



Civil and Infrastructure Engineering   Structural Engineering   Construction Engineering   BIM   Construction Modelling

# Further Redlumb Farm

## Produced for Everhaus Limited

Date: 31/07/2024

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## 1.0 INTRODUCTION

This report is for discharge planning condition 5 of the Further Redlumb Farm development.

Condition 5 from the planning approval document application ref: 21/00661/FUL stated that:

*Notwithstanding any detail shown on the approved plans or provided with the application submission, no development shall take place until a scheme for the discharge of surface water from the site (including surface water from hardstanding and parking areas) has been submitted to and approved in writing by the Local Planning Authority. The surface water drainage scheme shall be based on the hierarchy of drainage options in the National Planning Practice Guidance, shall be accompanied by evidence of an assessment of the site conditions, and shall accord with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacement national standards. The duly approved scheme shall be implemented prior to first occupation of the dwelling hereby permitted and retained as such thereafter.*

*Reason: To prevent an increased risk of flooding as a result of the development and to ensure satisfactory disposal of surface water from the site in accordance with Policy GB of the adopted Rochdale Core Strategy, saved Policy EM/7 of the adopted Rochdale Unitary Development Plan and the National Planning Policy Framework.*

*Reason for pre-commencement condition: Drainage infrastructure will need to be implemented prior to commencement of above ground works and a scheme therefore needs to be agreed in advance of the same.*

### 1.1. Site description

The site lies to the north of Overtown Lane from Overtown Lane, which is accessed directly from Edenfield Road (680) which links Rochdale with the Pennine town of England.

It is in an elevated position within the Pennine foothills and is a short drive from the local village centre facilities in Norden.

The site is sloping with existing levels varying from 291.00 to 294.00 AOD (refer to the enclosed site topographical survey).



Figure 1 – Site Plan as Existing

The proposed development consists of a new single storey residential building with an access road/driveway.



Figure 22 – Proposed Development

## 2.0 DESIGN CRITERIA

As of April 2015, the Lead Local Flood Authority (LLFA) has become a statutory consultee on planning applications for surface water management. As the LLFA, Rochdale Borough Council is therefore responsible for the approval of surface water drainage systems for new developments.

The NPPF recognises that flood risk and other environmental damage can be managed by minimising the changes in the volume and rate of surface water runoff from development sites and recommends that priority is given to the use of SuDS in new development.

The Non-Statutory Technical Standards for Sustainable Drainage Systems set out general recommendations to control of development runoff, including the requirement to ensure that runoff from the site is not increased by development, and the requirement to manage surface water runoff for events up to the 1 in 100 (1%) Annual Exceedance Probability event (including an additional allowance for the projected impacts of climate change).

Planning Policy Guidance (PPG) advises that climate change allowances should be determined with reference to the guidance provided in the EA document 'Flood Risk Assessments: Climate Change Allowances' (first published in February 2016 and recently updated May 2022). As the site is proposed for uses which have a design life of 100 years an additional allowance on rainfall intensity has been incorporated into the surface water management strategy i.e., a 45% increase in rainfall intensity

## 3.0 PROPOSED DRAINAGE SCHEME

### 3.1. Storm drainage strategy

The proposed storm drainage strategy for the site involves the installation of gravity drains to manage runoff from the roof, side footpaths, and driveway hardstanding. These drains will direct the water to a below ground soakaway system located to the south of the access road. The access road and driveway will be drained using external road gullies placed at low points in the access road.

### 3.2. Permeability Testing

The Phase II SI report borehole logs and trial pits indicate that the site has a geology of sandstone overlain with clay. The permeability testing conducted in the two trial pits, identified as SA1 and SA2, as detailed in the attached Phase II Site Investigation (SI) report by Earth Environmental and Geotechnical. The tests yielded the following infiltration rates:

- SA1:  $1.21 \times 10^{-5}$  m/s
- SA2:  $2.29 \times 10^{-7}$  m/s

The two infiltration tests vary significantly in rates achieved. This is due to SA 1 trial pit reaching the underlying sandstone strata while SA2 was tested within the clay sub strata. It is proposed that the soakaway will be set to a level that reached the sandstone substrata and consequently, an infiltration rate of  $1.21 \times 10^{-5}$  m/s has been adopted for calculating the required surface water soakaway.

### 3.3. Soakaway Method

Hydraulic modelling was undertaken using FEH22 rainfall data for up to and including the 1 in 100 year storm event + 45% allowance for climate change, to determine the required size of soakaway required. Two types of soakaway systems have been considered within the design: a below ground plastic crate system with a 95% void ratio and a gravel/stone infill with a 30% void ratio. The hydraulic modelling results are appended to this report, a summary of the soakaway size is outlined below.:

- **Plastic Water Crate:** Dimensions 7m x 6m x 2m deep with a 95% void ratio. Total volume achieved: 84m<sup>3</sup>
- **Stone Infill:** Dimensions 10m x 11m x 2m deep with a 30% void ratio. Total volume achieved: 220m<sup>3</sup>

The calculations show that either of the soakaways have sufficient capacity to manage the surface water runoff for all storm events up to and including the 1 in 100 year + 45% climate change with minimal localised flooding.

The final choice of soakaway design will be undertaken by the detail design engineer and will be of a minimum volume as stated above.

Based on the above information and the appended calculation it has been shown that surface water can be managed on site to NPPF and non-statutory guidelines and should satisfy for discharge of condition 5 of the planning approval.

3.0 TOPOGRAPHICAL SITE PLAN



**Castle Keep Surveys Drawing Legend**

**Topographical Linetypes:**

|                                |                          |
|--------------------------------|--------------------------|
| ..... Road                     | ..... Wall               |
| ..... Drop Kerb                | ..... Silt Drain         |
| ..... Top of Step              | ..... ACO Drain          |
| ..... Bottom of Step           | ..... Channel Drain      |
| ..... Top of Bank              | ..... Above Surface Pipe |
| ..... Bottom of Bank           | ..... Verge Line         |
| ..... Building Line            | ..... Tree Canopy Line   |
| ..... Building Canopy          | ..... Bush Canopy Line   |
| ..... Track                    | ..... Hedge              |
| ..... Channel                  | ..... Surface Feature    |
| ..... Kerb                     | ..... Survey Extents     |
| ..... Concrete                 |                          |
| ..... Footpaths                |                          |
| ..... Surface Change           |                          |
| ..... Tactile Edge             |                          |
| ..... Barrier                  |                          |
| ..... Chain Fence              |                          |
| ..... Post & Wire Fence        |                          |
| ..... Wooden Fence             |                          |
| ..... Overhead British Telecom |                          |
| ..... Overhead Electric        |                          |

**Symbols:**

|                          |                               |
|--------------------------|-------------------------------|
| TP Telegraph Pole        | CL 000.000 Manhole            |
| LP Lamp Post             | IL 000.000                    |
| EP Electric Post         | IC Inspection Chamber         |
| TL Traffic Light         | CL 000.000                    |
| FL Floodlight            | CL 000.000                    |
| CTV Cable TV IC          | CL 000.000                    |
| SC Stop Cock             | BT BT Cover                   |
| GV Gas Valve             | CL 000.000                    |
| GU Gully                 | CL 000.000                    |
| BOL Bollard              | CL 000.000                    |
| Spot Level               | SV Stop Valve                 |
| Post                     | WM Water Meter                |
| Column                   | AV Air Valve                  |
| ER Earth Rod             | FH Fire Hydrant               |
| GR Gas Riser             | GV Gas Valve                  |
| RWP Rain Water Pipe      | Cabinet                       |
| RS Road Sign             | Sign Post                     |
| SIGN Sign Post           | CL 100.000 Circular Manhole   |
| SVP Soil Vent Pipe       | IL 100.000 Triangular Manhole |
| RE Rodding Eye           | CL 100.000                    |
| Duct                     | WSL Water Spot Level          |
| Gate                     | IL 000.000                    |
| Stay                     | IL 000.000                    |
| PIPE Pipe                | Tree                          |
| EAVES Building Shot      | EOS End of Signal             |
| Building Ridge Shot      | SEAT Seat                     |
| FFL Finished Floor Level | Tree Stump                    |
| THL Threshold Level      | Bore Hole                     |
| Soffit Level             | BORE HOLE                     |
| Top Of Wall              | CKS1 Station Control Details  |
| Cope Level               | Level=0.000                   |

**Approximate National Grid North**

**CASTLE KEEP SURVEYS**

**Job Title**

Further Red Lumb Farm  
Red Lumb Street  
Rochdale

**Client Name**

EVERHAUS  
PRECISION BUILT

**Drawing Title**

Topographical Survey

|              |                 |           |
|--------------|-----------------|-----------|
| <b>Scale</b> | <b>Surveyor</b> | <b>WH</b> |
| 1:200 @ A1   |                 |           |
| <b>Date</b>  | <b>Approved</b> | <b>PK</b> |
| 02/07/24     |                 |           |

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| <b>Revision/Amendments</b> | <b>By</b>          | <b>Checked</b>  |
| CKS - 2051                 |                    | 001             |
| <b>Project Number</b>      | <b>Drawing No.</b> | <b>Revision</b> |

## 4.0 SITE INVESTIGATION REPORT



EARTH ENVIRONMENTAL  
& GEOTECHNICAL

## Phase II Site Investigation Report

Further Red Lumb  
Rochdale

June 2024

On behalf of  
Everhaus Limited

Earth Environmental & Geotechnical Ltd  
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**GEOENVIRONMENTAL SITE  
INVESTIGATION REPORT**

**FURTHER RED LUMB**

**RED LUMB**

**ROCHDALE**

**Report Ref: M0981**

**June 2024**

Prepared on Behalf of:

**Everhaus Limited**

By:

Earth Environmental & Geotechnical Ltd  
The Wilton Centre  
Wilton  
TS10 4RF

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## GEOENVIRONMENTAL SITE INVESTIGATION REPORT

### FURTHER RED LUMB, RED LUMB, ROCHDALE

*Report Reference:* M0981

*Version* A.0

*Date:* 12<sup>th</sup> June 2024

*Prepared for:* Everhaus Limited

*Prepared by:* Earth Environmental & Geotechnical Ltd  
The Wilton Centre  
Wilton  
TS10 4RF

*Definition of Version Code:*

- D. Applied during initial drafting of the report before it has been reviewed.
- C. Applied after the report has been reviewed but before it has been approved by the Project Manager.
- B. Applied after the Project Manager has approved the report ready for issue to the client.
- A. Applied to reports after external/internal review.

The version number starts at "0" and is raised by "1" at each re-type.

*Written by:*



**Harriet Scott**  
**Graduate GeoEnvironmental Consultant**

*Approved by:*



**Paul Finnimore**  
**Director**

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## 1.0 EXECUTIVE SUMMARY

|                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Appointment</b>                                                                                                                                                                                                                    | 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.                                                                                                                                                                                                                                                                                           |
| <b>The Investigation</b>                                                                                                                                                                                                              | The assessment comprised five windowless boreholes, two machine excavated trial pits, Geotechnical testing, Chemical testing and gas monitoring.                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>The Site</b>                                                                                                                                                                                                                       | 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. |
| <b>Ground Conditions Encountered</b>                                                                                                                                                                                                  | 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.                                |
| <b>Geotechnical Assessment</b>                                                                                                                                                                                                        | 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.                                                                                                                            |
| <b>Ground Gas Assessment</b>                                                                                                                                                                                                          | 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.<br><br>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.                                                                                                                                             |
| <b>Contamination Assessment</b>                                                                                                                                                                                                       | Risk from contamination to groundworkers during development – Low.<br>Risk from contamination to future site users – Low.<br>Risk from the contamination from leachates – Low.<br>No asbestos was identified in the samples analysed.                                                                                                                                                                                                                                                                                                 |
| <b><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></b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## 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 M0799/23 dated 11<sup>th</sup> October 2023. 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.

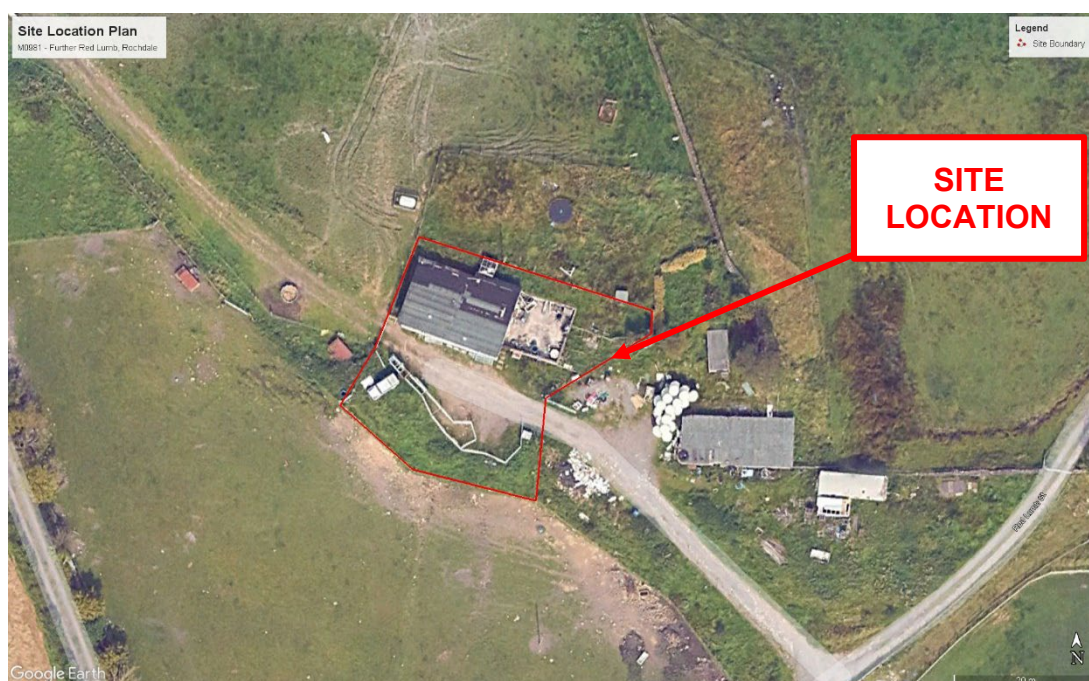
Recommendations within this report are also based on exploratory records and examination of samples and, where applicable, laboratory tests. No liability can be accepted for conditions not revealed by the trial pits particularly at intervening locations. Whilst every effort is made to ensure accuracy 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 21<sup>st</sup> 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<sup>(2015)</sup> except where superseded by the soil and rock description methodology in BS EN14688-1<sup>(2002)</sup>, BS EN 14688-2<sup>(2004)</sup> and BS EN 14689-1<sup>(2003)</sup>.

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<br>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 (SO<sub>4</sub>), 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**

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### **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.

The geotechnical testing is currently pending.

### **6.2 Permeability Testing**

Permeability testing was conducted in SA1 and SA2 in accordance with BRE Digest 365, a measured infiltration rate was at  $1.21 \times 10^{-5}$ m/s in SA1 and  $2.29 \times 10^{-7}$ 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 4 summarises anticipated allowable bearing pressures for strip and pad foundations placed in the natural clay. The bearing capacities are calculated based on Hansen's <sup>(1978)</sup> method and assuming a factor of safety against bearing capacity failure of 3.

Groundwater was encountered at BH3 at 3.00m bgl.

**Table 4: 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 <sup>2</sup> ) |
|-------------------|--------------------------|--------------------------|-----------------|---------------------|-------------------------------------------------|
| Cohesive          | 95kN/m <sup>2</sup>      | 0.90*                    | Strip           | 1.00                | 245                                             |
|                   |                          |                          | Pad             | 1.0 x 1.0           | 315                                             |
|                   |                          |                          | Pad             | 2.0 x 2.0           | 339                                             |
| Cohesive          | 95kN/m <sup>2</sup>      | 0.55                     | Raft            | 11.5 x 25.0         | >50                                             |

*\*Assumed but awaiting geotechnical testing.*

### 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<sup>(2005)</sup>, 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' <sup>(1991)</sup> 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 5: 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 <sup>(2015)</sup> (S4ULs).

The soil chemical testing results are summarised in Table 6, overleaf.

**Table 6: 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                 |
| <b>Polycyclic Aromatic Carbons</b> |                                               |           |           |           |           |           |                   |
| 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                 |
| <b>Phenols</b>                     |                                               |           |           |           |           |           |                   |
| 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 7, 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 7: 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 <sup>(A)</sup>     | 10                                     | 0.3      | 0.2      | 0                  |
| Cadmium                                                                                                                                                                                                                                                                                            | 0.9 <sup>(M)</sup>    | 5                                      | < 0.2    | < 0.2    | 0                  |
| Chromium                                                                                                                                                                                                                                                                                           | 32 <sup>(M)</sup>     | 50                                     | 0.8      | 0.4      | 0                  |
| Lead                                                                                                                                                                                                                                                                                               | 14 <sup>(M)</sup>     | 10                                     | < 0.2    | < 0.2    | 0                  |
| Mercury                                                                                                                                                                                                                                                                                            | 0.07 <sup>(M)</sup>   | 1                                      | < 0.04   | < 0.04   | 0                  |
| Selenium                                                                                                                                                                                                                                                                                           | -                     | 10                                     | < 0.2    | < 0.2    | 0                  |
| Nickel                                                                                                                                                                                                                                                                                             | 34 <sup>(M)</sup>     | 20                                     | 0.4      | 1.1      | 0                  |
| Zinc                                                                                                                                                                                                                                                                                               | 10.9 <sup>(A)</sup>   | 5000                                   | 6        | 2        | 0                  |
| Cyanide                                                                                                                                                                                                                                                                                            | 5 <sup>(M)</sup>      | 50                                     | < 5      | < 5      | 0                  |
| Phenol                                                                                                                                                                                                                                                                                             | 46 <sup>(M)</sup>     | 500                                    | < 10     | < 10     | 0                  |
| Sulphate                                                                                                                                                                                                                                                                                           | 400000 <sup>(A)</sup> | 250000                                 | 2        | 2        | 0                  |
| pH                                                                                                                                                                                                                                                                                                 | 6 - 9 <sup>(M)</sup>  | -                                      | 7.8      | 7.9      | 0                  |
| <p>*All values in µg/l unless otherwise stated<br/>           *EQS Standards – (M) = Maximum Allowable Concentration Standard, (A) = Annual Average Standard.<br/>           Zinc EQS is based on bioavailability.<br/> <b>Values in red are elevated above the recommended guidance value</b></p> |                       |                                        |          |          |                    |

## 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 29<sup>th</sup> of May 2024 and the 11<sup>th</sup> of June 2024. The results recorded methane (CH<sub>4</sub>) levels of between 0.0 % (v/v) and 0.1 % (v/v) and carbon dioxide (CO<sub>2</sub>) 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 16 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:**  $GSV = 0.1 \times 2.8 / 100 = \mathbf{0.0028 \text{ litres/hr}}$
- **Methane:**  $GSV = 0.1 \times 0.1 / 100 = \mathbf{0.0001 \text{ litres/hr}}$

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

| <b>Characteristic Situation (CS)</b> | <b>Risk Classification</b> | <b>Gas Screening Value<br/>CH<sub>4</sub> or CO<sub>2</sub> (l/hr)</b> | <b>Additional Factors</b>                                                                             | <b>Typical source of generation</b>                               |
|--------------------------------------|----------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1                                    | Very Low                   | <0.07                                                                  | Typically, < 1% methane<br>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                                              |

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## 11.0 CONCLUSIONS & RECOMMENDATIONS

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### 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  $1.21 \times 10^{-5}$ m/s in SA1 and  $2.29 \times 10^{-7}$ 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<sup>(2002)</sup>, 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).

## **12.7 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.

## **12.8 Other Matters**

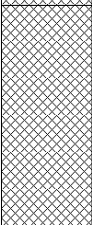
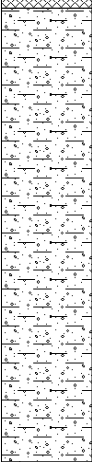
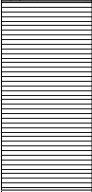
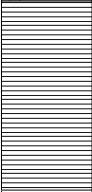
Due diligence is required during the construction period, and should any further evidence of contamination be found, appropriate investigation and / or action should be taken. The significance of any contamination not discovered by this investigation is outside the scope of this report.

## **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<br>BH1         | Hole Type<br>WS | Level                               | Logged By | Scale<br>1:20                  | Page Number<br>Sheet 1 of 1 |

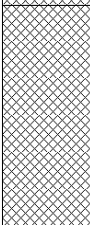
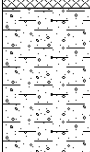
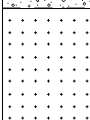
| Well                                                                                | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend                                                                              | Stratum Description                                                                                                                                                                                                                                                                     |   |
|-------------------------------------------------------------------------------------|---------------|----------------------------|------|---------|-----------|-----------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                     |               | Depth (m)                  | Type | Results |           |           |                                                                                     |                                                                                                                                                                                                                                                                                         |   |
|   |               | 0.20                       |      |         | 0.20      |           |    | MADE GROUND: Orangish brown clayey topsoil with rootlets and fine to coarse gravel of shale, coal and sandstone.                                                                                                                                                                        | 1 |
|                                                                                     |               | 0.50                       |      | HVP=46  |           |           |    | MADE GROUND: Dark brown clayey gravelly topsoil. Fine to coarse gravel and cobbles of rounded to sub angular weathered sandstone.                                                                                                                                                       |   |
|                                                                                     |               | 0.80                       |      |         | 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. |   |
|                                                                                     |               | 1.00                       |      | HVP=65  |           |           |                                                                                     |                                                                                                                                                                                                                                                                                         |   |
|                                                                                     |               | 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                       |      |         | 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 |  |  |  |  |  |  |  |  |  |  <b>EARTH ENVIRONMENTAL<br/>&amp; GEOTECHNICAL</b> |  |
|---------|--|--|--|--|--|--|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------|--|

# 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<br>BH2         | Hole Type<br>WS | Level                               | Logged By | Scale<br>1:20                  | Page Number<br>Sheet 1 of 1 |

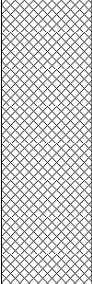
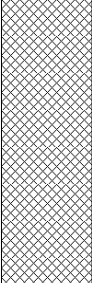
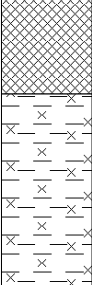
| Well                                                                              | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m)                                                                         | Legend                                                                                                                                                                                          | Stratum Description                                                                                                 |   |
|-----------------------------------------------------------------------------------|---------------|----------------------------|------|---------|-----------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|---|
|                                                                                   |               | Depth (m)                  | Type | Results |           |                                                                                   |                                                                                                                                                                                                 |                                                                                                                     |   |
|  |               | 0.50                       |      | HVP=58  | 0.20      |                                                                                   |                                                                                                                | MADE GROUND: Dark grey clayey topsoil.                                                                              | 1 |
|                                                                                   |               |                            |      |         | 0.80      |                                                                                   |                                                                                                                | MADE GROUND: soft greyish brown sandy, gravelly clay. Gravel is fine to coarse of rounded to sub angular sandstone. |   |
|                                                                                   |               | 1.00                       |      | HVP=80  | 1.20      |  | Firm dark grey with brown mottling sandy, gravelly CLAY. Fine to coarse gravel and cobbles of sub rounded to sub angular sandstone.                                                             |                                                                                                                     |   |
|                                                                                   |               |                            |      |         | 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. |                                                                                                                     |   |
|                                                                                   |               |                            |      |         |           |                                                                                   |                                                                                                                                                                                                 |                                                                                                                     |   |
|                                                                                   |               |                            |      |         |           |                                                                                   |                                                                                                                                                                                                 |                                                                                                                     | 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 |  |  |  |  |  |  |  |  |  |  <b>EARTH ENVIRONMENTAL<br/>&amp; GEOTECHNICAL</b> |  |
|---------|--|--|--|--|--|--|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------|--|

# 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<br>BH3         | Hole Type<br>WS | Level                               | Logged By | Scale<br>1:20                  | Page Number<br>Sheet 1 of 1 |

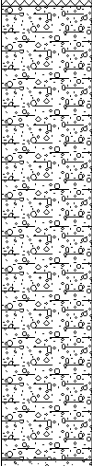
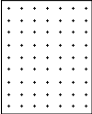
| Well                                                                               | Water Strikes                                                                      | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend                                                                              | 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      |           |  | Very weak thinly to thickly laminated dark bluish grey SHALE. Some areas of orangish brown discolouration on lamination surfaces.                                        | 3 |
|                                                                                    |                                                                                    |                            |      |         | 4.00      |           |  | 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 |  |  |  |  |  |  |  |  |  |  <b>EARTH ENVIRONMENTAL<br/>&amp; GEOTECHNICAL</b> |  |
|---------|--|--|--|--|--|--|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------|--|

# 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<br>BH4         | Hole Type<br>WS | Level                               | Logged By | Scale<br>1:20                  | Page Number<br>Sheet 1 of 1 |

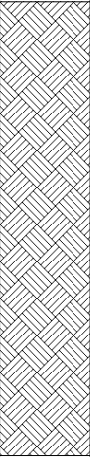
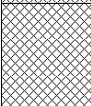
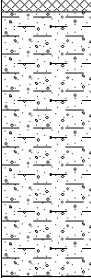
| Well | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend                                                                              | Stratum Description                                                                                                                                                                                                        |   |
|------|---------------|----------------------------|------|---------|-----------|-----------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               | 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.                                                                                              |   |
|      |               | 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 |
|      |               | 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 |
|      |               |                            |      |         | 2.00      |           |                                                                                     | End of Borehole at 2.000m                                                                                                                                                                                                  | 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 |  |  |  |  |  |  |  |  |  |  <b>EARTH ENVIRONMENTAL<br/>&amp; GEOTECHNICAL</b> |  |
|---------|--|--|--|--|--|--|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------|--|

# 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<br>BH5         | Location Type<br>TP | Level                               | Logged By | Scale<br>1:20                  | Page Number<br>Sheet 1 of 1 |

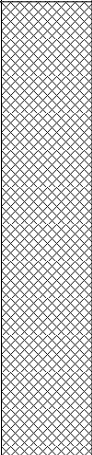
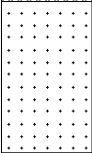
| Backfill                                                                          | Water<br>Strikes | Sample and In Situ Testing |      |         | Depth<br>(m) | Level<br>(m) | Legend                                                                            | Stratum Description                                                                                                                                                                       |   |
|-----------------------------------------------------------------------------------|------------------|----------------------------|------|---------|--------------|--------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                   |                  | 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 |  |
|---------|---------------------------------------------------------------------------------------|

# 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<br>SA1         | Location Type<br>TP | Level                               | Logged By | Scale<br>1:10                  | Page Number<br>Sheet 1 of 1 |

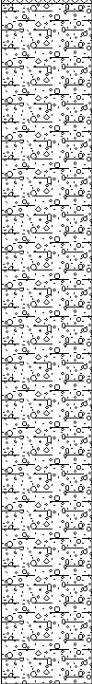
| Backfill | Water<br>Strikes | Sample and In Situ Testing |      |         | Depth<br>(m) | Level<br>(m) | Legend                                                                             | Stratum Description                                                                                                                                                                                                        |   |
|----------|------------------|----------------------------|------|---------|--------------|--------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|          |                  | 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                                                                                                                                                                                             |   |
|          |                  |                            |      |         |              |              |                                                                                    |                                                                                                                                                                                                                            | 1 |
|          |                  |                            |      |         |              |              |                                                                                    |                                                                                                                                                                                                                            | 2 |

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

|         |                                                                                                                                         |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Remarks |  <b>EARTH ENVIRONMENTAL<br/>&amp; GEOTECHNICAL</b> |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------|

# 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<br>SA2         | Location Type<br>TP | Level                               | Logged By | Scale<br>1:10                  | Page Number<br>Sheet 1 of 1 |

| Backfill | Water<br>Strikes | Sample and In Situ Testing |      |         | Depth<br>(m) | Level<br>(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.                                        |   |
|          |                  |                            |      |         |              |              |  | 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         |              |                                                                                    | 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 |  |  |  |  |  |  |  <b>EARTH ENVIRONMENTAL<br/>&amp; GEOTECHNICAL</b> |
|---------|--|--|--|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------|

**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

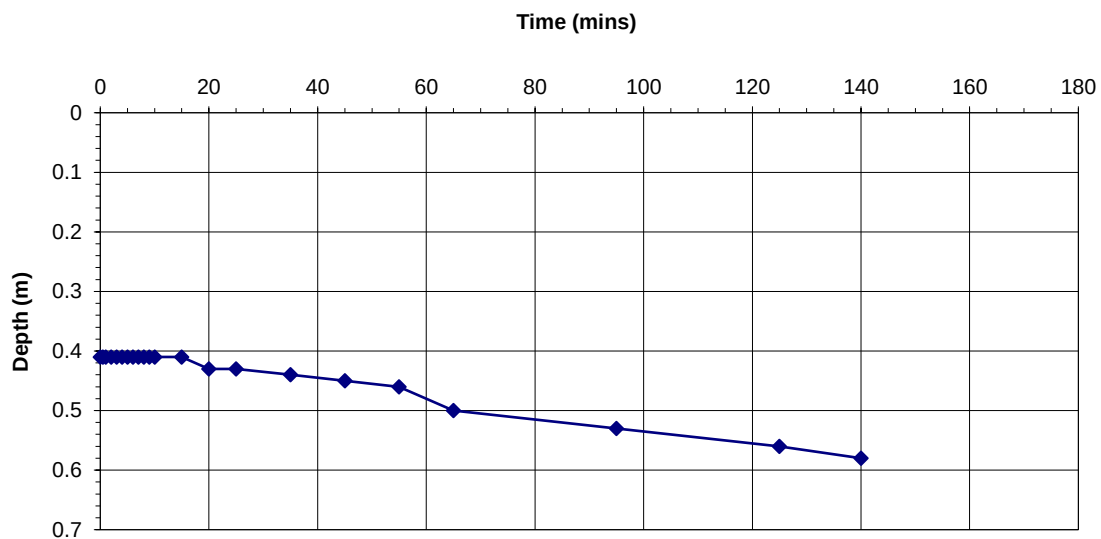
**Pit No:** TP1

**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 <sup>2</sup> ) =    |                 |              | 1.920       |
| 9          | 0.41      | Vp <sub>75-25</sub> (m <sup>3</sup> ) = |                 |              | 0.163       |
| 10         | 0.41      | a <sub>p50</sub> (m <sup>2</sup> ) =    |                 |              | 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  |

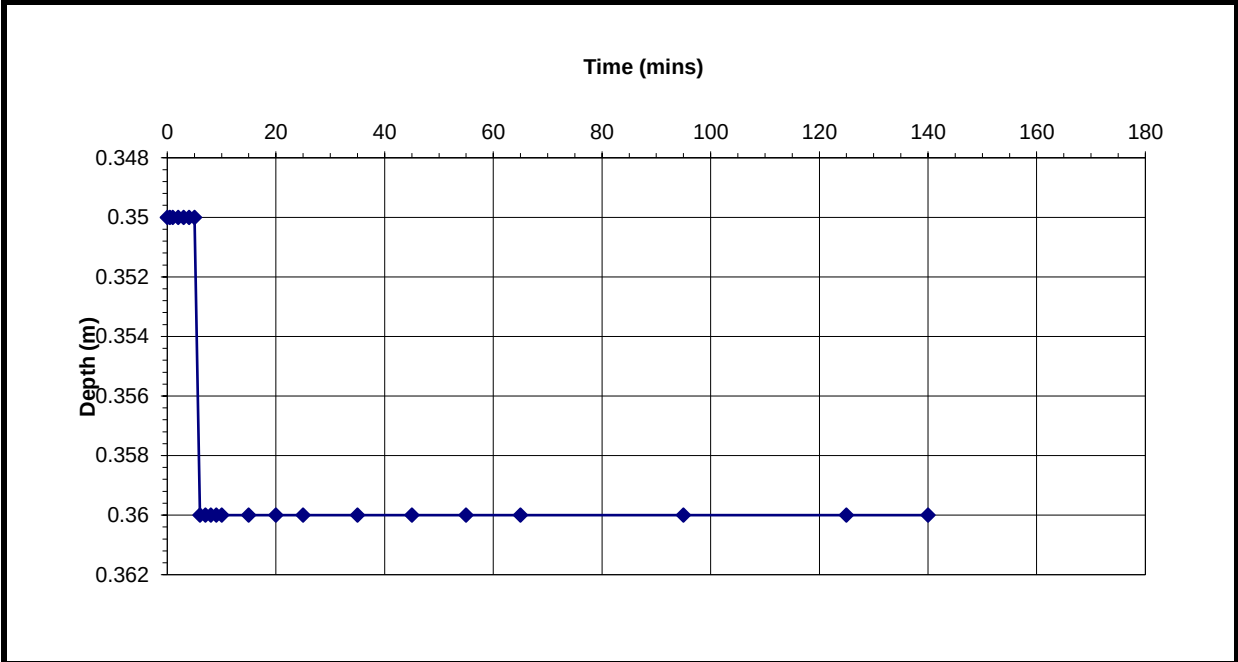


**SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991**  
**BRE Digest 365, Figure 2, Page 5**

|                |                            |                 |   |  |
|----------------|----------------------------|-----------------|---|--|
| <b>Client:</b> | Everhaus Limited           |                 |   |  |
| <b>Site:</b>   | Further Rad Lumb, Rochdale |                 |   |  |
| <b>Job No:</b> | M0981                      |                 |   |  |
| <b>Pit No:</b> | TP2                        | <b>Test No:</b> | 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 <sup>2</sup> ) =    |                 |              | 2.025       |
| 9          | 0.36      | V <sub>p75-25</sub> (m <sup>3</sup> ) = |                 |              | 0.010       |
| 10         | 0.36      | a <sub>D50</sub> (m <sup>2</sup> ) =    |                 |              | 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  |



## **APPENDIX 2**

### **CHEMICAL TESTING RESULTS**



Paul Finnimore  
Earth Environmental & Geotechnical Ltd  
Houldsworth Mill Business Centre  
Houldsworth Street  
Reddish  
Stockport  
Cheshire  
SK5 6DA

**Normec DETS Limited**  
Unit 1  
Rose Lane Industrial Estate  
Rose Lane  
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 <sup>(S)</sup>        | 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 <sub>4</sub>     | mg/kg    | < 200  | MCERTS        | 570          |      | 761          | 265          |
| Total Sulphate as SO <sub>4</sub>     | %        | < 0.02 | MCERTS        | 0.06         |      | 0.08         | 0.03         |
| W/S Sulphate as SO <sub>4</sub> (2:1) | mg/l     | < 10   | MCERTS        | 28           | 14   | 163          | 32           |
| W/S Sulphate as SO <sub>4</sub> (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



**Normec DETS Limited**  
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**Tel : 01622 850410**



#### Soil Analysis Certificate

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

| Determinand                           | Unit     | RL     | Accreditation |  |              |              |      |
|---------------------------------------|----------|--------|---------------|--|--------------|--------------|------|
| Asbestos Screen <sup>(S)</sup>        | 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 <sub>4</sub>     | mg/kg    | < 200  | MCERTS        |  | 468          | 608          |      |
| Total Sulphate as SO <sub>4</sub>     | %        | < 0.02 | MCERTS        |  | 0.05         | 0.06         |      |
| W/S Sulphate as SO <sub>4</sub> (2:1) | mg/l     | < 10   | MCERTS        |  | 18           | 41           | 13   |
| W/S Sulphate as SO <sub>4</sub> (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)

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



Normec DETS Limited  
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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 <sub>4</sub>       | 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 <sup>(S)</sup>

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



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**Maidstone**  
**Kent ME17 2JN**  
**Tel : 01622 850410**

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



Normec DETS Limited  
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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 <sup>U/S</sup>

Unsuitable Sample <sup>U/S</sup>

~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 diphénylcarbazide 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 @ 450°C                                                                                                                        | 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 (all: 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 (all: 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



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# 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 (COD)                                                                                                                  | 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**

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



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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**

### **GROUND GAS MONITORING RESULTS**

## GAS MONITORING DATASHEET

|           |                  |
|-----------|------------------|
| Site name | Further Red Lumb |
| Job No    | M0981            |

**Gas monitor model:**  
GA2000 multi gas analyser & GFM 610 Flow

[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.

## 5.0 STROM DRAIN CALCULATIONS

|                             |         |                           |         |                 |       |
|-----------------------------|---------|---------------------------|---------|-----------------|-------|
| Base Inf Coefficient (m/hr) | 0.04356 | Invert Level (m)          | 287.000 | Depth (m)       | 2.000 |
| Side Inf Coefficient (m/hr) | 0.04356 | Time to half empty (mins) | 1616    | Inf Depth (m)   | 1.000 |
| Safety Factor               | 2.0     | Pit Width (m)             | 7.000   | Number Required | 1     |
| Porosity                    | 0.95    | Pit Length (m)            | 6.000   |                 |       |

Soakaway Plastic Crates

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.83%

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|--------|
| 15 minute summer  | 1       | 10          | 290.893   | 0.093     | 11.9         | 0.0663        | 0.0000     | OK     |
| 15 minute summer  | 2       | 10          | 290.637   | 0.087     | 15.2         | 0.0249        | 0.0000     | OK     |
| 15 minute summer  | 3       | 11          | 290.374   | 0.105     | 15.1         | 0.0167        | 0.0000     | OK     |
| 15 minute summer  | 4       | 10          | 290.823   | 0.023     | 0.8          | 0.0044        | 0.0000     | OK     |
| 15 minute summer  | 5       | 11          | 290.750   | 0.095     | 7.3          | 0.0400        | 0.0000     | OK     |
| 15 minute summer  | 6       | 10          | 290.141   | 0.089     | 40.3         | 0.0850        | 0.0000     | OK     |
| 360 minute winter | 7       | 360         | 288.013   | -0.987    | 5.6          | 40.4304       | 0.0000     | OK     |

| Link Event<br>(Upstream Depth) | US Node | Link         | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) |
|--------------------------------|---------|--------------|---------|---------------|----------------|----------|---------------|
| 15 minute summer               | 1       | 1.000        | 2       | 11.7          | 1.059          | 0.649    | 0.2149        |
| 15 minute summer               | 2       | 1.001        | 3       | 15.1          | 1.275          | 0.591    | 0.1619        |
| 15 minute summer               | 3       | 1.002        | 6       | 15.1          | 1.193          | 0.760    | 0.1686        |
| 15 minute summer               | 4       | 2.000        | 5       | 0.8           | 0.167          | 0.113    | 0.0522        |
| 15 minute summer               | 5       | 2.001        | 6       | 6.9           | 0.948          | 1.026    | 0.1333        |
| 15 minute summer               | 6       | 1.003        | 7       | 40.2          | 3.844          | 0.593    | 0.0769        |
| 360 minute winter              | 7       | Infiltration |         | 0.4           |                |          |               |

Soakaway Plastic Crates

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.83%

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute summer  | 1       | 10          | 290.912   | 0.112     | 15.4         | 0.0803        | 0.0000     | OK         |
| 15 minute summer  | 2       | 10          | 290.656   | 0.105     | 19.6         | 0.0302        | 0.0000     | OK         |
| 15 minute summer  | 3       | 11          | 290.406   | 0.137     | 19.4         | 0.0218        | 0.0000     | OK         |
| 15 minute summer  | 4       | 12          | 290.867   | 0.067     | 1.0          | 0.0130        | 0.0000     | OK         |
| 15 minute summer  | 5       | 11          | 290.861   | 0.206     | 9.0          | 0.0869        | 0.0000     | SURCHARGED |
| 15 minute summer  | 6       | 10          | 290.158   | 0.106     | 51.0         | 0.1009        | 0.0000     | OK         |
| 480 minute winter | 7       | 472         | 288.410   | -0.590    | 5.7          | 56.2659       | 0.0000     | OK         |

| Link Event<br>(Upstream Depth) | US Node | Link         | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) |
|--------------------------------|---------|--------------|---------|---------------|----------------|----------|---------------|
| 15 minute summer               | 1       | 1.000        | 2       | 15.1          | 1.111          | 0.839    | 0.2648        |
| 15 minute summer               | 2       | 1.001        | 3       | 19.4          | 1.322          | 0.762    | 0.2052        |
| 15 minute summer               | 3       | 1.002        | 6       | 19.4          | 1.231          | 0.975    | 0.2187        |
| 15 minute summer               | 4       | 2.000        | 5       | 1.5           | 0.255          | 0.223    | 0.0776        |
| 15 minute summer               | 5       | 2.001        | 6       | 8.1           | 1.036          | 1.197    | 0.1376        |
| 15 minute summer               | 6       | 1.003        | 7       | 50.9          | 4.018          | 0.750    | 0.0929        |
| 480 minute winter              | 7       | Infiltration |         | 0.4           |                |          |               |

Soakaway  
Plastic Crates

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.83%

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute summer  | 1       | 12          | 291.259   | 0.459     | 22.3         | 0.3294        | 0.0000     | SURCHARGED |
| 15 minute summer  | 2       | 12          | 291.004   | 0.454     | 26.2         | 0.1299        | 0.0000     | SURCHARGED |
| 15 minute summer  | 3       | 12          | 290.678   | 0.409     | 24.4         | 0.0650        | 0.0000     | SURCHARGED |
| 15 minute summer  | 4       | 12          | 291.163   | 0.363     | 3.4          | 0.0707        | 0.0000     | SURCHARGED |
| 15 minute summer  | 5       | 12          | 291.156   | 0.501     | 12.2         | 0.2108        | 0.0000     | SURCHARGED |
| 15 minute summer  | 6       | 11          | 290.379   | 0.327     | 66.8         | 0.3116        | 0.0000     | SURCHARGED |
| 720 minute winter | 7       | 570         | 290.000   | 1.000     | 5.9          | 79.8200       | 5.5333     | FLOOD      |

| Link Event<br>(Upstream Depth) | US Node | Link         | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) |
|--------------------------------|---------|--------------|---------|---------------|----------------|----------|---------------|
| 15 minute summer               | 1       | 1.000        | 2       | 19.6          | 1.113          | 1.088    | 0.3424        |
| 15 minute summer               | 2       | 1.001        | 3       | 24.4          | 1.384          | 0.955    | 0.2413        |
| 15 minute summer               | 3       | 1.002        | 6       | 25.5          | 1.450          | 1.284    | 0.2346        |
| 15 minute summer               | 4       | 2.000        | 5       | 2.9           | 0.417          | 0.428    | 0.0910        |
| 15 minute summer               | 5       | 2.001        | 6       | 10.7          | 1.372          | 1.588    | 0.1401        |
| 15 minute summer               | 6       | 1.003        | 7       | 65.1          | 4.200          | 0.960    | 0.1191        |
| 720 minute winter              | 7       | Infiltration |         | 0.4           |                |          |               |

|                             |         |                           |         |                 |       |
|-----------------------------|---------|---------------------------|---------|-----------------|-------|
| Base Inf Coefficient (m/hr) | 0.04356 | Invert Level (m)          | 287.000 | Depth (m)       | 2.000 |
| Side Inf Coefficient (m/hr) | 0.04356 | Time to half empty (mins) | 598     | Inf Depth (m)   | 1.000 |
| Safety Factor               | 2.0     | Pit Width (m)             | 10.000  | Number Required | 1     |
| Porosity                    | 0.30    | Pit Length (m)            | 11.000  |                 |       |

Stone Infilled  
Soakaway

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.83%

| Node Event        | US<br>Node | Peak<br>(mins) | Level<br>(m) | Depth<br>(m) | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status |
|-------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 15 minute summer  | 1          | 10             | 290.893      | 0.093        | 11.9            | 0.0663           | 0.0000        | OK     |
| 15 minute summer  | 2          | 10             | 290.637      | 0.087        | 15.2            | 0.0249           | 0.0000        | OK     |
| 15 minute summer  | 3          | 11             | 290.374      | 0.105        | 15.1            | 0.0167           | 0.0000        | OK     |
| 15 minute summer  | 4          | 10             | 290.823      | 0.023        | 0.8             | 0.0044           | 0.0000        | OK     |
| 15 minute summer  | 5          | 11             | 290.750      | 0.095        | 7.3             | 0.0400           | 0.0000        | OK     |
| 15 minute summer  | 6          | 10             | 290.141      | 0.089        | 40.3            | 0.0850           | 0.0000        | OK     |
| 240 minute winter | 7          | 236            | 287.984      | -1.016       | 7.5             | 32.4713          | 0.0000        | OK     |

| Link Event<br>(Upstream Depth) | US<br>Node | Link         | DS<br>Node | Outflow<br>(l/s) | Velocity<br>(m/s) | Flow/Cap | Link<br>Vol (m³) |
|--------------------------------|------------|--------------|------------|------------------|-------------------|----------|------------------|
| 15 minute summer               | 1          | 1.000        | 2          | 11.7             | 1.059             | 0.649    | 0.2149           |
| 15 minute summer               | 2          | 1.001        | 3          | 15.1             | 1.275             | 0.591    | 0.1619           |
| 15 minute summer               | 3          | 1.002        | 6          | 15.1             | 1.193             | 0.760    | 0.1686           |
| 15 minute summer               | 4          | 2.000        | 5          | 0.8              | 0.167             | 0.113    | 0.0522           |
| 15 minute summer               | 5          | 2.001        | 6          | 6.9              | 0.948             | 1.026    | 0.1333           |
| 15 minute summer               | 6          | 1.003        | 7          | 40.2             | 3.844             | 0.593    | 0.0769           |
| 240 minute winter              | 7          | Infiltration |            | 0.9              |                   |          |                  |

Stone Infilled  
Soakaway

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.83%

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute summer  | 1       | 10          | 290.912   | 0.112     | 15.4         | 0.0803        | 0.0000     | OK         |
| 15 minute summer  | 2       | 10          | 290.656   | 0.105     | 19.6         | 0.0302        | 0.0000     | OK         |
| 15 minute summer  | 3       | 11          | 290.406   | 0.137     | 19.4         | 0.0218        | 0.0000     | OK         |
| 15 minute summer  | 4       | 12          | 290.867   | 0.067     | 1.0          | 0.0130        | 0.0000     | OK         |
| 15 minute summer  | 5       | 11          | 290.861   | 0.206     | 9.0          | 0.0869        | 0.0000     | SURCHARGED |
| 15 minute summer  | 6       | 10          | 290.158   | 0.106     | 51.0         | 0.1009        | 0.0000     | OK         |
| 360 minute winter | 7       | 352         | 288.387   | -0.613    | 7.2          | 45.7681       | 0.0000     | OK         |

| Link Event<br>(Upstream Depth) | US Node | Link         | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) |
|--------------------------------|---------|--------------|---------|---------------|----------------|----------|---------------|
| 15 minute summer               | 1       | 1.000        | 2       | 15.1          | 1.111          | 0.839    | 0.2648        |
| 15 minute summer               | 2       | 1.001        | 3       | 19.4          | 1.322          | 0.762    | 0.2052        |
| 15 minute summer               | 3       | 1.002        | 6       | 19.4          | 1.231          | 0.975    | 0.2187        |
| 15 minute summer               | 4       | 2.000        | 5       | 1.5           | 0.255          | 0.223    | 0.0776        |
| 15 minute summer               | 5       | 2.001        | 6       | 8.1           | 1.036          | 1.197    | 0.1376        |
| 15 minute summer               | 6       | 1.003        | 7       | 50.9          | 4.018          | 0.750    | 0.0929        |
| 360 minute winter              | 7       | Infiltration |         | 0.9           |                |          |               |

Stone Infilled  
Soakaway

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.83%

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute summer  | 1       | 12          | 291.259   | 0.459     | 22.3         | 0.3294        | 0.0000     | SURCHARGED |
| 15 minute summer  | 2       | 12          | 291.004   | 0.454     | 26.2         | 0.1299        | 0.0000     | SURCHARGED |
| 15 minute summer  | 3       | 12          | 290.678   | 0.409     | 24.4         | 0.0650        | 0.0000     | SURCHARGED |
| 15 minute summer  | 4       | 12          | 291.163   | 0.363     | 3.4          | 0.0707        | 0.0000     | SURCHARGED |
| 15 minute summer  | 5       | 12          | 291.156   | 0.501     | 12.2         | 0.2108        | 0.0000     | SURCHARGED |
| 15 minute summer  | 6       | 11          | 290.379   | 0.327     | 66.8         | 0.3116        | 0.0000     | SURCHARGED |
| 360 minute winter | 7       | 272         | 290.000   | 1.000     | 10.6         | 66.0165       | 5.1946     | FLOOD      |

| Link Event<br>(Upstream Depth) | US Node | Link         | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) |
|--------------------------------|---------|--------------|---------|---------------|----------------|----------|---------------|
| 15 minute summer               | 1       | 1.000        | 2       | 19.6          | 1.113          | 1.088    | 0.3424        |
| 15 minute summer               | 2       | 1.001        | 3       | 24.4          | 1.384          | 0.955    | 0.2413        |
| 15 minute summer               | 3       | 1.002        | 6       | 25.5          | 1.450          | 1.284    | 0.2346        |
| 15 minute summer               | 4       | 2.000        | 5       | 2.9           | 0.417          | 0.428    | 0.0910        |
| 15 minute summer               | 5       | 2.001        | 6       | 10.7          | 1.372          | 1.588    | 0.1401        |
| 15 minute summer               | 6       | 1.003        | 7       | 65.1          | 4.200          | 0.960    | 0.1191        |
| 360 minute winter              | 7       | Infiltration |         | 0.9           |                |          |               |

## 6.0 PROPOSED SITE DRAINAGE PLAN

LEGEND

PROPOSED SURFACE WATER DRAINAGE

PROPOSED FOUL WATER PIPE

PERFORATED PIPE

PROPOSED SOAKAWAY

FOUL WATER SEWER TREATMENT PLANT

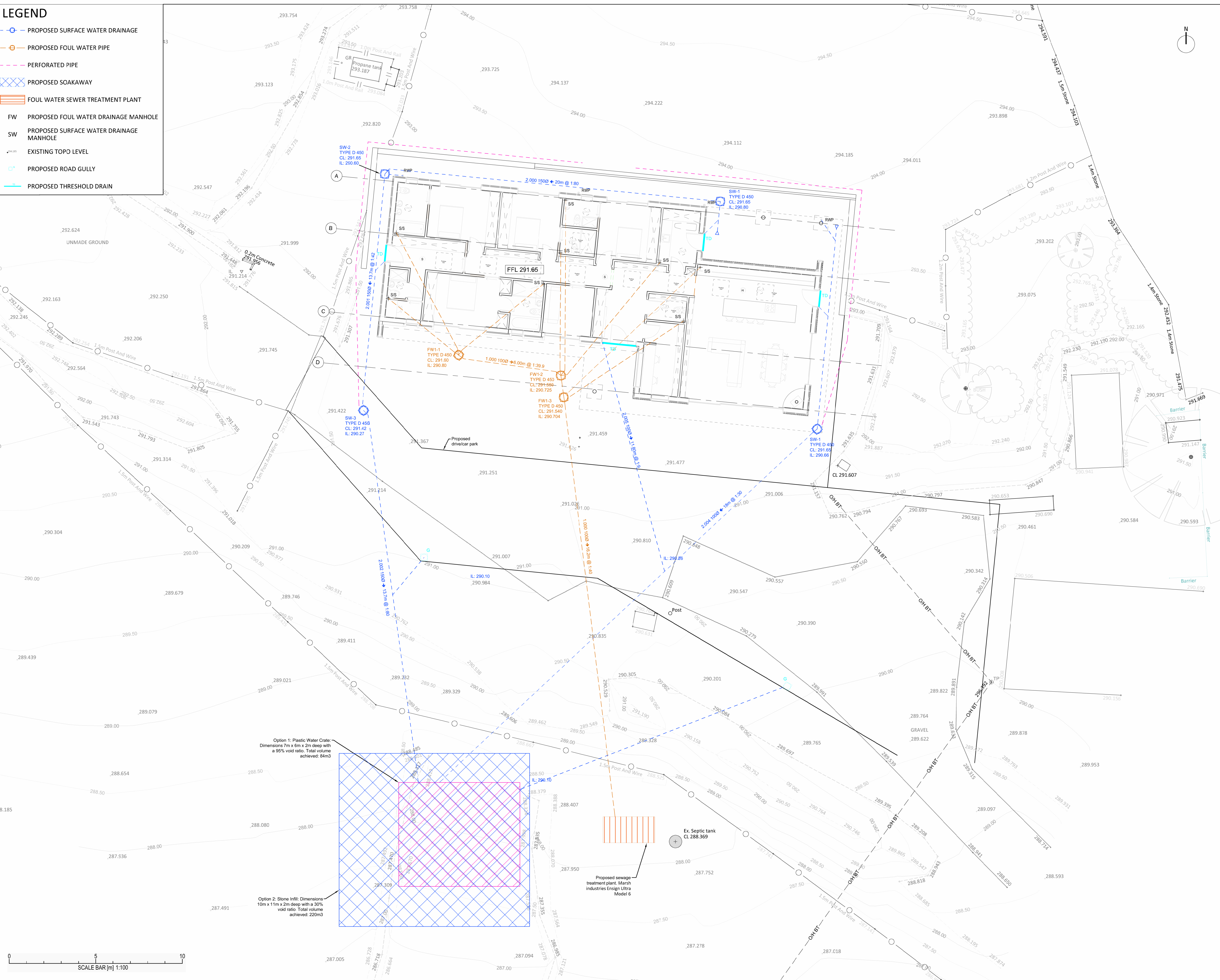
FW PROPOSED FOUL WATER DRAINAGE MANHOLE

SW PROPOSED SURFACE WATER DRAINAGE MANHOLE

EXISTING TOPO LEVEL

PROPOSED ROAD GULLY

PROPOSED THRESHOLD DRAIN



Notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE SPECIFICATION OF WORKS, ALL THE DRAWINGS AND DOCUMENTS LISTED THEREIN AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER INCLUDING THE RISK ASSESSMENT (SEE COM NOTES).
2. DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
3. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN MILLIMETERS UNLESS OTHERWISE STATED.
4. ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS.
5. NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS PERMITTED WITHOUT PRIOR PERMISSION FROM THE ENGINEER.
6. THE CONTRACTOR SHALL UNDERTAKE SUCH MATERIALS TESTING AS INDICATED IN THE SPECIFICATIONS AND SHALL INCLUDE THE COST OF TESTING IN THE TENDER.
7. ALL EXCAVATED MATERIAL WHERE NOT SUITABLE FOR REUSE SHALL BE DISPOSED OF AT AN APPROVED TIP OFF-SITE.
8. ALL SWP, SS AND RWP'S SHOWN INDICATIVELY. MEP AND ARCHITECT TO CONFIRM FINAL LOCATION.

|     |          |                                 |     |     |     |
|-----|----------|---------------------------------|-----|-----|-----|
| P2  | 01/08/24 | Soakaway and Sewage Plant Moved | VS  | MG  | MG  |
| P1  | 31/07/24 | For Information                 | VS  | MG  | MG  |
| Rev | Date     | Description                     | Drn | Chk | Apd |

Key Plan

DESIGN 4 STRUCTURES

Studio 8, 6-8 Cole Street, London, SE1 4YH  
Website: www.design4structures.com | Tel No: 02079934348

Client  
Everhaus Limited

Project  
Further Redlumb Farm

PRELIMINARY

Drawing Title  
Proposed Below Ground Drainage Sketch

|          |                |          |         |          |
|----------|----------------|----------|---------|----------|
| Date     | Scale @A1- @A3 | Drawn By | Checked | Approved |
| 30/07/24 | 1:100          | JK       | JK      | MG       |

|                           |          |
|---------------------------|----------|
| Drawing No.               | Revision |
| 11171-D4S-00-ZZ-DR-C-1000 | P2       |

# DESIGN 4 STRUCTURES

## London

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## Telford

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Hadley Park East  
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## Greece

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Trikala  
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