



EARTH ENVIRONMENTAL
& GEOTECHNICAL

Phase II Site Investigation Report

Further Red Lumb
Rochdale

June 2024

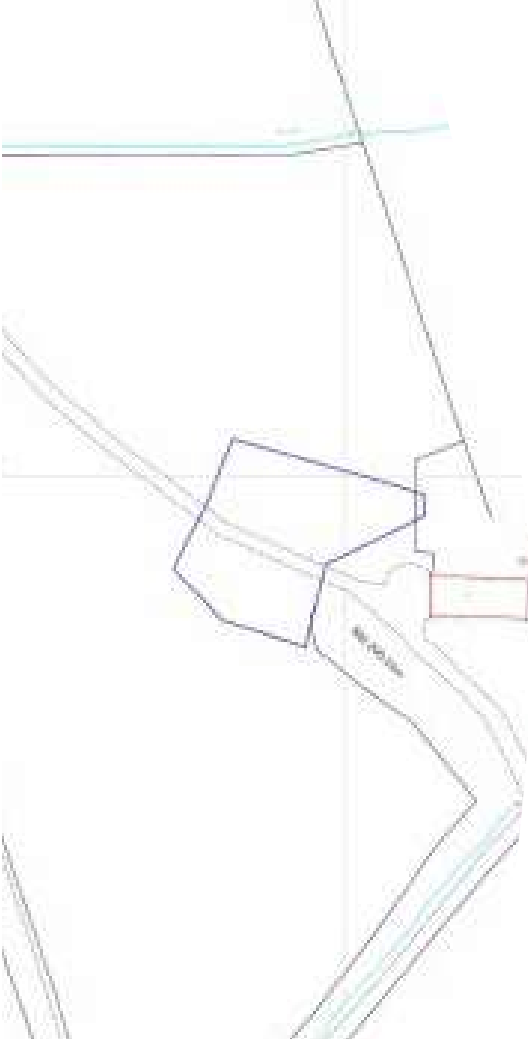
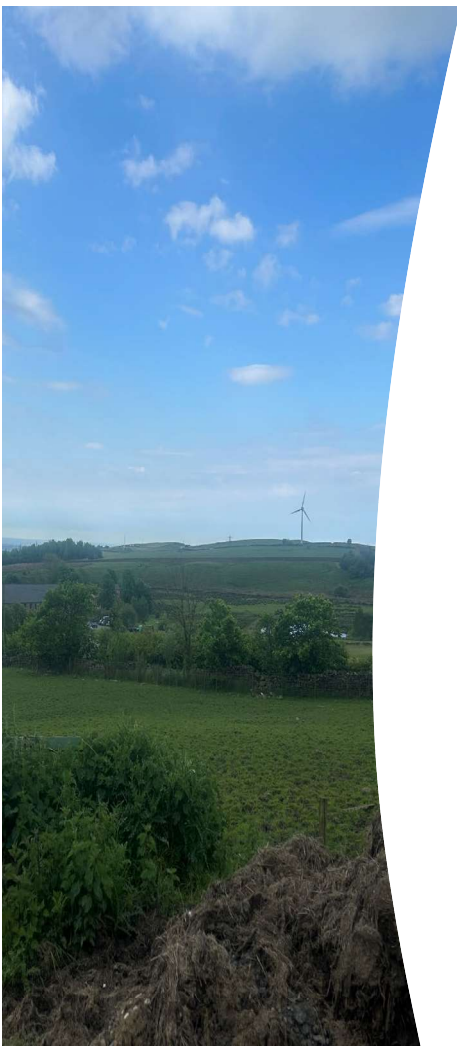
On behalf of

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**GEOENVIRONMENTAL SITE
INVESTIGATION REPORT**

FURTHER RED LUMB

RED LUMB

ROCHDALE

Report Ref: M0981/A1

June 2024

Prepared on Behalf of:

Everhaus Limited

By:

Earth Environmental & Geotechnical Ltd
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Wilton
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GEOENVIRONMENTAL SITE INVESTIGATION REPORT

FURTHER RED LUMB, RED LUMB, ROCHDALE

Report Reference: M0981

Version A.1

Date: 18th June 2024

Prepared for: Everhaus Limited

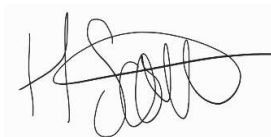
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Definition of Version Code:

- D. Applied during initial drafting of the report before it has been reviewed.
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TABLE OF CONTENTS

1.0	EXECUTIVE SUMMARY	1
2.0	INTRODUCTION	2
2.1	BACKGROUND	2
2.2	PREVIOUS INVESTIGATIONS	2
2.3	TERMS OF REFERENCE	2
2.4	REPORT SCOPE	2
2.5	LIMITATIONS OF THE STUDY	3
3.0	SITE LOCATION AND DESCRIPTION	6
3.1	PROPOSED DEVELOPMENT	6
4.0	SITE INVESTIGATION	7
4.1	EXPLORATORY FIELDWORK	7
4.2	LABORATORY TESTING	9
4.2.1	<i>Environmental Testing</i>	9
5.0	GROUND CONDITIONS ENCOUNTERED	10
5.1	SOIL PROFILE ENCOUNTERED	10
5.4	GROUNDWATER	11
6.0	ENGINEERING PROPERTIES OF SOILS ENCOUNTERED	12
6.1	GENERAL	12
6.2	CLAY	12
7.0	GEOTECHNICAL ASSESSMENT	16
7.1	PROPOSED DEVELOPMENT	16
7.2	GROUND CONDITIONS ENCOUNTERED	16
7.3.1	Strip and Pad Foundations	16
7.4	CHEMICAL ATTACK ON BURIED CONCRETE	17
7.5	TEMPORARY WORKS	17
8.0	SOIL CONTAMINATION RISK ASSESSMENT	18
8.1	TIER I HUMAN HEALTH SOIL RISK ASSESSMENT – GROUNDWORKERS DURING DEVELOPMENT	18
8.2	TIER I HUMAN HEALTH SOIL RISK ASSESSMENT – FUTURE SITE USERS	18
9.0	GROUNDWATER CONTAMINATION RISK ASSESSMENT	20
10.0	GROUND GAS AND RADON GAS CONTAMINATION RISK ASSESSMENT	21
11.0	CONCLUSIONS & RECOMMENDATIONS	23
11.1	SOIL CONTAMINATION	23
11.2	ASBESTOS	23
11.3	FOUNDATIONS	23
11.5	GROUND GAS	23
11.6	RISK TO BURIED (WATER) SERVICES	23
11.7	SITE PERSONNEL	24
11.8	OTHER MATTERS	24

LIST OF FIGURES

Figure 1	Site Location Plan
Figure 2	General Site Photographs
Figure 3	Proposed Development Plan
Figure 4	Exploratory Hole Location Plan
Figure 5	Plasticity Chart

TABLES

Table 1	Sampling Location Justification
Table 2	Summary of Exploratory Holes Undertaken
Table 3	Summary of Ground Conditions Encountered
Table 4	Summary of Laboratory Geotechnical Test Results
Table 5	Summary of Design Parameters (Clay)
Table 6	Soil Desiccation Indicators in the Clay
Table 7	Summary of Allowable Bearing Pressures
Table 8	Summary of Guideline Values for Protection of Workers and the General Public During Development of Contaminated Land
Table 9	Soil Results Comparison with C4SL/S4UL Values
Table 10	Groundwater Results Comparisons with EQS/Drinking Water Quality Values
Table 11	Characteristic Situations

APPENDICES

Appendix 1	Exploratory Hole Logs and Infiltration Test Results
Appendix 2	Chemical Testing Results
Appendix 3	Geotechnical Testing Results
Appendix 4	Ground Gas Monitoring Results
Appendix 5	Report Limitations

1.0 EXECUTIVE SUMMARY

Appointment	A Site Investigation has been commissioned by Everhaus Ltd to determine ground conditions for a proposed residential, single storey dwelling development at a site northwest of Further Red Lumb Farm, Red Lumb Street, Rochdale, OL12 7TX.
The Investigation	The assessment comprised five windowless boreholes, two machine excavated trial pits, Geotechnical testing, Chemical testing and gas monitoring.
The Site	The site area is located to the northwest of Further Red Lumb Farm, Red Lumb Street, Rochdale with the nearest postcode being OL12 7TX. The approximate National Grid Reference for the centre of the site is X: 384391, Y: 415893. The site is accessed from the southeast from Edenfield Road via Overtown Lane and Red Lumb Street. The immediate surrounding area to north, east, south and west consist of agricultural land. Farm buildings are located east of the site, with farmsteads located further south, east and west.
Ground Conditions Encountered	In general, the exploratory holes at the location generally encountered made ground to depths between 0.00m and 2.00m bgl, underlain by soft to stiff grey to brown sandy gravelly clay at depths between 0.25m and 2.80m bgl. BH1 and BH3 had very weak thinly to thickly laminated grey shale underlying the clay between depths of 2.00m and 4.00m; whereas BH2 and BH4 were underlain by weak yellowish brown coarse grained weathered sandstone with sandy clay infilling gaps between fragments.
Geotechnical Assessment	Traditional Strip or a raft foundation can be adopted, the strip foundations should be taken down below any Made Ground and placed in the natural cohesive material. If any Made Ground, particularly loose or soft material, is encountered at foundation level this should be excavated and replaced with suitable granular fill or the foundation extended at least 150mm into suitable natural strata.
Ground Gas Assessment	Based on the three gas visits undertaken to date, ground gas protection measures in line with CS1 Ground Gas Protection are required, however a further three ground monitoring visits are planned, and this may change. The site is not located within a Radon Affected Area as defined by the Health Protection Agency, and therefore No Radon Protection measures are required.
Contamination Assessment	Risk from contamination to groundworkers during development – Low. Risk from contamination to future site users – Low. Risk from the contamination from leachates – Low. No asbestos was identified in the samples analysed.
<i>This sheet is intended to provide a summary only of the report. It does not provide a definitive engineering analysis for the purposes of costing or construction and is subject to the limitation of the agreed brief.</i>	

2.0 INTRODUCTION

2.1 Background

A Site Investigation has been commissioned by Everhaus Ltd to determine the ground conditions for a proposed residential single storey dwelling being developed at a site northwest of Further Red Lumb Farm, Red Lumb Street, Rochdale, OL12 7TX.

2.2 Previous Investigations

2.2.1 Earth Environmental and Geotechnical Ltd, Desk Study – M0981 Desk Study – Further Red Lumb, Red Lumb, Rochdale dated June 2024.

Historically the site has been undeveloped, with agricultural land to the north, east south and west; however, the site once provided access to the mine adit to the north of the site. Site development did not occur until at least 2012 with the construction of a dwelling. In terms of Coal Mining, there are no recorded or possible unrecorded workings and the three mine entries surrounding the site pose a low risk to the development.

The overall risk to current and future site users is **MODERATE**, with the main risks being associated with ground gas from underground workings. Along with made ground associated with the former track which provides access to a mine entry with historical residential use.

The overall risk to construction workers is concluded to be **LOW**.

The risk to groundwater is concluded to be **LOW** as there is no evidence of widespread sources of significant mobile contamination present at the assessment site.

2.3 Terms of Reference

Earth Environmental and Geotechnical Ltd (EEG) have been commissioned by the Client, to undertake a Site Investigation of the site in accordance with proposal M0981/24 dated 16th April 2024. The objectives of this investigation are as follows:

- *Factual information on the work undertaken including sampling location plan, borehole logs, chemical and geotechnical testing.*
- *Tier 1 (semi-quantitative) risk assessment will be undertaken. This will compare the concentrations of soil and ground gas contaminants identified against current and appropriate published guidelines, in relation to identified receptors, e.g. existing/ future end users and site neighbours. If required, recommendations will be provided for suitable remediation options should significant contamination be encountered.*
- *Assessment of ground conditions for foundation design and provision of recommendations for foundations.*

2.4 Report Scope

This report presents full factual records of the site work carried out, the ground conditions encountered in the exploratory holes and laboratory test results. All information collected has

been used to provide an interpretation of the ground conditions, with recommendations on potential ground contamination risks for the proposed development.

2.5 Limitations of the Study

The report is written in the context of an agreed scope of work and budget and should not be used in a different context. New information, improved practices or changes in legislation may require a reinterpretation of the report in whole or in part. EEG reserve the right to amend either conclusions or recommendations considering any further information that may become available. The report is provided for the sole use by the client and is confidential to them.

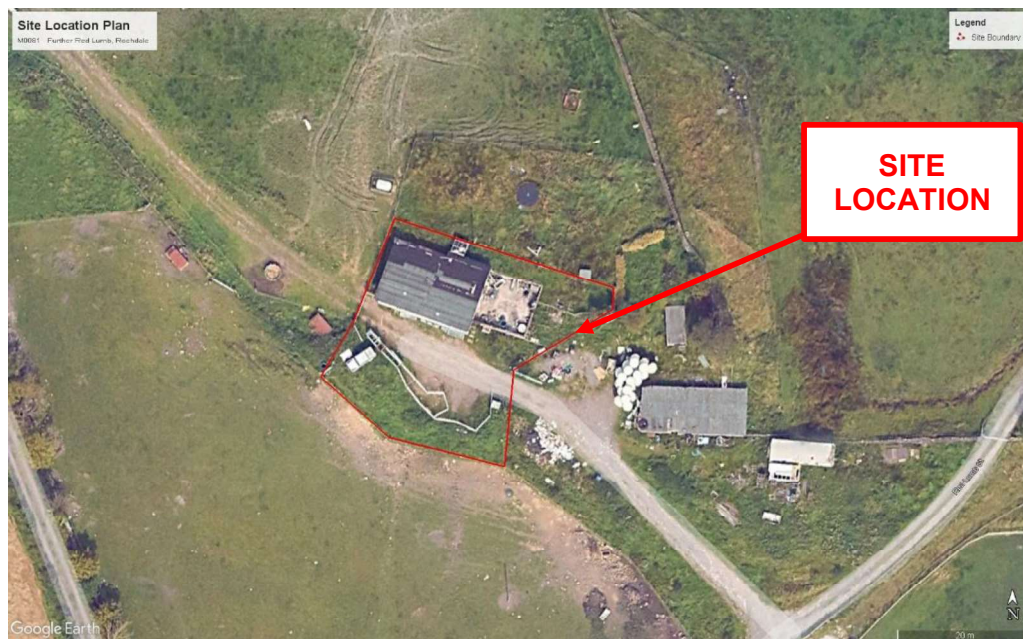
Recommendations within this report are also based on exploratory records and examination of samples and, where applicable, laboratory tests. No liability can be accepted for conditions not revealed by the trial pits particularly at intervening locations. Whilst every effort is made to ensure accuracy of data supplied, all opinions expressed as to the spatial distribution of strata between sampling locations is for guidance only and no responsibility is accepted as to its accuracy.

3.0 SITE LOCATION & DESCRIPTION

The site area is located to the northwest of Further Red Lumb Farm, Red Lumb Street, Rochdale with the nearest postcode being OL12 7TX. The approximate National Grid Reference for the centre of the site is X: 384391, Y: 415893. The site is accessed from the southeast from Edenfield Road via Overtown Lane and Red Lumb Street. The immediate surrounding area to north, east, south and west consist of agricultural land. Farm buildings are located east of the site, with farmsteads located further south, east and west.

A location plan is shown below as Figure 1.

Figure 1: Site Location Plan



General site photographs are presented in Figure 2, overleaf.

Figure 2: General Site Photographs

View on the day of the site works and the drilling of a borehole using the window sample rig.



View showing spoil from BH3.

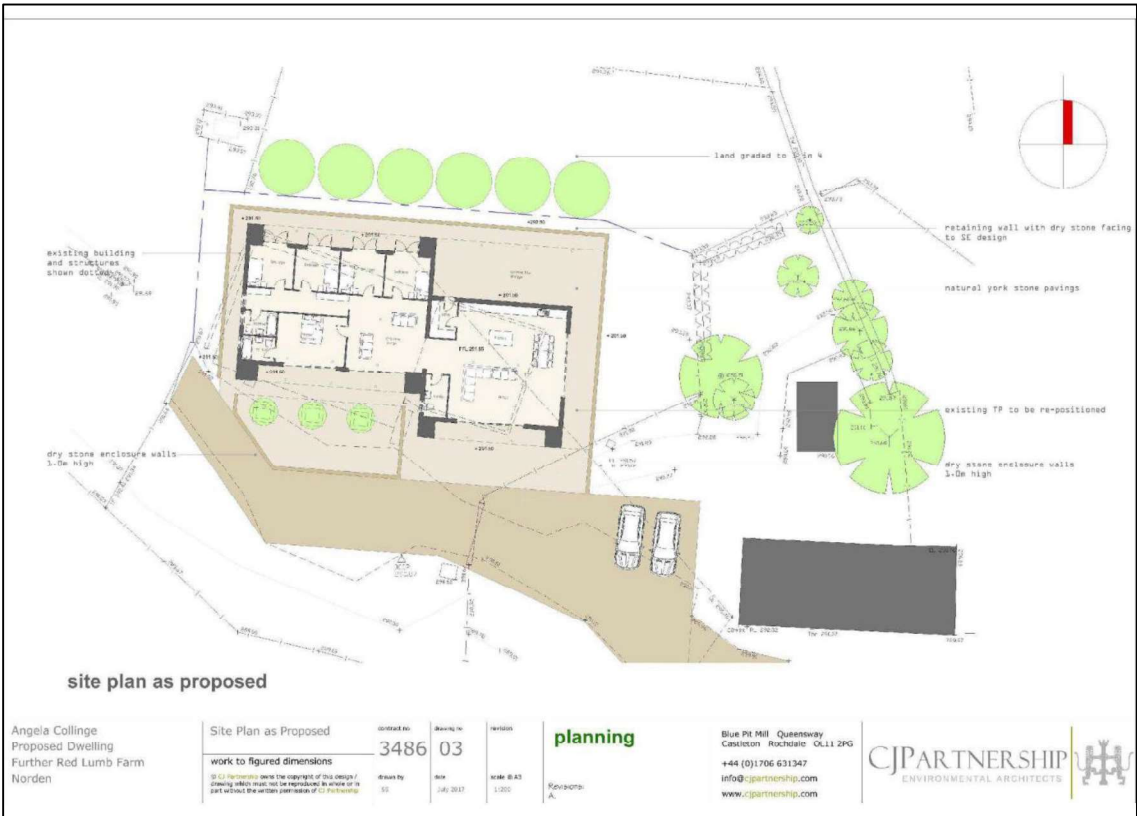


3.1 Proposed Development

The client intends to demolish the existing building structure and construct a new single storey dwelling with soft landscaping built in its place.

A proposed development plan is shown in Figure 3, below.

Figure 3: Proposed Development Plan



4.0 SITE INVESTIGATION

4.1 Exploratory Fieldwork

The fieldwork was carried out by EEG on the 21st of May 2024 and entailed:

- Five window sample boreholes (designated BH1 to BH5) were each sunk to depths of between 1.20m to 4.00m below existing ground level. Due to restricted access, BH5 had to be excavated by hand to 1.20m. Window sampler boring is carried out with a small, track-mounted rig, which uses a chain-driven trip hammer to drive sampling tubes or penetrometers into the ground. These tools are coupled to the anvil of the hammer by solid drill rods. Sampling tubes comprise “windowless samplers”, which are plain sampler tubes in which a continuous disturbed sample is recovered within a semi-rigid plastic liner. In order to reduce friction within the borehole, sampling tubes of progressively smaller diameter are used as the borehole depth increases. Sampler diameters generally range from between approximately 90mm to 50mm. Standard Penetration Tests (SPTs) were undertaken in the boreholes in accordance with BS EN ISO 22476-3. Groundwater observations were noted where possible. These observations relate to the time of the investigation only, and do not necessarily reflect seasonal fluctuations. Exploratory hole logs are included in Appendix 1. Exploratory hole locations were selected on-site by an EEG engineer based on the proposed development layout and avoiding known services. BH1, BH2 and BH5 were backfilled using arisings/spoil, whereas BH4 and BH5 had ground gas monitoring pipes installed.
- Two trial pits (SA1 and SA2) were excavated in the centre of the site by use of a 3-tonne 360 tracked excavator to a maximum depth of 1.00m bgl. Soakaway tests were carried out in all of the trial pits in accordance with BRE Digest 365, the results of which are included in the Appendix 1.

Exploratory hole locations were selected on-site by an EEG engineer based on the proposed development layout and avoiding known services. Each exploratory location was scanned using a Cable Avoidance Tool (CAT) in order to locate unrecorded underground services, and the exploratory locations were repositioned if necessary.

Table 1 below indicates the appropriate features targeted.

Table 1: Sampling Location Justification

Exploratory Hole	Sampling Location
BH1 to BH4	Proposed placement of residential building being developed.
BH5	Proposed placement of sewage system to the south of the proposed property.
SA1 and SA2	Proposed placement of residential building being developed.

On completion, samples recovered from the site were taken to specialist laboratories for chemical testing.

Soil samples of approximately 1.25kg were recovered in amber jars for volatile analysis and plastic tubs for general analysis. All the samples were labelled and stored in cool boxes prior to being collected by courier at the end of the day for delivery to the DETS laboratory.

If collection was not possible the same day, then samples were stored in the sample storage fridge at the EEG offices below 4°C.

Samples were tracked using appropriate Chain of Custody forms provided by DETS.

It should be noted that hexavalent chromium soil is analysed using the USEPA recommended method of alkaline leach. This method limits chromium (VI) reduction to chromium (III).

All site investigation work was supervised full time by a representative of EEG. The logging of soils and rocks has been carried out in accordance with BS5930⁽²⁰¹⁵⁾ except where superseded by the soil and rock description methodology in BS EN14688-1⁽²⁰⁰²⁾, BS EN 14688-2⁽²⁰⁰⁴⁾ and BS EN 14689-1⁽²⁰⁰³⁾.

An Exploratory Hole Location Plan is presented as Figure 4, below.

A summary of exploratory holes undertaken during the assessment are presented in Table 2 below.

Table 2: Summary of Exploratory Holes Undertaken

Hole	Type*	Depth (m)	Date Started	Date Finished	Backfill Details**
BH1	WS	2.50	21/05/2024	21/05/2024	S
BH2		1.50	21/05/2024	21/05/2024	S
BH3		4.00	21/05/2024	21/05/2024	B + G + SP
BH4		2.00	21/05/2024	21/05/2024	B + G + SP
BH5		1.20	21/05/2024	21/05/2024	S
SA1	TP	0.80	21/05/2024	21/05/2024	S
SA2	TP	1.00	21/05/2024	21/05/2024	S
WS=Window Sample, TP=Trial Pit B=Bentonite G=Gravel SP= Standpipe for gas monitoring S=Spoil					

Figure 4: Exploratory Hole Location Plan



4.2 Laboratory Testing

4.2.1 Environmental Testing

The environmental chemistry of the ground was investigated by specialist chemical analysis of selected samples, scheduled by EEG, and carried out by DETS, a UKAS and MCERTS accredited laboratory.

Chemical analyses were carried out on five soil samples and were submitted for the following suite of determinants:

Asbestos Screen, Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Cyanide, Phenol, Sulphate (SO₄), Sulphide, pH, Soil Organic Matter and Speciated Polycyclic Aromatic Hydrocarbons (PAH).

The results of the laboratory contamination tests are discussed in Section 8 and included in Appendix 2.

5.0 GROUND CONDITIONS ENCOUNTERED

5.1 Soil Profile Encountered

BGS digital mapping shows that the site is underlain by superficial deposits of Devensian age till (diamicton). The underlying bedrock consists of coarse-grained sandstone of the Rough Rock Formation and associated localised interbedded mudstone and siltstone. The sequence of strata encountered beneath the site was as follows:

- **Made Ground** was encountered in all the boreholes, comprising:
 - Brown clayey topsoil with rootlets and fine to coarse gravel of rounded to sub-angular shale, coal and sandstone and occasional brick fragments.
 - Dark brown clayey gravelly topsoil with fine to coarse gravel and cobbles of rounded to sub angular weathered sandstone.
 - Soft greyish brown sandy gravelly clay.
 - Dark grey clayey topsoil.
- **Clay** was encountered in all the boreholes comprising:
 - Firm to stiff dark bluish grey with brown mottling sandy gravelly CLAY with occasional cobbles. Fine to coarse gravel and cobbles of sub rounded to angular sandstone.
 - Soft to firm orangish brown with grey mottling sandy, gravelly, cobbly CLAY. Fine to coarse gravel and cobbles of rounded to angular sandstone.
 - Soft to firm dark bluish grey slightly silty CLAY.
- **Shale** was encountered in BH1 and BH3, comprising:
 - Very weak, thinly to thickly laminated grey with brown mottling SHALE. Often has reddish brown to orange discolouration on lamination surfaces.
- **Sandstone** was encountered in BH2 and BH6, comprising:
 - Weak thinly bedded yellowish brown coarse grained highly weathered SANDSTONE with sandy clay infilling gaps between sandstone fragments. Contains well-sorted, rounded to sub-angular grains of quartz, feldspar and mica.

The depths of the various materials encountered in the exploratory holes are summarised in Table 3, below.

Table 3: Summary of Ground Conditions Encountered

Hole	Depth to Stratum (m bgl)				
	MADE GROUND	CLAY	SHALE	SANDSTONE	GROUNDWATER
BH1	GL-0.80	0.80-2.00	2.00-2.50	-	-
BH2	GL-0.80	0.80-1.20	-	1.20-1.50	-
BH3	GL-2.00	2.00-2.80	2.80-3.00	-	3.00

Hole	Depth to Stratum (m bgl)				
	MADE GROUND	CLAY	SHALE	SANDSTONE	GROUNDWATER
BH4	GL-0.25	0.25-1.70	-	1.70-2.00	-
BH5	GL-0.50	0.50-1.20	-	-	-
SA1	GL-0.60	-	-	0.60-0.80	-
SA2	GL-0.10	0.10-1.00	-		-

5.4 Groundwater

Ground water was only recorded in BH3 during the site works at 3.00m bgl.

6.0 ENGINEERING PROPERTIES OF SOILS ENCOUNTERED

6.1 General

The following sections discuss the engineering properties of the strata encountered, based on results of in-situ and laboratory testing obtained during this investigation.

Table 4: Summary of Laboratory Geotechnical Test Results

Location	Depth (m)	Strata*	CLASSIFICATION								CHEMICAL	
			Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Modified Plasticity Index (%)	PSD Gravel (%)	PSD Sand (%)	PSD Silt (%)	PSD Clay (%)	pH Value
BH01	2.00	CLAY	16	48	15	33	32				6.3	14
BH03	2.00	CLAY	14	48	22	26	26				6.0	13

6.2 Clay

Table 4, below, shows the derived undrained shear strength of the clay soils based on laboratory test results and shear strength values.

The **water-soluble sulphate** content of the two samples ranged from 13mg/l to 14mg/l SO₄, together with a **pH value** of between 6.0 to 6.3.

Table 5: Summary of Design Parameters (Clay)

Depth	Shear Vane Result Range (kN/m ²)	Lower Quartile Shear Vane (kN/m ²)	Coefficient of Volume Compressibility** (mv)
1.00	65-80	69.5 (Medium Strength)	0.15 (Medium Compressibility)
2.00	66-104	75.5 (High Strength)	0.14 (Medium Compressibility)
**Based on correlation by Stroud & Butler ⁽¹⁹⁷⁵⁾			

In accordance with NHBC Chapter 4.2 Building Near Trees ⁽²⁰⁰³⁾ soils can be classified in terms of volume change potential, using the relationship:

$$I'_p = I_p \times \frac{\% \text{ less than } 425\mu\text{m}}{100\%}$$

I'_p = modified plasticity index,
 I_p = plasticity index.

Based on the laboratory test results, the above relationship and Table 1 of NHBC Chapter 4.2, the samples of Clay are shown to have **medium volume change potential**.

The **Natural Moisture Content** (NMC) and **Liquid Limit** (LL) of the soil can be used to give an indication of **soil desiccation**, i.e., where the NMC is less than 40% of the LL, the soil is inferred to be desiccated, as summarised in Table 6, below.

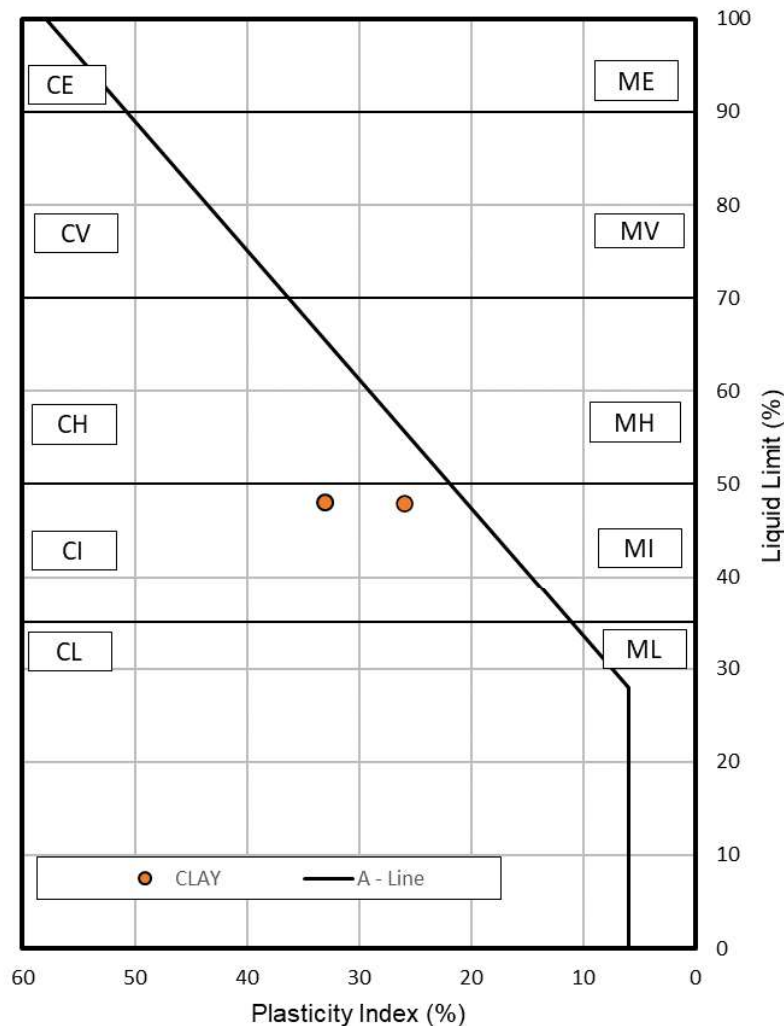
Table 6: Soil Desiccation Indicators in the Clay

Location	Depth (m)	Liquid Limit (%)	40% Liquid Limit (%)	Natural Moisture Content (%)	Desiccation
BH01	2.00	48	19	16	Yes
BH03	2.00	48	19	14	Yes

The results in the above table show that generally the clay samples collected show evidence of desiccation, however there are no vegetation or trees within 20m radius of the site.

Atterberg Limit tests were carried out on six samples of the clay. Results of the tests reported **liquid limit** values in the range of 48% and **plastic limit** values in the range of 15% to 22%, resulting in values of **plasticity index** in the range of 26% to 33%. These results suggest the clay to be of **Intermediate plasticity**. Results are shown on the Plasticity Chart in Figure 5, overleaf.

Figure 5 Plasticity Chart



For design purposes, a value of plasticity index = 31% is recommended, based on the upper quartile value of the results.

The **coefficient of volume compressibility (mv)** has been estimated using the following correlation by Stroud and Butler ⁽¹⁹⁷⁵⁾: for a clay with a plasticity index of 31%, $mv = 1 / (0.472 \times N \text{ value})$. This correlation gives values of coefficient of volume compressibility of between 0.14 m²/MN and 0.15m²/MN, as shown in Table 4. The results suggest the clay has a **medium compressibility**.

6.3 Permeability Testing

Permeability testing was conducted in SA1 and SA2 in accordance with BRE Digest 365, a measured infiltration rate was at 1.21×10^{-5} m/s in SA1 and 2.29×10^{-7} m/s in SA2 which is presented in full in Appendix 1.

7.0 GEOTECHNICAL ASSESSMENT

7.1 Proposed Development

The client intends to demolish the existing building structure and a new single storey dwelling with soft landscaping will be built in its place.

At the time of writing this report the anticipated structural loadings were not known.

7.2 Ground Conditions Encountered

In general, the exploratory holes at the location generally encountered made ground to depths between 0.00m and 2.00m bgl, underlain by soft to stiff grey to brown sandy gravelly clay at depths between 0.25m and 2.80m bgl. BH1 and BH3 had very weak thinly to thickly laminated grey shale underlying the clay between depths of 2.00m and 4.00m, whereas BH2 and BH4 were underlain by weak yellowish brown coarse grained weathered sandstone with sandy clay infilling gaps between fragments.

7.3.1 Strip and Pad Foundations

Strip and pad foundations should be taken down below any Made Ground and placed in the natural cohesive material. If any Made Ground, particularly loose or soft material, is encountered at foundation level this should be excavated and replaced with suitable granular fill or the foundation extended at least 150mm into suitable natural strata.

The raft foundations can be placed directly on either the made ground or the natural material but should be suitably compact prior to placement and any obviously loose spots should be replaced with suitably compact hardcore.

Foundations should be placed in materials of similar bearing and consolidation characteristics to avoid potential differential settlement occurring.

Table 7 summarises anticipated allowable bearing pressures for strip and pad foundations placed in the natural clay. The bearing capacities are calculated based on Hansen's ⁽¹⁹⁷⁸⁾ method and assuming a factor of safety against bearing capacity failure of 3.

Groundwater was encountered at BH3 at 3.00m bgl.

Table 7: Summary of Allowable Bearing Pressures

Foundation Strata	Design Value (Section 6)	Foundation Depth (m bgl)	Foundation Type	Foundation Size (m)	Allowable Bearing Pressure (kN/m ²)
Cohesive	95kN/m ²	0.90	Strip	0.60	160
			Pad	1.0 x 1.0	175
			Pad	2.0 x 2.0	161
Cohesive	95kN/m ²	0.55	Raft	11.5 x 25.0	133

Table 8 below summarises anticipated settlements of the above foundations in clay based on design values discussed in Section 6. Settlement in cohesive soils typically comprises a small amount of immediate settlement as loads are applied and a larger proportion of consolidation settlement, which will occur over a longer period. As the proposed foundation loading is not

known, for the purposes of these calculations a foundation loading of between 100kN/m² and 50kN/m² has been used.

Table 8: Summary of Anticipated Settlement (Cohesive)

Foundation Depth (m bgl)	Foundation Type	Foundation Size (m)	Foundation Loading (kN)	Settlement (mm)		
				Centre	Corner	Average
0.90	Strip	1.00	100	-	-	13
	Pad	1.0 x 1.0	100	18	4	13
	Pad	2.0 x 2.0	100	27	7	20
0.55	Raft	11.5 x 25.0	50	18	4	13

Made ground is not considered an appropriate bearing stratum due to its variable nature. Floor slabs may be designed as ground bearing where Made Ground is excavated and replaced with suitable granular fill placed in accordance with an engineering specification.

All foundation excavations should be inspected by a suitable qualified engineer to prove that the founding strata is suitable and uniform along the length of the foundation, and capable of taking the anticipated structural loadings. If foundations cross from granular to cohesive soils, nominal reinforcement should be incorporated.

7.4 Chemical Attack on Buried Concrete

Chemical tests (see Appendices) show low levels of water-soluble sulphates and near neutral conditions. Based on these conditions, it is recommended that for concrete placed in natural strata the Design Sulphate Class for the site, as defined in BRE Special Digest 1⁽²⁰⁰⁵⁾, be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1s. The recommendations of BRE Special Digest 1 should be followed for concrete foundations and ground bearing floor slabs.

7.5 Temporary Works

Formations will be susceptible to damage both by weather and trafficking, and should be protected immediately on exposure, particularly in areas where construction plant will access the site.

Excavations in Made Ground are likely to be unstable and should be battered back to an angle of 1 in 2, or a system of close sheeting and shoring adopted to ensure stability, and where personnel are required to enter excavations. All excavations should be adequately supported where personnel are required to enter.

Groundwater seepages could be encountered near surface within excavations, particularly during the wetter months of the year. Pumping of excavations from a suitable located sump is likely to be required to keep excavations dry.

All natural materials on site should be capable of being excavated using conventional excavating machinery.

8.0 SOIL CONTAMINATION RISK ASSESSMENT

8.1 Tier I Human Health Soil Risk Assessment – Groundworkers During Development

To assess the risk of soil contamination to construction and ground workers during development, guidelines from the HSE Document 'Protection of workers and the public during development of contaminated land' ⁽¹⁹⁹¹⁾ are used. The document assesses soil contamination test results and classifies the site as being uncontaminated or contaminated with varying degrees of contamination from 'slight' to 'unusually heavy'. The guideline values and laboratory test results are summarised in the following table:

Table 8: Summary of Guideline Values for Protection of Workers and the General Public During Development of Contaminated Land

Contaminant	Typical Values* for:					Test Results	Class
	Uncontaminated Soils	Slight Contamination	Contaminated	Heavy Contamination	Unusually Heavy Contamination		
	Class A	Class B	Class C	Class D	Class E		
pH (acid)	6 - 7	5 - 6	4 - 5	2 - 4	<2	6.2 - 7.3	A
pH (alkaline)	7 - 8	8 - 9	9 - 10	10 - 12	12	6.2 - 7.3	A
Arsenic	0 - 30	30 - 50	50 - 100	100 - 500	500	5 - 15	A
Cadmium	0 - 1	1 - 3	3 - 10	10 - 50	50	<2 - 0.4	A
Chromium	0 - 100	100 - 200	200 - 500	500 - 2500	2500	13 - 24	A
Copper	0 - 100	100 - 200	200 - 500	500 - 2500	2500	22 - 27	A
Lead	0 - 500	500 - 1000	1000 - 2000	2000 - 1%	1.0%	23 - 50	A
Mercury	0 - 1	1 - 3	3 - 10	10 - 50	50	<1.0	B
Nickel	0 - 20	20 - 50	50 - 200	200 - 1000	1000	9 - 28	A
Zinc	0 - 250	250 - 500	500 - 1000	1000 - 5000	5000	88 - 193	A
Boron	0 - 2	2 - 5	5 - 50	50 - 250	250	<1.0	A
Selenium	0 - 1	1 - 3	3 - 10	10 - 50	50	<2.0	B
Beryllium	0 - 5	5 - 10	10 - 20	20 - 50	50	<0.5 - 1.1	A
Vanadium	0 - 100	100 - 200	200 - 500	500 - 2500	2500	21 - 40	A
Sulphate	0 - 2000	2000 - 5000	5000 - 1%	1% - 5%	5.05%	14 - 163	A
Cyanide (free)	0 - 1	1 - 5	5 - 50	50 - 100	100	<1.0	A
Phenol	0 - 2	2 - 5	5 - 50	50 - 250	250	<2.0 - 8.8	C

Based on the above results it is considered there is a **LOW** potential risk from soil contamination to construction workers, ground workers and members of the public during construction. Appropriate measures, such as PPE, site health plans, and appropriate disposal of material arisings will mitigate any risk.

8.2 Tier I Human Health Soil Risk Assessment – Future Site Users

The following section provides a Human Health Soil Assessment for future site users. The following section compares the results of contamination analyses to residential with home grown produce of end development as specified by Defra/LQM/CIEH. As part of the contamination assessment, the chemical results obtained by EEG have been screened against accepted compliance criteria, namely:

- Defra C4SL Health Criteria Values (March 2014), where available; and
- Tier 1 assessment values - based on LQM/CIEH Sutable 4 Use Levels ⁽²⁰¹⁵⁾ (S4ULs).

The soil chemical testing results are summarised in Table 9, overleaf.

Table 9: Soil Results Comparison with C4SL/S4UL Values

Determinand	C4SL/S4UL Levels Residential With HGP (mg/kg)	BH1 0.20m	BH2 0.20m	BH2 0.50m	BH3 0.20m	BH3 0.50m	No of Exceedances
Arsenic	37	15	5	6	6	7	0
Beryllium	1.7	1.1	< 0.5	0.9	< 0.5	< 0.5	0
Boron	290	< 1	< 1	< 1	< 1	< 1	0
Cadmium	22	0.3	0.3	< 0.2	0.4	0.2	0
Chromium	910	23	19	24	19	13	0
Chromium VI	21	< 2	< 2	< 2	< 2	< 2	0
Copper	2400	25	23	26	27	22	0
Lead	200	50	23	28	41	46	0
Mercury	40	< 1	< 1	< 1	< 1	< 1	0
Nickel	130	28	22	19	20	9	0
Selenium	250	< 2	< 2	< 2	< 2	< 2	0
Vanadium	410	38	40	36	38	21	0
Zinc	3700	91	184	117	193	88	0
Polycyclic Aromatic Carbons							
Naphthalene	13	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Acenaphthylene	920	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Acenaphthene	1100	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Fluorene	860	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Phenanthrene	440	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Anthracene	11000	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Fluoranthene	890	0.16	< 0.1	1.13	< 0.1	< 0.1	0
Pyrene	2000	0.14	< 0.1	1.11	< 0.1	< 0.1	0
Benzo(a)anthracene	13	< 0.1	< 0.1	0.54	< 0.1	< 0.1	0
Chrysene	27	< 0.1	< 0.1	0.50	< 0.1	< 0.1	0
Benzo(a)pyrene	5	< 0.1	< 0.1	0.69	< 0.1	< 0.1	0
Benzo(b)fluoranthene	3.7	< 0.1	< 0.1	0.74	< 0.1	< 0.1	0
Benzo(k)fluoranthene	100	< 0.1	< 0.1	0.27	< 0.1	< 0.1	0
Indeno(1,2,3-cd) pyrene	41	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Dibenz (a, h) anthracene	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Benzo(ghi)perylene	350	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Phenols							
Phenol	1100	8.8	<2	<2	<2	<2	0

Based on the above table, no contaminant concentrations were found in exceedance of the screening criteria relevant to a residential with home grown produce.

Asbestos fibres or fragments were not identified in any of the samples tested during this investigation.

9.0 GROUNDWATER CONTAMINATION RISK ASSESSMENT

In the absence of specific UK guidelines regarding groundwater quality in the UK, chemical results obtained by EEG have been compared with the following statutory and non-statutory standards:

- Environmental Quality Standards (EQS); and
- UK Drinking Water standards (2000).

Many of the EQS values lie just above the method detection limit for parameters and as such, are extremely conservative. For the purposes of this report, it is considered the most appropriate EQS data are those established for freshwater. In the absence of EQS values, Drinking Water Standards have been used for comparison of results. Again, these standards are highly conservative, especially in this site context.

EQS values have been derived to protect surface water. There are no surface water features within 250m, and the surrounding area is agricultural land.

Two samples of made ground were subject to leachate testing from BH2 at 0.20mbgl and BH2 at 0.50mbgl.

A direct comparison was made between the leachate analysis results and the EQS and Drinking Water Standards, and the results are summarised in Table 10, below.

Given the environmental setting of the site, and no exceedances, the risk to groundwater from contamination is considered low.

Further detail on the water chemical testing results can be found in Appendix 2.

Table 10: Groundwater Results Comparisons with EQS/Drinking Water Quality Values

Determinand	EQS Value (1)	Drinking Water Quality (DWQ) Value (2)	BH2 0.20	BH2 0.50	No. of Exceedances
Arsenic	50 ^(A)	10	0.3	0.2	0
Cadmium	0.9 ^(M)	5	< 0.2	< 0.2	0
Chromium	32 ^(M)	50	0.8	0.4	0
Lead	14 ^(M)	10	< 0.2	< 0.2	0
Mercury	0.07 ^(M)	1	< 0.04	< 0.04	0
Selenium	-	10	< 0.2	< 0.2	0
Nickel	34 ^(M)	20	0.4	1.1	0
Zinc	10.9 ^(A)	5000	6	2	0
Cyanide	5 ^(M)	50	< 5	< 5	0
Phenol	46 ^(M)	500	< 10	< 10	0
Sulphate	400000 ^(A)	250000	2	2	0
pH	6 - 9 ^(M)	-	7.8	7.9	0
*All values in µg/l unless otherwise stated *EQS Standards – (M) = Maximum Allowable Concentration Standard, (A) = Annual Average Standard. Zinc EQS is based on bioavailability. Values in red are elevated above the recommended guidance value					

10.0 GROUND GAS AND RADON GAS CONTAMINATION RISK ASSESSMENT

10.1 Radon Gas

The site is not located within a Radon Affected Area as defined by the Health Protection Agency, and therefore **No Radon Protection** measures are required.

10.2 Analyses of Monitoring Results

The potential risk associated with gases being generated in the ground (whether from natural or man-made sources) depends on the concentrations of gas and its flow rate to the surface. These factors are assessed by monitoring of the gas installations in the boreholes. The variable nature of gas generation and the effect of barometric pressure on gas flow, means that the volume of gas potentially reaching the ground surface is normally inconsistent over time.

Three Gas Monitoring visits have been completed by Earth Environmental & Geotechnical Ltd. The monitoring visits were conducted between 29th of May 2024 and the 11th of June 2024. The results recorded methane (CH₄) levels of between 0.0 % (v/v) and 0.1 % (v/v) and carbon dioxide (CO₂) levels of between 0.9% v/v and 2.8% v/v. Oxygen concentrations of between 17.5% and 20.1 v/v were also recorded.

Gas flow rates were recorded between 0.0l/hr and 0.1l/hr from the boreholes on site. For assessment purposes, the steady detection flow rate of 0.1 litres/hour has been used.

Atmospheric pressure was recorded at 1016 mb and 1033mb.

Full results of the completed monitoring visit are presented in Appendix 4.

Table 11 overleaf, adapted from Table 1 of the technical paper Risk and Reliability in Gas Protection Design by Card et al. 2019, shows a summary of the current UK practice with respect to appropriate gas protection measures based upon a Gas Screening Value (GSV). A GSV for the site has been obtained by multiplying the maximum concentration of gas by the maximum flow rate, which represents worst-case scenario conditions.

- Carbon dioxide: maximum flow rate = 0.1l/hr, max concentration = 2.8%
- Methane: maximum flow rate = 0.1l/hr, max concentration = 0.1%.

Based on the above figures, the GSV is calculated as:

- **Carbon dioxide:** $GSV = 0.1 \times 2.8 / 100 = 0.0028 \text{ litres/hr}$
- **Methane:** $GSV = 0.1 \times 0.1 / 100 = 0.0001 \text{ litres/hr}$

The CIRIA guidance document notes that ‘...the GSV is a guideline value and not an absolute threshold’.

The above results to date, the information recorded to date suggest the site can be given a Characteristic Situation 1, i.e., ‘very low risk’ in accordance with Table 8 overleaf.

Therefore, ground gas protection measures are not considered necessary for the proposed development at this site, however this is subject to change as a further three visits are planned.

Table 11: Characteristic Situations (Wilson et al 2006/2007 modified from Wilson and Card, 1999)

Characteristic Situation (CS)	Risk Classification	Gas Screening Value CH_4 or CO_2 (l/hr)	Additional Factors	Typical source of generation
1	Very Low	<0.07	Typically, < 1% methane Typically, < 5% carbon dioxide	Typical made ground
2	Low	<0.7	Borehole air flow rate to not exceed 70l/hr otherwise consider increase to Characteristic Situation 3	Typical made ground
3	Moderate	<3.5		Old landfill, inert waste, flooded mine workings
4	Moderate to High	<15	Quantitative risk assessment	Mine workings susceptible to flooding, completed landfill
5	High	<70		Mineworking unflooded inactive with shallow workings near surface
6	Very High	>70		Recent landfill site

11.0 CONCLUSIONS & RECOMMENDATIONS

11.1 Soil Contamination

There is a **low** potential risk from soil contamination to construction workers and ground workers during development, and appropriate measures such as PPE, site health plans, appropriate disposal of material arisings will be required to mitigate this risk.

Based on the results of the chemical testing, no contaminant concentrations were found in exceedance of the screening criteria relevant to a residential with home grown produce End Use. Therefore, no remediation of the soil is required for the proposed development.

11.2 Asbestos

Asbestos fibres or fragments were not identified in any of the samples tested during this investigation.

11.3 Foundations

Traditional Strip or a raft foundation can be adopted, the strip foundations should be taken down below any Made Ground and placed in the natural cohesive material. If any Made Ground, particularly loose or soft material, is encountered at foundation level this should be excavated and replaced with suitable granular fill or the foundation extended at least 150mm into suitable natural strata.

It recommended that for foundations and ground floor slabs in contact with the made ground, the Design Sulphate Class should be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1s.

11.4 Permeability Testing

Permeability testing was conducted in SA1 and SA2 in accordance with BRE Digest 365, a measured infiltration rate was at 1.21×10^{-5} m/s in SA1 and 2.29×10^{-7} m/s in SA2 which is presented in full in Appendix 1.

11.5 Ground Gas

Based on the gas visits, ground gas protection measures in line with CS1 Ground Gas Protection, however further ground monitoring visits are planned, and this may change.

Radon Protection is not required for the proposed structure, as the site is in an area where less than 1% of homes are above the action level.

11.6 Risk to Buried (Water) Services

It is considered that due to the low levels of contamination encountered standard materials are likely to be appropriate for new water pipes. Further advice should be sought from the local water company.

Previous guidance on buried water pipes was contained in Water Regulations Advisory Scheme (WRAS) Guidance Note No. 9-04-03⁽²⁰⁰²⁾, however this has been superseded by the UK Water

Industry Research Report 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' Ref 10/WM/03/21 (January 2011).

11.7 Site Personnel

As with all construction sites, personnel working on the site during the construction period should be encouraged to maintain a high standard of personal hygiene and on-site washing facilities should be available.

11.8 Other Matters

Due diligence is required during the construction period, and should any further evidence of contamination be found, appropriate investigation and / or action should be taken. The significance of any contamination not discovered by this investigation is outside the scope of this report.

APPENDIX 1

EXPLORATORY HOLE LOGS

Window Sample Drilling Log

Project Name: Further Red Lumb		Client: Everhaus Limited		Date: 21/05/2024	
Location: Red Lumb, Rochdale		Contractor: Bainbridge Brothers Ltd		Co-ords: E384379.00 N415911.00	
Project No. : M0981		Crew Name:		Drilling Equipment:	
Borehole Number BH1	Hole Type WS	Level		Logged By	Scale 1:20
					Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Orangish brown clayey topsoil with rootlets and fine to coarse gravel of shale, coal and sandstone.	
		0.50		HVP=46				MADE GROUND: Dark brown clayey gravelly topsoil. Fine to coarse gravel and cobbles of rounded to sub angular weathered sandstone.	
		1.00		HVP=65	0.80			Firm to stiff grey with brown mottling slightly sandy, gravelly CLAY. Gravel is fine to coarse of sub rounded to sub angular sandstone, coal and shale. Occasional horizons of blackish grey discolouration near the base of strata and a more crumbly texture at the base of the unit.	1
		1.50		HVP=70					
		2.00		HVP=66	2.00			Very weak, thinly to thickly laminated grey with brown mottling SHALE. Highly fractured during coring due to low strength. Often has reddish brown to orange discolouration on lamination surfaces.	2
					2.50			End of Borehole at 2.500m	3
									4

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks										 EARTH ENVIRONMENTAL & GEOTECHNICAL	
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Window Sample Drilling Log

Project Name: Further Red Lumb				Client: Everhaus Limited				Date: 21/05/2024			
Location: Red Lumb, Rochdale				Contractor: Bainbridge Brothers Ltd				Co-ords: E384404.00 N415892.00			
Project No. : M0981				Crew Name:				Drilling Equipment:			
Borehole Number BH2		Hole Type WS		Level		Logged By		Scale 1:20		Page Number Sheet 1 of 1	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Dark grey clayey topsoil.	1
		0.50		HVP=58				MADE GROUND: soft greyish brown sandy, gravelly clay. Gravel is fine to coarse of rounded to sub angular sandstone.	
					0.80				
		1.00		HVP=80				Firm dark grey with brown mottling sandy, gravelly CLAY. Fine to coarse gravel and cobbles of sub rounded to sub angular sandstone.	
					1.20				
					1.50			Weak thinly bedded yellowish brown coarse-grained, highly weathered SANDSTONE with sandy clay infilling gaps. Contains well-sorted, rounded to sub angular grains of quartz, feldspar and mica.	2
End of Borehole at 1.500m									
								3	
								4	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks


**EARTH ENVIRONMENTAL
& GEOTECHNICAL**

Window Sample Drilling Log

Project Name: Further Red Lumb				Client: Everhaus Limited				Date: 21/05/2024			
Location: Red Lumb, Rochdale				Contractor: Bainbridge Brothers Ltd				Co-ords: E384377.00 N415894.00			
Project No. : M0981				Crew Name:				Drilling Equipment:			
Borehole Number BH3		Hole Type WS		Level		Logged By		Scale 1:20		Page Number Sheet 1 of 1	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Greyish brown clayey topsoil with rootlets and occasional fine to coarse gravel of sub rounded to angular coal, shale and sandstone.	
		0.50		HVP=70				MADE GROUND: Dark brown with grey mottling slightly sandy, gravelly clay. Fine to coarse gravel and cobbles of rounded to angular sandstone, shale, coal and some brick.	
		1.00		HVP=71					1
		1.50		HVP=68					
		2.00		HVP=104	2.00			Soft to firm dark bluish grey slightly silty CLAY. Sandstone cobble at 2.35m. More consolidated crumbly texture below 2.40m.	2
		2.50		HVP=56	2.80				
					4.00			Very weak thinly to thickly laminated dark bluish grey SHALE. Some areas of orangish brown discolouration on lamination surfaces.	3
								End of Borehole at 4.000m	4

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks


**EARTH ENVIRONMENTAL
& GEOTECHNICAL**

Window Sample Drilling Log

Project Name: Further Red Lumb				Client: Everhaus Limited				Date: 21/05/2024			
Location: Red Lumb, Rochdale				Contractor: Bainbridge Brothers Ltd				Co-ords: E384400.00 N415887.00			
Project No. : M0981				Crew Name:				Drilling Equipment:			
Borehole Number BH4		Hole Type WS		Level		Logged By		Scale 1:20		Page Number Sheet 1 of 1	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.25			MADE GROUND: Brownish grey clayey topsoil with rootlets and occasional fine to coarse gravel of rounded to angular sandstone.	1
		0.50		HVP=61			Soft to firm orangish brown with grey mottling sandy, gravelly, cobbly CLAY. Fine to coarse gravel and cobbles of rounded to angular sandstone.		
		1.00		HVP=74					
		1.20		HVP=63					
		1.50		HVP=123	1.45		Firm to stiff dark bluish grey with brown mottling slightly sandy, slightly gravelly CLAY with occasional cobbles. Fine to coarse gravel and cobbles of sub rounded to angular sandstone.		
					1.70		Weak thinly bedded yellowish brown coarse-grained highly weathered SANDSTONE with sandy clay infilling gaps between sandstone fragments. Contains well-sorted, rounded to sub-angular grains of quartz, feldspar and mica.		
			2.00		End of Borehole at 2.000m			2	
									3
									4

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks


**EARTH ENVIRONMENTAL
& GEOTECHNICAL**

Window Sample Drilling Log

Project Name: Further Red Lumb			Client: Everhaus Limited			Date: 21/05/2024			
Location: Red Lumb, Rochdale			Contractor: Bainbridge Brothers Ltd			Co-ords: E384395.00 N415870.00			
Project No. : M0981			Crew Name:			Equipment:			
Location Number BH5		Location Type TP		Level		Logged By		Scale 1:20	Page Number Sheet 1 of 1

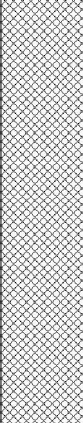
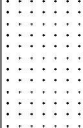
Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Dark grey clayey topsoil with rootlets.	1
		0.40		HVP=42				MADE GROUND: Dark brown with grey mottling slightly sandy, gravelly clay. Fine to coarse gravel and cobbles of rounded to angular sandstone.	
		0.60		HVP=64	0.50			Firm to stiff dark bluish grey with brown mottling slightly sandy, slightly gravelly CLAY with occasional cobbles. Fine to coarse gravel and cobbles of sub rounded to angular sandstone.	
					1.20			Borehole terminated at 1.200m	
									2
									3
									4

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks


**EARTH ENVIRONMENTAL
& GEOTECHNICAL**

Trial Pit Log

Project Name: Further Red Lumb			Client: Everhaus Limited			Date: 21/05/2024			
Location: Red Lumb, Rochdale			Contractor: Bainbridge Brothers Ltd			Co-ords: E384379.00 N415896.00			
Project No. : M0981			Crew Name:			Equipment:			
Location Number SA1		Location Type TP		Level		Logged By		Scale 1:10	Page Number Sheet 1 of 1
Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.60			MADE GROUND: Dark brown sandy, gravelly, cobbly clay. Fine to coarse gravel and cobbles of rounded to angular sandstone, shale and brick. Plastic waste was also noted in this stratum.	
					0.80			Weak thinly bedded yellowish brown coarse-grained highly weathered SANDSTONE with sandy clay infilling gaps between sandstone fragments. Contains well-sorted, rounded to sub-angular grains of quartz, feldspar and mica.	
								Trial Pit Terminated at 0.800m	
Dimensions		Trench Support and Comment				Pumping Data			
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks			Date	Rate	Remarks
Remarks									

Trial Pit Log

Project Name: Further Red Lumb			Client: Everhaus Limited			Date: 21/05/2024			
Location: Red Lumb, Rochdale			Contractor: Bainbridge Brothers Ltd			Co-ords: E384393.00 N415890.00			
Project No. : M0981			Crew Name:			Equipment:			
Location Number SA2		Location Type TP		Level		Logged By		Scale 1:10	Page Number Sheet 1 of 1

Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10		 MADE GROUND: Brown sandy gravelly clay. Fine to coarse gravel of rounded to angular sandstone and brick.		
					1.00		 Soft to firm orangish brown with grey mottling sandy, gravelly, cobbly CLAY. Fine to coarse gravel and cobbles of rounded to angular sandstone.		
							Trial Pit Terminated at 1.000m		1
									2

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks


**EARTH ENVIRONMENTAL
& GEOTECHNICAL**

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991					
BRE Digest 365, Figure 2, Page 5					
Client: Everhaus Limited					
Site: Further Rad Lumb, Rochdale					
Job No: M0981					
Pit No: TP1		Test No: 1			
CALCULATION OF SOIL INFILTRATION RATE					
Time (min)	Depth (m)	Pit Dimensions		Length (m) =	1.60
0	0.41			Width (m) =	1.20
0.5	0.41			Depth (m) =	0.80
1	0.41				
2	0.41	Depth at start of test (m) = 0.410			
3	0.41	Depth at end of test (m) = 0.580			
4	0.41	75% level (m) = 0.453			
5	0.41	50% Effective Depth 0.305			
6	0.41	25% level (m) = 0.538			
7	0.41				
8	0.41	Base area of pit (m ²) = 1.920			
9	0.41	V _{p75-25} (m ³) = 0.163			
10	0.41	a _{0.50} (m ²) = 3.628			
15	0.41				
20	0.43	From the graph:			
25	0.43	tp 75 (min) = 48			
35	0.44	tp 25 (min) = 110			
45	0.45				
55	0.46	Soil infiltration rate, f, (m/s) =		1.21E-05 normal test	
65	0.5				
95	0.53				
125	0.56	Input by:	PF	Date:	11/06/2024
140	0.58	Checked by:	PF	Date:	11/06/2024

Time (mins)

Time (mins)	Depth (m)
0	0.41
10	0.41
20	0.41
30	0.42
40	0.43
50	0.44
60	0.45
70	0.46
80	0.47
90	0.48
100	0.50
110	0.51
120	0.52
130	0.53
140	0.54
150	0.55
160	0.56
170	0.57
180	0.58

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991					
BRE Digest 365, Figure 2, Page 5					
Client: Everhaus Limited					
Site: Further Rad Lumb, Rochdale					
Job No: M0981					
Pit No: TP2		Test No: 1			
CALCULATION OF SOIL INFILTRATION RATE					
Time (min)	Depth (m)	Pit Dimensions		Length (m) =	1.50
0	0.35			Width (m) =	1.35
0.5	0.35			Depth (m) =	1.00
1	0.35				
2	0.35	Depth at start of test (m) = 0.350			
3	0.35	Depth at end of test (m) = 0.360			
4	0.35	75% level (m) = 0.353			
5	0.35	50% Effective Depth 0.645			
6	0.36	25% level (m) = 0.358			
7	0.36				
8	0.36	Base area of pit (m ²) = 2.025			
9	0.36	V _{p75-25} (m ³) = 0.010			
10	0.36	a _{0.50} (m ²) = 5.702			
15	0.36				
20	0.36	From the graph:			
25	0.36	tp 75 (min) = 5.5			
35	0.36	tp 25 (min) = 135			
45	0.36				
55	0.36	Soil infiltration rate, f, (m/s) =		2.29E-07	normal test
65	0.36				
95	0.36				
125	0.36	Input by:	PF	Date:	11/06/2024
140	0.36	Checked by:	PF	Date:	11/06/2024

Time (mins)

Depth (m)

Time (mins)	Depth (m)
0	0.350
5.5	0.353
135	0.358
140	0.360

APPENDIX 2

CHEMICAL TESTING RESULTS



Paul Finnimore
Earth Environmental & Geotechnical Ltd
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Reddish
Stockport
Cheshire
SK5 6DA

Normec DETS Limited
Unit 1
Rose Lane Industrial Estate
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Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-05824

Site Reference: Further Red Lumb, Rochdale

Project / Job Ref: M0981 - Northeast Office

Order No: M0981/DETS/HS

Sample Receipt Date: 28/05/2024

Sample Scheduled Date: 28/05/2024

Report Issue Number: 1

Reporting Date: 05/06/2024

Authorised by:

Steve Knight
Customer Support Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



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Soil Analysis Certificate

DETS Report No: 24-05824	~Date Sampled	21/05/24	21/05/24	21/05/24	21/05/24	21/05/24
Earth Environmental & Geotechnical Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Further Red Lumb, Rochdale	~TP / BH No	BH1	BH1	BH2	BH2	BH2
~Project / Job Ref: M0981 - Northeast Office	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: M0981/DETS/HS	~Depth (m)	0.20	2.00	0.20	0.20	0.50
Reporting Date: 05/06/2024	DETS Sample No	717617	717618	717619	717620	717621

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected		Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	6.2	6.3	7.3	7.3
Total Cyanide	mg/kg	< 1	NONE	< 1		< 1	< 1
Complex Cyanide	mg/kg	< 1	NONE	< 1		< 1	< 1
Free Cyanide	mg/kg	< 1	NONE	< 1		< 1	< 1
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	570		761	265
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.06		0.08	0.03
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	28	14	163	32
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.03	0.01	0.16	0.03
Sulphide	mg/kg	< 5	NONE	9		< 5	< 5
Organic Matter (SOM)	%	< 0.1	MCERTS	5.5		9	4.5
Arsenic (As)	mg/kg	< 2	MCERTS	15		5	6
Barium (Ba)	mg/kg	< 2.5	MCERTS	186		82	74
Beryllium (Be)	mg/kg	< 0.5	MCERTS	1.1		< 0.5	0.9
W/S Boron	mg/kg	< 1	NONE	< 1		< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3		0.3	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	23		19	24
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2		< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	25		23	26
Lead (Pb)	mg/kg	< 3	MCERTS	50		23	28
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1		< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	28		22	19
Selenium (Se)	mg/kg	< 2	MCERTS	< 2		< 2	< 2
Vanadium (V)	mg/kg	< 1	MCERTS	38		40	36
Zinc (Zn)	mg/kg	< 3	MCERTS	91		184	117
Total Phenols (monohydric)	mg/kg	< 2	NONE	8.8		< 2	< 2
TPH (EPH EC10-EC40) : EH_1D_Total	mg/kg	< 6	MCERTS	< 6		557	456

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion

Subcontracted analysis (S)

~Sample details provided by customer and can affect the validity of results



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Soil Analysis Certificate

DETS Report No: 24-05824	~Date Sampled	21/05/24	21/05/24	21/05/24	21/05/24
Earth Environmental & Geotechnical Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Further Red Lumb, Rochdale	~TP / BH No	BH2	BH3	BH3	BH3
~Project / Job Ref: M0981 - Northeast Office	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: M0981/DETS/HS	~Depth (m)	0.50	0.20	0.50	0.20
Reporting Date: 05/06/2024	DETS Sample No	717622	717623	717624	717625

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025		Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS		7.4	7.3	6.0
Total Cyanide	mg/kg	< 1	NONE		< 1	< 1	
Complex Cyanide	mg/kg	< 1	NONE		< 1	< 1	
Free Cyanide	mg/kg	< 1	NONE		< 1	< 1	
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS		468	608	
Total Sulphate as SO ₄	%	< 0.02	MCERTS		0.05	0.06	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS		18	41	13
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS		0.02	0.04	0.01
Sulphide	mg/kg	< 5	NONE		< 5	< 5	
Organic Matter (SOM)	%	< 0.1	MCERTS		13.6	4.8	
Arsenic (As)	mg/kg	< 2	MCERTS		6	7	
Barium (Ba)	mg/kg	< 2.5	MCERTS		106	209	
Beryllium (Be)	mg/kg	< 0.5	MCERTS		< 0.5	< 0.5	
W/S Boron	mg/kg	< 1	NONE		< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS		0.4	0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS		19	13	
Chromium (hexavalent)	mg/kg	< 2	NONE		< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS		27	22	
Lead (Pb)	mg/kg	< 3	MCERTS		41	46	
Mercury (Hg)	mg/kg	< 1	MCERTS		< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS		20	9	
Selenium (Se)	mg/kg	< 2	MCERTS		< 2	< 2	
Vanadium (V)	mg/kg	< 1	MCERTS		38	21	
Zinc (Zn)	mg/kg	< 3	MCERTS		193	88	
Total Phenols (monohydric)	mg/kg	< 2	NONE		< 2	< 2	
TPH (EPH EC10-EC40) : EH_1D_Total	mg/kg	< 6	MCERTS		< 6	9	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion

Subcontracted analysis (S)

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Soil Analysis Certificate - Speciated PAHs

DETS Report No: 24-05824	~Date Sampled	21/05/24	21/05/24	21/05/24	21/05/24	21/05/24
Earth Environmental & Geotechnical Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Further Red Lumb, Rochdale	~TP / BH No	BH1	BH2	BH2	BH3	BH3
~Project / Job Ref: M0981 - Northeast Office	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: M0981/DETS/HS	~Depth (m)	0.20	0.20	0.50	0.20	0.50
Reporting Date: 05/06/2024	DETS Sample No	717617	717619	717621	717623	717624

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	1.13	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.14	< 0.1	1.11	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.54	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.50	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.74	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.27	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.69	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	5	< 1.6	< 1.6

~Sample details provided by customer and can affect the validity of results



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Leachate Analysis Certificate					
DETS Report No: 24-05824	~Date Sampled	21/05/24	21/05/24		
Earth Environmental & Geotechnical Ltd	~Time Sampled	None Supplied	None Supplied		
~Site Reference: Further Red Lumb, Rochdale	~TP / BH No	BH2	BH2		
~Project / Job Ref: M0981 - Northeast Office	~Additional Refs	None Supplied	None Supplied		
~Order No: M0981/DETS/HS	~Depth (m)	0.20	0.50		
Reporting Date: 05/06/2024	DETS Sample No	717620	717622		

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	ISO17025	7.8	7.9		
Total Cyanide	ug/l	< 5	ISO17025	< 5	< 5		
Sulphate as SO ₄	mg/l	< 1	ISO17025	2	2		
Total Organic Carbon (TOC)	mg/l	< 1	NONE	13.2	13.4		
Arsenic	ug/l	< 0.2	ISO17025	0.3	0.2		
Barium	ug/l	< 0.2	ISO17025	11.4	7.5		
Beryllium	ug/l	< 0.2	ISO17025	< 0.2	< 0.2		
Boron	ug/l	< 1	ISO17025	10	10		
Cadmium	ug/l	< 0.2	ISO17025	< 0.2	< 0.2		
Chromium	ug/l	< 0.2	ISO17025	0.8	0.4		
Chromium (hexavalent)	ug/l	< 20	NONE	< 20	< 20		
Copper	ug/l	< 0.2	ISO17025	2.4	1.6		
Lead	ug/l	< 0.2	ISO17025	< 0.2	< 0.2		
Mercury	ug/l	< 0.04	ISO17025	< 0.04	< 0.04		
Nickel	ug/l	< 0.2	ISO17025	0.4	1.1		
Selenium	ug/l	< 0.2	ISO17025	< 0.2	< 0.2		
Vanadium	ug/l	< 0.2	ISO17025	0.6	0.6		
Zinc	ug/l	< 1	ISO17025	6	2		
Total Phenols (monohydric)	ug/l	< 10	ISO17025	< 10	< 10		
TPH (EPH EC10-EC40) : EH 1D Total	ug/l	< 10	NONE	< 10	< 10		

Subcontracted analysis⁽⁵⁾

~Sample details provided by customer and can affect the validity of results



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Leachate Analysis Certificate - Speciated PAH						
DETS Report No: 24-05824	~Date Sampled	21/05/24	21/05/24			
Earth Environmental & Geotechnical Ltd	~Time Sampled	None Supplied	None Supplied			
~Site Reference: Further Red Lumb, Rochdale	~TP / BH No	BH2	BH2			
~Project / Job Ref: M0981 - Northeast Office	~Additional Refs	None Supplied	None Supplied			
~Order No: M0981/DETS/HS	~Depth (m)	0.20	0.50			
Reporting Date: 05/06/2024	DETS Sample No	717620	717622			

Determinand	Unit	RL	Accreditation					
Naphthalene	ug/l	< 0.01	NONE	0.02	0.02			
Acenaphthylene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Acenaphthene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Fluorene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Phenanthrene	ug/l	< 0.01	NONE	0.02	0.02			
Anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Fluoranthene	ug/l	< 0.01	NONE	< 0.01	0.02			
Pyrene	ug/l	< 0.01	NONE	< 0.01	0.02			
Benzo(a)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Chrysene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Benzo(b)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Benzo(k)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Benzo(a)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Indeno(1,2,3-cd)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Dibenz(a,h)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01			
Benzo(ghi)perylene	ug/l	0.008	NONE	< 0.008	< 0.008			
Total EPA-16 PAHs	ug/l	< 0.16	NONE	< 0.16	< 0.16			



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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 24-05824	
Earth Environmental & Geotechnical Ltd	
~Site Reference: Further Red Lumb, Rochdale	
~Project / Job Ref: M0981 - Northeast Office	
~Order No: M0981/DETS/HS	
Reporting Date: 05/06/2024	

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
717617	BH1	None Supplied	0.20	22.6	Brown sandy clay
717618	BH1	None Supplied	2.00	14.5	Brown sandy clay
717619	BH2	None Supplied	0.20	7.7	Brown sandy clay with stones and vegetation
717621	BH2	None Supplied	0.50	16	Brown sandy clay
717623	BH3	None Supplied	0.20	7.2	Brown sandy clay with stones and brick
717624	BH3	None Supplied	0.50	14.2	Brown sandy clay with stones and brick
717625	BH3	None Supplied	0.20	15.4	Brown sandy clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{U/5}

~Sample details provided by customer and can affect the validity of results



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-05824

Earth Environmental & Geotechnical Ltd

~Site Reference: Further Red Lumb, Rochdale

~Project / Job Ref: M0981 - Northeast Office

~Order No: M0981/DETS/HS

Reporting Date: 05/06/2024

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried

AR As Received

~Sample details provided by customer and can affect the validity of results



Normec DETS Limited
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Water Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-05824

Earth Environmental & Geotechnical Ltd

~Site Reference: Further Red Lumb, Rochdale

~Project / Job Ref: M0981 - Northeast Office

~Order No: M0981/DETS/HS

Reporting Date: 05/06/2024

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	U	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	UF	Biological Oxygen Demand (BOD)	Determination using BOD sensors measuring the change of pressure	E133
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detection	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered

UF Unfiltered

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List of HWOL Acronyms and Operators	
DETS Report No: 24-05824	
Earth Environmental & Geotechnical Ltd	
~Site Reference: Further Red Lumb, Rochdale	
~Project / Job Ref: M0981 - Northeast Office	
~Order No: M0981/DETS/HS	
Reporting Date: 05/06/2024	

Acronym	Description
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total
~	Sample details provided by customer and can affect the validity of results

TPH (EPH EC10-EC40) - EH_1D_Total

APPENDIX 3

GEOTECHNICAL TESTING RESULTS

Laboratory Report Front Sheet		G2M Testing (Stockton) 12-16 Yarm Road, Stockton on Tees, TS18 3NA 01642 033318 info@g2mtesting.co.uk	
Site name	Job number		
Further Red Lumb, Rochdale	M0981		

Client details:

Reference: M0981
 Name: Earth Environmental & Geotechnical
 Address: Wilton Centre
 Redcar
 TS10 4RF

Telephone: 01642 438125
 Email: paulf@earthenvironmental.co.uk

FAO: Paul Finnimore

Samples received: 06/06/2024

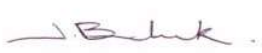
Date commenced: 06/06/2024

Date reported: 17/06/2024

Observations and interpretations are outside of the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the above reporting date the samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature: 	Approved Signatories: ☐ D.Anderson (Managing Director) ☒ J. Brischuk (Laboratory Manager) ☐
--	--

Summary of Classification Tests

G2M Testing (Stockton)

12-16 Yarm Road,
Stockton on Tees,
TS18 3NA

01642 033318

info@g2mtesting.co.uk



10258

Site name	Job number
Further Red Lumb, Rochdale	M0981

[illegible]

All tests found in G2M Testing UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description	Category	BS Test Code	
w	Moisture content		BS 1377:1990 Part 2 Clause 3.2	
wa	Equivalent moisture content passing 425µm sieve		BS 1377:1990 Part 2 Clause 3.2	
wL	Liquid limit	Single point	-s	BS 1377:1990 Part 2 Clause 4.4
		Four point	-f	BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit		BS 1377:1990 Part 2 Clause 5.2	
Pa	Percentage passing 425um sieve			
Pr	Percentage retained 425um sieve			
IP	Plasticity index		BS 1377:1990 Part 2 Clause 5.4	
IL	Liquidity index		BS 1377:1990 Part 2 Clause 5.4	
	Suffix indicating test is "Not UKAS Accredited"	*		

Approved by	JBrischuk
Approval date	17/06/2024 14:13
Date report generated	
Report Number	

APPENDIX 4

GROUND GAS MONITORING RESULTS

EARTH ENVIRONMENTAL
& GEOTECHNICAL

Site name	Further Red Lumb
Job No	M0981

[illegible]

APPENDIX 4

REPORT LIMITATIONS

REPORT LIMITATIONS

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

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

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

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

The report was written in 2024 and should be read considering any subsequent changes in legislation, statutory requirements, and industry best practices. Ground conditions can also change over time and further investigations, or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of Earth Environmental & Geotechnical Ltd. In the absence of such written advice of Earth Environmental & Geotechnical Ltd, reliance on the report in the future shall be at the client's own and sole risk. Should Earth Environmental & Geotechnical Ltd be requested to review the report in the future, Earth Environmental & Geotechnical Ltd shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between Earth Environmental & Geotechnical Ltd and the client.

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

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

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

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

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

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

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