₁₀-C₄₀;
 - Three TPH Criteria Working Group (TPHCWG) aliphatic and aromatic fractions;
 - Three BTEX;
 - Eight samples for Organic Matter; and
 - Six asbestos screening with one quantification.
- 7.9 The results of the soil chemical testing are presented as **Appendix 10**.

Geotechnical Testing

- 7.10 The following geotechnical testing was undertaken on representative undisturbed and disturbed samples:
- Twenty five samples tested for moisture content;
 - Eleven samples tested for Atterberg (liquid and plastic) limits;
 - Four samples tested for particle density;
 - Eight samples tested for particle size distribution by wet sieve;
 - Four samples tested for sedimentation by pipette;
 - Three samples for single stage triaxial testing;
 - Two samples for one-dimensional (oedometer) consolidation testing;
 - Five samples tested for 2.5kg compaction testing;
 - Eleven samples tested for aqueous sulphate and pH; and

- Eight samples tested for organic matter content.

7.11 The results of the geotechnical testing are included as **Appendix 11**.

Limitations and Uncertainty

- 7.12 Several trial pits were terminated early due to water ingress resulting in unstable and collapsing trial pit walls.
- 7.13 Due to very soft and wet ground conditions by the return site investigation, it was only possible to install monitoring wells at DS204, DS205 and DS206 using hand tools.

8. GROUND CONDITIONS ENCOUNTERED

Geological Summary

- 8.1 Ground conditions at the site generally confirmed the expected geology, comprising Topsoil or Made Ground over superficial deposits of Hummocky Glacial Deposits.
- 8.2 The recorded ground conditions are summarised in **Table 8-1** and uncorrected SPT results collected from the borehole locations are presented on the exploratory hole records presented in **Appendix 7**.

Table 8-1: Summary of Ground Conditions

Stratum	Top Depth (m)		Base Depth (m)		Thickness (m)		SPT N Value	
	Min	Max	Min	Max	Min	Max	Min	Max
Topsoil	0.0	0.0	0.1	0.9	0.1	0.9	NR	NR
Reworked Natural	0.0	0.0	0.2	0.4	0.2	0.4	NR	NR
Made Ground	0.0	0.2	0.5	>1.4	0.5	>1.3	NR	NR
Hummocky Glacial Deposits	0.3	1.4	>15.45		>15.05		0	>50

Geological Descriptions

Topsoil

- 8.3 Topsoil was encountered within 14 out of the 24 exploratory holes, being present on the whole site except for the Silverhill Farm area in the north; thicknesses ranged between 0.1m and 0.9m. Both granular and cohesive compositions of Topsoil were identified on the site.
- 8.4 Granular deposits of Topsoil were identified within 3 out of the 14 locations, found within the north western area of the site and generally described as a dark brown slightly clayey slightly gravelly fine to coarse sand with abundant rootlets. The gravels were angular to sub rounded fine to coarse sandstone.
- 8.5 Cohesive deposits of Topsoil were identified within 17 out of the 20 locations across the rest of the site generally described as a soft dark brown slightly gravelly or silty sandy clay with abundant roots and rootlets. The sand was fine to coarse and the gravels were angular to sub rounded fine to coarse sandstone, quartzite, mudstone and coal.
- 8.6 The depth of topsoil over the site may vary from that encountered at the locations investigated within the scope of this investigation which may result in inaccurate estimations of topsoil quantities on the site.

Reworked Natural

- 8.7 Reworked Topsoil was identified within 6 out of the 24 exploratory hole locations, with thicknesses ranging between 0.2m and 0.4m. The reworked ground was generally

located within the south and southeast of the site, with one location found in the north. The composition of the reworked natural ground showed consistency, generally being described as a soft dark brown slightly gravelly sandy clay with abundant roots and rootlets; three locations contained a low cobble content. The sand was fine to coarse and the gravel was angular to sub rounded fine to coarse sandstone, quartzite, brick, coal and pottery. Cobbles were angular and subangular sandstone and brick.

Made Ground

- 8.8 Made Ground was encountered within 6 out of 24 locations, generally within the north of the site where Silver Hill Farm is located, with thicknesses ranging between 0.5m and >1.30m.
- 8.9 One location (TP03) identified concrete at a thickness of 0.1m within Silver Hill Farm. Four locations identified a cohesive composition of Made Ground generally described as a very soft to firm dark brown or light brown mottled orange and grey or multicoloured sandy gravelly clay. The sand was fine to coarse and the gravel was angular to sub rounded fine to coarse brick, ash, concrete, sandstone, pottery and coal. Three of these locations identified a low cobble content where the cobbles were generally described as angular and subangular sandstone, concrete and brick.
- 8.10 Four of the locations identified a granular composition of Made Ground with two locations being described as a brown slightly clayey gravelly fine to coarse sand, one location being described as dark brown slightly gravelly cobbles and one location being described as a dark brown slightly clayey sandy gravel. All locations had cobbles present, generally described as angular and subangular sandstone, brick and concrete. Sand was fine to coarse and gravels were generally described as angular to sub rounded fine to coarse brick, sandstone, coal, concrete, wood and plastic. Relic sub floor structures are potentially present in the Silverhill Farm area of the site. At TP102, what appeared to be a filled subfloor structured was encountered but the location had to be backfilled before completion due to collapse and water inundation.

Hummocky (Moundy) Glacial Deposits

- 8.11 Hummocky (Moundy) Glacial Deposits were identified underlying Made Ground in all locations where the extent of the Made Ground was proven, with thicknesses being unproven. The Glacial deposits were identified as predominantly cohesive, with granular strata recorded in eleven of the investigation locations.
- 8.12 Four locations identified the superficial deposits as a very soft pinkish/greyish/orangish brown sandy gravelly silt and twenty two locations were described as a very soft to stiff light/dark/orangish/greying/reddish brown sandy gravelly, sometimes silty, clay. Sand was fine to coarse and gravel was angular to sub rounded fine to coarse coal, siltstone and mudstone.
- 8.13 Nine locations generally described the granular compositions of the Hummocky (Moundy) Glacial Deposits as a very loose to very dense orangish brown clayey or silty gravelly fine to coarse sand with gravels being described as angular to sub rounded fine to coarse mudstone, coal and sandstone. Two locations identified the superficial deposits as very loose to dense orangish brown sand and gravel with occasional silt and

clay bands. Two further locations were described as greyish and orangish brown slightly clayey sandy gravel of angular to sub rounded fine to coarse mudstone and sandstone with a low cobble content; cobbles were angular and subangular sandstone.

Groundwater Strikes

- 8.14 Groundwater was encountered across the site mainly in the Hummocky Glacial Deposits, as summarised in **Table 8-2**.

Table 8-2: Summary of Groundwater Strikes

Stratum	Number of Strikes	Depth Groundwater Encountered (m bgl)	
		Min	Max
Topsoil	2	0.2	0.3
Made Ground	3	0.4	1.2
Hummocky Glacial Deposits	21	0.5	3.2

- 8.15 During subsequent monitoring, groundwater was recorded between 0.59m bgl and 4.22m bgl. Groundwater elevation was reported between 153.93m AOD (BH03) and 157.82m AOD (BH02) with marginal changes noted at BH01 and BH02, and greater fluctuations at BH03.
- 8.16 Based on the observed geology, variable groundwater strike depths, and variable resting groundwater levels observed during the monitoring, it is considered that there is not a significant and consistent groundwater flow regime at the site. Groundwater is likely to accumulate and flow within granular pockets in a variety of directions.

Contamination Observations

- 8.17 Contamination observations made during the ground investigation are summarised in **Table 8-3**.

Table 8-3: Summary of Contamination Observations

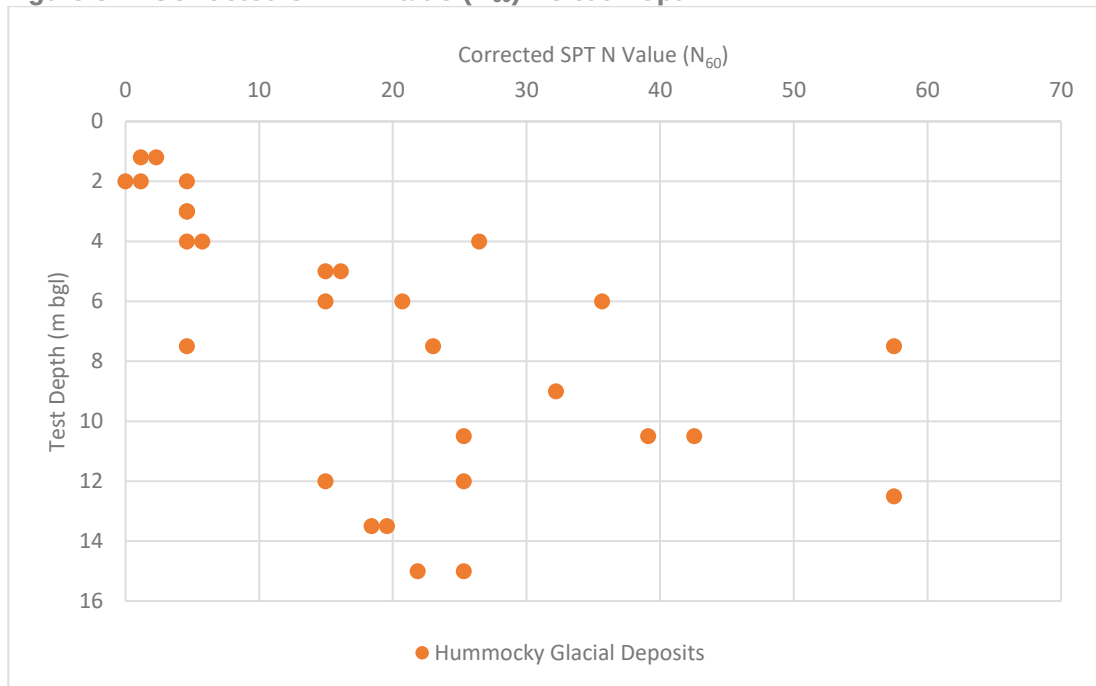
Location	Depth (m bgl)	Observations	PID Concentration (ppm)
TP01	0.4-0.5	Black staining on northern face of trial pit.	1.3
TP02	0.4	Manure odour noted in groundwater	0.3
TP03	0.5	Black staining on northern face of trial pit.	1.2

In Situ Testing

Standard Penetration Testing

- 8.18 A plot of corrected SPT 'N₆₀' Value Vs Depth is presented as **Figure 8-1**.

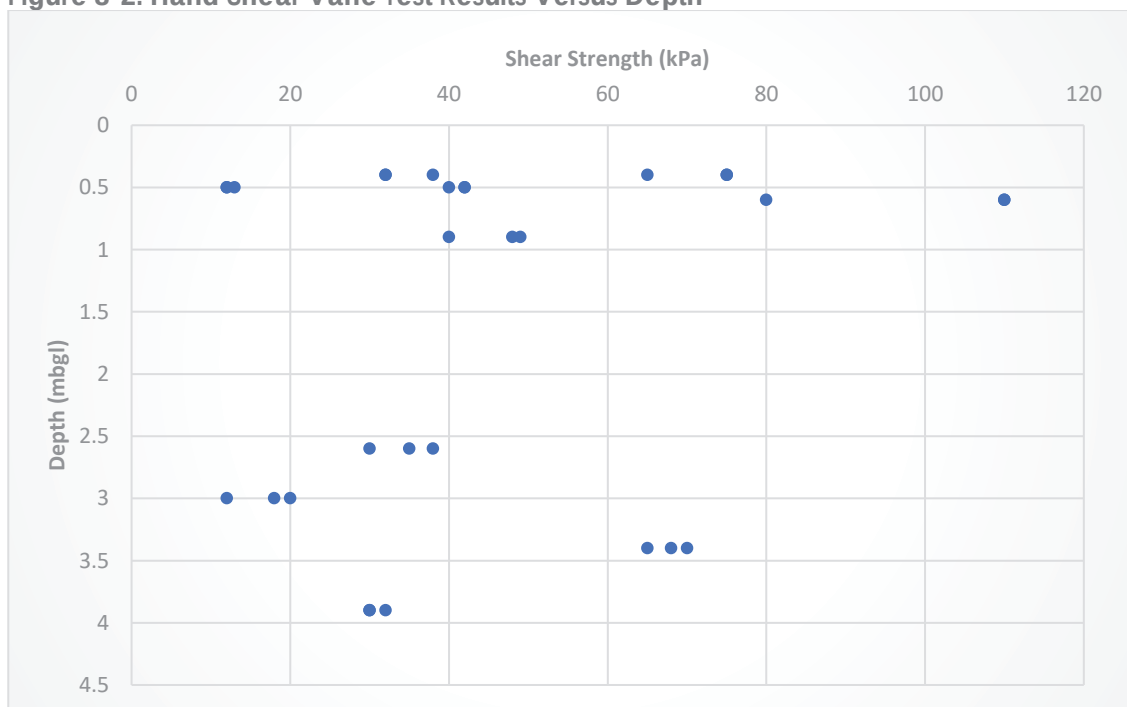
Figure 8-1: Corrected SPT 'N' Value (N_{60}) Versus Depth



Hand Shear Vane Tests

- 8.19 Where suitable cohesive deposits were encountered hand shear vane tests were undertaken. The tests comprised three tests with the average taken as the peak results and presented as **Figure 8-2**. The HSV results obtained at trial pits are presented on the exploratory hole records presented in **Appendix 7**.

Figure 8-2: Hand Shear Vane Test Results Versus Depth



9. GEOTECHNICAL ASSESSMENT

Introduction

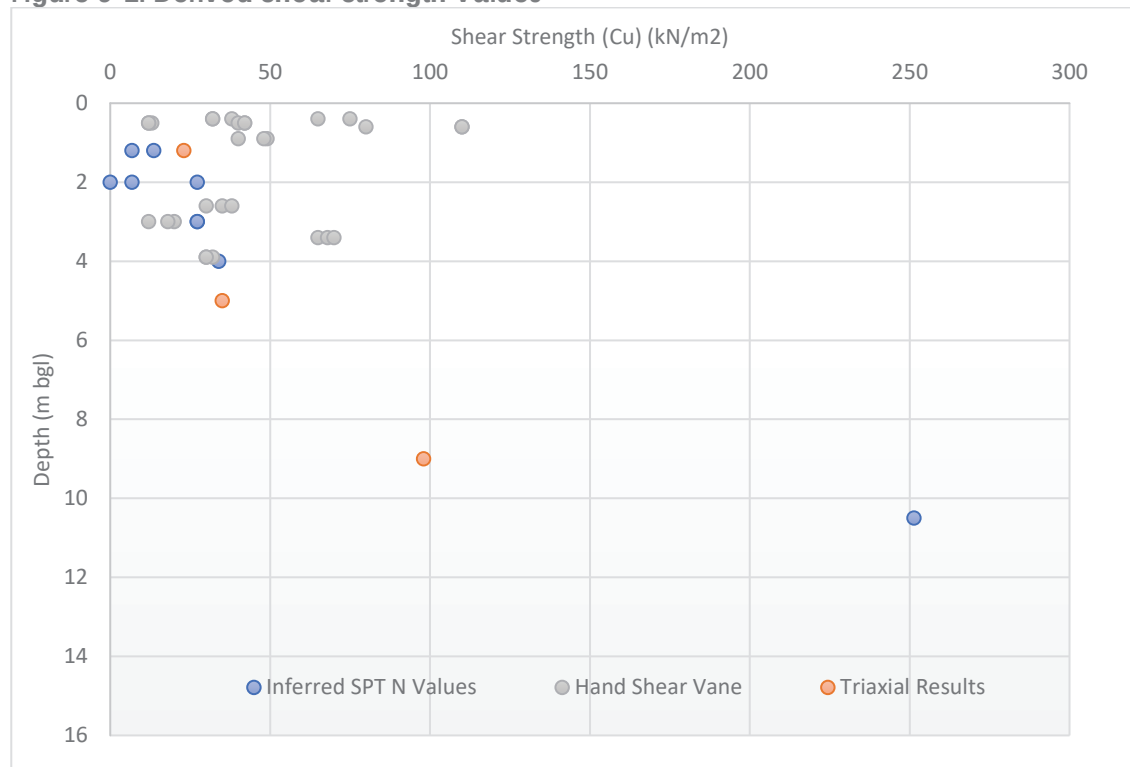
- 9.1 The proposed development is anticipated to involve the development of currently vacant land for a residential end use with approximately 78 units being proposed. Highways infrastructure and vehicle parking is also being proposed. At the time of writing, no specific design loads were available. However, based on the proposed development, it is envisaged that houses would have line-loads of no more than circa 80kPa and slab loadings of no more than circa 10kPa.
- 9.2 The alternative development option may be a commercial end use of small trade counters or similar, again, no design loads are currently available, though for the purpose of this assessment, column loads are considered to be potentially up to 125kPa with slab loads of up to 35kPa.
- 9.3 Highly variable thicknesses of soft and likely compressible topsoil and subsoil have been recorded at the site with thicknesses varying between 0.25m (location BH01) and 1.0m (location BH02). Made Ground of in excess of 1.4m thick, including sub floor structures, has been recorded in the Silverhill Farm area of the site.
- 9.4 Neither untreated Topsoil or Made Ground is considered a suitable founding stratum for either pavements, floor slabs or foundations due to the potential for excessive differential and/or total settlement. Consequently, it is proposed that these materials are either excavated and replaced with a suitable imported granular material and/or treated to a suitable engineering standard where applicable.
- 9.5 Geotechnical results are included as **Appendix 11**.

Ground Model

- 9.6 For the purpose of foundation appraisal, groundwater is considered to be at 0.6m bgl. Historical data and BWB's experience of the local area indicates that the groundwater flow is very seasonal and is expected to flow in granular layers at shallow depth during winter months.
- 9.7 Based on the ground conditions discussed in **Section 8** a geotechnical ground model, indicating various geotechnical parameters, has been developed. This model provides the basis for geotechnical analysis undertaken within this report. There is principally one geological stratum at the site beneath the Topsoil, sub soil and any Made Ground, the Hummocky Glacial Deposits, which can be sub divided into two types; cohesive layers and granular layers; present in multiple inconsistent layers but generally becoming more granular with depth.
- 9.8 Shear strength (C_u) values for the cohesive Hummocky Glacial Deposits at the site have been obtained on site using a hand shear vane, from triaxial laboratory test data on undisturbed soil samples and by converting SPT N_{300} values based on a Plasticity Index of 14 and relationship between shear strength and N_{300} values (Stroud (1975)). The shear strength values have been plotted and are indicated on **Figure 9-1**. The hand shear

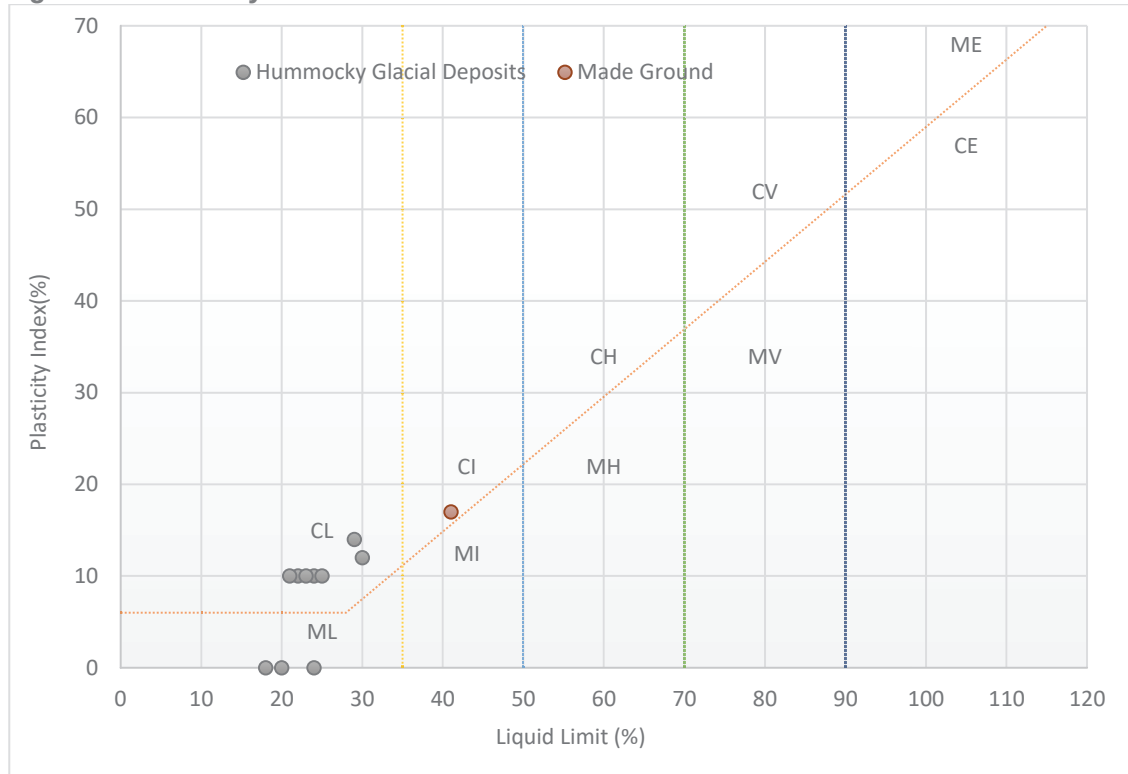
vane results indicate some slightly higher shear strengths in the top 4.0m. However, based on site observations, these materials were very inconsistent and often pockets mixed within softer materials. These higher results are therefore not considered reliable particularly as SPTs and triaxial results correlate more closely with the lower hand shear vane results. Shear strength are therefore indicated to be circa 20kPa increasing to 35kPa in the top 5.0m.

Figure 9-1: Derived Shear Strength Values



9.9 The plasticity index adopted is based on the Plasticity index laboratory testing undertaken. The results indicated low plasticity clays with low volume change potential as indicated in **Figure 9-2** below.

Figure 9-2: Plasticity Index Chart



Foundation Solutions

- 9.10 Due to the low strength of the shallow deposits and locally organic nature, a conventional shallow spread or trench fill solution is not considered to be a viable foundation solution.
- 9.11 Buried obstructions may be present in the Silverhill Farm area and will need to be removed before the following solutions are implemented.

Ground Improvement Techniques

- 9.12 For residential development, a vibro ground improvement option, such as stone columns, is unlikely to be suitable. Controlled Modulus Columns (CMCs) may be a viable option but may not provide a significant cost saving over driven piles a specialist ground improvement contractor should be consulted to further investigate this option.
- 9.13 For a small commercial / light industrial development, a vibro solution may be a viable option following improvement of the surface (see **Section 9.32 to 9.36**) although the shear strength of the ground as at the lowest end of the scale that may be considered suitable to treat with this method. Consultation with a specialist ground improvement contractor should be undertaken to assess whether this is a viable option.

Piles

- 9.14 For a residential end use, a piled solution is likely to present the most economical solution at the site and provides an alternative solution for commercial development if vibro

stone columns aren't feasible; driven piles potentially provide the cheapest piled solution. However, noise and vibrational effects on nearby developments associated with their installation need to be considered before adopting this solution. In addition, the possibility of relic foundations/slabs within the Made Ground cannot be discounted, as they have been observed as part of this investigation in the Silverhill Farm area.

- 9.15 Should the environmental issues of noise and vibration preclude the use of driven piles, consideration could be given to the use of continuous flight auger (CFA) piles. Early consultation with a suitably experienced CFA piling contractor should be sought to determine the viability of this technique. One disadvantage of CFA piling is that spoil is brought to the surface, which would require off-site disposal, if it cannot be reused elsewhere on site.
- 9.16 Cable percussion boreholes were advanced to a maximum depth of 15.45m bgl. As such, depending on the proposed working loads and proposed pile length, it may be necessary to undertake additional intrusive works to confirm the competency of the soils beneath the toe of the piles, should piles be required to be extended below 10.00m bgl in accordance with guidance set out in Federation of Piling Specialists (FPS) and Eurocode 7.
- 9.17 A piled foundation solution would be potentially viable subject to the following:
- Soils generated from pile installation should be assessed in line with appropriate Duty of Care legislation and undergo waste classification prior to disposal;
 - A fully warranted site specific pile design should be undertaken by a specialised piling contractor, once loadings are confirmed; and
 - A working platform designed in accordance with BRE470.
- 9.18 A specialist piling contractor should be consulted to further assess the most economical and suitable piling solution.

Floor Slabs

Residential

- 9.19 A suspended slab would be required in the Silverhill Farm area of the site due to NHBC requirements where Made Ground thicknesses exceed 600mm. Outside of this area it is possible that a ground bearing floor slab could be used for residential properties for loads of up to 10kPa, with less than 25mm settlement, subject to removal of topsoil and construction on a proof rolled granular layer. However, it is anticipated that gas protection will be required, for which further assessment is being undertaken to confirm requirements. A suspended slab, such as beam and block, may therefore be a more pragmatic solution.

Commercial

- 9.20 Ground improvement and/or reengineering of the near surface soils may be viable which would facilitate a ground bearing slab. Otherwise, a fully suspended slab would be required with loads transferred to pile caps. However, the solution will need to

consider the gas protection requirements which are still under assessment / consideration.

Roads and Pavements

- 9.21 Although no specific near surface testing has been undertaken to inform pavement design, the ground investigation data has confirmed that the shallow deposits are highly variable and often very soft which would suggest very low corresponding CBR values (<3%). Much of the soft organic shallow topsoil and subsoil deposits will need to be removed and replaced with imported granular fill to accommodate development at the site. Additional CBR Testing will be required following the soil strip to assess the CBR values and identify whether liming will be required to improve the surface to accommodate pavements.

Drainage

- 9.22 No soakaway drainage testing has been undertaken at the site. However, the site is anticipated to be affected by seasonal shallow groundwater and so a soakaway drainage solution is unlikely to be a viable option. Instead an attenuated (tank/pond) solution or a positive drainage solution should be considered instead.

Excavations

Ease of Excavation

- 9.23 Conventional plant is expected to be suitable for excavations at the site although a breaker will be required to removed obstructions within the Silverhill Farm area.

Stability of Excavation

- 9.24 Excavations displayed generally average to poor stability during the site investigation once granular horizons were encountered with running sands a potential issues that will need to be considered during development. The issues will be significantly reduced if works are undertaken during dryer periods such as summer months. The use of temporary support, such as trench boxes may need to be considered.
- 9.25 Excavation may also become unstable if left open for any significant periods. Where personnel entry is required for inspection; excavations should be sufficiently enlarged and an assessment of safe temporary angles should be made. Alternatively, temporary shoring should be provided.

Legislation on Personnel Entry to Excavations

- 9.26 It is recommended that no excavations should be entered without appropriate support and a full risk assessment should be completed prior to entry. Mitigation measures to protect from accumulating ground gases should be implemented.

Groundwater

- 9.27 Groundwater is likely to be a seasonal issue at the site with excavations likely to require dewatering during late autumn through to spring. However, this be highly dependent upon precipitation totals in the local areas.
- 9.28 If development, and particularly excavations are undertaken during wetter periods then groundwater level control, such as dewatering at well points or slit trenches may need to be incorporated.
- 9.29 Standard pumping equipment is likely to be suitable for the above although may need to be run for long periods of time. The local water board should be consulted to assess whether a temporary discharge consent is required if discharging to the local drainage network is considered. The groundwater should be desilted prior to discharge but contamination of the groundwater is not considered to be an issue.

Buried Obstructions

- 9.30 Buried concrete obstructions are likely to be encountered in the Silverhill Farm area of the site. Any excavations to remove obstructions that are taken below the formation level should be backfilled with engineered fill.

Chemical Attack on Buried Concrete

- 9.31 Water soluble sulphate concentrations in soils varied from 11 mg/l to 2200 mg/l with soil pH values ranging from 6.5 to 8.6. Total sulphur concentration ranged from 0.00018% to 0.0047%. No groundwater testing has been undertaken.
- 9.32 In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils at the site would therefore be classified as Design Sulphate Class DS-3 and ACEC Class AC-3 for soils and groundwater, when considering the most appropriate type of concrete to be used at the site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).

Earthworks

- 9.33 Due to the very soft to soft cohesive nature of the sub surface an earthworks exercise will be required to prepare the surface for the machinery required to install foundations. Based on the materials encountered, the materials are likely to be variable as indicated by the Particle Size Results summarised in **Table 9-1** below.

Table 9-1: Particle Size Distribution Results Summary

Location	Depth	Geology	Cobble Content	Gravel Content	Sand Content	Silt/Clay Content	Series 600 Earthworks Class (Table 6/2)
BH01	12.5	Hummocky Glacial Deposits	0	0.6	49.6	49.8	2A&2B

Location	Depth	Geology	Cobble Content	Gravel Content	Sand Content	Silt/Clay Content	Series 600 Earthworks Class (Table 6/2)
BH02	10.5	Hummocky Glacial Deposits	0	5.3	63.6	31.2	2A&2B
BH02	14	Hummocky Glacial Deposits	0	1.7	85.9	12.4	1A
BH03	3.9	Hummocky Glacial Deposits	0	55.6	30.9	13.5	1A
BH03	9	Hummocky Glacial Deposits	0	0.8	89.4	9.8	1A
TP03	0.6	Hummocky Glacial Deposits	0	14.2	52	33.8	2A&2B
TP07	2.2	Hummocky Glacial Deposits	0	20.9	66.8	12.3	1A
TP20	1.9	Hummocky Glacial Deposits	0	47.7	31.6	20.7	2C

- 9.34 Materials are likely to be wet of optimum as indicated by the optimum moisture contents results summarised in **Table 9-2** below. However, it should be noted that the samples are from near surface deposits and the SI has been undertaken during a very wet Autumn. BWBs experience on the wider site area has indicated that high volumes of lime will be required to prepare the surface during wet weather and/or winter working.

Table 9-2: Optimum Moisture Content Results

Location	Geology	Depth	Max Dry Density	Optimum Moisture Content	Moisture Content	Wet/Dry of Optimum
TP01	Hummocky Glacial Deposits	2	1.91	9.1	13.5	Wet
TP03	Hummocky Glacial Deposits	0.6	1.81	12	18.4	Wet
TP07	Hummocky Glacial Deposits	2.2	1.85	9	13.1	Wet
BH01	Hummocky Glacial Deposits	1.2	1.83	9.4	19.7	Wet
BH02	Hummocky Glacial Deposits	0.5	1.79	10	19.7	Wet

- 9.35 The suitability of earthworks materials has been assessed based on the testing carried out as part of this investigation. The materials encountered on site may vary from those analysed; furthermore, inclement weather or winter working may result in materials being unsuitable for incorporation within the works without modification by lime, cement or other methods. In particular, cohesive soils are very susceptible to 'wet weather working' and we strongly recommend that consideration should be given to lime and/or cement stabilisation of these materials if the earthworks are undertaken during inclement weather or the winter period.

- 9.36 Stockpiled materials often deteriorate due to water infiltration and they may become unsuitable for incorporation in the works; further testing and re-assessment should be made prior to the finalisation and implementation of the earthworks design.
- 9.37 Minor earthworks are likely to be necessary to enable either ground improvement and/or a piled foundation solution. Furthermore, they could potentially act as a means to facilitate a ground bearing floor slab for a commercial development. An End Product Earthworks Specification will likely be required for the development.

10. GROUND GAS ASSESSMENT

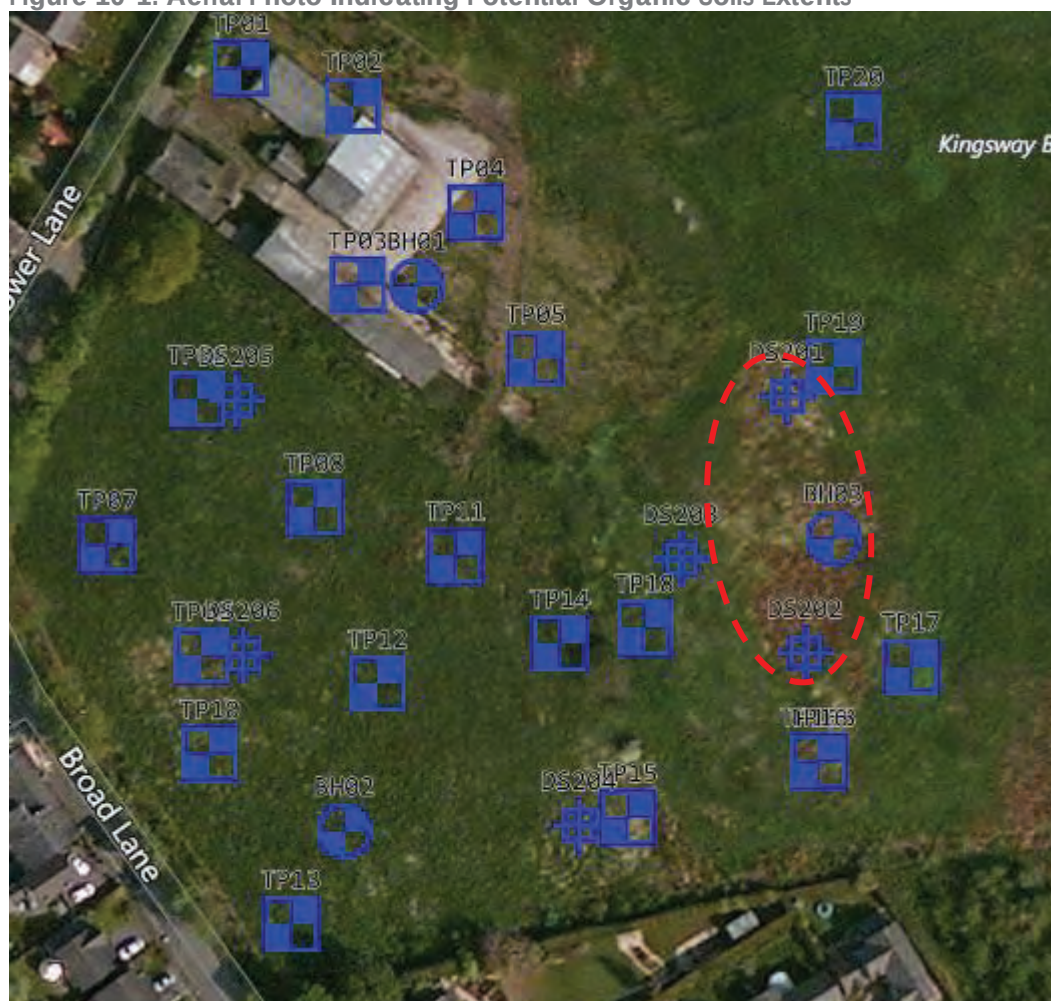
Introduction

- 10.1 Ground gas assessment has been undertaken to assess the risks associated with ground gases to new buildings and their occupants. The results obtained have been assessed in accordance with CIRIA C665 *Assessing risks posed by hazardous ground gases to buildings* (2007), and with reference to BS 8485:2015(+A1:2019) *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*.
- 10.2 Based on the findings of the desk study and the ground investigation undertaken, the following potential sources of hazardous ground gas have been identified:
- Localised Made Ground at Silver Hill Farm; and
 - Shallow natural deposits with high organic content.

Methodology

- 10.3 The assessment of potential ground gas generation is based on the observation of trends and changes in gas evolution by the direct measurement of ground gases from gas wells. The works included measurement of methane, carbon dioxide, oxygen, hydrogen sulphide, carbon monoxide, gas flows and barometric pressure. A PID survey was undertaken to measure volatile organic compounds (VOCs) within the borehole response zones.
- 10.4 The boreholes were installed with ground gas monitoring wells with response zones targeting the Made Ground at BH01 and the organic shallow natural deposits at BH02 and BH03. Exploratory hole records showing monitoring well construction are presented within **Appendix 7**.
- 10.5 Locations BH01, BH02 and BH03 were monitored during the first three visits, which recorded high levels of gas (notably methane) at BH03. It was hypothesised that the elevated gas concentrations were due to highly organic shallow deposits in the boreholes vicinity, with methane prevailing due to water logging promoting anaerobic conditions. Therefore, an additional six monitoring wells were installed across the site. DS201, DS202 and DS203 were installed close to BH03 to assess the local impact with DS204, DS205 and DS206 positioned across the rest of the site to assess the hypothesis that the gas impact is localised. Bing™ Mapping aerial imagery presented overleaf as **Figure 10-1** indicates brown surface vegetation in the east of the site. Based on BWBs experience across the site, such areas are indicative of highly organic deposits and the likely source of the ground gas recorded. While light brown patches are indicated elsewhere, they are smaller and lighter in colour with exploratory holes in these areas identifying significantly less organic deposits.

Figure 10-1: Aerial Photo Indicating Potential Organic Soils Extents



Results

Ground Gas Concentrations and Flow

- 10.6 The minimum and maximum steady state concentrations recorded for borehole flow, carbon dioxide and methane are summarised below in **Table 10-1**. The preliminary ground gas monitoring results are presented in **Appendix 9**.

Table 10-1: Summary of Recorded Ground Gas Results

Borehole ID	Targeted Geology	Steady Flow (l/hr)		Carbon Dioxide (%v/v)		Methane (%v/v)	
		min.	max.	min.	max.	min.	max.
BH01	MG/HGD	<0.1	<0.1	<0.1	0.9	<0.1	<0.1
BH02	HGD	<0.1	<0.1	0.9	5.0	<0.1	<0.1
BH03	HGD	-3.9	8.4	0.6	9.8	4.0	66.5
DS201	HGD	<0.1	<0.1	1.0	5.0	<0.1	<0.1
DS202	HGD	<0.1	<0.1	6.9	13.2	56.6	73.5

Borehole ID	Targeted Geology	Steady Flow (l/hr)		Carbon Dioxide (%v/v)		Methane (%v/v)	
		min.	max.	min.	max.	min.	max.
DS203	HGD	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
DS204	HGD	<0.1	<0.1	0.1	0.3	<0.1	<0.1
DS205	HGD	<0.1	<0.1	0.3	0.5	<0.1	<0.1
DS206	HGD	<0.1	<0.1	<0.1	0.1	<0.1	<0.1

- 10.7 Hydrogen sulphide and carbon monoxide concentrations were not recorded above the limit of detection of the equipment (1ppm) during monitoring visits except some slightly elevated carbon monoxide concentrations during the first visit. They were not present during subsequent visits suggesting the low level recorded may be associated with the drilling process.
- 10.8 Eight soil samples from the dynamic sample holes were tested for Organic Matter. Concentrations were recorded between 5.4% and 0.9% with the highest concentrations all recorded at locations DS201 and DS202 with concentrations between 3.9 and 5.4%. Elsewhere, the maximum concentrations was 1.9% at DS204. The results correlate with the higher levels of gas recorded providing further evidence that the high levels of gas being generated are localised in the eastern area of the site.

Atmospheric Pressure

- 10.9 The atmospheric pressures were recorded as follows:
- Round 1 – 983mB during the site visit rising from 982mB over the preceding 12 hours;
 - Round 2 – 1001mB during the site visit static at 1001mB over the preceding 12 hours;
 - Round 3 – 1008mB during the site visit static at 1008mB over the preceding 12 hours;
 - Round 4 – 980mB during the site visit falling from 983mB over the preceding 12 hours;
 - Round 5 – 1005mB during the site visit falling from 1015mB over the preceding 12 hours; and
 - Round 6 – 977mB during the site visit falling from 979mB over the preceding 12 hours.
- 10.10 On this basis, the monitoring is considered likely to have captured the worst-case gassing scenario at the site as generally, ground gas emissions tend to increase when atmospheric pressure falls rapidly and at low pressures.

PID Readings

- 10.11 Low PID readings were recorded during the monitoring between 0.1ppm (the limit of detection of the equipment) and 2.1ppm (BH02). A source of the PID VOC is not immediately obvious, however, the low concentrations are not considered to represent a significant risk to human health.

Risk Assessment

- 10.12 CIRIA C665 presents current best practice on the assessment of ground gases for commercial and residential buildings (with the exception of low-rise traditional housing). For low rise traditional housing with a clear vented underfloor void NHBC *Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present* (2007) has been referred to.
- 10.13 The above guidance presents a risk-based approach to calculate gas screening values (GSVs), calculated as follows:

$$\text{Gas screening value (l/hr)} = \frac{\text{gas concentration (\%)} \times \text{measured borehole flow rate (l/h)}}{100}$$

- 10.14 A Maximum GSV of 5.586l/hr for methane was calculated for the site, giving a classification of CS4/Red Site at BH03. A summary of the results is provided in **Table 10-2** below:

Table 10-2: Borehole Specific Gas Classification

Borehole Ref.	GSV (l/hr)	Borehole Specific Classification	
		CS	NHBC
BH01	0.001	1	Green
BH02	0.005	1 – Consider Increase to CS2	Amber 1
03	5.586	4	Red
DS201	0.005	1 – Consider Increase to CS2	Amber 1
DS202	0.074	2	Red
DS203	0.000	1	Green
DS204	0.000	1	Green
DS205	0.001	1	Green
DS206	0.000	1	Green

- 10.15 The potential source of the elevated ground gas is likely to be the soils having a high organic soil content, as recorded at BH03. Organic odours were also noted at TP05, TP08 and TP15.
- 10.16 The NHBC guidance states that standard residential housing is not normally acceptable with a Red classification without further ground gas risk assessment and/or possible remedial mitigation measures to reduce/remove the source of the ground gases.

Recommendations

- 10.17 If development is to occur in the vicinity of BH03 and DS202 then the organic material should be excavated (anticipated to be between 3 and 4m). This material can be disposed of at landfill or reused on site within an are of Public Open Space. The material

should then be replaced with a suitable imported clean material. Given there is a propensity for organic material to be present at the site and potential for lateral gas migration (such as along service runs) it is recommended that CS2 / Amber 1 gas protection is installed across the site.

11. HUMAN HEALTH RISK ASSESSMENT

11.1 Soil contaminant data have been compared against published assessment criteria, which includes reference to the LQM/CIEH S4ULs for Human Health Risk Assessment Copyright Land Quality Management Limited reproduced with permission; publication number S4UL3271. Where no relevant published assessment criteria are available, such as for cyanide, data have been compared against Generic Site Assessment Criteria (GSAC) developed by BWB using the CLEA model 1.07.

11.2 Details of the derivation of the GSACs are presented in **Appendix 12**, along with the human health soils assessment.

Sources

11.3 Limited sources of contamination have been identified on the site with limited areas of Made Ground present at Silver Hill Farm, as well as sources associated with the farm, such as farming machinery.

Receptors and Pathways

11.4 It is likely that the site is to be developed for residential end use for which the key receptor is considered to be a female child in the first six years of life and assessment criteria for residential land use with homegrown produce have been adopted.

11.5 Exposure pathways considered in this assessment are presented in **Table 11-1**.

Table 11-1: Residential Exposure Pathways

Source:	Shallow Soils			Deep Soils
Pathway	Residential housing with private gardens	Residential housing with communal landscaped areas	Residential housing with hard standing areas	Residential housing
Ingestion of Soil	✓	✓	✗	✗
Ingestion of site derived household dust	✓	✓	✗	✗
Ingestion of contaminated vegetables	✓	✗	✗	✗
Ingestion of soil attached to vegetables	✓	✗	✗	✗
Dermal contact with Soil	✓	✓	✗	✗
Dermal contact with site derived household dust	✓	✓	✗	✗
Inhalation of fugitive soil dust	✓	✓	✗	✗
Inhalation of fugitive site derived household dust	✓	✓	✗	✗
Inhalation of vapours outside	✓	✓	✓	✓

Source:	Shallow Soils			Deep Soils
Pathway	Residential housing with private gardens	Residential housing with communal landscaped areas	Residential housing with hard standing areas	Residential housing
Inhalation of vapours inside	✓	✓	✓	✓

Results

- 11.6 Marginally elevated hydrocarbon concentrations and PAH compounds have been recorded in the Made Ground within the Silver Hill Farm area of the site. All other concentrations were below their respective GSACs as presented in **Appendix 12**. A table presenting a summary of the exceedances identified in the results is presented as **Table 11-2**.

Table 11-2: Summary of Assessment Criteria Exceedances

Contaminant	No of Samples	Range of contamination	Generic Screening level (mg/kg)	No of Exceedances
TPH (>EC12-16) aromatic	3	4.6-220	140	1
TPH (>EC16-21) aromatic	3	29-670	260	1
Total TPH	8	<10-2000	500	2
Naphthalene	8	<0.05-34	2.3	1
Benzo(a)anthracene	8	<0.05-33	7.2	1
Chrysene	8	<0.05-27	15	1
Benzo(b)fluoranthene	8	<0.05-26	2.6	2
Benzo(a)pyrene	8	<0.05-26	2.2	2
Dibenzo(a,h)anthracene	8	<0.05-4.1	0.24	4

- 11.7 Asbestos was detected in one of the six samples tested, as summarised in **Table 11-3**.

Table 11-3: Asbestos Results

Location	Depth (m)	Type	Total Percentage of Asbestos in Sample
TP04	0.5	Chrysotile – Loose Fibrous Debris	0.003

Summary

- 11.8 Asbestos and marginally elevated TPH and PAH have been recorded in the Made Ground in the vicinity of the former farm buildings which are indicated to represent a risk to human health. If the Made Ground is to remain on site as part of the proposed development, a clean capping layer and marker membrane is required in garden areas to sever the pathway to future site users.

- 11.9 Alternatively, removal of the localised Made Ground from the site would remove the source and the requirement for a capping layer/ marker membrane in gardens.

12. CONTROLLED WATERS ASSESSMENT

Receptors

12.1 The following controlled waters receptors have been identified, which require assessment:

- Secondary A Aquifer in superficial deposits; and
- Unnamed Tributaries 40m north of site.

Pathways

12.2 Controlled water risk assessment has been undertaken through assessment of leachable concentrations of contaminants in soil referring to exposure pathways considered and referencing **Table 12-1**.

Table 12-1: Controlled Water Exposure Pathways

Controlled Waters Exposure Pathway	Receptor
Leaching of soil contamination into recharge infiltration	✓
Vertical migration of impacted pore water through unsaturated zone into underlying aquifer	✓
Horizontal migration of groundwater through aquifer to off-site receptors	✓

Assessment

- 12.3 No groundwater, surface water or leachate testing was undertaken as part of this assessment.
- 12.4 Given the lack of contaminants recorded within the superficial deposits and the predominantly cohesive nature of the superficial deposits, it is considered highly unlikely that a pathway exists from the localised Made Ground to the wider Secondary A Aquifer.
- 12.5 Similarly, given the variable presence of granular strata in the Hummocky Glacial Deposits and the lack of a significant groundwater flow across the site, it is unlikely that there is a clear pathway towards the local unnamed tributary.
- 12.6 It is therefore considered that the site poses a low risk to controlled waters. Furthermore, the development of the site will reduce the rainfall infiltration at the site, and inhibit leachate migration, thereby further reducing the risk to controlled waters.

13. UPDATED ENVIRONMENTAL RISK ASESMENT

- 13.1 The preliminary risk assessment presented in **Section 6** has been updated following the completion of the ground investigation and assessment of obtained data. The updated conceptual site model is presented as **Table 13-1**.

Table 13-1: Updated Conceptual Site Model

Source	Pathway	Receptor	Con	Prob	Risk	Potential Mitigation/Investigation Requirements
Asbestos and marginally elevated TPH and PAH in localised Made Ground	Dermal contact, ingestion and inhalation of particulates.	Future site users (residential)	Md	Lw	M/L	Where Made Ground is present in proposed garden areas around the former farm buildings, the provision of a clean capping layer with appropriate demarcation at depth would sever the pathway to impacted soils.
		Intrusive maintenance workers	Md	Lw	M/L	The risk to intrusive maintenance workers could be mitigated through the adoption of appropriate PPE.
	Direct contact.	Water utility pipes	Md	Lw	M/L	Organic compounds in the shallow soils could taint the water supply. A ground investigation and subsequent laboratory analysis should be undertaken to inform the design of new services.
Elevated carbon dioxide and methane concentrations	Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane).	Future site users (residential)	Sv	Li	H	If development is to occur in the vicinity of BH03 and DS202 then the organic material generating methane gas should be excavated. This material can be disposed of at landfill or reused on site within an area of Public Open Space. The material should then be replaced with a suitable imported clean material. Given there is a propensity for organic material to be present at the site and potential for lateral gas migration (such as along service runs) it is recommended that CS2 / Amber 1 gas protection is installed across the site.
Elevated sulphate concentrations in the natural soils	Direct contact.	Buried structures/ foundations.	Md	Lw	M/L	Sulphates and low pH in the ground could accelerate the degradation of buried concrete structures (e.g. foundations). Design Sulphate Class DS-3 and ACEC Class AC-3 for soils and groundwater, when considering the most appropriate type of concrete to be used at the site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).
VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor, Hi = High, Li = Likely, Lw = Low Likelihood, Ul = Unlikely						

14. ENVIRONMENTAL LIABILITY ASSESSMENT & DEVELOPMENT IMPLICATIONS

Statutory Liability

- 14.1 The contaminated land regime has implications for those who cause or knowingly permit land to be contaminated, or who own or occupy land that is contaminated. Contaminated land is defined in Section 78A(2) of Part IIA of the Environmental Protection Act 1990 as:

“Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

- i. Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- ii. Significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused.”*

- 14.2 Harm is defined in Section 78(4) of the Environmental Protection Act 1990 as:

“Harm to the health of living organisms or other interference with ecological systems of which they form part and, in the case of man, includes harm to his property.”

- 14.3 Once an area of land has been identified as contaminated land, appropriate persons will be identified as being responsible for the cost of cleaning up the land by the enforcing authority. The appropriate person will be liable for all or part of the remediation of the land. Two classes of appropriate person have been identified:

- Class A appropriate persons are those who cause or knowingly permit the pollutants to be in, on or under the land.
- Class B appropriate persons are the owners(s) or occupier(s) of the land.

- 14.4 Where no Class A appropriate persons can be identified, then Class B appropriate persons may become liable.

- 14.5 Based on the information available regarding the site, the potential for Statutory Authority action based on “pollution of controlled water” or “significant harm” as defined by Part IIA of the Environmental Protection Act 1990 is considered to be LOW.

Third Party Liability

- 14.6 Based on the information contained in this report, it is the opinion of BWB that the potential for legal action by surrounding landowners, based on the potential for contamination to migrate off-site, is considered to be LOW.

15. WASTE MANAGEMENT

Waste Classification

- 15.1 Soil samples have been characterised against hazardous waste criteria using Hazwasteonline. The results of the waste classification are presented in **Appendix 14**. The assessment indicates that the soils analysed are likely to be classified as non-hazardous except for Made Ground around the farm which is likely to be hazardous. The waste classification assessment only applies to those soils that have been tested. If other soils are to be disposed of off-site then further analysis may be required.
- 15.2 Asbestos has been found at the site but only at one location at a concentration at 0.003% and no visible asbestos has been noted. The presence of visible asbestos containing materials in waste or at concentrations exceeding 0.1% by weight will classify the waste as mixed and require disposal as hazardous waste irrespective of the chemical properties of the waste.
- 15.3 Should any soils require disposal off site, an assessment of waste classification of the soils for disposal should be made by a competent person. Further chemical analysis may be required to fully characterise waste soils for disposal to landfill or re-use off site. WAC analysis may be required for disposal of soils as inert or hazardous.

16. CONCLUSION AND RECOMMENDATIONS

Conclusions

- 16.1 The site comprised a derelict farm in the north west area (Silverhill Farm) with grasslands across the rest of the site. No significant changes have occurred throughout the mapped history of the site.
- 16.2 The proposed development at this stage is likely to comprise either a small commercial/light industrial development or residential properties with an estimated 78 units predominantly of 3 or 4 bedrooms including gardens, landscaping and associated infrastructure.
- 16.3 Ground conditions encountered during the intrusive ground investigation comprised very soft organic Topsoil over predominantly cohesive Hummocky Glacial Deposits (a Secondary A Aquifer). Made Ground was encountered within 6 out of 24 locations, generally within the north west of the site where Silver Hill Farm is located, with thicknesses ranging between 0.5m and >1.30m. The Made Ground variable in composition but commonly included brick and concrete, including some boulders and occasionally plastic and wood.
- 16.4 During subsequent monitoring, groundwater was recorded between 0.59m bgl and 4.22m bgl. Based on the observed geology, variable groundwater strike depths, and variable resting groundwater levels observed during the monitoring, it is considered that there is not a significant and consistent groundwater flow regime at the site. Groundwater is likely to accumulate and flow within granular pockets in a variety of directions.

Environmental

- 16.5 Ground gas monitoring results have indicated limited elevated carbon dioxide concentrations at locations in the western half of the site based on BS8485:2015 methodology. However, significantly elevated carbon dioxide and notably, methane concentrations as well as positive flows which are commensurate with a CS4 /NHBC Red have been identified in a small area in the east of the site.
- 16.6 Asbestos and marginally elevated TPH and PAH have been recorded in the Made Ground in the vicinity of the former farm buildings which are indicated to represent a risk to human health. If the Made Ground is to remain on site as part of the proposed development, a clean capping layer and marker membrane is required in garden areas to sever the pathway to future site users. Alternatively, removal of the localised Made Ground from the site would remove the source and the requirement for a capping layer/ marker membrane in gardens. No significant risk to controlled waters has been identified.
- 16.7 Made Ground around Silverhill Farm may be classified as hazardous for waste disposal purposes. Otherwise, materials are likely to be classified as Non-Hazardous.

- 16.8 Barrier water supply pipes are likely to be required in the Silverhill Farm area of the site. Elsewhere, standard piping is likely to be suitable.

Geotechnical

- 16.9 For residential development, a vibro ground improvement option, such as stone columns, is unlikely to be suitable. Controlled Modulus Columns (CMCs) may be a viable option but may not provide a significant cost saving over driven piles, which is likely to present the most economical solution at the site. However, noise and vibrational effects on nearby developments associated with their installation need to be considered before adopting this solution. In addition, the possibility of relic foundations/slabs within the Made Ground cannot be discounted, as they have been observed as part of this investigation in the Silverhill Farm area.
- 16.10 A suspended slab would be required in the Silverhill Farm area of the site due to NHBC requirements where Made Ground thicknesses exceed 600mm. Outside of this area it is possible that a ground bearing floor slab could be used for residential properties for loads of up to 10kPa, with less than 25mm settlement, subject to removal of topsoil and construction on a proof rolled granular layer.
- 16.11 For a small commercial / light industrial development, a vibro solution may be a viable option following improvement of the surface. Ground improvement and/or reengineering of the near surface soils may be viable which would facilitate a ground bearing slab. Treatment of the top 2.0m of soils may facilitate a ground bearing slab of up to 30kPa. Otherwise, a fully suspended slab would be required with loads transferred to pile caps. Consultation with a specialist ground improvement contractor should be undertaken to assess whether this is a viable option.
- 16.12 An earthworks exercise will be required to strip topsoil and prepare the surface for plant movement and foundation installation. Based on BWBs experience of similar ground conditions across the wider business park, significant quantities of lime are likely to be required to reduce the moisture content of the soils and improve the ground, particularly during inclement and/or winter months.
- 16.13 Groundwater is likely to be a seasonal issue with excavations likely to require dewatering during late autumn through to spring. However, this will be highly dependent upon precipitation totals in the local areas. If excavations are undertaken during wetter periods then groundwater level control, such as dewatering at well points or slit trenches may need to be incorporated.

Design Sulphate Class DS-3 and ACEC Class AC-3 for soils and groundwater, when considering the most appropriate type of concrete to be used at the site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).

Recommendations

- 16.14 If development is to occur in the vicinity of BH03 and DS202 then the organic material generating elevated methane and carbon dioxide concentrations should be excavated and removed. This material can be disposed of at landfill or reused on site

within an area of Public Open Space. The material should then be replaced with a suitable imported clean material. Given there is a propensity for organic material to be present at the site and potential for lateral gas migration (such as along service runs) it is recommended that CS2 / Amber 1 gas protection is installed across the site.

- 16.15 A remediation strategy will be required to inform mitigation requirements including gas protection and clean soil cover as well as setting out contingency arrangements should previously unforeseen contamination be encountered.
- 16.16 For a piling solution, a working platform should be designed in accordance with BRE470. A specialist piling / ground improvement contractor should be consulted to further assess the most economical and suitable piling solution.

17. REFERENCES

1. British Standards Institution, (BSI), BS 8485:2015, Code of Practice for the characterization and remediation from ground gas in affected developments
2. British Standards Institution, (BSI), BS 8576:2013, Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)
3. British Standards Institution, (BSI), BS 10175:2011+A2:2017, Investigation of Contaminated Sites – Code of Practice
4. British Standards Institution, (BSI), BS5930:2015) Code of practice for ground investigations
5. British Standards Institution, (BSI), BS EN 1997-1:2004 Incorporating corrigendum February 2009, Eurocode 7 – Geotechnical Design – Part 1: General rules.
6. British Standards Institution, (BSI), BS EN 1997-2:2007 Incorporating corrigendum June 2010, Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and testing.
7. Building Research Establishment Special Digest 1 *Third Edition*. Concrete in Aggressive Ground (2005)
8. Building Research Establishment (BRE) BR211, Radon; Guidance on Protective Measures for New Buildings (2015)
9. Construction Industry Research and Information Association (CIRIA), Report 132, A Guide to Safe working on Contaminated Sites (1996).
10. Construction Industry Research and Information Association (CIRIA). 2001, C522 Contaminated land risk assessment, A guide to good practice.
11. Construction Industry Research and Information Association (CIRIA). 2007, Report C665, Assessing Risk Posed by on Hazardous Ground Gases to Buildings
12. Department for Communities and Local Government (DCLG), 2012, National Planning Policy Framework.
13. Department for Environment Food and Rural Affairs (DEFRA), 2012, Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance.
14. Environment Agency report CLR11 'Model Procedures for the Management of Land Contamination'.
15. Environment Agency 2008, Updated technical background to the CLEA model Science Report – SC050021/SR3
16. Environment Agency 2008, Human health toxicological assessment of contaminants in soil Science Report – SC050021/SR2
17. Environment Agency 2009, CLEA Software (Version 1.05) Handbook Better Regulation Science Programme Science report: SC050021/SR4

18. Environment Agency 2008, A review of body weight and height data used within the Contaminated Land Exposure Assessment model (CLEA) Project SC050021/ Technical Review 1
19. Environment Agency, 2006, Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination
20. Health and Safety Executive (HSE) 'Protection of workers and the general public during the Development of Contaminated Land (1991).
21. NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66: 2008.

DRAWINGS

Drawing 1: Site Layout Plan

Project Id: NTE2554 Title: Site Plan
Project Title: Plot W, Kingsway Business Park, Rochdale Scale: 1:1500
Location: Rochdale Engineer: JA
Client: Wilson Bowden Developments Ltd Contractor:

Legend Key

- Locations By Type - Empty
- ⊙ Locations By Type - CP
- ⊕ Locations By Type - DP
- ⊞ Locations By Type - TP



APPENDICES

Appendix 1: Proposed Site Layout Plan

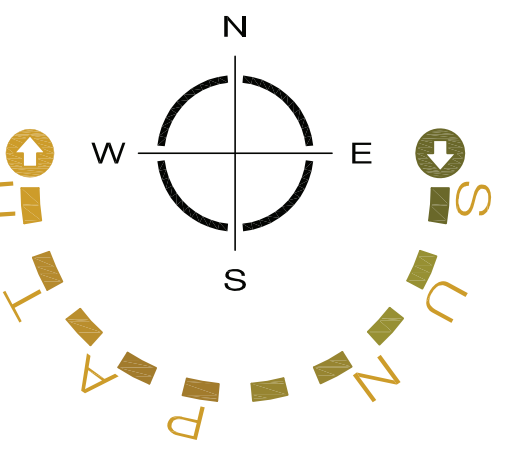
KEY TO LAND USES

BUSINESS USES

- B1(a) Office
- B1/ B2/ B8
- Car Showrooms

ANCILLARY USES

- Residential
- Leisure
- Hotel
- Mixed Development including Retail in Use Classes A1-A5, Leisure, Hotel, Residential & B1 Uses
- Local Services
- Small Scale Uses Appropriate to the Setting of the Listed Building
- New Buffer Landscaping



For Planning



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PROJECT
KINGSWAY BUSINESS PARK
ROCHDALE

TITLE
MASTERPLAN
PARAMETERS PLAN

SCALE
1:2500 @ A0

DRAWN
SF

DRAWING NO
2013-233/102

FILE PATH
T:\2013\2013-233\CAD\05-Autocad\Drawn\102

DATE
13/03/14

REVIEWED

REVISION
A

PARAMETERS PLAN

KINGSWAY PLOT W
SKETCH 04



KINGSWAY PLOT W - SK03

House Type	Accommodation	Floor Area M²	Floor Area Ft²	Total Units	Total Ft²
APARTMENT					
ALVERTON	2B/4P	63.8	687	4	2748
3 BED					
MAIDSTONE (End)	3B/5P	77.1	830	30	24900
MAIDSTONE (Mid)	3B/5P	77.1	830	12	9960
NORBURY (End)	3B/6P	102.9	1107	10	11070
NORBURY (Mid)	3B/6P	102.9	1107	5	5535
MORESBY (End)	3B/5P	79.4	854	8	6832
4 BED					
KINGSLEY	4B/6P	100.3	1080	5	5400
WINDERMERE	4B/8P	99.7	1073	2	2146
ALDERNEY	4B/7P	113.8	1225	2	2450
				78	71041
AFFORDABLE RENT / INTERMEDIATE					
				0	0
				78	71041

Parcel Area	(Acres)	4.95
Parcel Area	(Hectares)	2.00
Total POS, Undevelopable & SSR	(Acres)	0.60
Developable	(Acres)	4.35
Developable	(Hectares)	1.76
Coverage	(Sq Ft / Acre)	16331.26
Density	(Units/Hectare)	44.31
Av. Unit Size	(Sq Ft)	910.78



Key:

Rev	Amendment	Drawn/Date:

Barratt/David Wilson Homes
North West
303 Bridgewater Place
2nd Floor
Warrington
Cheshire
WA3 6XF
TEL: 01925 846600

Project
PLOT - W
KINGSWAY
ROCHDALE

Drawing Title
SKETCH 04

Status
For Comment

Scale
1:500 @ A1

Date
05/18

Drawn By
CW

Drawing Ref
SK04

Revision
/

Appendix 2: Site Photographs



Photo 1—View across main site area



Photo 2—View across main site area



Photo 3—View across main site area



Photo 4—View of derelict Silverhill Farm buildings



Photo 5—View of derelict Silverhill Farm buildings

Appendix 3: Groundsure Report



BWB Consulting Limited

5th Floor, Waterfront House, Station Street,
Nottingham, NG2 3DQ

Groundsure
Reference:

HMD-214-6443776

Your Reference: POR028892

Report Date 5 Nov 2019

Report Delivery Method: Email - pdf

Enviro Insight

Address: Plot W Kingsway Business Park, Lower Lane, ROCHDALE, OL16 4PR

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,

A handwritten signature in black ink, appearing to be "Andy O.", written in a cursive style.

Managing Director
Groundsure Limited

Enc.
Groundsure Enviroinsight

Address: Plot W Kingsway Business Park, Lower Lane, ROCHDALE, OL16 4PR
Date: 5 Nov 2019
Reference: HMD-214-6443776
Client: BWB Consulting Limited

NW

N

NE

W

E



SW

S

SE

Aerial Photograph Capture date: 26-Mar-2012
Grid Reference: 391216,411245
Site Size: 2.2613ha

Report Reference: HMD-214-6443776
Client Reference: POR028892

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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	3	1	11
1.2 Additional Information – Historical Tank Database	4	0	1	14
1.3 Additional Information – Historical Energy Features Database	0	0	4	13
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	0	0
1.6 Historical military sites	0	0	0	0
1.7 Potentially Infilled Land	1	0	0	10
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	0
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	1
2.2 Records of COMAH and NIHHS sites	0	0	0	1
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	0	0	0	2
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	0	0	1	2
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	0	0	0	2
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	0

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	0	0	4	Not searched
4.2 Records of Petrol and Fuel Sites	0	0	0	0
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 Records of Artificial Ground and Made Ground present beneath the study site	None identified
5.2 Records of Superficial Ground and Drift Geology present beneath the study site	Identified
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 Records of Strata Classification in the Superficial Geology within 500m of the study site	Identified					
6.2 Records of Strata Classification in the Bedrock Geology within 500m of the study site	Identified					
	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	2	5	0	2
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	15
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	1	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 Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site	No	No	No	No	Yes	No
6.10 Ordnance Survey MasterMap Water Network entries within 500m of the site	0	4	14	76	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 Environment Agency Zone 2 floodplains within 250m of the study site	None identified					
7.2 Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	None identified					
7.3 Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site	Very Low					
7.4 Flood Defences within 250m of the study site	None identified					
7.5 Areas benefiting from Flood Defences within 250m of the study site	None identified					
7.6 Areas used for Flood Storage within 250m of the study site	None identified					
7.7 Maximum BGS Groundwater Flooding susceptibility within 50m of the study site	Potential at Surface					
7.8 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	3
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	4
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	0	0
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
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	0	0	0	0	0	0
8.14 Records of Green Belt land	0	0	0	1	1	7

Section 9: Natural Hazards	
9.1 Maximum risk of natural ground subsidence	Low
9.1.1 Maximum Shrink-Swell hazard rating identified on the study site	Low
9.1.2 Maximum Landslides hazard rating identified on the study site	Very Low
9.1.3 Maximum Soluble Rocks hazard rating identified on the study site	Negligible
9.1.4 Maximum Compressible Ground hazard rating identified on the study site	Negligible
9.1.5 Maximum Collapsible Rocks hazard rating identified on the study site	Very Low
9.1.6 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 site 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 Coal mining areas within 75m of the study site	Identified
10.2 Non-Coal Mining areas within 50m of the study site boundary	None identified
10.3 Brine affected areas within 75m of the study site	None identified

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 licences, 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.

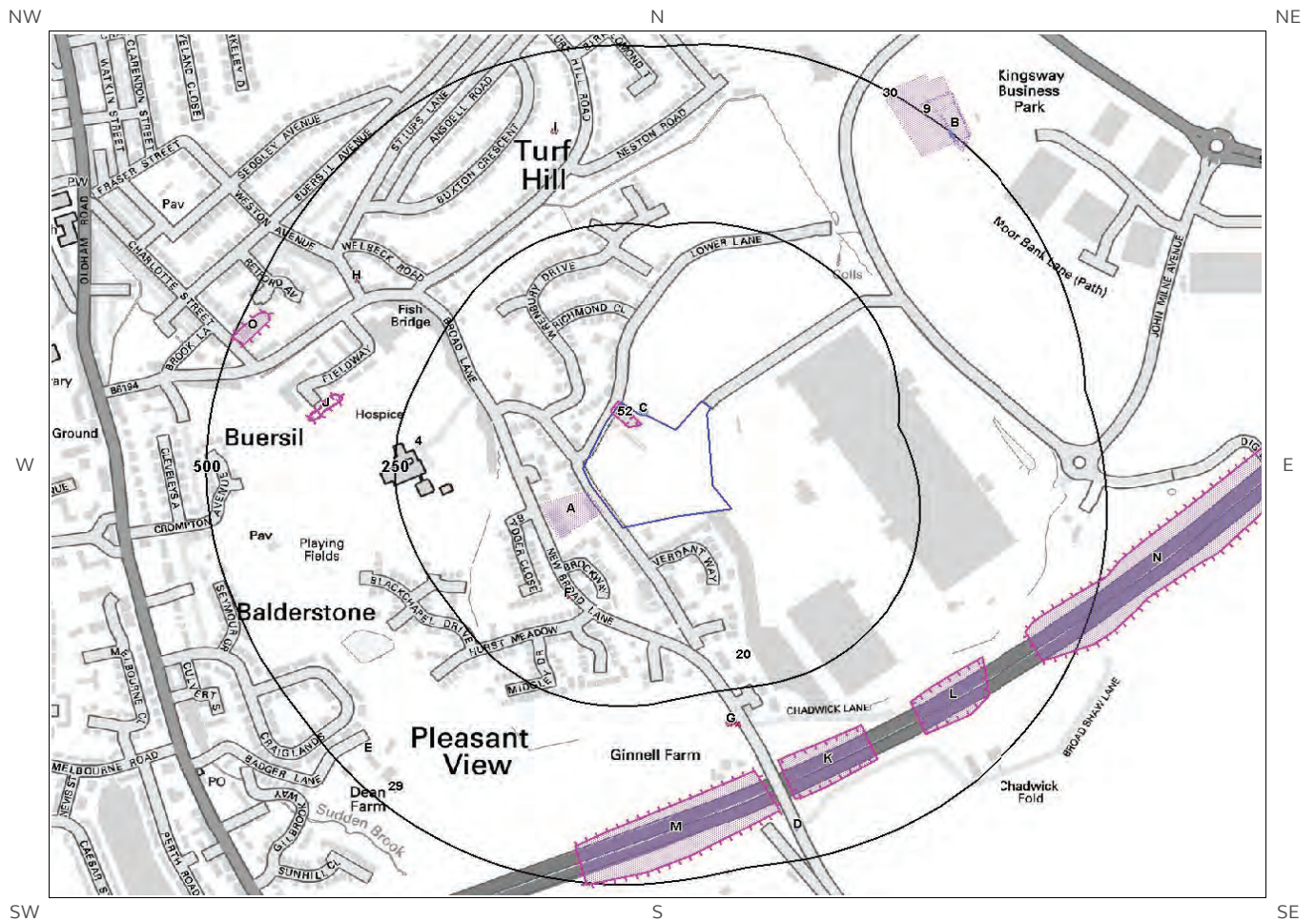
Note: Maps

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).

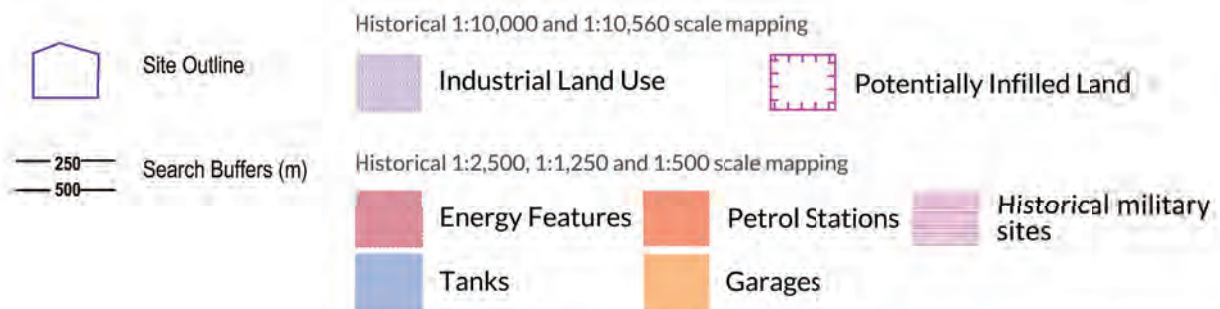
Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

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 Land Use



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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: 15

ID	Distance [m]	Direction	Use	Date
1A	8	SW	Unspecified Works	1891
2A	8	SW	Unspecified Works	1908
3A	8	SW	Unspecified Commercial/Industrial	1928
4	217	W	Pump	1851
5K	347	SE	Cuttings	1976
6L	359	SE	Cuttings	1976
7M	367	S	Cuttings	1976
8N	428	SE	Cuttings	1976
9	451	NE	Unspecified Factory	1976
10O	464	NW	Unspecified Pit	1908
11B	490	NE	Iron Works	1954
12B	493	NE	Iron Works	1928
13B	493	NE	Iron Works	1908
14B	493	NE	Unspecified Mill	1967
15B	495	NE	Iron Works	1938

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: 19

ID	Distance (m)	Direction	Use	Date
16C	0	On Site	Unspecified Tank	1993
17C	0	On Site	Unspecified Tank	1994
18C	0	On Site	Unspecified Tank	1994
19C	0	On Site	Unspecified Tank	1999
20	208	S	Unspecified Tank	1976
21D	452	S	Unspecified Tank	1955
22D	452	S	Unspecified Tank	1966
23D	453	S	Unspecified Tank	1955

24E	461	SW	Unspecified Tank	1955
25E	461	SW	Unspecified Tank	1966
26E	461	SW	Unspecified Tank	1955
27E	461	SW	Unspecified Tank	1977
28E	461	SW	Unspecified Tank	1966
29	473	SW	Unspecified Tank	1996
30	492	NE	Unspecified Tank	1987
31B	495	NE	Unspecified Tank	1910
32B	496	NE	Unspecified Tank	1930
33B	496	NE	Unspecified Tank	1955
34B	496	NE	Unspecified Tank	1955

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:

17

ID	Distance (m)	Direction	Use	Date
35F	119	SW	Electricity Substation	1993
36F	119	SW	Electricity Substation	1994
37F	119	SW	Electricity Substation	1999
38F	119	SW	Electricity Substation	1994
39G	290	S	Electricity Substation	1995
40G	290	S	Electricity Substation	1994
41G	291	S	Electricity Substation	1976
42G	297	S	Electricity Substation	1955
43G	297	S	Electricity Substation	1966
44G	297	S	Electricity Substation	1955
45H	383	NW	Electricity Substation	1980
46H	384	NW	Electricity Substation	1990
47H	384	NW	Electricity Substation	1955
48H	384	NW	Electricity Substation	1955
49I	385	N	Electricity Substation	1999
50H	385	NW	Electricity Substation	1955
51I	386	N	Electricity Substation	1987

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: 0

Database searched and no data found.

1.6 Historical military sites

Certain military installations were not noted on historic mapping for security reasons. Whilst not all military land is necessarily of concern, Groundsure has researched and digitised a number of Ordnance Factories and other military industrial features (e.g. Ordnance Depots, Munitions Testing Grounds) which may be of contaminative concern. This research was drawn from a number of different sources, and should not be regarded as a definitive or exhaustive database of potentially contaminative military installations. The boundaries of sites within this database have been estimated from the best evidence available to Groundsure at the time of compilation.

Records of historical military sites within 500m of the search boundary: 0

Database searched and no data found.

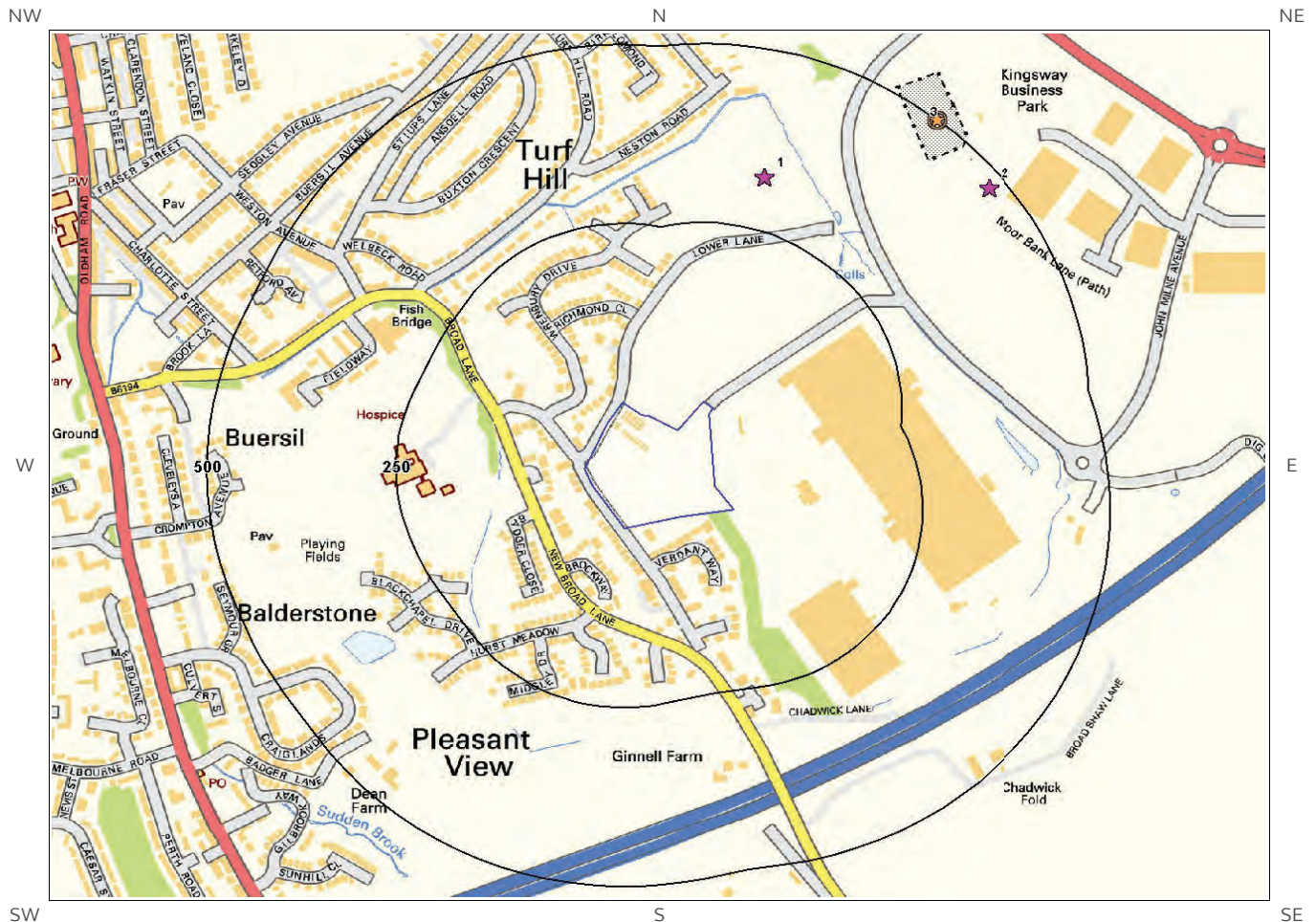
1.7 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 11

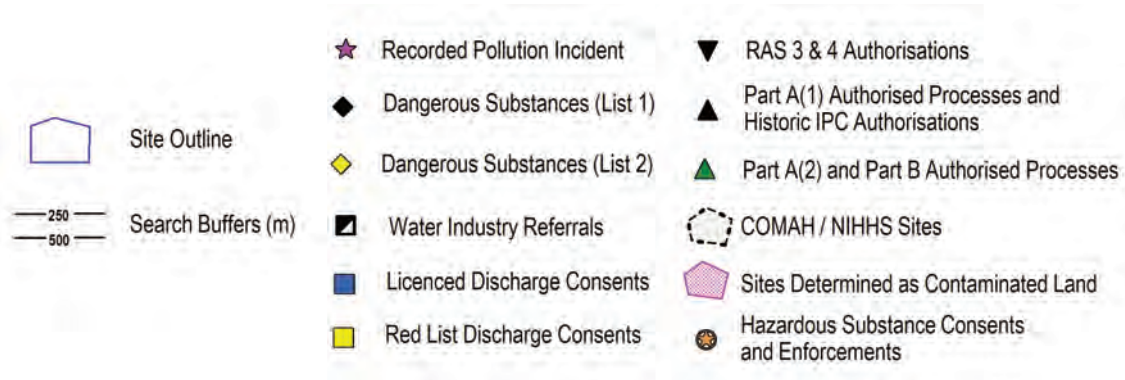
The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
52	0	On Site	Pond	1891
53J	334	W	Pond	1908
54J	334	W	Pond	1928
55J	335	W	Pond	1967
56J	335	W	Pond	1976
57J	335	W	Pond	1954
58K	347	SE	Cuttings	1976
59L	359	SE	Cuttings	1976
60M	367	S	Cuttings	1976
61N	428	SE	Cuttings	1976
62O	464	NW	Unspecified Pit	1908

2. Environmental Permits, Incidents and Registers Map



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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:

0

Database searched and no data found.

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:

1

The following records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Application Reference Number	NGR	Application Status	Application Date	Address	Details	Details of Enforcement Action
5A	500	NE	92/D28756	391579 411719	Approved	20/10/1992	British Vita PLC (Vitaluxan), Lower Lane Mill, Lower Lane, Milnrow, Rochdale, Lancashire, England, OL16 4NG	Application for Hazardous Substances Consent (Deemed Consent).	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified

2.2 Dangerous or Hazardous Sites

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

1

The following COMAH & NIHHS Authorisation records provided by the Health and Safety Executive are represented as polygons or buffered points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Company	Address	Operational Status	Tier
3	448	NE	British Vita Plc(vitaluxan)	British Vita Plc(vitaluxan), Lower Lane, Miln Row, Rochdale	Historical NIHHS Site	-

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:

2

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details
1	324	N	391350.0 411640.0	Incident Date: 27-Apr-2001 Incident Identification: 3803.0 Pollutant: General Biodegradable Materials and Wastes Pollutant Description: Blood and Offal Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
2	478	NE	391648.0 411625.0	Incident Date: 08-Aug-2003 Incident Identification: 180279.0 Pollutant: Oils and Fuel Pollutant Description: Other Oil or Fuel Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)

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

0

Database searched and no data found.

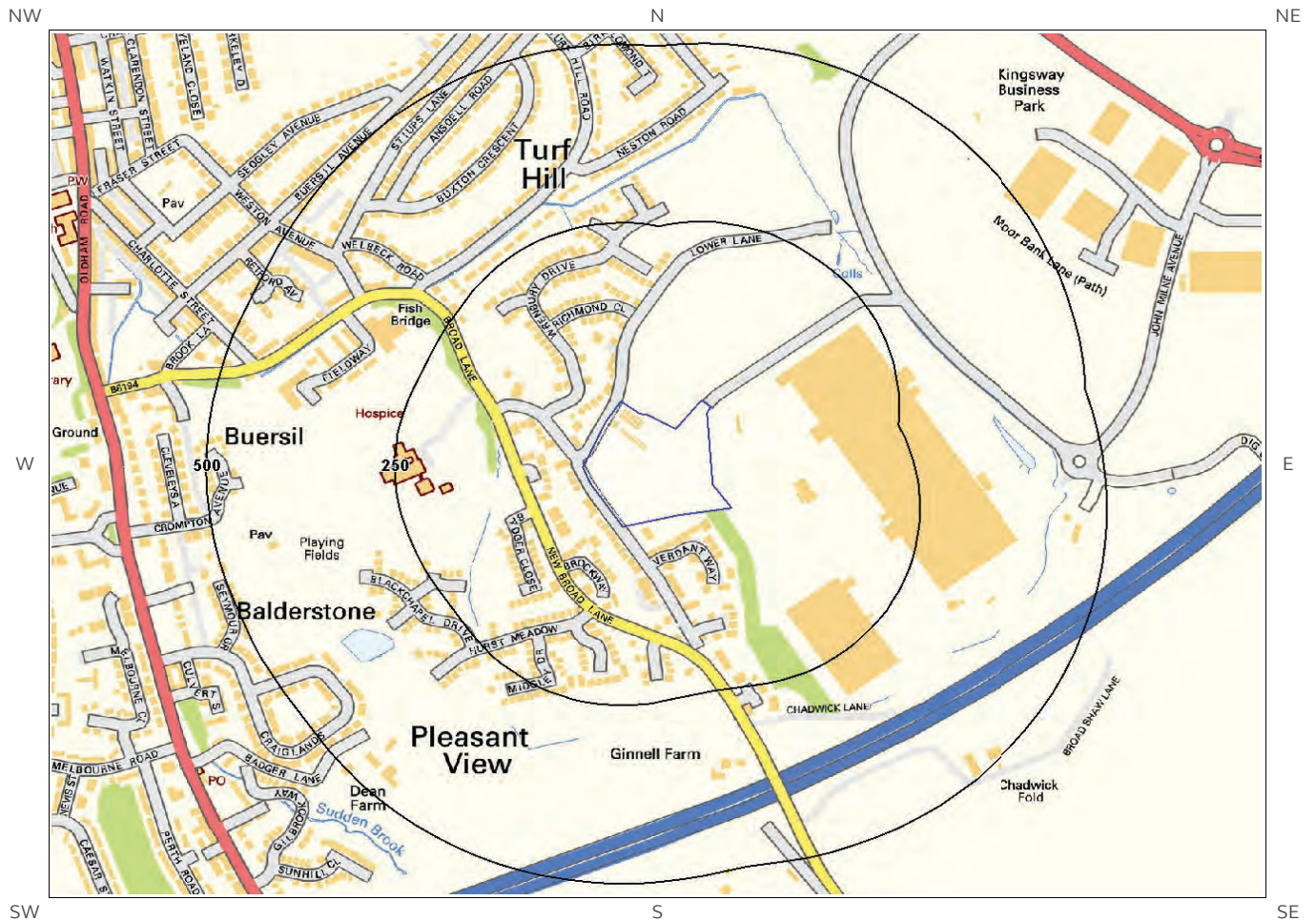
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

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



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

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:

3

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
Not shown	895	SE		Site Address: Burnedge Mill, Rochdale Waste Licence: Yes Site Reference: D050, RD/LIC/303/83 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 05-Apr-1984 Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: Richardson and Carroll First Recorded: 01-May-1984 Last Recorded: 31-Dec-1986
Not shown	1042	E		Site Address: Dig Gate Farm, Dig Gate Lane, Milnrow Waste Licence: Yes Site Reference: D028, RD/LIC/449/86 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 10-Sep-1986 Licence Surrendered: Licence Holder Address: Dig Gate Lane, Milnrow, Rochdale Operator: - Licence Holder: Mark Greenwood First Recorded: 01-Oct-1986 Last Recorded: 31-Dec-1987
Not shown	1167	NE		Site Address: Little Lane, Off Harbour Lane, Milnrow, Greater Manchester Waste Licence: - Site Reference: D073 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:

2

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
Not shown	1154	NE	392299 412145	Little Lane, Off Harbour Lane, Milnrow	Rochdale Council	Polygon
Not shown	1268	NE	391991 412552	Buckley hill lane,Rochdale	Rochdale	Polygon

3.2 Other Waste Sites

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

0

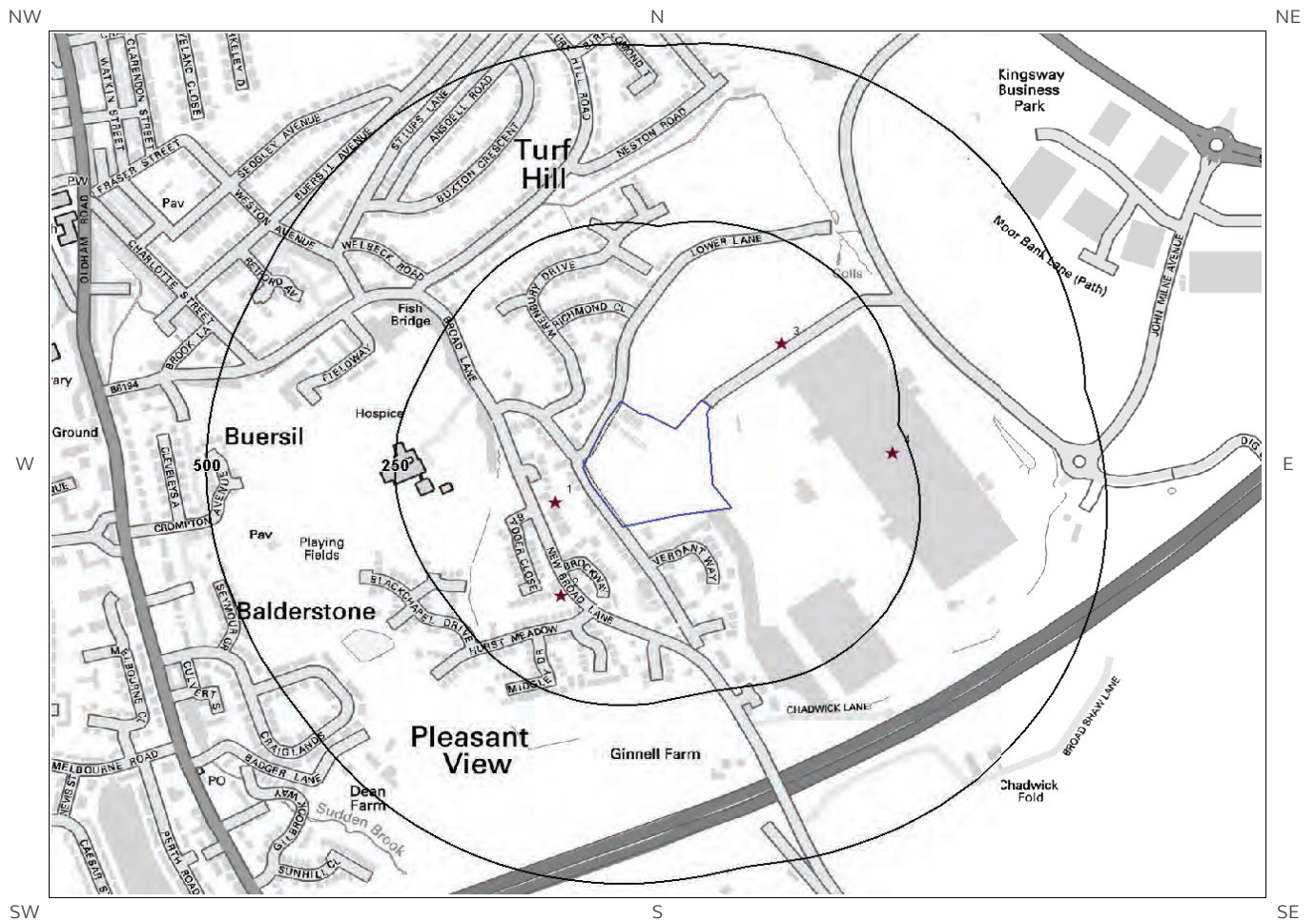
Database searched and no data found.

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

0

Database searched and no data found.

4. Current Land Use Map



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4. Current Land Uses

4.1 Current Industrial Data

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

4

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

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	53	SW	Electricity Sub Station	391075 411184	Greater Manchester, OL16	Electrical Features	Infrastructure and Facilities
2	126	SW	Electricity Sub Station	391083 411053	Greater Manchester, OL16	Electrical Features	Infrastructure and Facilities
3	129	NE	Electricity Sub Station	391376 411406	Greater Manchester, OL16	Electrical Features	Infrastructure and Facilities
4	226	E	N F T	391522 411252	Asda Chilled Distribution Centre, James Kearns Avenue, Kingsway Business Park, Rochdale, Greater Manchester, OL16 4NZ	Catering and Non Specific Food Products	Foodstuffs

4.2 Petrol and Fuel Sites

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

0

Database searched and no data found.

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
HMGDD-DMTN	HUMMOCKY (MOUNDY) GLACIAL DEPOSITS, DEVENSIAN	DIAMICTON

5.3 Bedrock and Solid Geology

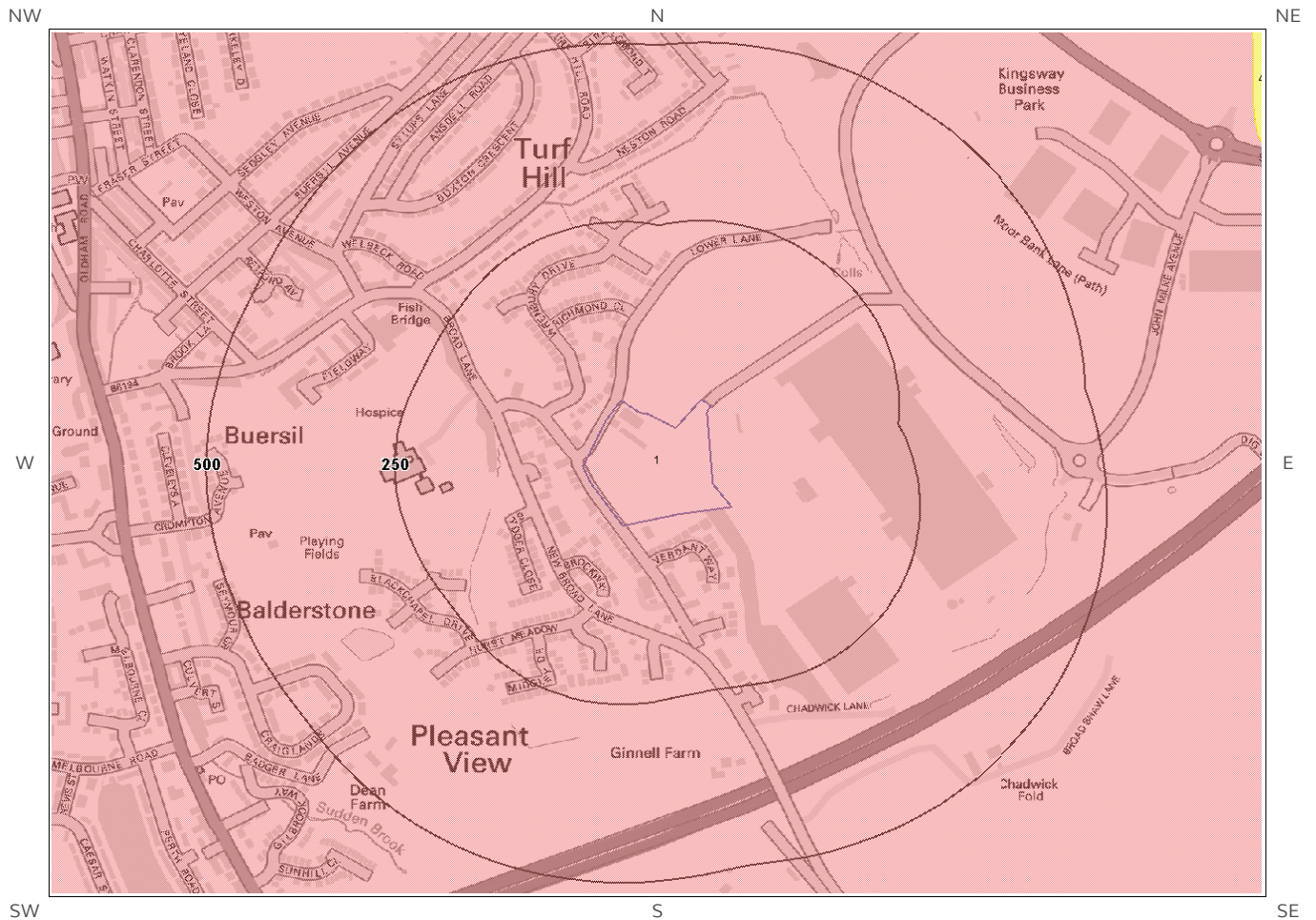
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
PLCM-MDSS	PENNINE LOWER COAL MEASURES FORMATION	MUDSTONE, SILTSTONE AND SANDSTONE

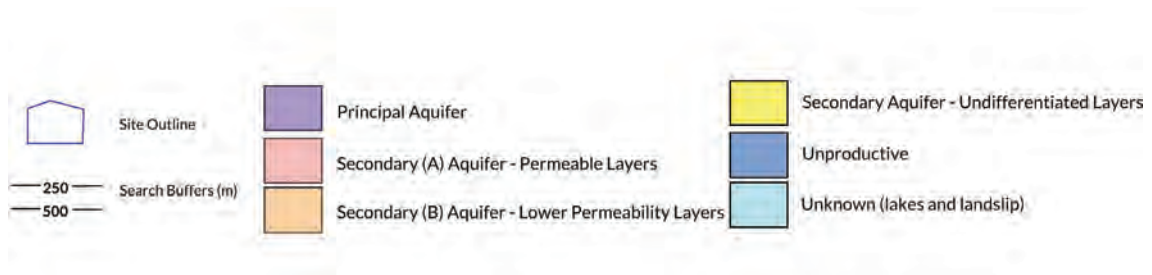
(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

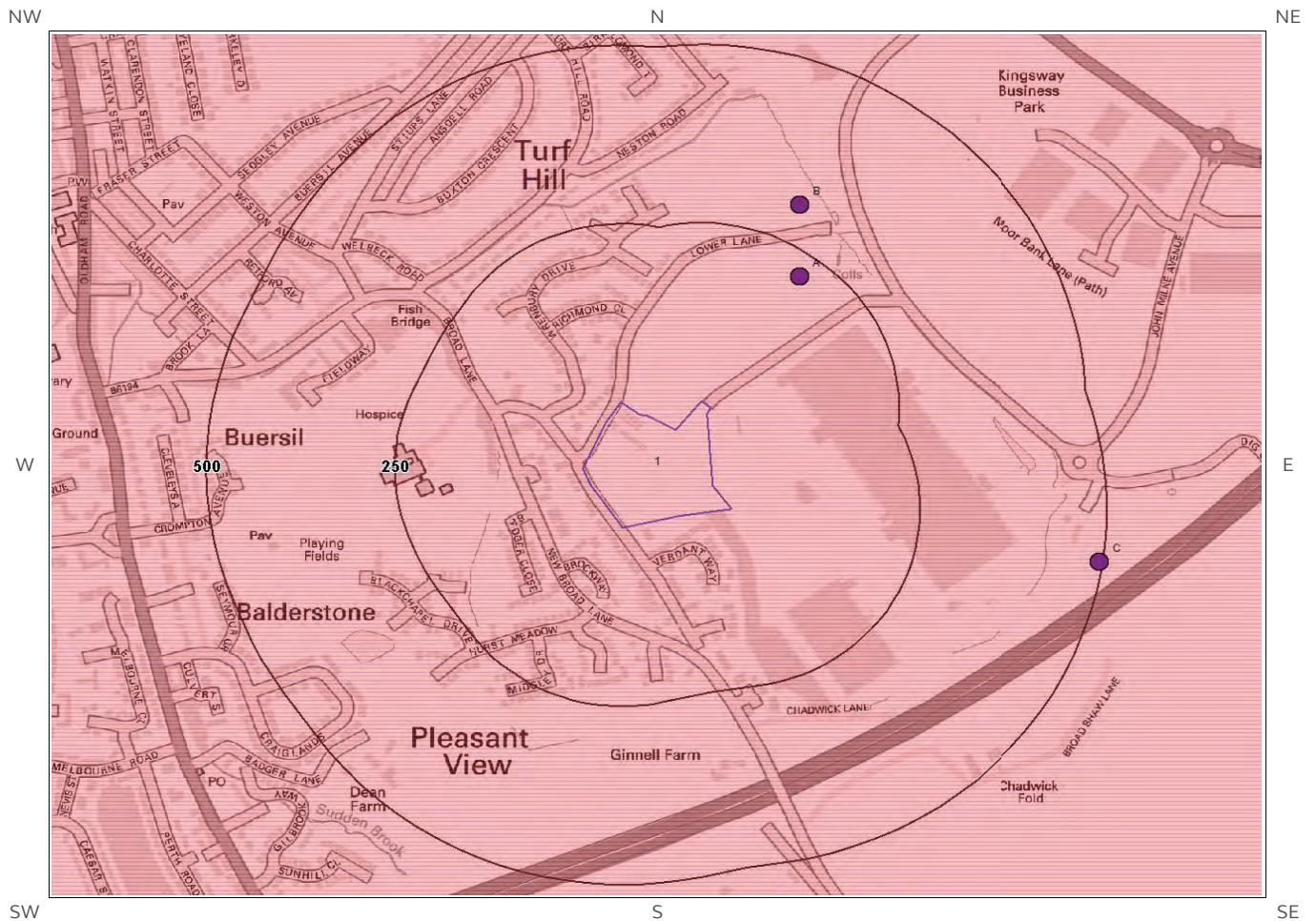
6a. Aquifer Within Superficial Geology



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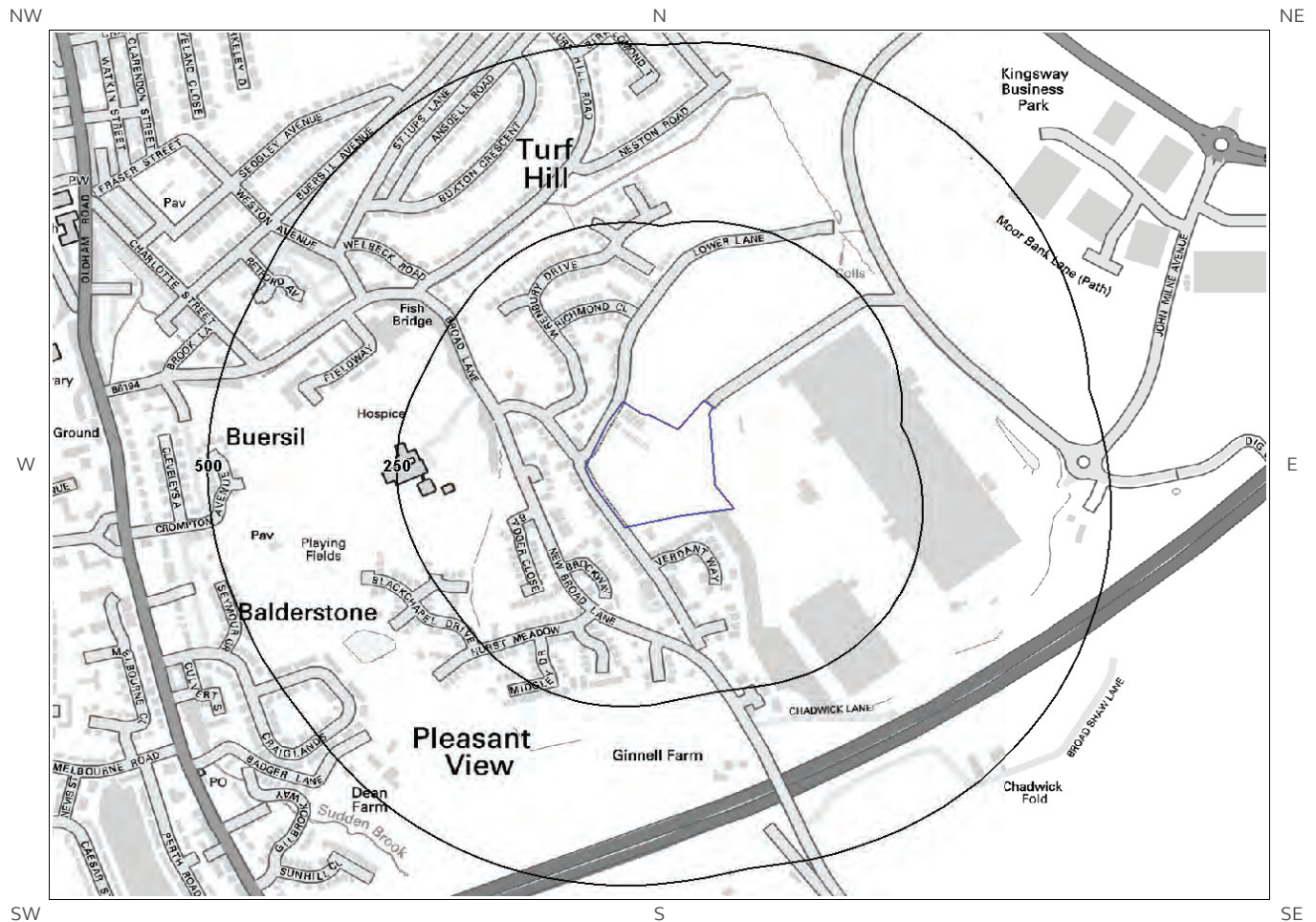


6b. Aquifer Within Bedrock Geology and Abstraction Licences

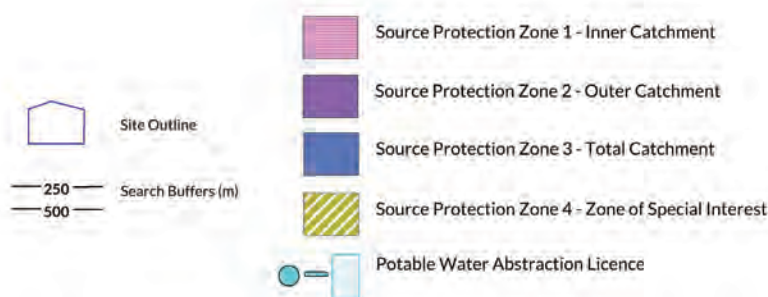


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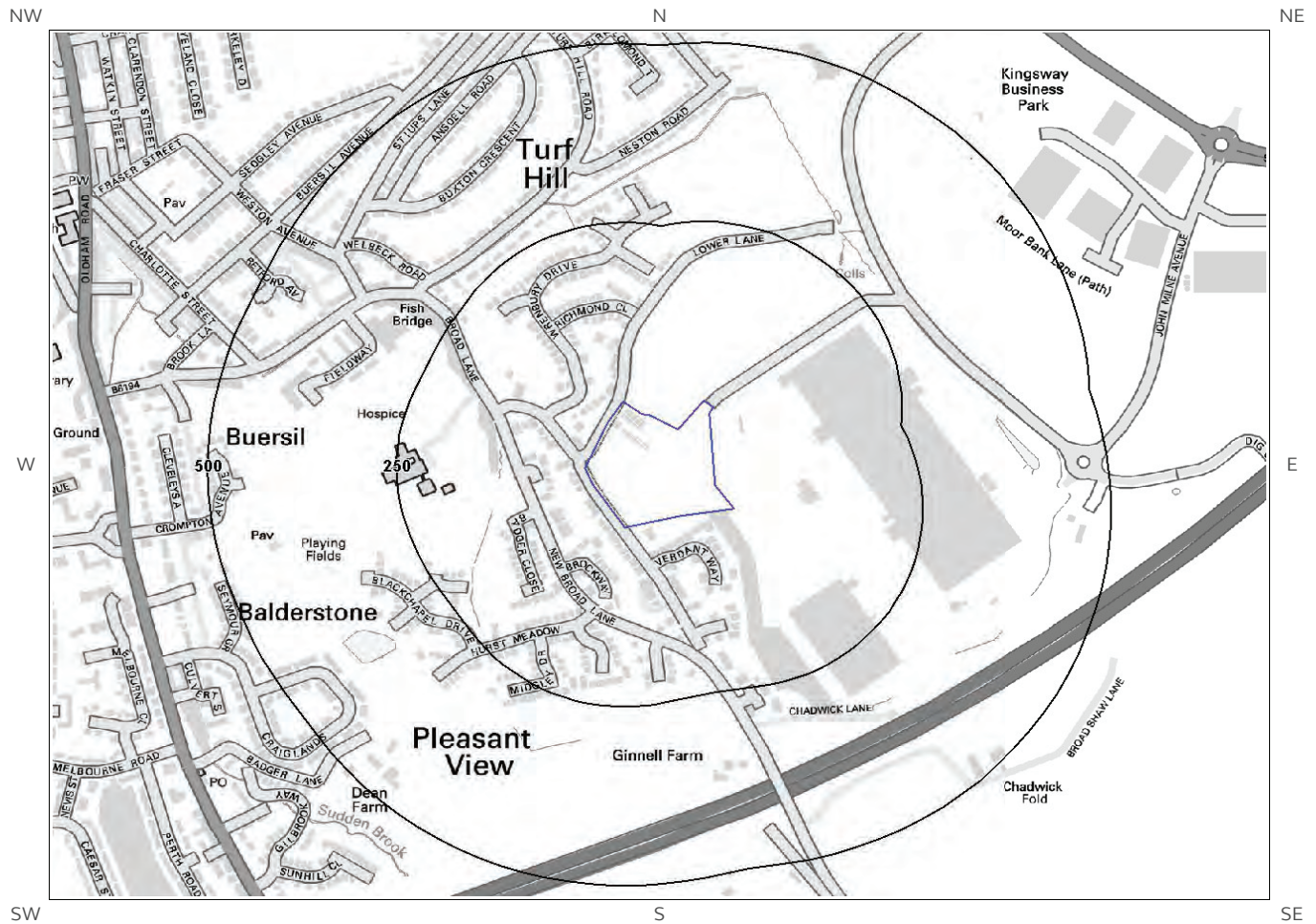
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licences



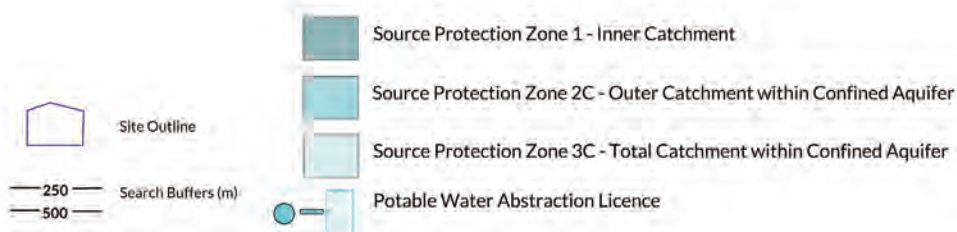
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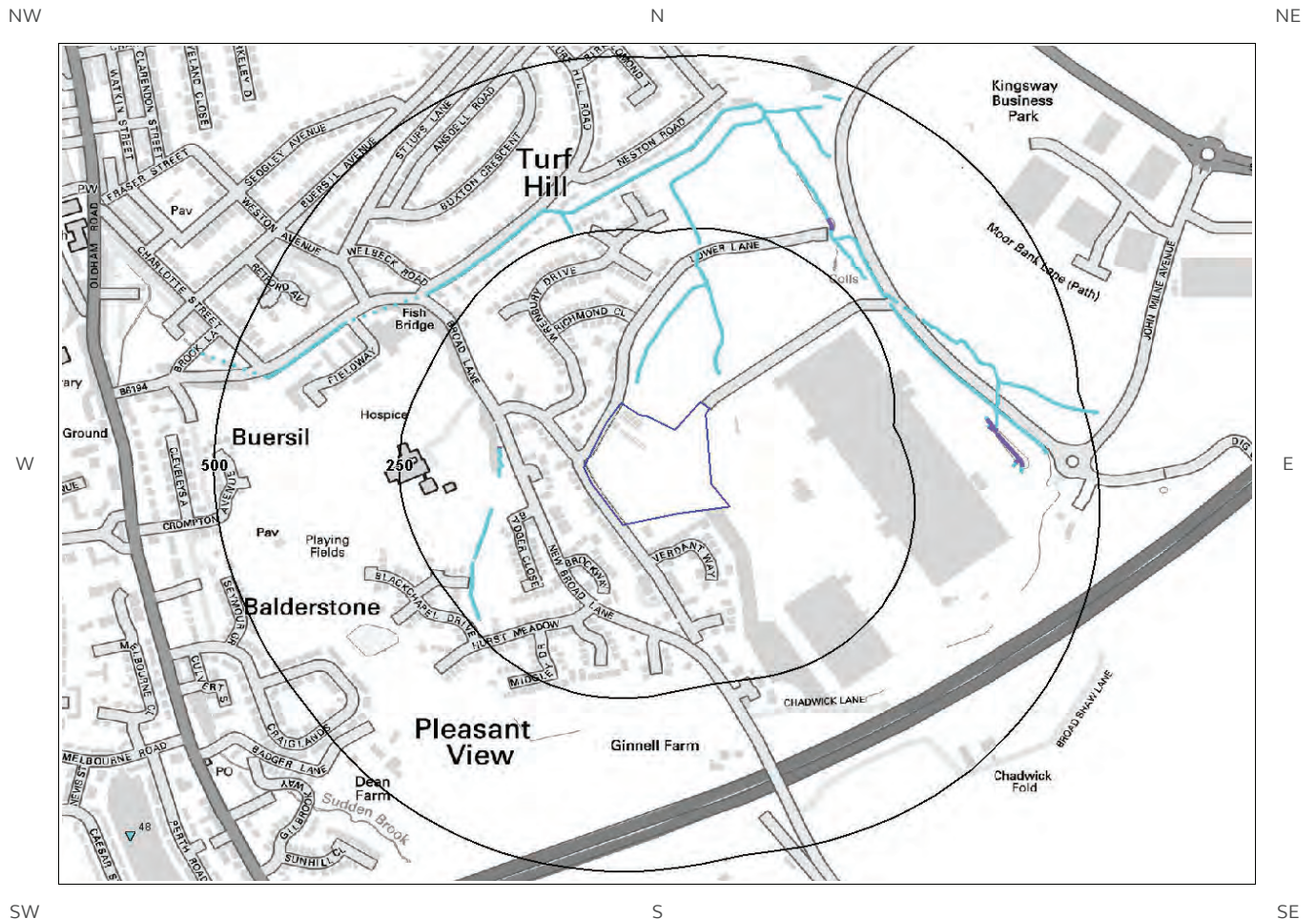
6d. Hydrogeology – Source Protection Zones within confined aquifer



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6e. Hydrology – Watercourse Network and River Quality



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6. Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

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
1	0	On Site	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

6.2 Aquifer within Bedrock Deposits

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	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

6.3 Groundwater Abstraction Licences

Groundwater Abstraction Licences within 2000m of the study site

Identified

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
2A	217	NE	391400 411500	Status: Historical Licence No: 2569002060 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: "WELL AT CASTLE FARM, LOWER LANE, MILNROW" Data Type: Point Name: SANDERSON Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 11/02/1966 Version End Date:
3A	217	NE	391400 411500	Status: Historical Licence No: 2569002060 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: WELL AT CASTLE FARM, LOWER LANE, MILNROW Data Type: Point Name: SANDERSON Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 11/02/1966 Version End Date:
4B	303	NE	391400 411600	Status: Historical Licence No: 2569002159 Details: General Farming & Domestic Direct Source: Ground Water - North West Region Point: WELL AT FARM LOWER LANE MILNROW ROCHDALE Data Type: Point Name: HARTLE Annual Volume (m ³): 5,123 Max Daily Volume (m ³): 32 Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 01/04/2007 Version End Date:
5B	303	NE	391400 411600	Status: Historical Licence No: 2569002159 Details: General Farming & Domestic Direct Source: Ground Water - North West Region Point: WELL AT FARM, LOWER LANE, MILNROW, ROCHDALE Data Type: Point Name: HARTLE Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 01/02/1966 Version End Date:
6B	303	NE	391400 411600	Status: Historical Licence No: 2569002159 Details: General Farming & Domestic Direct Source: Ground Water - North West Region Point: "WELL AT FARM, LOWER LANE, MILNROW, ROCHDALE" Data Type: Point Name: HARTLE Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 01/02/1966 Version End Date:

ID	Distance (m)	Direction	NGR	Details
7C	495	E	391800 411100	Status: Historical Licence No: 2569002086 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: WELL AT BROADSHAW FARM, MILNROW, ROCHDALE Data Type: Point Name: CROSTON Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 02/02/1966 Version End Date:
8C	495	E	391800 411100	Status: Historical Licence No: 2569002086 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: "WELL AT BROADSHAW FARM, MILNROW, ROCHDALE" Data Type: Point Name: CROSTON Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 02/02/1966 Version End Date:
Not shown	1059	SE	392200 410600	Status: Historical Licence No: 2569002204 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: BOREHOLE AT PREMISES, OLD BARN FARM, BURNEDGE, ROCHDALE Data Type: Point Name: CRYER Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 24/04/1969 Version End Date:
Not shown	1059	SE	392200 410600	Status: Historical Licence No: 2569002204 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: "BOREHOLE AT PREMISES, OLD BARN FARM, BURNEDGE, ROCHDALE" Data Type: Point Name: CRYER Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: Expiry Date: Issue No: Version Start Date: 24/04/1969 Version End Date:

6.4 Surface Water Abstraction Licences

Surface Water Abstraction Licences within 2000m of the study site

Identified

The following Surface Water 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	1069	NW	390200 411800	Status: Historical Licence No: 2569002178 Details: Boiler Feed Direct Source: "Surface, Non-Tidal - North West Region" Point: "CATCHPIT FED BY SURFACE DRAINAGE AT PREMISES, ROCHDALE" Data Type: Point Name: DUNPHY COMBUSTION LTD. Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 18/02/1966 Expiry Date: - Issue No: 101 Version Start Date: 12/02/1991 Version End Date:
Not shown	1069	NW	390200 411800	Status: Active Licence No: 2569002178 Annual Volume (m³): 2,318 Max Daily Volume (m³): 34

ID	Distance (m)	Direction	NGR	Details
				Details: Boiler Feed Direct Source: Surface, Non-Tidal - North West Region Point: CATCHPIT FED BY SURFACE DRAINAGE AT PREMISES, ROCHDALE Data Type: Point Name: DUNPHY COMBUSTION LTD Application No: - Original Start Date: 18/02/1966 Expiry Date: - Issue No: 101 Version Start Date: 12/02/1991 Version End Date:
Not shown	1262	NW	390070 411960	Status: Historical Licence No: 2569002107 Details: Boiler Feed Direct Source: Surface, Non-Tidal - North West Region Point: ROCHDALE CANAL AT QUEENSWAY,ROCHDALE Data Type: Point Name: SEALOCRETE PLA LTD Annual Volume (m³): 10,456 Max Daily Volume (m³): 45 Application No: - Original Start Date: 02/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/04/2008 Version End Date:
Not shown	1262	NW	390070 411960	Status: Historical Licence No: 2569002107 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Surface, Non-Tidal - North West Region Point: ROCHDALE CANAL AT QUEENSWAY,ROCHDALE Data Type: Point Name: SEALOCRETE PLA LTD Annual Volume (m³): 10,456 Max Daily Volume (m³): 45 Application No: - Original Start Date: 02/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/04/2008 Version End Date:
Not shown	1262	NW	390070 411960	Status: Historical Licence No: 2569002107 Details: Boiler Feed Direct Source: "Surface, Non-Tidal - North West Region" Point: "ROCHDALE CANAL AT QUEENSWAY,ROCHDALE" Data Type: Point Name: SEALOCRETE PLA LTD Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 02/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 20/12/1993 Version End Date:
Not shown	1262	NW	390070 411960	Status: Historical Licence No: 2569002107 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: "Surface, Non-Tidal - North West Region" Point: "ROCHDALE CANAL AT QUEENSWAY,ROCHDALE" Data Type: Point Name: SEALOCRETE PLA LTD Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 02/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 20/12/1993 Version End Date:
Not shown	1303	NW	390300 412300	Status: Historical Licence No: 2569002076 Details: Boiler Feed Direct Source: Surface, Non-Tidal - North West Region Point: ROCHDALE CANAL AT ROCHDALE, LANCs Data Type: Point Name: J & J MAKIN CONVERTORS LTD Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 18/01/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/04/1993 Version End Date:
Not shown	1760	E	393000 411700	Status: Historical Licence No: 2569002064 Details: Boiler Feed Direct Source: Surface, Non-Tidal - North West Region Point: R BEAL AT NEWHEY, MILNROW, ROCHDALE Data Type: Point Name: THE SECRETARY Annual Volume (m³): 327,312 Max Daily Volume (m³): 2,955 Application No: - Original Start Date: 18/01/1966 Expiry Date: - Issue No: 100 Version Start Date: 21/06/1993 Version End Date:
Not shown	1760	E	393000 411700	Status: Active Licence No: 2569002233 Details: General Cooling (Existing Licences Only) Annual Volume (m³): 66,370 Max Daily Volume (m³): 182 Application No: -

ID	Distance (m)	Direction	NGR	Details	
				(Low Loss) Direct Source: Surface, Non-Tidal - North West Region Point: R BEAL AT MILNROW Data Type: Point Name: SUN CHEMICAL LTD	Original Start Date: 13/08/1986 Expiry Date: - Issue No: 102 Version Start Date: 01/01/2005 Version End Date:
Not shown	1760	E	393000 411700	Status: Historical Licence No: 2569002064 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Surface, Non-Tidal - North West Region Point: R BEAL AT NEWHEY, MILNROW, ROCHDALE Data Type: Point Name: ELLENROAD TRUST LTD	Annual Volume (m³): 327,312 Max Daily Volume (m³): 2,955 Application No: - Original Start Date: 18/01/1966 Expiry Date: - Issue No: 101 Version Start Date: 11/09/2008 Version End Date:
Not shown	1760	E	393000 411700	Status: Historical Licence No: 2569002064 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: "Surface, Non-Tidal - North West Region" Point: "R BEAL AT NEWHEY, MILNROW, ROCHDALE" Data Type: Point Name: THE SECRETARY	Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 18/01/1966 Expiry Date: - Issue No: 100 Version Start Date: 21/06/1993 Version End Date:
Not shown	1760	E	393000 411700	Status: Active Licence No: 2569002064 Details: Non-Evaporative Cooling Direct Source: Surface, Non-Tidal - North West Region Point: R BEAL AT NEWHEY, MILNROW, ROCHDALE Data Type: Point Name: ELLENROAD TRUST LTD	Annual Volume (m³): 3,520 Max Daily Volume (m³): 350 Application No: - Original Start Date: 18/01/1966 Expiry Date: - Issue No: 103 Version Start Date: 30/01/2014 Version End Date:
Not shown	1760	E	393000 411700	Status: Historical Licence No: 2569002064 Details: Boiler Feed Direct Source: "Surface, Non-Tidal - North West Region" Point: "R BEAL AT NEWHEY, MILNROW, ROCHDALE" Data Type: Point Name: THE SECRETARY	Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 18/01/1966 Expiry Date: - Issue No: 100 Version Start Date: 21/06/1993 Version End Date:
Not shown	1912	NE	392700 412600	Status: Active Licence No: 2569002175 Details: General Cooling (Existing Licences Only) (High Loss) Direct Source: Surface, Non-Tidal - North West Region Point: RESERVOIR FED BY SPRINGS AT PREMISESMILNROW Data Type: Point Name: Precision Components Limited	Annual Volume (m³): 16,365 Max Daily Volume (m³): 55 Application No: - Original Start Date: 15/02/1966 Expiry Date: - Issue No: 101 Version Start Date: 30/11/2009 Version End Date:
Not shown	1912	NE	392700 412600	Status: Historical Licence No: 2569002175 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Surface, Non-Tidal - North West Region Point: RESERVOIR FED BY SPRINGS AT PREMISESMILNROW Data Type: Point Name: HOLROYD MACHINES TOOLS & ROTORS	Annual Volume (m³): 16,366 Max Daily Volume (m³): 55 Application No: - Original Start Date: 15/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/04/2007 Version End Date:

6.5 Potable Water Abstraction Licences

Potable Water Abstraction Licences within 2000m of the study site

None identified

Database searched and no data found.

6.6 Source Protection Zones

Source Protection Zones within 500m of the study site

None identified

Database searched and no data found.

6.7 Source Protection Zones within Confined Aquifer

Source Protection Zones within the Confined Aquifer within 500m of the study site

None identified

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

Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site Identified

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Minor Aquifer/High Leaching Potential	H2	Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.
205	NW	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.
460	E	Minor Aquifer/Low Leaching Potential	L	Soils in which pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants.

6.9 River Quality

Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site Identified

6.9.1 Biological Quality:

Biological Quality data describes water quality in terms of 83 groups of macroinvertebrates, some of which are pollution sensitive. The results are graded from A ('Very Good') to F ('Bad').

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

ID	Distance (m)	Direction	NGR	River Quality Grade	Biological Quality Grade				
					2005	2006	2007	2008	2009
48	802	SW	390500 410700	River Name: Sudden Bk Reach: Qsl At Balderstone To Roch End/Start of Stretch: Start of Stretch NGR	E	E	E	D	D

6.9.2 Chemical Quality:

Database searched and no data found.

6.10 Ordnance Survey MasterMap Water Network

Ordnance Survey MasterMap Water Network entries within 500m of the study site

This watercourse information is provided by Ordnance Survey MasterMap Water Network. The data provides a detailed centre line following the curve of the waterway precisely, so all distances provided in the report should be understood as measurements to the centreline rather than a measurement to the nearest point of the watercourse. Underground watercourses are inferred from entry and exit points so caution is advised in using these to indicate precise locations of underground watercourses when planning site investigation and development.

The following Ordnance Survey MasterMap Water Network records are represented on the Hydrology Map (6e):

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
1	34 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
9	34 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
2	48 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
10	48 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
3	111 W	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
11	111 W	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
4	117 W	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.0
12	117 W	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.0
5	138 SW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
13	138 SW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
6	174 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
14	174 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
7	196 SW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
15	196 SW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
8	197 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
16	197 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
9	237 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
17	237 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
10	255 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
18	255 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
11	279 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 1.7
19	279	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
	NW			Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 1.7
12	281 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
20	281 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
13	282 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 1.9
14	282 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
21	282 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 1.9
22	282 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
15	283 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 1.9
Not shown	283 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 1.9
16	287 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
17	287 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
18	287 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
24	287 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions)

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
				Average Width in Watercourse Section (m): Not Provided
25	287 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
26	287 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
19	289 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
27	289 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
20	296 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
28	296 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
21	298 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
29	298 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
22	304 NE	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 4.9
30	304 NE	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 4.9
23	305 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
31	305 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
24	316 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	316 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
25	325 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
33	325 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
26	367 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
34	367 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
27	368 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
35	368 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
28	369 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
29	369 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
36	369 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
37	369 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
30	377	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
	E			Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
31	377 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
38	377 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
39	377 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
32	378 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
40	378 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
33	379 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 1.5
41	379 NW	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 1.5
34	387 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
35	387 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
36	387 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
42	387 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
43	387 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions)

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
				Average Width in Watercourse Section (m): Not Provided
Not shown	387 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
37	393 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	393 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
38	395 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
39	395 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	395 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	395 NE	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
40	397 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	397 E	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
41	398 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	398 E	-	Lake, loch or reservoir.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
42	422 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
Not shown	422 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
43	427 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
44	427 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	427 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	427 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
45	443 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	443 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
46	447 W	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	447 W	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
47	472 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	472 N	-	Inland river not influenced by normal tidal action.	Catchment Area: Mersey Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided

6.11 Surface Water Features

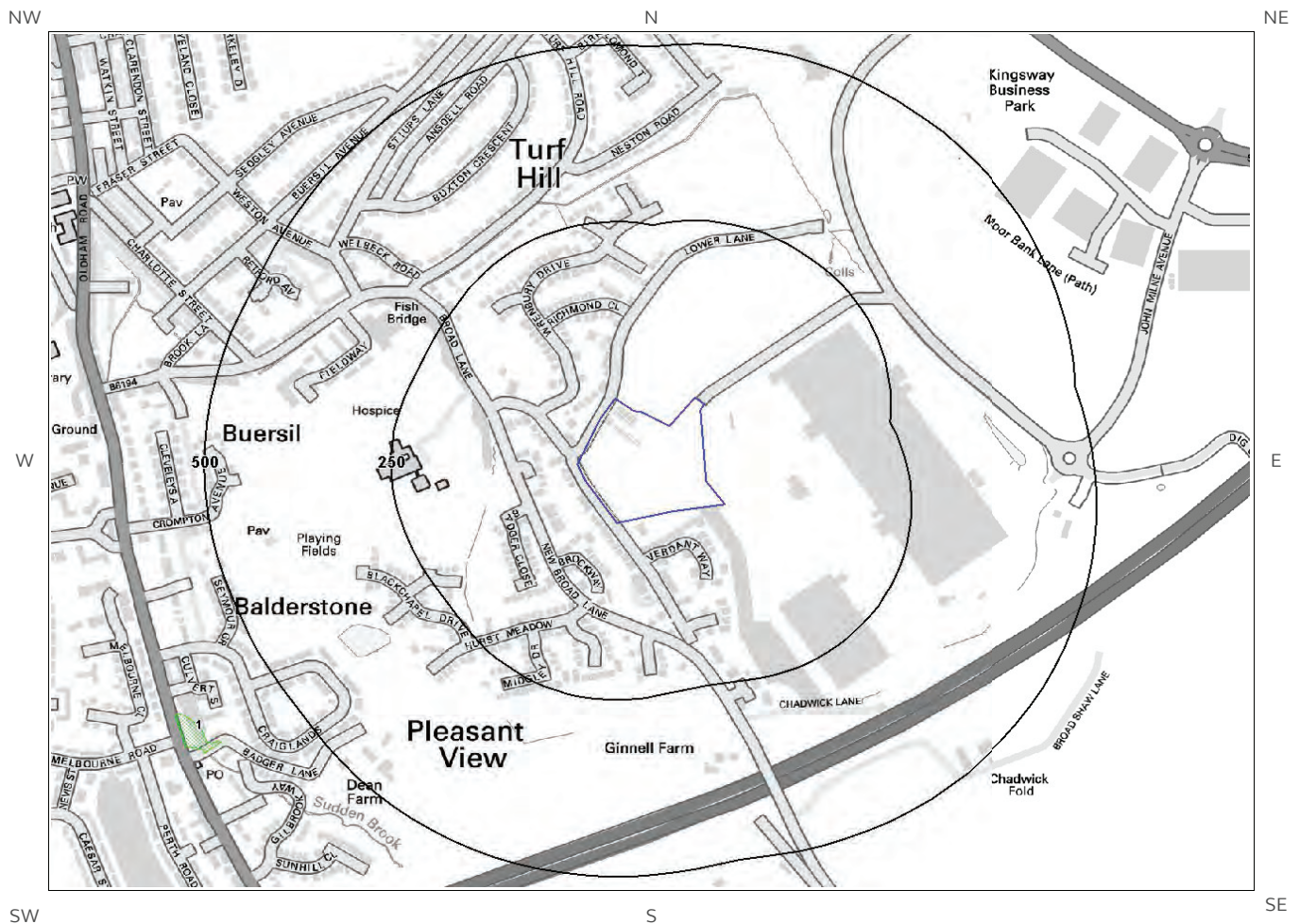
Surface water features within 250m of the study site

Identified

The following surface water records are not represented on mapping:

Distance (m)	Direction
114	W
138	SW
196	SW

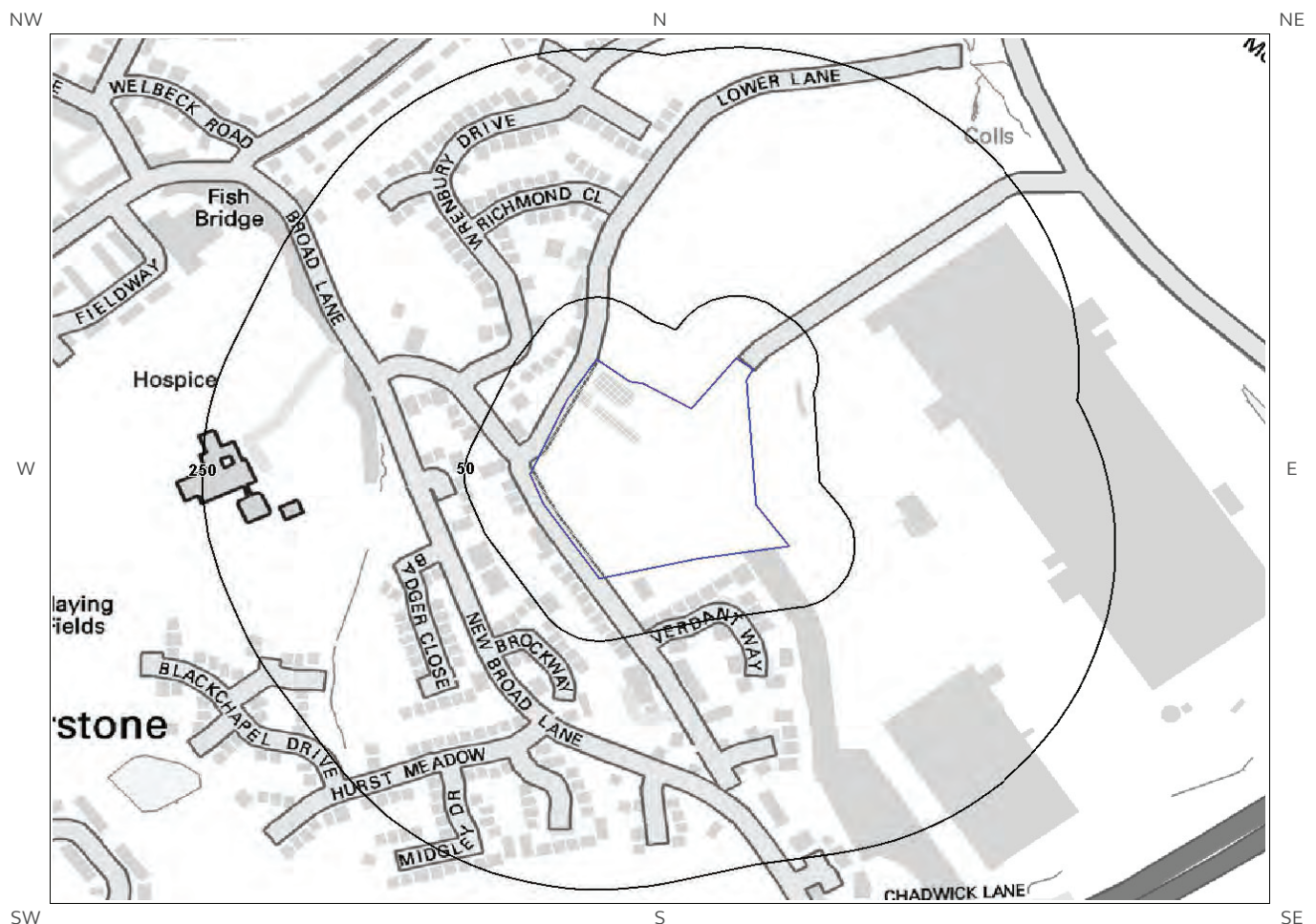
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



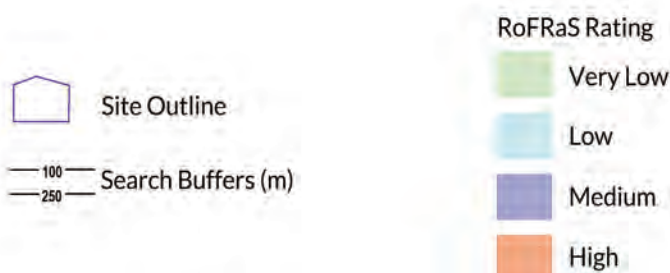
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7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



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7 Flooding

7.1 River and Coastal Zone 2 Flooding

Environment Agency/Natural Resources Wales Zone 2 floodplain within 250m None identified

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

Environment Agency/Natural Resources Wales Zone 3 floodplain within 250m None identified

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

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

Flood Defences within 250m of the study site None identified
Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Areas benefiting from Flood Defences within 250m of the study site None identified

7.6 Areas benefiting from Flood Storage

Areas used for Flood Storage within 250m of the study site

None identified

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site

Identified

Clearwater Flooding or Superficial Deposits Flooding

Superficial Deposits 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 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

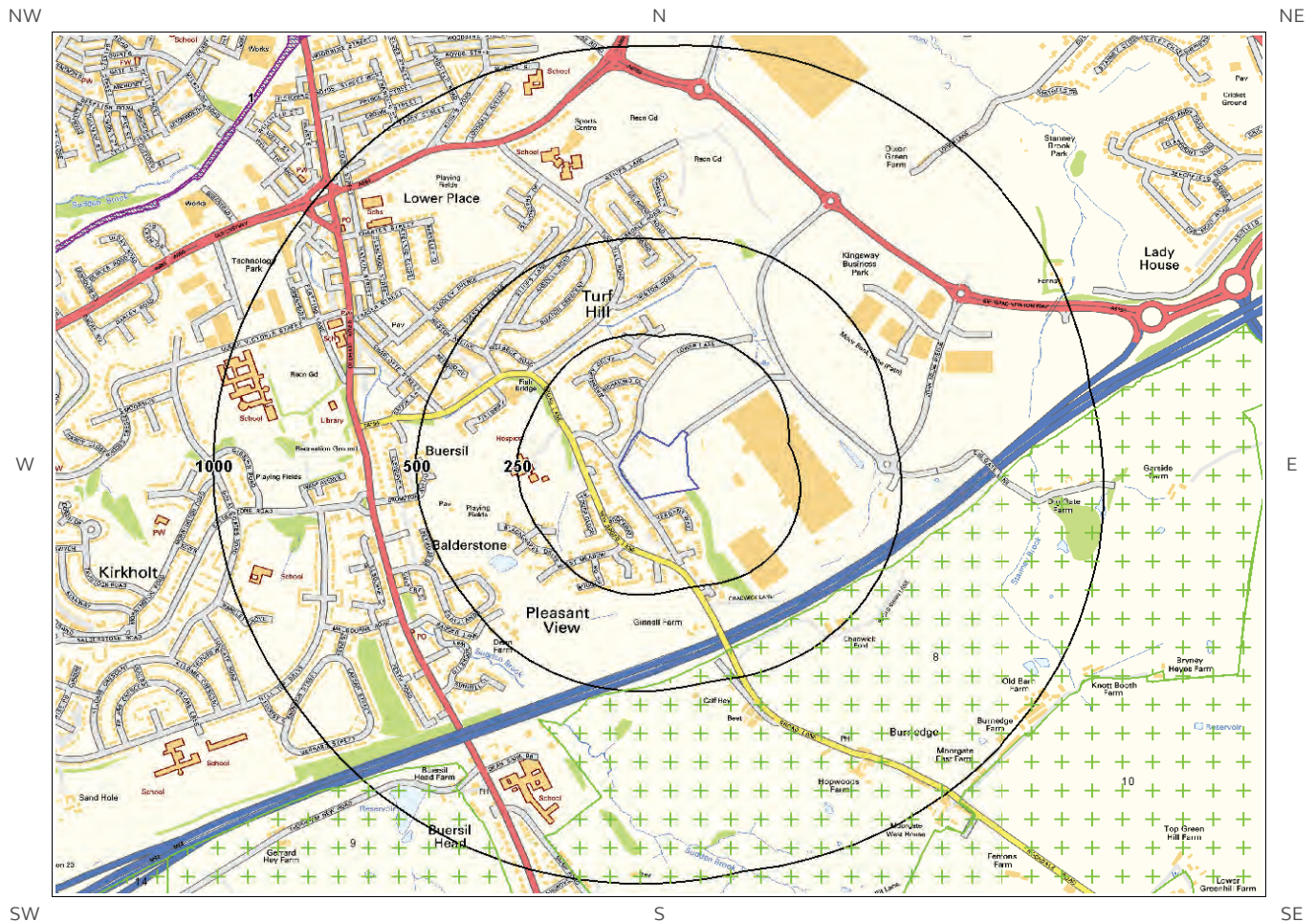
British Geological Survey confidence rating in this result

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



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8. Designated Environmentally Sensitive Sites

Designated Environmentally Sensitive Sites within 2000m of the study site

Identified

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

3

The following Site of Special Scientific Interest (SSSI) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SSSI Name	Data Source
5	1135	N	Rochdale Canal	Natural England
Not shown	1562	W	Rochdale Canal	Natural England
Not shown	1795	W	Rochdale Canal	Natural England

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:

4

The following Special Area of Conservation (SAC) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SAC Name	Data Source
1	1135	N	Rochdale Canal	Natural England
2	1309	NW	Rochdale Canal	Natural England
Not shown	1562	W	Rochdale Canal	Natural England
Not shown	1795	W	Rochdale Canal	Natural England

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:

0

Database searched and no data found.

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

0

Database searched and no data found.

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:

0

Database searched and no data found.

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

9

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ID	Distance	Direction	Green Belt Name	Local Authority Name
8	405	SE	Liverpool, Manchester and West Yorks Greenbelt	Rochdale
9	823	SW	Liverpool, Manchester and West Yorks Greenbelt	Rochdale
10	1021	SE	Liverpool, Manchester and West Yorks Greenbelt	Oldham District (B)
Not shown	1148	S	Liverpool, Manchester and West Yorks Greenbelt	Rochdale
Not shown	1180	S	Liverpool, Manchester and West Yorks Greenbelt	Rochdale
Not shown	1261	S	Liverpool, Manchester and West Yorks Greenbelt	Oldham District (B)
14	1492	SW	Liverpool, Manchester and West Yorks Greenbelt	Rochdale
Not shown	1636	SW	Liverpool, Manchester and West Yorks Greenbelt	Rochdale
Not shown	1939	SW	Liverpool, Manchester and West Yorks Greenbelt	Oldham 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

Maximum Shrink-Swell** hazard rating identified on the study site Low

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

Hazard
Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

9.1.2 Landslides

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

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

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

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

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.

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

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 site is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

The radon data in this report is supplied by the BGS/Public Health England and is the definitive map of Radon Affected Areas in Great Britain and Northern Ireland. The dataset was created using long-term radon measurements in over 479,000 homes across Great Britain and 23,000 homes across Northern Ireland, combined with geological data. The dataset is considered accurate to 50m to allow for the margin of error in geological lines, and the findings of this report supercede any answer given in the less accurate Indicative Atlas of Radon in Great Britain, which simplifies the data to give the highest risk within any given 1km grid square. As such, the radon atlas is considered indicative, whereas the data given in this report is considered definitive.

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

Coal mining areas within 75m of the study site

Identified

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

Distance (m)	Direction	Details
0	On Site	The site lies in or in proximity to the coal mining reporting area as defined by the Coal Authority

10.2 Non-Coal Mining

Non-Coal Mining areas within 50m of the study site boundary

None identified

Database searched and no data found.

10.3 Brine Affected Areas

Brine affected areas within 75m of the study site

None identified

Guidance: No Guidance Required.

Contact Details

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



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Phone: 01706 647 474
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Gemapping PLC
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BWB Consulting Limited

5th Floor, Waterfront House, Station Street,
Nottingham, NG2 3DQ

Groundsure
Reference:

HMD-214-6443777

Your Reference: POR028892

Report Date 5 Nov 2019

Report Delivery Email - pdf
Method:

Geo Insight

Address: Plot W Kingsway Business Park, Lower Lane, ROCHDALE, OL16 4PR

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,

Managing Director
Groundsure Limited

Enc.
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Address: Plot W Kingsway Business Park, Lower Lane, ROCHDALE, OL16 4PR

Date: 5 Nov 2019

Reference: HMD-214-6443777

Client: BWB Consulting Limited

NW N NE



SW S SE

Aerial Photograph Capture date: 26-Mar-2012

Grid Reference: 391216,411245

Site Size: 2.2613ha

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Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the 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: Geology 1:10,000 Scale

1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	Yes
	1.2.2 Are there any records of landslide within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and linear features	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records of linear features within 500m of the study site boundary at 1:10,000 scale?	Yes

Section 2: Geology 1:50,000 Scale

2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	No
2.2 Superficial Geology and Landslips	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	Yes
	2.2.3 Are there any records of landslide within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

Section 2: Geology 1:50,000 Scale

2.3 Bedrock, Solid Geology and linear features

2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.

2.3.2 Are there any records relating to permeability of bedrock ground within the study site boundary?

Yes

2.3.3 Are there any records of linear features within 500m of the study site boundary?

Yes

Section 3: Radon

3. Radon

3.1 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.

3.2 Radon Protection

No radon protective measures are necessary.

Section 4: Ground Workings

	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	1	0	0	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	0	0	0	0
4.3 Current Ground Workings	0	0	0	0	4

Section 5: Mining, Extraction & Natural Cavities

	On-site	0-50m	51-250	251-500	501-1000
5.1 Historical Mining	0	0	0	0	0
5.2 Coal Mining	1	0	0	0	0
5.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
5.4 Non-Coal Mining*	0	0	0	0	0
5.5 Non-Coal Mining Cavities	0	0	0	0	0
5.5 Natural Cavities	0	0	0	0	0

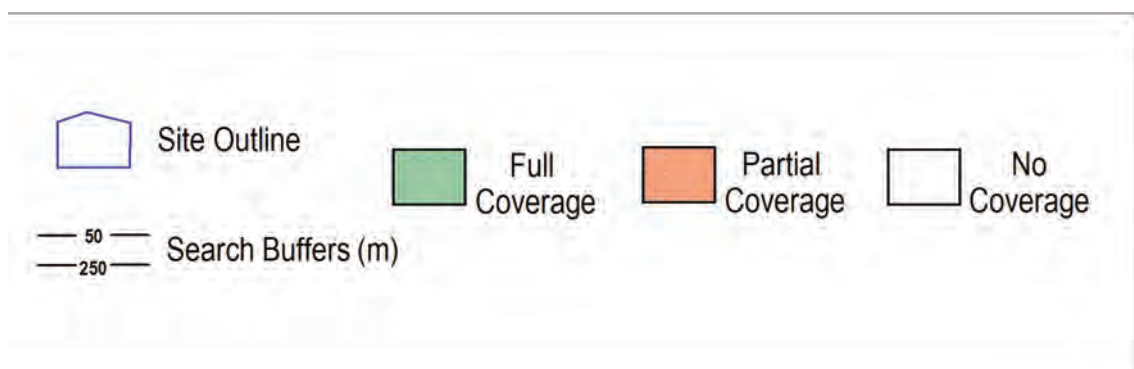
Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Cornwall and Devon Metalliferous Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0
Section 6: Natural Ground Subsidence	On-site				
6.1 Shrink-Swell Clay	Low				
6.2 Landslides	Very Low				
6.3 Ground Dissolution of Soluble Rocks	Negligible				
6.4 Compressible Deposits	Negligible				
6.5 Collapsible Deposits	Very Low				
6.5 Running Sand	Very Low				
Section 7: Borehole Records	On-site	0-50m	51-250		
7 BGS Recorded Boreholes	0	0	1		
Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250		
8 Records of Background Soil Chemistry	1	0	0		
Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500	
9.1 Tunnels	0	0	0	Not Searched	
9.2 Historical Railway and Tunnel Features	0	0	0	Not Searched	
9.3 Historical Railways	0	0	0	Not Searched	
9.4 Active Railways	0	0	0	Not Searched	
9.5 Railway Projects	0	0	0	0	

1:10,000 Scale Availability



1_10,000 Availability Legend

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Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	Some deposits are mapped	Full	Full	Some deposits are mapped
2	1113.0	Some deposits are mapped	Full	Full	Some deposits are mapped
N3	1148.0	Some deposits are mapped	Full	Full	Some deposits are mapped
N4	1636.0	Some deposits are mapped	Full	Full	Some deposits are mapped

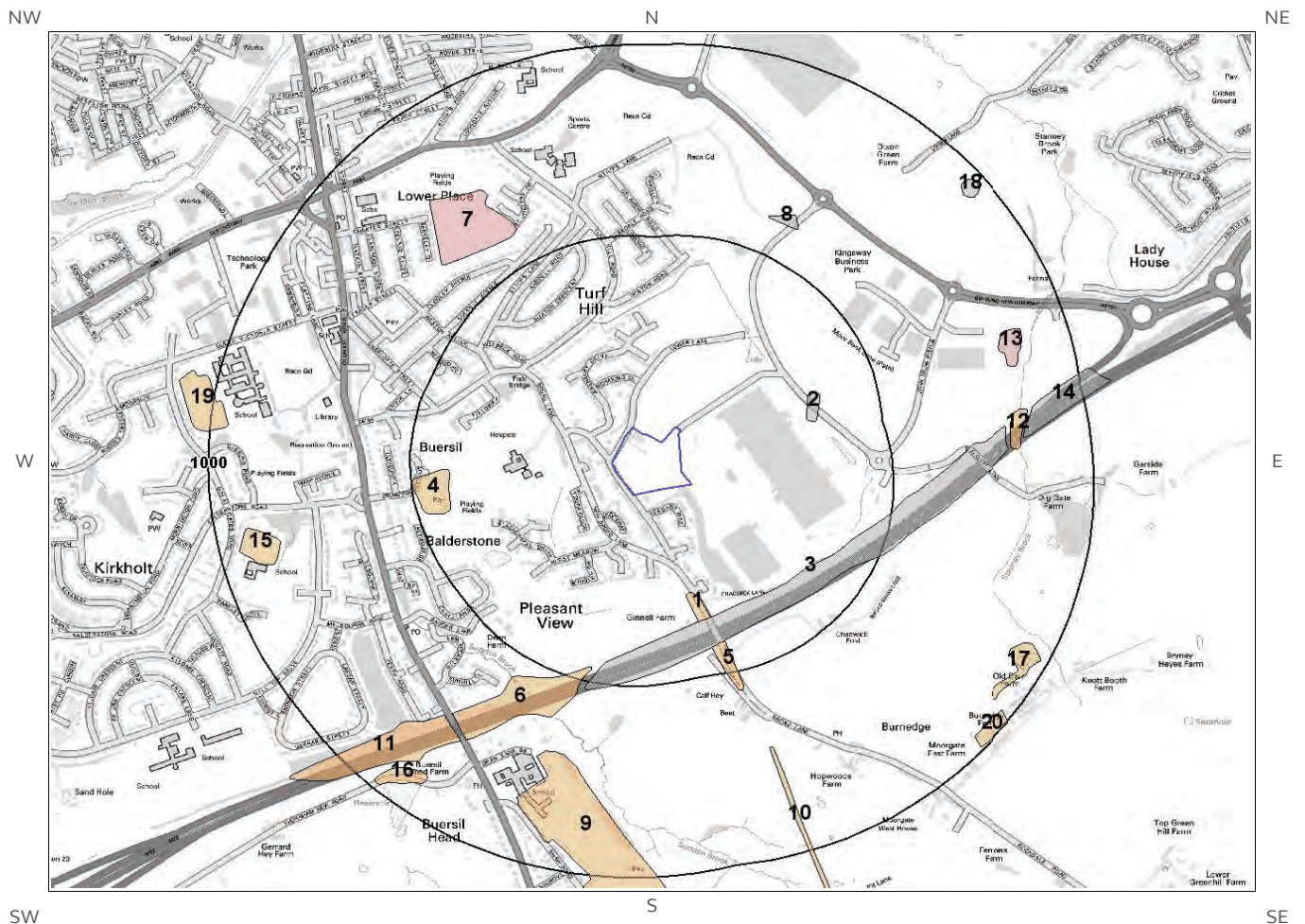
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

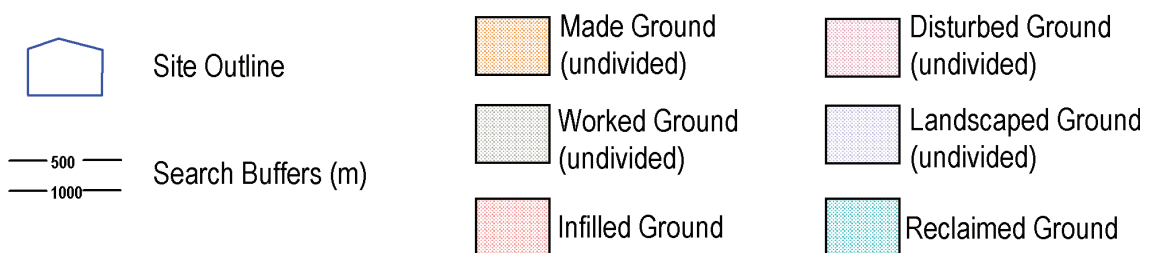
1 Geology (1:10,000 scale).

1.1 Artificial Ground map (1:10,000 scale)



Artificial Ground Legend

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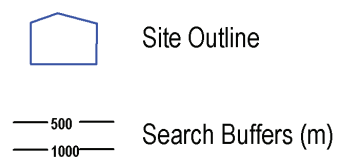
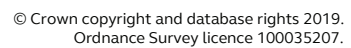
1. Geology 1:10,000 scale

1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	277.0	S	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
2	314.0	E	WGR-VOID	Worked Ground (Undivided)	Void
3	331.0	SE	WGR-VOID	Worked Ground (Undivided)	Void
4	404.0	W	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
5	413.0	S	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
6	462.0	S	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit



1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
2	0.0	On Site	HMGDD-DMTN	Hummocky (moundy) Glacial Deposits, Devensian - Diamicton	Diamicton
3	40.0	NE	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel
4	215.0	NE	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel
5	230.0	N	PEAT-P	Peat - Peat	Peat
6	445.0	SE	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel

1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

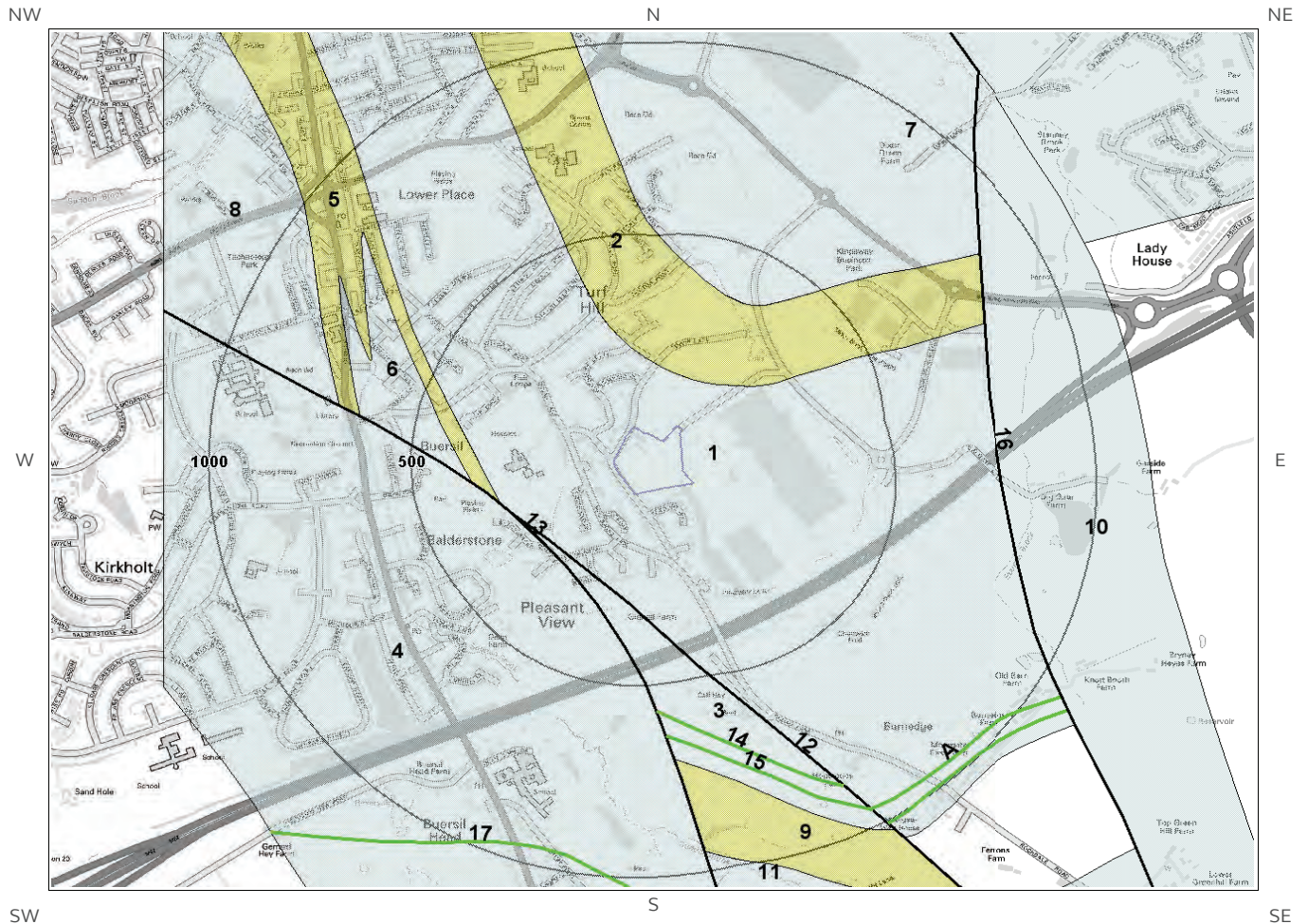
No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

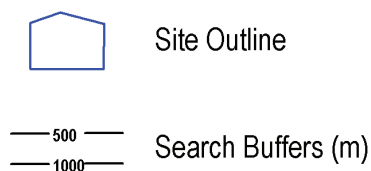
This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3 Bedrock and linear features map (1:10,000 scale)



Bedrock and linear features Legend

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1.3 Bedrock and linear features

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1	0.0	On Site	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age
2	125.0	N	MLRS-SDST	Milnrow Sandstone - Sandstone	Langsettian Sub-age
3	228.0	SW	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age
4	253.0	SW	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age
5	299.0	W	OL-SDST	Old Lawrence Rock - Sandstone	Langsettian Sub-age
6	352.0	W	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age
7	359.0	NE	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age

1.3.2 Linear features

Are there any records of linear features within 500m of the study site boundary at 1:10,000 scale? Yes

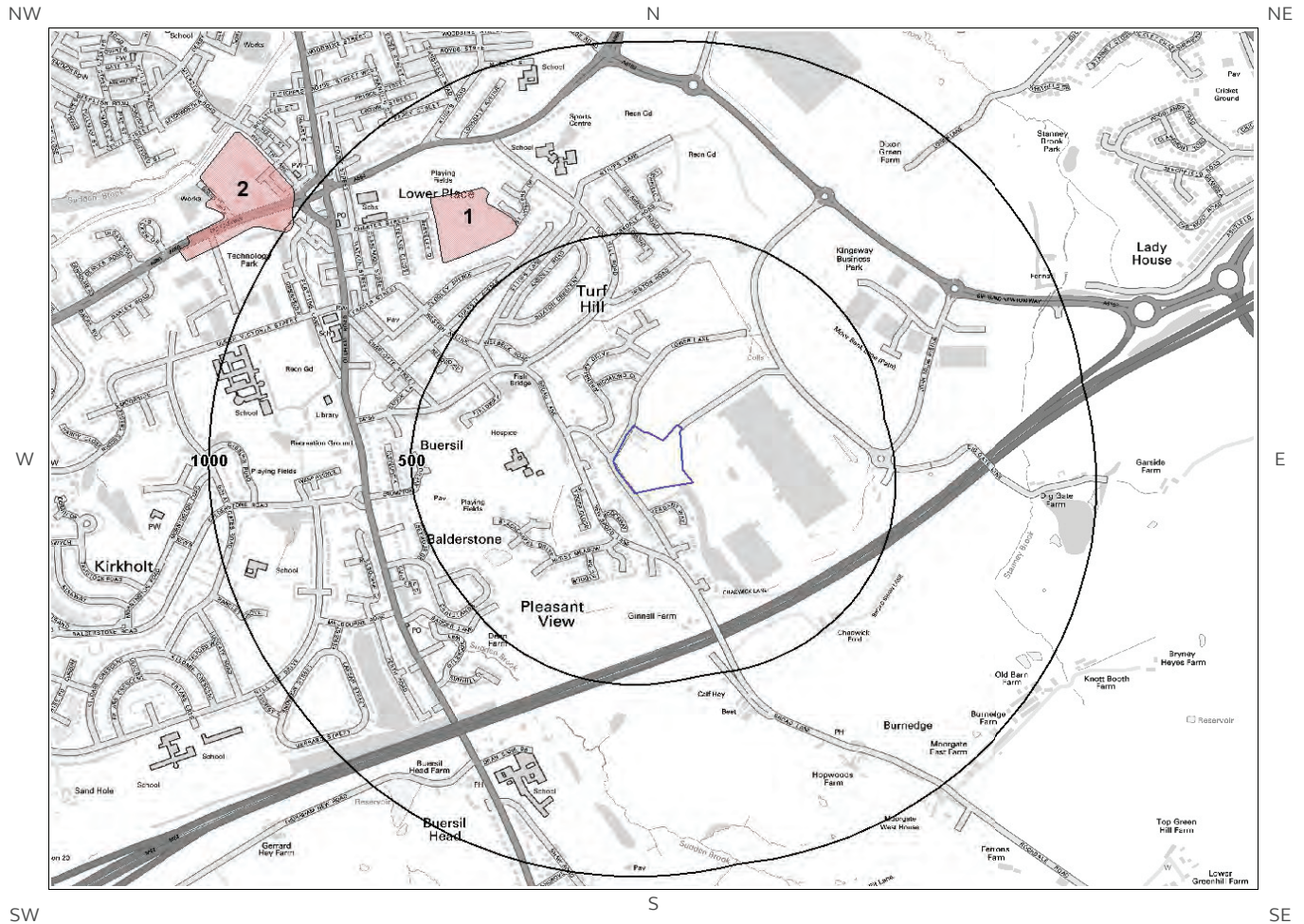
ID	Distance (m)	Direction	Category Description	Feature Description
12	228.0	SW	FAULT	Normal fault, inferred; crossmarks on downthrow side
13	253.0	SW	FAULT	Normal fault, inferred; crossmarks on downthrow side

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

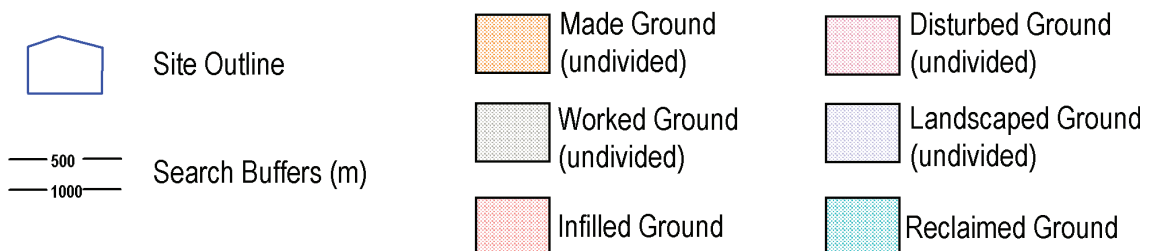
This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2 Geology 1:50,000 Scale

2.1 Artificial Ground map



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2. Geology 1:50,000 scale

2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 085

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? No

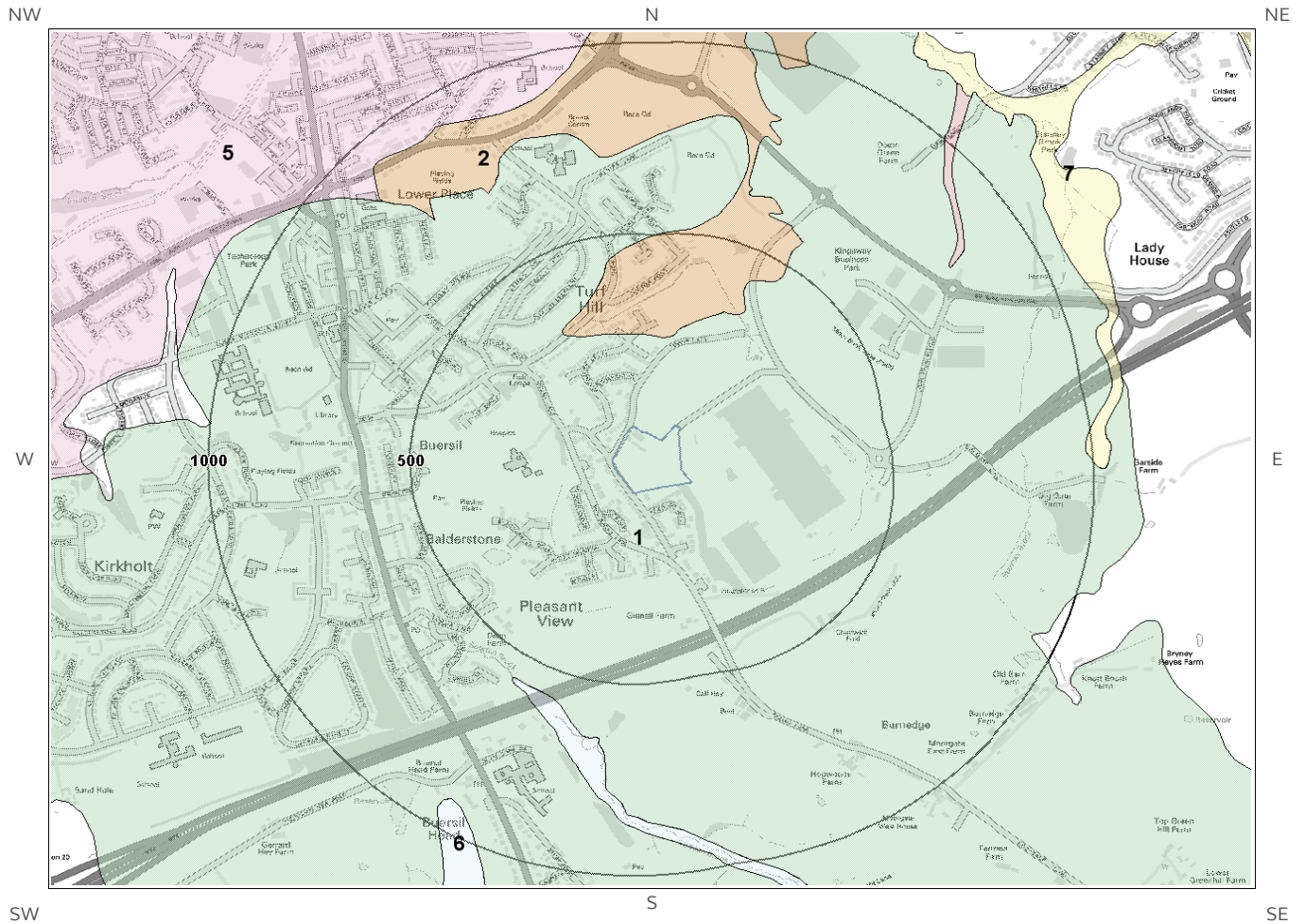
Database searched and no data found.

2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

Database searched and no data found.

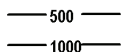
2.2 Superficial Deposits and Landslips map (1:50,000 scale)



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Site Outline



Search Buffers (m)

2.2 Superficial Deposits and Landslips

2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	HMGDD-DMTN	HUMMOCKY (MOUNDY) GLACIAL DEPOSITS, DEVENSIAN	DIAMICTON
2	230.0	N	PEAT-P	PEAT	PEAT

2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	High	Low

2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary? No

Database searched and no data found.