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# LAND AT CROW TREES BROW, CHATBURN

## Site Investigation & Ground Assessment


Prepared for:

PRINGLE HOMES

Report Ref: BEK-23127-1

October 2023

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# Project Quality Assurance Information Sheet

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|---|---|
| Site | Land at Crow Trees Brow, Chatburn |
| Report Title | Site Investigation & Ground Assessment |
| Report Status | Final |
| Report No | BEK-23127 |
| Date | October 2023 |
| Prepared For | **PRINGLE HOMES LIMITED**<br>The Coach House Hollowforth Lane<br>Woodplumpton<br>Preston<br>PR4 0BD |
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**PROJECT NO:** 23127

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**DATE:** October 2023

## REVISION STATUS / HISTORY

| Rev | Date | Issue / Comment | Prepared | Checked |
|---|---|---|---|---|
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## GENERAL REPORT LIMITATIONS

BEK Enviro Limited (BEK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and BEK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by BEK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

No part of this report may be copied or duplicated without the express permission of BEK and the party for whom it was prepared. 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.

Unless explicitly agreed otherwise, in writing, this report has been prepared under BEK's limited standard Terms and Conditions as included within our proposal to the Client.

The report needs to be considered in the light of the BEK proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

# TABLE OF CONTENTS

# 1. INTRODUCTION

## 1.1 Appointment

1.1.1 BEK Enviro (BEK) has been commissioned by Pringle Homes to carry out a site investigation for a parcel of land located at Crows Tree Brow, Chatburn, Lancashire (hereafter referred to as 'the site'). The investigation will inform a quantitative risk assessment with respect to contamination at the site to support the proposed residential development, and provide recommendations for foundation design.

1.1.2 The site location and site layout are presented on BEK Drawing No 23127-1 and BEK Drawing No 23127-2, respectively. Copies of these drawings are presented in Appendix F.

## 1.2 Proposed Development

1.2.1 The report has been prepared to support a planning application for the construction of 37 residential dwelling, alongside the refurbishment of the Grade II listed farmhouse and conversion/extension of the existing dairy building.

1.2.2 The proposed site plan is shown on LMP Architects Drawing No 21/139/P01 Revision D, dated September 2022, a copy of which is presented in Appendix F.

## 1.3 Objective & Scope of Work

1.3.1 The site investigation was undertaken by BEK during October 2023 in accordance with the recommendations detailed in the Desk Study report prepared by BETTS GEO Consulting Engineers (Report Ref: 22CHE293/DS, dated April 2022).

1.3.2 This report has been prepared to provide a summary of the site details and ground conditions encountered as well as a quantitative assessment of the potential pollutant linkages identified within the Desk Study. The Desk Study should be read in conjunction with this report.

## 1.4 Limitations

1.4.1 The conclusions and recommendations presented in this report are the result of our professional interpretation of the information currently available. BEK reserve the right to amend the conclusions and recommendations if further information becomes available.

1.4.2 However, it should be noted that much of the information has been derived from reports written by others and BEK takes no responsibility for the accuracy of that information. Notwithstanding the above, the reports reviewed have all been written by professional environmental consultants with a duty of care to provide relevant and accurate information.

1.4.3 The comments given in this report and the opinions expressed are based on review of reports provided to BEK, ground conditions encountered during site works and the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigations and therefore could not be taken into account.

1.4.4 Issues associated with invasive plant species are outside the remit of this report.

# 2. BACKGROUND INFORMATION

2.0.1 This section provides an overview of the findings and recommendations presented in the Desk Study.

## 2.1 Site Location, Layout & History

2.1.1 The site is located south of Crow Trees Brow, Chatburn, Clitheroe, Lancashire. The National Grid Reference for the site is 376789, 443933. The site occupies an area approximately 1.7 hectares.

2.1.2 The site is accessed from Crow Trees Brow. The north of the site occupies a residential dwelling with garden and allotments, and a number of outbuildings associated with Crow Trees Farm. The remainder of the site comprises grassed fields.

2.1.3 The earliest available map shows the site to comprise an area of farm buildings in the north of the site with the rest of the site undeveloped. Circa 1910, a railway line is present along the southern site boundary. The site remains this way until present day, with the configuration of the farm buildings in the north changing slightly over time.

## 2.2 Environmental Setting

### Geology

2.2.1 There are no records of made ground deposits or superficial geology on site.

2.2.2 The recorded bedrock geology underlying the site is 'Chatburn Limestone Formation' which is dominated by limestone.

2.2.3 There are no faults or linear features located on site or within 250 m of the site.

### Mining and Ground Stability

2.2.4 The site does not lie within an area affected by historical coal mining.

2.2.5 There are records of non-coal mining on site with the Enviro+GeoInsight Report described as 'vein mineral' mining and localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localized and are at a level where they need not be considered.

2.2.6 There is a Historical Mine Planning area located some 68 m west of the site. This refers to Bold Venture that has surface mineral working of limestone.

2.2.7 There are four BritPits located within 250 m of the site. The closest one refers to a Limestone quarry situated some 93 m south-west at Chatburn, Clitheroe. The operations have now ceased.

2.2.8 There are 5 surface ground working on site all listed as cuttings. These are all associated with the railway line located immediately south of the site.

2.2.9 The Enviro+GeoInsight Report provides hazard ratings associated with ground subsidence at the site, as summarised below:

| | |
|---|---|
| Shrink-Swell Clay: | Negligible |
| Landslides: | Very Low |
| Ground Dissolution of Soluble Rocks: | Very Low |
| Compressible Deposits: | Negligible |
| Collapsible Deposits: | Very Low |
| Running Sands: | Negligible |

2.2.10 It can be seen from the above that the site is unlikely to be affected by natural ground instability

Hydrogeology

2.2.11 The bedrock strata is classified as a Secondary A aquifer.

2.2.12 There is one groundwater abstraction located within 250 m of the site. This refers to an active groundwater abstraction licence located some 122 m west of the site (licence No NW/071/0309/009) which details of dewatering at Castle Cement Limited.

Hydrology

2.2.13 The nearest surface water feature to the site is Heys Brook which is located some 80 m north-east of the site.

2.2.14 There are four licences discharge to controlled waters within 250 m. The closest of which is located some 40 m south-east of the site and refers The Royds Septic Tank and Soakaway at The Royds, Chatburn which describes 'sewage discharge – final treated effluent – not water company'.

2.2.15 There are no surface water abstractions located within 250 m of the site.

Contaminated Land and Landfill Activities

2.2.16 There are no current landfill sites within 250 m of the site.

2.2.17 There are two records of historic landfills within 250 m of the site. These are show in the table below:

| Location | Address | Information | Licence Holder | First and Last Recorded |
|---|---|---|---|---|
| 127m North-west | Chatburn, Off Chatburn Old Road, Clitheroe, Lancashire | Site Reference: K1/03/005 Waste Type: Inert, Industrial, Commercial, Household, Liquid, Sludge | Ribble Valley Borough Council | First: 01/11/1953 Last: 31/12/1978 |
| 237m North-east | E Jackson, Bridge Road, Chatburn, Clitheroe, Lancashire | Site Reference: K1/03/027 Waste Type: Inert | Ken Bennet | N/A |

***Table 1:*** *Historic Landfill (EA/NRW) Facilities Located Within 250 m of the Site*

2.2.18 There are nine waste exceptions within 250 m. The closest six referred to are located 95 m west of the site and are associated with a waste treating exemption, using waste exemption, storing waste exemption and disposing of waste exception - all not on a farm.

2.2.19 There are two EA recorded pollution incidents on site and a further two within 50 m of the site. The incidents on site both refer to 'fumes' in June 2001. The incident has a category of 3 (Minor) impact on air.

2.2.20 There are no NIHHS or COMAH sites or recorded Part A(1), A(2), Part B or IPPC Authorised Activities within 250 m of the site.

2.2.21 There are 17 railway features within 250 m of the site. The closest one refers to The Ribble Valley Line located 9 m south-east of the site.

2.2.22 There are three historical potentially contaminative land uses recorded on site. These all refer to 'cuttings' dating from 1910 to 1950 (these are associated with the railway line immediately south of the site).

2.2.23 There are five current potentially contaminative land uses within 250 m of the site. This closest refers to a telephone exchange 122 m south-west of the site.

Sensitive Land Use

2.2.24 The site is not affected by any of the ecological systems identified as a statutory receptor in the DETR Circular 01/2006.

2.2.25 There is a grade 2 listed building on site named 'Crow Trees Farmhouse'.

2.2.26 The site is located within a conservation area of Chatburn, Ribble Valley.

Radon

2.2.27 The Groundsure report states that the site is situated within an intermediate risk area of radon (5-10% of home above the action level) while the UK Radon interactive mapping tolls states the site is situated within a high risk area of radon (10-30% of homes above the action level).

## 2.3 Initial Contamination Conceptual Model

2.3.1 Based on a review of available information, the desk study identifies 'Source-Pathway-Receptor Linkages' and provides the following table with respect to potential contamination sources:

| Type of Contamination | Potential Sources | Potential Pathway | Potential Receptors | Pollution Linkage | Comment | Estimated Level of Risk |
|---|---|---|---|---|---|---|
| **Ground Gas** | Current/ Historic Site Use<br><br>Railway Line 0m S<br><br>Limestone Quarries within 250m of Site<br><br>Historic Landfill 127m NE<br><br>Historic Garage 66m NE | Inhalation of Vapours | Construction/ Maintenance Workers | **Active** | Localised sources of ground gas identified on site. Highest risk from landfill located 127m NE Ground investigation and ground gas monitoring to confirm. PPE to protect | **Low** |
| | | Vapours Penetrating Unprotected Buildings | Future Site Users | **Active** | Localised sources of ground gas identified on site. Highest risk from landfill located 127m NE. Ground investigation and ground gas monitoring to confirm. Future site use to be residential. | **Low - Moderate** |
| **Surface and Near Surface Contaminants Within Soils** | As above | Ingestion, Inhalation, Dermal Contact | Current Site Users | **Potentially Active** | Localised contamination anticipated on site in vicinity of farm to the north and cutting area to the south of site. Possible contamination sources off site include historic landfill and infilled quarry. Potential for PAH's, heavy metals, TPH's and asbestos. Current site use is as a farm and agricultural land. | **Low - Moderate** |
| | | | Construction Workers | **Active** | Localised contamination anticipated on site in vicinity of farm to the north and cutting area to the south of site. Possible contamination sources off site include historic landfill and infilled quarry. Potential for PAH's, heavy metals, TPH's and asbestos. PPE to protect. | **Low** |
| | | | Future Site Users | **Active** | Localised contamination anticipated on site in vicinity of farm to the north and cutting area to the south of site. Possible contamination sources off site include historic landfill and infilled quarry. Potential for PAH's, heavy metals, TPH's and asbestos. Future site use to be residential with homegrown produce. | **Low - Moderate** |
| | | | Adjacent Land Users | **Potentially Active** | Adjacent land use mainly residential to the north and agricultural to the E, S & W. | **Low - Moderate** |
| | | Direct Contact | Structures | **Potentially Active** | Possible high sulphates and pH's from any localised Made Ground on site. | **Low - Moderate** |
| | | Absorption in Root Zone | Plants | **Potentially Active** | Potential for PAH's, heavy metals, TPH's and asbestos. Future site use to be residential with homegrown produce. | **Low - Moderate** |
| **Mobile Contaminants, Leachables e.g. from Pollution Sources Adjacent to Site/On Site** | As above | Leaching into Groundwater | Groundwater | **Potentially Active** | Localised contamination sources identified on site. No superficial deposits anticipated on site with underlying limestone being classed as a Secondary A Aquifer. Possible pathway into bedrock. | **Moderate** |
| | | Off-site Migration in Groundwater | Abstractions | **Potentially Active** | Localised contamination anticipated on site. The nearest groundwater abstraction point is located 122m W of site. No superficial deposits anticipated on site. Possible pathway into bedrock. | **Low - Moderate** |
| | | | Controlled Waters | **Potentially Active** | Nearest surface water course is located 79m NE is site. | **Low - Moderate** |
| **Organic and Inorganic Contaminants Within Soils / Groundwater** | As above | Potable Water Supply Pipes | Utilities Workers | **Potentially Active** | Localised contamination sources identified on site Risk assessed once water pipelines and final layout are known. Ground investigation to confirm, then liaise with local water authority supplier. | **Low - Moderate** |

## 2.4 BEK Comments

2.4.1 BEK considers the BETTS Desk Study to be concise and well written and generally the assessment conforms with current guidance on the assessment of potential risks associated with contamination.

2.4.2 The assessment of risks from ground gas should follow the standard presented in 'Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings' (BS8485:2015+A1:2019).

2.4.3 The Desk Study states that '*there is contradicting information regarding Radon on site. The Groundsure report states that the site is situated within an intermediate risk area of radon (5-10% of home above the action level) while the UK Radon interactive mapping tolls states the site is situated within a high risk area of radon (10-30% of homes above the action level). A site specific Radon Report will be required to confirm however* ***at least*** *basic radon protection measures will be required across the site'.* It appears that BETTS have made the observation of the site being in a high risk area of radon of 10-30 % based on the indicative radon atlas map. These show the worst level of radon potential for every 1 kilometre square.

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

2.4.5 As such, the radon atlas is considered indicative, whereas the data given in this report is considered definitive. Therefore, the radon risk level for the site should be based on the 5-10% of homes being above the action level. A site specific radon report is not considered to be required given that the Groundsure report is effectively providing this in all cases'.

2.4.6 To summarise, the radon risk level for the site should be based on the 5-10% of homes being above the action level and basic radon measures are considered to be required at the site.

# 3. SITE INVESTIGATION

## 3.1 General

3.1.1 This section provides a summary of the site investigation works undertaken by BEK during October 2023.

3.1.2 The site investigation has been designed to provide indicative information for the ground conditions across the site and to provide a quantitative assessment of potential risks associated with contamination and to provide recommendations with respect to foundation design.

3.1.3 All exploration locations were set out by the site engineer in order to establish representative conditions at the site. The exploratory locations are illustrated on BEK Drawing No 23127-3, presented in Appendix F.

## 3.2 Window Sample Boreholes

3.2.1 Six boreholes were drilled using a window sample borehole rig to a maximum depth of 2.8 m. In-situ testing (SPTs) were carried out in each of the boreholes.

3.2.2 Gas and Groundwater monitoring wells were installed in three of the boreholes (Boreholes WS1, WS3 and WS6).

3.2.3 Representative samples were recovered for chemical testing in accordance with the potential contaminants of concern highlighted within the Desk Study.

3.2.4 The ground conditions were recorded by an engineer from BEK and copies of the borehole records are presented in Appendix A.

## 3.3 Machine Excavated Trial Pits

3.3.1 Eleven trial pits were excavated at the site to a maximum depth of 2.1 m to prove ground conditions and to facilitate infiltration testing. In-situ testing (shear vanes) were carried out where clay was encountered.

3.3.2 Representative samples were recovered for chemical testing in accordance with the potential contaminants of concern highlighted within the Desk Study.

3.3.3 The ground conditions were recorded by an engineer from BEK. Copies of the trial pit records are presented in Appendix A and photographs of the trial pits are presented in Appendix E.

## 3.4 Exploratory Locations Rationale

3.4.1 The site investigation was designed by BEK to confirm general ground conditions across the full site and quantify the nature and extent of any made ground.

## 3.5 Laboratory Testing

Soil Chemical Testing

3.5.1 Chemical laboratory testing was undertaken by the UKAS accredited laboratory of Envirolab. All testing was undertaken to MCERTS standard (where available). The following samples were submitted for chemical analysis:

- Eight samples were tested for the standard BEK soil suite which includes: Arsenic (Total), Cadmium (Total), Copper (Total), Lead (Total), Nickel (Total), Zinc (Total), Chromium (Total), Selenium (Total), Mercury (Total), Boron (Soluble), Hexavalent Chromium, Cyanide (Total), pH, 16 EPA Poly-Aromatic Hydrocarbons (PAH), Total Phenols, Sulphate (acid soluble), Sulphate 2:1 extract and Soil Organic Matter
- Eight samples were tested for Speciated Total Petroleum Hydrocarbons (TPH-CWG)
- Two samples were subjected to PCBs - WHO12
- Eight samples were subjected to Asbestos ID testing

3.5.2 Copies of the chemical test results are presented in Appendix B.

Geotechnical Testing

3.5.3 Following a review of ground conditions, three natural clay bulk samples were submitted to the UKAS accredited laboratory of Murray Rix and were tested for Plasticity Index and Moisture Content.

3.5.4 Copies of the geotechnical test results are presented in Appendix C.

## 3.6 Ground Conditions

*Made Ground*

3.6.1 Made ground was encountered at the surface of three exploratory locations to a maximum depth of 0.5 m. The made ground subtypes encountered are described below:

'*Cobble set*' - was encountered at the surface of Trial Pit TP1 to 0.2 m.

'*Black/grey very gravelly sand with occasional brick*' - this strata was encountered at the surface of Trial Pit TP2 to 0.3 m and in Trial Pit TP1 at 0.2 m to 0.5 m.

'*Tarmacadam on to black/brown gravelly sand with rare broken brick fragments and occasional small cobble*' - this strata was encountered at the surface of Borehole WS2 to 0.2 m.

*Topsoil*

3.6.2 Topsoil generally described as 'black/brown silty clayey sand with rootlets' was encountered in all other locations varying in thickness from 0.2 m to 0.4 m.

*Natural Strata*

3.6.3 Superficial strata was encountered in all exploratory locations and generally comprised the following:

*Brown silty clayey sand* was encountered beneath the made ground/topsoil in all locations.

*Brown sandy gravelly clay* was encountered in all locations with the exception of Trial Pit TP7.

*Organic peat* was encountered in Trial Pit TP5 at 0.9 m to 1 m.

3.6.4 Suspected bedrock was encountered in 14 exploratory locations at depths ranging between 0.6 m and 2.3 m and comprised the following:

*Black/grey limestone* was encountered the base of Trial Pits TP1, TP2, TP7, TP8, TP9, TP10 and TP11 and Boreholes WS2, WS3, WS4, WS5 and WS6.

*Shale* was encountered at the base of Trial Pit TP5.

*Sandstone and limestone* were encountered at the base of Trial Pit TP6

3.6.5 Groundwater was not encountered during the site investigation.

3.6.6 There was no visual/olfactory evidence for the presence of contamination identified during the intrusive site investigation.

## 3.7 Infiltration Testing

3.7.1 The site investigation works included infiltration tests to determine soil infiltration rates using the BRE 365 (2016) methodology to assess the viability of disposal of surface water from the site via infiltration.

3.7.2 In accordance with BRE 365 'the trial pit should be 0.3 m to 1 m wide and 1 to 3 m long. It should have vertical sides trimmed square and, if necessary for stability, should be filled with granular material. The pit should be filled with water and allowed to drain three times to near empty; each time record the water level and time filling. The soil infiltration rate id calculated from the time taken for the water level to fall from 75% to 25% effective storage depth in the pit, using the lowest *f* value of the three results for the design'.

3.7.3 Two infiltration tests were undertaken at the site within Trial Pits TP3 and TP6 in accordance with BRE 365 (2016). Water was discharged into the pits and the time taken to fall from 75% effective depth to 25% effective depth was recorded.

3.7.4 The water within the Trial Pit TP3 (SA1) failed to reach 75% effective depth after approximately 5 hours of the test. Therefore the test within Trial Pit TP3 is considered to have failed and discharge of surface water from the proposed development via infiltration methods is not considered to be viable at this location.

3.7.5 The water within the Trial Pit TP6 (SA2) reached 25% effective depth within all three tests with the discharge rates determined as follows:

| Trial Pit No. | Infiltration Test Number | Infiltration Rate (m/s) |
|---|---|---|
| TP3 (SA1) | 1 | Test Failed |
| TP6 (SA2) | 1 | $1.11 \times 10^{-3}$ |
| | 2 | $1.09 \times 10^{-4}$ |
| | 3 | $5.97 \times 10^{-5}$ |

***Table 2:*** *Infiltration Test Results*

3.7.6 Copies of the full infiltration test results are included within Appendix D.

## 3.8 Environmental Monitoring

3.8.1 Gas and groundwater monitoring is ongoing and the results will be assessed within an addendum report that will be completed when the gas monitoring programme has been completed.

Groundwater

3.8.2 Groundwater levels have been monitored on one occasion in the boreholes are summarised in the Table 2:

| Borehole Location | Recorded Water Level (m bgl) |
|---|---|
| WS1 | Dry |
| WS3 | Dry |
| WS6 | Dry |

***Table 3:*** *Summary of Water Levels in Boreholes (to date)*

3.8.3 It can be seen from the above table that groundwater was not present within boreholes at the site.

3.8.4 Note that seasonal variations in water levels cannot be accounted for over the short monitoring period. Laterally continuous perched water is not considered to be present.

Gas Monitoring

3.8.5 The boreholes have been monitored for ground gas on one occasion to date and a summary of the gas monitoring results are presented in Table 3:

| Location | Concentrations (% v/v) | | | Maximum Flow Rate (l/hr) |
|---|---|---|---|---|
| | Carbon Dioxide | Methane | Oxygen | |
| WS1 | 3.4 - 3.6 | 0 | 14 - 14.4 | 0 |
| WS3 | - | - | - | - |
| WS6 | 1.4 - 1.8 | 0 | 17.6 - 18.8 | 0 |

*Table 4: Summary of Gas Monitoring Data*

3.8.6 It is noted that it was not possible to monitor Borehole WS3 on the first visit due to the surrounding ground having collapsed over the tap. This was rectified on site and monitoring of this borehole will take place on subsequent visits.

3.8.7 Based on the above results, the risks from ground gas at the site is considered to be very low to negligible.

3.8.8 The gas monitoring program is incomplete, a full Gas Risk Assessment will be prepared as a separate report.

3.8.9 It is noted that basic radon protection measures will be required in all new build properties on site. These may need to be upgraded to incorporate carbon dioxide and methane protection, depending on the outcome of the Gas Risk Assessment.

# 4. QUANTITATIVE RISK ASSESSMENT

## 4.1 Potentially Significant Pollutant Linkages

4.1.1 Potentially significant pollutant linkages identified within the preliminary conceptual model include:

(i) Human Health - risks associated with contamination in the made ground and/or natural strata: via direct contact, ingestion of contaminated soils or via inhalation (asbestos and/or vapours)

(ii) Human Health - risks associated with indoor inhalation of ground gas.

(iii) Controlled Waters - risks associated with contamination in the made ground and/or natural strata affecting the quality of perched water. Risks are associated with dissolution of contamination into perched water and vertical/lateral migration to water receptors.

(iv) Property (including services, flora and concrete) – risks associated contamination affecting concrete, flora and service pipes.

## 4.2 Risk Assessment: Human Health Risks from Exposure to Contaminated Soil

4.2.1 The risks to human health have been assessed by inspection of shallow soils for the presence of elevated contaminants based on the expected contaminant findings detailed in the conceptual model and completion of a quantitative risk assessment.

4.2.2 The soil contamination concentrations have initially been compared to a range of generic assessment criteria. These include the use of the Land Quality Management and Chartered Institute of Environmental Health assessment criteria (S4ULs), Category 4 Screening Levels (C4SLs) and the Contaminated Land: Applications in Real Environments assessment criteria (CL:AIRE).

4.2.3 These assessment criteria have been derived using the CLEA model and fully justified input parameters to be protective of risks to human health considering a residential end use (with homegrown produce). The initial assessment assumes a soil organic matter (SOM) of 1 % as a conservative approach.

4.2.4 The following table summarises the chemical test results for the samples tested and lists the relevant assessment criteria and the samples with a concentration in excess of the assessment criteria. Note that only determinands with a concentration above the laboratory limit of detection are presented in the table below:

| Determinand | Range of Concentrations (mg/kg) | Assessment Criteria (mg/kg) | Samples Fail |
|---|---|---|---|
| Arsenic | 2 - 9 | 37[1] | --- |
| Cadmium | <0.5 - 1.5 | 11[1] | --- |
| Chromium | 7 - 26 | 910[1] | --- |
| Copper | 12 - 33 | 2400[1] | --- |
| Lead | 29 - 87 | 210[2] | --- |
| Mercury | <0.17 - 1.9 | 40[1] | |
| Nickel | 6 - 21 | 180[1] | --- |
| Zinc | 108 - 246 | 3700[1] | --- |
| Acenaphthene | <0.01 - 0.25 | 210[1] | --- |
| Acenaphthylene | <0.01 - 0.05 | 170[1] | --- |
| Anthracene | <0.02 – 0.76 | 2400[1] | --- |
| Benzo(a)anthracene | <0.04 - 4.74 | 7.2[1] | --- |
| Benzo(a)pyrene | <0.04 - 9.25 | 5[2] | TP1 (0.25 m) |
| Benzo(b)fluoranthene | <0.05 - 11.8 | 2.6[1] | TP1 (0.25 m), WS2 (1.5 m) |
| Benzo(ghi)perylene | <0.05 - 5.44 | 320[1] | --- |
| Benzo(k)fluoranthene | <0.07 - 4.4 | 77[1] | --- |
| Chrysene | <0.06 - 5.8 | 15[1] | --- |
| Dibenzo(ah)anthracene | <0.04 - 0.91 | 0.24[1] | TP1 (0.25 m), TP2 (0.15 m), WS2 (1.5 m) |
| Fluoranthene | <0.08 - 6.92 | 280[1] | --- |
| Fluorene | <0.01 - 0.14 | 170[1] | --- |
| Indeno(123-cd)pyrene | <0.03 - 6.37 | 27[1] | --- |
| Phenanthrene | 0.07 - 2.84 | 95[1] | --- |
| Pyrene | <0.07 - 5.88 | 620[1] | --- |
| Aliphatic Hydrocarbons >C16-C21 | <1 - 2 | 65000*[1] | --- |
| Aliphatic Hydrocarbons >C21-C35 | 3 - 16 | 65000*[1] | --- |
| Aromatic Hydrocarbons >C12-C16 | <1 - 3 | 140[1] | --- |
| Aromatic Hydrocarbons >C16-C21 | 1 - 24 | 260[1] | --- |
| Aromatic Hydrocarbons >C21-C35 | 3 - 177 | 1100[1] | --- |
| Asbestos ID | 0 of 5 samples | NAD | --- |

***Table 5:*** *Summary of Contamination Assessment*

Notes from Table
1 CIEH/LQM Derived Assessment Criteria (S4ULs based on 1% SOM)
NAD - No Asbestos Detected

4.2.5 It can be seen from the above table that the majority of results are below residential criteria, however elevated concentrations of PAH compounds (benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(ah)anthracene) were encountered in samples recovered from the made ground.

4.2.6 None of the samples tested proved positive with respect to the presence of asbestos.

Further Assessment - Polycyclic Aromatic Hydrocarbons

4.2.7 Elevated PAH Compounds were encountered in three locations at the site. Elevated benzo(a)pyrene was encountered in Trial Pit TP1 (0.25 m), elevated benzo(b)fluoranthene was encountered in Trial Pit TP1 (0.25 m) and Borehole WS2 (1.5 m) and elevated dibenzo(ah)anthracene was encountered in Trial Pits TP1 (0.25 m), TP2 (0.15 m) and Borehole WS2 (1.5 m).

4.2.8 A spatial review of the locations of elevated PAH contamination shows it is present in the location of the farm buildings in the north of the site. It is also noted that the three locations where contamination has been identified are the only locations where made ground was identified.

4.2.9 The principal human exposure pathway for the 16 PAH USEPA compounds tested (with the exception of naphthalene) is through dermal contact, ingestion of soil, and indoor dust consumption or consumption of home grown produce.

4.2.10 Specific mitigation measures will be required to address the PAH contamination encountered within the made ground in the north of the site.

## 4.3 Risk Assessment: Human Health Risks from Exposure to Hazardous Gases

4.3.1 Low to moderate risks from ground gas have been identified in the Desk Study, due to landfill sites located within 250 m of the site.

4.3.2 Based on the ground conditions encountered at the site and the gas monitoring data to date, the potential risks from ground gas are considered to be low.

4.3.3 A separate Ground Gas Risk Assessment will be prepared upon completion of the current gas monitoring programme.

4.3.4 It is noted that basic radon protection measures will be required in all new build properties on site. These may need to be upgraded to incorporate carbon dioxide and methane protection, depending on the outcome of the Gas Risk Assessment.

## 4.4 Risk Assessment: Controlled Waters

4.4.1 Potential risks to the quality of surface water and groundwater have been identified in the ground conceptual model.

4.4.2 Risks are associated with contamination in the made ground and/or natural strata affecting the quality of perched water and surface waters in the vicinity of the site. Risks are also associated with the dissolution of contamination into perched water and vertical or lateral migration to water receptors.

4.4.3 It is noted that the closest surface water feature to the site is some 80 m north-east. The potential for significant contamination to migrate to this receptor from the site is considered to be very low.

4.4.4 The site investigation encountered a significant thickness of relatively impermeable superficial clay deposits across the majority of the site which will likely inhibit vertical migration of contamination to the underlying bedrock aquifers.

4.4.5 Furthermore, the soil contamination levels within the majority of samples tested were below the limit of detection and below stringent residential development thresholds.

4.4.6 Given that very low to negligible levels of contamination were encountered within the soil overlying the majority of the site and considering the vast majority of the site is underlain with a significant thickness of impermeable clay, the potential risks to controlled waters are considered to be very low.

## 4.5 Risk Assessment: Buildings

4.4.1 Risks to buildings include the assessment of the aggressive nature of the shallow ground with respect to concrete, the risks to the degradation of water pipes and flora due to contamination.

Risk to Concrete

4.5.2 To assess the potential risks to concrete, BEK has compared the previous site investigation data to assessment criteria presented in the BRE Special Digest 1: Concrete in Aggressive Ground.

4.5.3 With consideration to the range of pH values and sulphate concentrations, the concrete classification suitable for the site would be DS-1 AC-1.

Risks to Services

4.4.4 Potable water supply pipes can be at risk from degradation if the shallow ground consists of specific organic contamination.

4.4.5 Guidance published by UKWIR includes a methodology for the site investigation and risk assessment to determine pipe specification.

4.4.6 Site investigation may be required along the intended route of the water pipeline and samples recovered from specific depths and tested for specific contaminants of concern.

4.4.7 On the basis of the ground conditions encountered, risks to water supply pipelines are considered to be very low, however it is recommended that consultation is undertaken with the water service supplier to confirm this.

Risks to Flora

4.5.8 Copper, nickel and zinc are toxic to plants. The effects of copper, nickel and zinc are often regarded as additive.

4.5.9 The assessment criteria used for copper, nickel and zinc, are 'pseudo total concentrations' are derived from BS3882:2007 as follows:

| Phytotoxic Contaminant | pH Range | | |
|---|---|---|---|
| | <6.0 | 6.0 to 7.0 | >7.0 |
| Zinc (nitric acid extractable) | <200 | <200 | <300 |
| Copper (nitric acid extractable) | <100 | <135 | <200 |
| Nickel (nitric acid extractable) | <60 | <75 | <110 |

*Table 6: Limits for Phytotoxic Contaminants (Units mg/kg)*

4.5.10 By comparing the chemical test results (Appendix B) to the concentrations in the above table, it can be seen that there are four elevated phytotoxic concentrations of zinc encountered at the site.

4.5.11 These are noted within Trial Pits TP11 (0.15 m), TP4 (0.1 m) and TP8 (0.15 m) and Borehole WS1 (0.1 m) where zinc concentrations range between 202 to 246 versus a concentration of 200 mg/kg. Notwithstanding, it is noted that the exceedances are only marginally over the 200 mg/kg. Ground conditions in these locations proves topsoil over natural strata with no deleterious elements or evidence of contamination.

4.5.12 BEK does not consider these marginal exceedances to represent a significant risk to flora and risks to flora are not considered further.

## 4.6 Risk Assessment: Conclusions

4.6.1 Made ground was encountered at the surface of three exploratory locations to a maximum depth of 0.5 m. Topsoil was encountered in all other locations to depths ranging between 0.2 m and 0.4 m. Brown silty clayey sand was encountered beneath the made ground/topsoil in all exploratory locations. Brown sandy gravelly clay was encountered in all locations with the exception of Trial Pit TP7. Suspected bedrock was encountered in 14 exploratory locations at depths ranging between 0.6 m and 2.3 m.

4.6.3 The samples recovered from site investigation have been tested for a wide range of contaminants in accordance with the recommendations outlined within the Desk Study and based on the observations made during the site investigation.

4.6.4 The chemical test results have been compared to relevant generic assessment criteria to identify potential contaminants of concern.

4.6.5 Based on the contamination assessment herein and with respect to the redevelopment of the site for residential use, there are elevated PAH compounds encountered within the made ground in the north of the site.

4.6.6 The gas monitoring program is on-going and a full Gas Risk Assessment will be prepared as a separate report. Basic radon protection measures will be required in all new build properties on site. These may need to be upgraded to incorporate carbon dioxide and methane protection, depending on the outcome of the Gas Risk Assessment.

4.6.7 Risks to controlled water are considered to be very low to negligible.

4.6.8 Risks to concrete are considered to be low and concrete classification of DS-1 AC-1 is likely to be suitable.

4.6.9 Potential risks to the service pipes are considered to be low, but advice should be sought from the water supply provider if new water pipes are to be installed.

## 5. GEOTECHNICAL ASSESSMENT

5.1 The proposed development consists of the construction of 37 new residential dwellings, the units are presumed to be a mix of detached and semi-detached dwelling houses, with two storey apartment blocks. It is anticipated that the new dwellings will be of two storey masonry construction with concrete ground floors, timber upper floors and timber trussed rafter roofs. It is presumed that the 1st floors within the apartment buildings will be formed from suspended concrete. The guidance given herein will therefore need to be reviewed in terms of the actual building type to be adopted, by a suitably qualified and experienced engineer.

5.2 Site investigation has confirmed that the site is predominately overlain with topsoil Brown silty clayey sand was encountered beneath the made ground/topsoil in all exploratory locations. Brown sandy gravelly clay was encountered in all locations with the exception of Trial Pit TP7. Suspected bedrock was encountered in 14 exploratory locations at depths ranging between 0.6 m and 2.3 m. Groundwater was not encountered at any of the locations.

5.3 Standard Penetration Tests (SPT) were conducted in the window sample boreholes, starting at a depth of 1 m and repeated at 1 m levels from 2 m onwards. The SPT results are summarised in Table 7 below:

| Locations | 1.0 - 1.45 m | 2.0 - 2.45 m |
|---|---|---|
| WS1 | 11 | 15 |
| WS2 | 10 | 27 |
| WS3 | 10 | 24 |
| WS4 | 10 | - |
| WS5 | 11 | - |
| WS6 | 10 | - |

***Table 7:*** *Window Sample SPT Results*

5.4 Shear strength of the clay was measured via hand vanes in the trial pits, the results of which are summarised in Table 8 below:

| Location | Shear Readings in kN/m$^2$ – (*Depth)* | |
|---|---|---|
| TP1 | 80 *(0.8m)* | 120 *(1.2m)* |
| TP2 | 92 *(1.2m)* | - |
| TP3 | 76 *(1.0m)* | 62 *(2.0m)* |
| TP4 | 99 *(0.8m)* | - |
| TP5 | 91*(0.6m)* | 82 *(1.6m)* |
| TP6 | 87 *(1.2m)* | 115 *(1.6m)* |
| TP8 | 77 *(0.8m)* | 42 *(1.4m)* |
| TP9 | 60*(1.5m)* | - |
| TP10 | 100 *(0.7m)* | 54 *(1.3m)* |
| TP11 | 82 *(0.5m)* | 60 *(1.0m)* |

***Table 8****: Trial Pit Shear Vane Results*

5.5 Clay samples were taken from Trial Pits TP6, TP9, and TP10. Atterberg tests were undertaken in the laboratory conditions to determine the plasticity index of the clay the results of which are presented in Appendix C. The modified plasticity index for each sample was calculated in accordance with NHBC guidance and summarised in Table 9 below:

| Plastic Limit Test Results | | | | | |
|---|---|---|---|---|---|
| **Location** | **Depth (m)** | **Plasticity Index (P.I.)** | **Retained 425 Sieve** | **Passing 425 Sieve** | **Modified P.I. (%)** |
| TP6 | 1.6m | **25** | 2.0% | 98.0% | **24.5** |
| TP9 | 1.5m | **26** | 1.0% | 99.0% | **25.8** |
| TP10 | 1.0m | **27** | 5.0% | 95.0% | **25.6** |
| | **Average** | **26** | | **Average:** | **25.3** |

*Table 9: Plasticity Results*

5.6 The plasticity results are reasonably consistent and can be categorised as medium volume change potential. Foundation formation depths should therefore be taken based on medium volume change potential, requiring a footing depth of 0.9m below existing or proposed ground level, whichever is the lower, in areas where clay soils are present. Clay heave potential must be considered as part of the foundation design and must be appraised in accordance with NHBC Ch.4.2 requirements.

Assessment and Conclusions

5.7 At formation levels at the majority of locations, stiff clay soils have been encountered. At Trial Pit TP7, formation level is below the top of the bedrock boundary. Generally, the underlying clay soils will provide a bearing capacity in excess of 100 kN/m$^2$, however there are a couple of anomalies. At 0.9 m in Trial Pit TP4 there is a thin band of peat, this is unsuitable to found structures on, so formation level at this location must be beneath the peat. In Trial Pit TP8 a low shear reading was encountered at 1.4 m below the surface. This reading suggests that a maximum bearing capacity of 85 kN/m$^2$ is present. For continuity, the 85 kN/m$^2$ value should be taken over the site.

5.8 We understand that the proposed properties are likely be formed from masonry walling, timber upper floors and roof and concrete ground floors. This is likely to generate foundation loadings of between 50 and 60 kN/m, which indicates that strip footings would be suitable to the underlying clay strata. For the apartment blocks, due to the concrete upper floors, this is likely to generate foundation loadings of between 60 and 70 kN/m, which indicates that strip footings would be suitable to the underlying clay strata. Should soft clays be encountered at formation depth, it is recommended that the formation of footings extended down to clays of suitable strength is encountered, with the over-dig backfilled with lean mix concrete.

5.9 All formations must be checked on site to confirm that the design bearing capacity is extent before foundations are installed. Should areas of poor ground be encountered, the excavations may require extending until suitable strata is found, and the design engineer's instruction must be sought.

5.10 As variations of the natural ground have been encountered across the site, adopting ground bearing slabs is not recommended. All ground floor slabs should be designed to be suspended and supported on walls or dwarf walls that are supported by the strip foundations.

5.11 Local trees may have a bearing on the proposed building foundations, which will need to be appraised by the foundation designer. Formation levels must be designed to comply with LABC requirements and NHBC Ch.4.2 guidance.

5.12 All foundation designs must be reviewed and designed by a suitably qualified design engineer. The above advice is based upon the ground condition information obtained during the survey. The design engineer must satisfy themselves that the information meets with their design requirements.

# 6. RECOMMENDATIONS

6.1 This report provides an assessment of the ground conditions based on the assessment of available site investigation information and quantifies the potential risks associated with contamination and provides a geotechnical assessment with respect to foundation design.

## Contamination Assessment

6.2 Based on the results of the contamination risk assessment undertaken at the site located at Crows Tree Brow, Chatburn and with consideration to the redevelopment of the site to residential, potential risks have been identified to human health.

6.3 To mitigate the potential risks, the following works are recommended:

(i) The extent of the made ground located in the north of site (within the confines of the farm area) should be delineated and removed from all garden areas or capped with a minimum of 600 mm of clean suitable soil (450 mm subsoil and 150 mm topsoil).

(ii) A ground gas risk assessment will be prepared on completion of the gas monitoring programme.

(iii) Basic radon protection measures will be required in all new build properties on site, these may need to be upgraded to incorporate carbon dioxide and methane protection, depending on the outcome of the gas risk assessment.

(iv) All ground workers adopts suitable PPE when working on the site and consider the requirements of site specific risk assessments and working method statements.

(v) All groundworkers should remain vigilant during ground excavations for the presence (or suspected presence) of contamination. Should suspected contamination be identified then work should cease and specialist advice sought.

(vi) Any material removed from the site should be disposed of in accordance with appropriate in accordance with appropriate legislation and regulations, including the Duty of Care Regulations.

(vi) Consideration should be given to the requirements of the water supply provider. They are likely to require the UKWIR risk assessment to be completed to determine the specification for the water pipes. BEK recommends that the water supply provider is contacted and enquiries made.

6.4 The ground conditions should be as anticipated during all excavations. Advice should be sought if ground conditions are significantly different or if visual/olfactory evidence of contamination is encountered.

6.5 The remediation works required should be detailed in a Remediation & Enabling Works Strategy along with the method of validation and reporting. This will need to consider the findings of the ground gas risk assessment.

Infiltration Rate

6.6 The water within the Trial Pit TP3 (SA1) failed to reach 75% effective depth after approximately 5 hours of the test. Therefore the test within Trial Pit TP3 is considered to have failed and discharge of surface water from the proposed development via infiltration methods is not considered to be viable at this location. The water within the Trial Pit TP6 (SA2) reached 25% effective depth within all three tests.

Geotechnical Assessment

6.7 At formation levels at the majority of locations, stiff clay soils have been encountered. At Trial Pit TP7, formation level is below the top of the bedrock boundary. Generally, the underlying clay soils will provide a bearing capacity in excess of 100 kN/m$^2$, however there are a couple of anomalies. At 0.9 m in Trial Pit TP4 there is a thin band of peat, this is unsuitable to found structures on, so formation level at this location must be beneath the peat. In Trial Pit TP8 a low shear reading was encountered at 1.4 m below the surface. This reading suggests that a maximum bearing capacity of 85 kN/m$^2$ is present. For continuity, the 85 kN/m$^2$ value should be taken over the site.

6.8 We understand that the proposed properties are likely be formed from masonry walling, timber upper floors and roof and concrete ground floors. This is likely to generate foundation loadings of between 50 and 60 kN/m, which indicates that strip footings would be suitable to the underlying clay strata. For the apartment blocks, due to the concrete upper floors, this is likely to generate foundation loadings of between 60 and 70 kN/m, which indicates that strip footings would be suitable to the underlying clay strata. Should soft clays be encountered at formation depth, it is recommended that the formation of footings extended down to clays of suitable strength is encountered, with the over-dig backfilled with lean mix concrete.

6.9 All formations must be checked on site to confirm that the design bearing capacity is extent before foundations are installed. Should areas of poor ground be encountered, the excavations may require extending until suitable strata is found, and the design engineer's instruction must be sought.

6.10 As variations of the natural ground have been encountered across the site, adopting ground bearing slabs is not recommended. All ground floor slabs should be designed to be suspended and supported on walls or dwarf walls that are supported by the strip foundations.

6.11 Local trees may have a bearing on the proposed building foundations, which will need to be appraised by the foundation designer. Formation levels must be designed to comply with LABC requirements and NHBC Ch.4.2 guidance.

6.12 All foundation designs must be reviewed and designed by a suitably qualified design engineer. The above advice is based upon the ground condition information obtained during the survey. The design engineer must satisfy themselves that the information meets with their design requirements.

Waste Soil Management

6.13 Careful management of soils during the excavation works will ensure optimum utilisation of soil resources. Excavated soils which require off-site disposal are anticipated to be classified in accordance with the following document: Guidance on the Disposal of "Contaminated Soils" Version 3 (April 2001); produced by the Environment Agency.

6.14 In all cases where excess soils require off-site disposal, the materials needs to be managed under the appropriate legislation and consideration given to any remedial techniques that could be used to improve the soil.

6.15 If waste soils are to be re-used on site then a suitable permit exemption should be put in place (if appropriate) or a Material Management Plan (MMP) should be prepared as part of compliance with the CL:AIRE Definition of Waste:Code of Practice.

# APPENDIX A

Exploratory Logs

# GEO-ENVIRONMENTAL CONSULTANTS

GEO-ENVIROMENTAL CONSULTING ENGINEERS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP1
**SHEET** 1/11

**COMPLETION**

**COMMENTS** Shear Vane at 0.8 m = 80 KPa, at 1.2 m = >120 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | | | | | | MADE GROUND: Grass onto cobble set | 0.1 |
| 0.2 | 0.25 | D = 0.25 m | | | | Black/grey very gravelly sand with occasional broken brick | 0.2 |
| 0.3 | | | | | | | 0.3 |
| 0.4 | | | | | | | 0.4 |
| 0.5 | | | | | | Brown clayey sand with rare clay pockets | 0.5 |
| 0.6 | | | | | | | 0.6 |
| 0.7 | | | | | | Brown sandy gravelly clay, occasional small cobbles | 0.7 |
| 0.8 | | | | | | | 0.8 |
| 0.9 | | | | | | | 0.9 |
| 1 | | | | | | | 1 |
| 1.1 | | | | | | | 1.1 |
| 1.2 | | | | | | | 1.2 |
| 1.3 | | | | | | | 1.3 |
| 1.4 | | | | | | | 1.4 |
| 1.5 | | | | | | | 1.5 |
| 1.6 | | | | | | | 1.6 |
| 1.7 | | | | | | | 1.7 |
| 1.8 | | | | | | | 1.8 |
| 1.9 | | | | | | | 1.9 |
| 2 | | | | | | Black/grey limestone | 2 |
| 2.1 | | | | | | Termination Depth at: 2.1 m | 2.1 |

GEO-ENVIRONMENTAL CONSULTANTS

GEO-ENVIROMENTAL CONSULTING ENGINEERS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP2
**SHEET** 2/11

**COMPLETION**

**COMMENTS** Shear Vane at 1.2 m = 92 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.15 | D = 0.15 m | | | | MADE GROUND: Grass onto black/grey very gravelly sand with occasional whole and broken brick and small cobbles | 0.1 |
| 0.2 | | | | | | | 0.2 |
| 0.3 | | | | | | Brown silty clayey sand | 0.3 |
| 0.4 | | | | | | | 0.4 |
| 0.5 | | | | | | | 0.5 |
| 0.6 | | | | | | Brown sandy gravelly clay with occasional small cobbles | 0.6 |
| 0.7 | | | | | | | 0.7 |
| 0.8 | | | | | | | 0.8 |
| 0.9 | | | | | | | 0.9 |
| 1 | | | | | | | 1 |
| 1.1 | | | | | | | 1.1 |
| 1.2 | | | | | | | 1.2 |
| 1.3 | | | | | | | 1.3 |
| 1.4 | | | | | | | 1.4 |
| 1.5 | | | | | | | 1.5 |
| 1.6 | | | | | | | 1.6 |
| 1.7 | | | | | | Black/grey limestone | 1.7 |
| 1.8 | | | | | | Termination Depth at: 1.8 m | 1.8 |
| 1.9 | | | | | | | 1.9 |
| 2 | | | | | | | 2 |
| 2.1 | | | | | | | 2.1 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP3
**SHEET** 3/11

**COMPLETION**

**COMMENTS** Shear Vane at 1 m = 76 KPa, at 2 m = 62 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.1 | D = 0.1 m | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.2 | | | | | | | 0.2 |
| 0.3 | | | | | | Brown silty clayey sand | 0.3 |
| 0.4 | | | | | | | 0.4 |
| 0.5 | | | | | | | 0.5 |
| 0.6 | | | | | | | 0.6 |
| 0.7 | | | | | | | 0.7 |
| 0.8 | | | | | | | 0.8 |
| 0.9 | | | | | | | 0.9 |
| 1 | | | | | | | 1 |
| 1.1 | | | | | | Brown sandy gravelly clay with occasional small cobbles | 1.1 |
| 1.2 | | | | | | | 1.2 |
| 1.3 | | | | | | | 1.3 |
| 1.4 | | | | | | | 1.4 |
| 1.5 | | | | | | | 1.5 |
| 1.6 | | | | | | | 1.6 |
| 1.7 | | | | | | | 1.7 |
| 1.8 | | | | | | | 1.8 |
| 1.9 | | | | | | | 1.9 |
| 2 | | | | | | | 2 |
| 2.1 | | | | | | Termination Depth at: 2.1 m | 2.1 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP4
**SHEET** 4/11

**COMPLETION**

**COMMENTS** Shear Vane at 0.8 m = 99 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.1 | D = 0.1 m | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.3 | | | | | | Brown silty clayey sand | 0.3 |
| 0.6 | | | | | | Brown sandy gravelly clay with occasional small cobbles | 0.6 |
| 0.9 | | | | | | Organic peat | 0.9 |
| 1.2 | | | | | | Shale | 1.2 |
| | | | | | | Termination Depth at: 1.2 m | |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP5
**SHEET** 5/11

**COMPLETION**

**COMMENTS** Shear Vane at 0.6 m = 91 KPa, at 1.6 m = 82 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.1 | D = 0.1 m | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.3 | | | | | | Brown silty clayey sand | 0.3 |
| 0.5 | | | | | | Brown sandy gravelly clay with occasional small cobbles | 0.5 |
| 1.2 | | | | | | Brown very sandy gravelly cobbly clay | 1.2 |
| 2 | | | | | | Termination Depth at: 2.0 m | 2 |
| 2.1 | | | | | | | 2.1 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP6
**SHEET** 6/11

**COMPLETION**

**COMMENTS** Shear Vane at 1.0 m = 87 KPa, at 1.6 m = 115 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.1 | D = 0.1 m | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.2 | | | | | | Brown silty clayey sand | 0.2 |
| 0.3 | | | | | | | 0.3 |
| 0.4 | | | | | | Brown sandy gravell clay with occasional small cobbles | 0.4 |
| 0.5 | | | | | | | 0.5 |
| 0.6 | | | | | | | 0.6 |
| 0.7 | | | | | | | 0.7 |
| 0.8 | | | | | | | 0.8 |
| 0.9 | | | | | | | 0.9 |
| 1 | | | | | | | 1 |
| 1.1 | | | | | | | 1.1 |
| 1.2 | | | | | | | 1.2 |
| 1.3 | | | | | | | 1.3 |
| 1.4 | | | | | | | 1.4 |
| 1.5 | | | | | | | 1.5 |
| 1.6 | 1.6 | B = 1.6 m | | | | | 1.6 |
| 1.7 | | | | | | | 1.7 |
| 1.8 | | | | | | | 1.8 |
| 1.9 | | | | | | Sandstone to the south and limestone to the north of the trial pit | 1.9 |
| 2 | | | | | | | 2 |
| 2.1 | | | | | | Termination Depth at: 2.0 m | 2.1 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP7
**SHEET** 7/11

**COMPLETION**

**COMMENTS** Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | | | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.2 | 0.2 | D = 0.2 m | | | | | 0.2 |
| 0.3 | | | | | | Brown silty clayey sand | 0.3 |
| 0.4 | | | | | | | 0.4 |
| 0.5 | | | | | | | 0.5 |
| 0.6 | | | | | | | 0.6 |
| 0.7 | | | | | | Black/grey limestone | 0.7 |
| 0.8 | | | | | | | 0.8 |
| 0.9 | | | | | | | 0.9 |
| 1 | | | | | | Termination Depth at: 0.9 m | 1 |
| 1.1 | | | | | | | 1.1 |
| 1.2 | | | | | | | 1.2 |
| 1.3 | | | | | | | 1.3 |
| 1.4 | | | | | | | 1.4 |
| 1.5 | | | | | | | 1.5 |
| 1.6 | | | | | | | 1.6 |
| 1.7 | | | | | | | 1.7 |
| 1.8 | | | | | | | 1.8 |
| 1.9 | | | | | | | 1.9 |
| 2 | | | | | | | 2 |
| 2.1 | | | | | | | 2.1 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP8
**SHEET** 8/11

**COMPLETION**

**COMMENTS** Shear Vane at 0.8 m = 77 KPa, at 1.4 m = 42 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.15 | D = 0.15 m | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.2 | | | | | | Brown silty clayey sand | 0.2 |
| 0.3 | | | | | | | 0.3 |
| 0.4 | | | | | | | 0.4 |
| 0.5 | | | | | | Brown sandy gravelly clay with occasional small cobbles | 0.5 |
| 0.6 | | | | | | | 0.6 |
| 0.7 | | | | | | | 0.7 |
| 0.8 | | | | | | | 0.8 |
| 0.9 | | | | | | | 0.9 |
| 1 | | | | | | | 1 |
| 1.1 | | | | | | | 1.1 |
| 1.2 | | | | | | | 1.2 |
| 1.3 | | | | | | | 1.3 |
| 1.4 | | | | | | | 1.4 |
| 1.5 | | | | | | | 1.5 |
| 1.6 | | | | | | | 1.6 |
| 1.7 | | | | | | | 1.7 |
| 1.8 | | | | | | Black/grey limestone | 1.8 |
| 1.9 | | | | | | Termination Depth at: 1.8 m | 1.9 |
| 2 | | | | | | | 2 |
| 2.1 | | | | | | | 2.1 |

# GEO-ENVIRONMENTAL CONSULTANTS

GEO-ENVIROMENTAL CONSULTING ENGINEERS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP9
**SHEET** 9/11

**COMPLETION**

**COMMENTS** Shear Vane at 1.5 m = 60 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.1 | D = 0.1 m | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.4 | | | | | | Brown silty clayey sand | 0.4 |
| 1.2 | | | | | | Brown sandy gravelly clay with occasional small cobbles | 1.2 |
| 1.5 | 1.5 | B = 1.5 m | | | | | 1.5 |
| 2 | | | | | | Black/grey limestone | 2 |
| 2.1 | | | | | | Termination Depth at: 2.1 m | 2.1 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP10
**SHEET** 10/11

**COMPLETION**

**COMMENTS** Shear Vane at 0.7 m = 100 KPa, at 1.3 m = 54 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.1 | D = 0.1 m | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.4 | | | | | | Brown silty clayey sand | 0.4 |
| 0.6 | | | | | | Brown sandy gravelly clay with occasional small cobbles | 0.6 |
| 1 | 1.0 | B = 1.0 m | | | | | 1 |
| 1.7 | | | | | | Black/grey limestone | 1.7 |
| 1.8 | | | | | | Termination Depth at: 1.8 m | 1.8 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJ. NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 2nd October 2023
**EXCAVATION METHOD** Trial Pit
**TRIAL PIT NO** TP11
**SHEET** 11/11

**COMPLETION**

**COMMENTS** Shear Vane at 0.5 m = 82 KPa, at 1.0 m = 60 KPa. Trial Pit Dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0.1 | 0.1 | D = 0.1 m | | | | Grass onto black very silty clayey sand with occasional rootlets. (TOPSOIL) | 0.1 |
| 0.2 | | | | | | | 0.2 |
| 0.3 | | | | | | Brown silty clayey sand | 0.3 |
| 0.4 | | | | | | | 0.4 |
| 0.5 | | | | | | Brown sandy gravelly clay with occasional small cobbles | 0.5 |
| 0.6 | | | | | | | 0.6 |
| 0.7 | | | | | | | 0.7 |
| 0.8 | | | | | | | 0.8 |
| 0.9 | | | | | | | 0.9 |
| 1 | | | | | | | 1 |
| 1.1 | | | | | | | 1.1 |
| 1.2 | | | | | | | 1.2 |
| 1.3 | | | | | | | 1.3 |
| 1.4 | | | | | | | 1.4 |
| 1.5 | | | | | | | 1.5 |
| 1.6 | | | | | | | 1.6 |
| 1.7 | | | | | | | 1.7 |
| 1.8 | | | | | | Black/grey limestone | 1.8 |
| 1.9 | | | | | | Termination Depth at: 1.8 m | 1.9 |
| 2 | | | | | | | 2 |
| 2.1 | | | | | | | 2.1 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJECT NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 3rd October 2023
**DRILLING METHOD** Window Sample Borehole
**BOREHOLE NO** WS1
**SHEET** 1/6

**COMPLETION** | **CASING** uPVC | **SCREEN** uPVC Factory Slotted

**COMMENTS** Borehole dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Well Instal. | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.1 | D = 0.1 m | | | | | Grass onto brown silty clayey sand with frequent rootlets. (TOPSOIL) | 0 |
| 0.2 | | | | | | | | 0.2 |
| 0.4 | | | | | | | Brown silty clayey sand | 0.4 |
| 0.6 | | | | | | | Stiff becoming very stiff brown sandy silty gravely clay | 0.6 |
| 0.8 | | | | | | | | 0.8 |
| 1 | 1.0 - 1.45<br>1.0 - 1.5 | SPT (C) N=11<br>B = 1.0 - 1.5 m | 2,2/2,3,3,3 | | | | | 1 |
| 1.2 | | | | | | | | 1.2 |
| 1.4 | 1.5 | D = 1.5 m | | | | | | 1.4 |
| 1.6 | | | | | | | | 1.6 |
| 1.8 | | | | | | | | 1.8 |
| 2 | 2.0 - 2.45 | SPT (C) N=15 | 2,3/3,4,4,4 | | | | | 2 |
| 2.2 | | | | | | | | 2.2 |
| 2.4 | | | | | | | Very stiff brown sandy clay with limestone gravels | 2.4 |
| 2.6 | 2.6 | D = 2.6 m | | | | | | 2.6 |
| 2.8 | | | | | | | Termination Depth at: 2.8 m | 2.8 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJECT NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 3rd October 2023
**DRILLING METHOD** Window Sample Borehole
**BOREHOLE NO** WS2
**SHEET** 2/6

**COMPLETION** | **CASING** uPVC | **SCREEN** uPVC Factory Slotted

**COMMENTS** Borehole dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Well Instal. | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.15 | D = 0.15 m | | | | | MADE GROUND: Tarmacadam onto black/brown gravelly sand, with rare broken brick fragments and occasional small cobble | 0 |
| 0.2 | | | | | | | Brown silty clayey sand | 0.2 |
| 0.4 | | | | | | | | 0.4 |
| 0.6 | | | | | | | Stiff becoming very stiff brown sandy silty gravelly clay | 0.6 |
| 0.8 | | | | | | | | 0.8 |
| 1 | 1.0 - 1.45 | SPT (C) N=10 | 2,2/2,2,3,3 | | | | | 1 |
| 1.2 | 1.2 | D = 1.2 m | | | | | | 1.2 |
| 1.4 | | | | | | | | 1.4 |
| 1.6 | | | | | | | | 1.6 |
| 1.8 | | | | | | | | 1.8 |
| 2 | 2.0 - 2.45 | SPT (C) N=22 | 3,3/4,5,8,10 | | | | | 2 |
| 2.2 | | | | | | | Black/grey limestone | 2.2 |
| 2.4 | 2.5 | D = 2.5 m | | | | | | 2.4 |
| 2.6 | | | | | | | Termination Depth at: 2.5 m | 2.6 |
| 2.8 | | | | | | | | 2.8 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJECT NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 3rd October 2023
**DRILLING METHOD** Window Sample Borehole
**BOREHOLE NO** WS3
**SHEET** 3/6

**COMPLETION** | **CASING** uPVC | **SCREEN** uPVC Factory Slotted

**COMMENTS** Borehole dry.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Well Instal. | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.15 | D = 0.15 m | | | | | Grass onto brown silty clayey sand with frequent rootlets. (TOPSOIL) | 0 |
| 0.2 | | | | | | | | 0.2 |
| 0.4 | | | | | | | Brown silty clayey sand | 0.4 |
| 0.6 | | | | | | | Stiff becoming very stiff brown sandy silty gravelly clay | 0.6 |
| 0.8 | | | | | | | | 0.8 |
| 1 | 1.0 | D = 1.0 m | | | | | | 1 |
| 1.2 | 1.0 - 1.45 | SPT (C) N=11 | 2,2/2,2,3,3 | | | | | 1.2 |
| 1.4 | | | | | | | | 1.4 |
| 1.6 | 1.5 - 2.0 | B = 1.5 - 2.0 m | | | | | | 1.6 |
| 1.8 | | | | | | | | 1.8 |
| 2 | 2.0 - 2.45 | SPT (C) N=24 | 3,3/4,4,6,10 | | | | | 2 |
| 2.2 | | | | | | | | 2.2 |
| 2.4 | 2.5 | D = 2.5 m | | | | | Black/grey limestone | 2.4 |
| 2.6 | | | | | | | Termination Depth at: 2.5 m | 2.6 |
| 2.8 | | | | | | | | 2.8 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJECT NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 3rd October 2023
**DRILLING METHOD** Window Sample Borehole
**BOREHOLE NO** WS4
**SHEET** 4/6

**COMPLETION** | **CASING** uPVC | **SCREEN** uPVC Factory Slotted

**COMMENTS** Borehole dry. Refusal at 1.50 m.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Well Instal. | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.15 | D = 0.15 m | | | | | Grass onto brown silty clayey sand with frequent rootlets. (TOPSOIL) | 0 |
| 0.2 | | | | | | | Brown silty clayey sand | 0.2 |
| 0.4 | 0.5 | D = 0.5 m | | | | | Stiff brown sandy silty clay with occasional gravels | 0.4 |
| 0.6 | 0.5 - 1.0 | B = 0.5 - 1.0 m | | | | | | 0.6 |
| 0.8 | | | | | | | | 0.8 |
| 1 | 1.0 - 1.45 | SPT (C) N=10 | 2,2/2,2,3,3 | | | | | 1 |
| 1.2 | | | | | | | Black/grey limestone | 1.2 |
| 1.4 | | | | | | | | 1.4 |
| 1.6 | | | | | | | Termination Depth at: 1.5 m | 1.6 |
| 1.8 | | | | | | | | 1.8 |
| 2 | | | | | | | | 2 |
| 2.2 | | | | | | | | 2.2 |
| 2.4 | | | | | | | | 2.4 |
| 2.6 | | | | | | | | 2.6 |
| 2.8 | | | | | | | | 2.8 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJECT NAME** Crow Trees Brow, Chatburn
**CLIENT** Pringle Homes

**DATE** 3rd October 2023
**DRILLING METHOD** Window Sample Borehole
**BOREHOLE NO** WS5
**SHEET** 5/6

**COMPLETION** | **CASING** uPVC | **SCREEN** uPVC Factory Slotted

**COMMENTS** Borehole dry. Refusal at 1.60 m.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Well Instal. | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | Grass onto brown silty clayey sand with frequent rootlets. (TOPSOIL) | 0 |
| 0.2 | 0.2 | D = 0.2 m | | | | | | 0.2 |
| 0.4 | | | | | | | Brown silty clayey sand | 0.4 |
| 0.6 | | | | | | | Stiff brown sandy silty gravelly clay | 0.6 |
| 0.8 | | | | | | | | 0.8 |
| 1 | 1.0 | D = 1.0 m | | | | | | 1 |
| 1.2 | 1.0 - 1.45 | SPT (C) N=11 | 2,2/2,3,3,3 | | | | | 1.2 |
| 1.4 | | | | | | | | 1.4 |
| 1.6 | | | | | | | Black/grey limestone | 1.6 |
| 1.8 | | | | | | | Termination Depth at: 1.6 m | 1.8 |
| 2 | | | | | | | | 2 |
| 2.2 | | | | | | | | 2.2 |
| 2.4 | | | | | | | | 2.4 |
| 2.6 | | | | | | | | 2.6 |
| 2.8 | | | | | | | | 2.8 |

GEO-ENVIROMENTAL CONSULTING ENGINEERS

# GEO-ENVIRONMENTAL CONSULTANTS

**PROJECT NUMBER** 23127
**PROJECT NAME** Crow Tree Brow, Chatburn
**CLIENT** Pringle Homes Limited

**DATE** 3rd October 2023
**DRILLING METHOD** Window Sample Borehole
**BOREHOLE NO** WS6
**SHEET** 6/6

**COMPLETION** | **CASING** uPVC | **SCREEN** uPVC Factory Slotted

**COMMENTS** Borehole dry. Refusal at 1.5 m.

| Depth (m) | Depth (m) | Samples/ Test | Field Records | Water | Well Instal. | Graphic Log | Material Description | Elevation (m) |
|---|---|---|---|---|---|---|---|---|
| | 0.15 | D = 0.15 m | | | | | Grass onto brown silty clayey sand with frequent rootlets. (TOPSOIL) | |
| 0.2 | | | | | | | | 0.2 |
| 0.4 | | | | | | | Brown silty clayey sand | 0.4 |
| 0.6 | | | | | | | Stiff brown sandy silty gravelly clay | 0.6 |
| 0.8 | 0.8 | D = 0.8 m | | | | | | 0.8 |
| 1 | 1.0 - 1.45 | SPT (C) N=11 | 2,2/2,2,3,3 | | | | | 1 |
| 1.2 | | | | | | | | 1.2 |
| 1.4 | | | | | | | Black/grey limestone | 1.4 |
| 1.6 | | | | | | | Termination Depth at: 1.5 m | 1.6 |
| 1.8 | | | | | | | | 1.8 |
| 2 | | | | | | | | 2 |
| 2.2 | | | | | | | | 2.2 |
| 2.4 | | | | | | | | 2.4 |
| 2.6 | | | | | | | | 2.6 |
| 2.8 | | | | | | | | 2.8 |

# APPENDIX B

Chemical Test Results

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

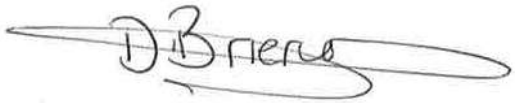
# FINAL ANALYTICAL TEST REPORT

**Envirolab Job Number:** 23/09777
**Issue Number:** 1 **Date:** 16 October, 2023

**Client:**
BEK Enviro Ltd
2 Landwick Court
Metcalfe Drive
Altham Business Park
Altham
Lancashire
BB5 5GY

**Project Manager:** Mick Buckley/James Mashiter
**Project Name:** Crows Nest, Chatburn
**Project Ref:** N/A
**Order No:** 7954-23127-MLM
**Date Samples Received:** 03/10/23
**Date Instructions Received:** 04/10/23
**Date Analysis Completed:** 16/10/23

**Approved by:**



Danielle Brierley
Client Services Supervisor

**Envirolab Job Number: 23/09777**

**Client Project Name: Crows Nest, Chatburn**

**Client Project Ref: N/A**

| Lab Sample ID | 23/09777/1 | 23/09777/2 | 23/09777/3 | 23/09777/4 | 23/09777/5 | 23/09777/6 | 23/09777/7 | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | TP6 | TP11 | TP1 | TP2 | TP4 | TP8 | WS1 | | | |
| Depth to Top | 0.10 | 0.15 | 0.25 | 0.15 | 0.10 | 0.15 | 0.10 | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 03-Oct-23 | | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | | |
| Sample Matrix Code | 6AE | 6AE | 4A | 6AE | 6AE | 6AE | 6AE | | | |
| % Stones >10mm$_A$ | <0.1 | <0.1 | 16.3 | 21.3 | <0.1 | <0.1 | <0.1 | % w/w | 0.1 | A-T-044 |
| Asbestos in soil$_D^{\#}$ | NAD | NAD | NAD | NAD | NAD | NAD | NAD | | | A-T-045 |
| Asbestos Matrix (visual)$_D$ | - | - | - | - | - | - | - | | | A-T-045 |
| Asbestos Matrix (microscope)$_D$ | - | - | - | - | - | - | - | | | A-T-045 |
| Asbestos ACM - Suitable for Water Absorption Test?$_D$ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | | | A-T-045 |
| pH$_D^{M\#}$ | 6.88 | 6.53 | 8.39 | 7.87 | 6.66 | 6.29 | 6.27 | pH | 0.01 | A-T-031s |
| Sulphate (water sol 2:1)$_D^{M\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | g/l | 0.01 | A-T-026s |
| Sulphate (acid soluble)$_D^{M\#}$ | 1100 | 1400 | 590 | 550 | 980 | 810 | 1100 | mg/kg | 200 | A-T-028s |
| Cyanide (total)$_A^{M\#}$ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | mg/kg | 1 | A-T-042sTCN |
| Phenols - Total by HPLC$_A$ | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | mg/kg | 0.2 | A-T-050s |
| Organic Matter$_D^{M\#}$ | 8.4 | 12.6 | 5.6 | 4.6 | 6.6 | 5.6 | 8.0 | % w/w | 0.1 | A-T-032s |
| Arsenic$_D^{M\#}$ | 9 | 9 | 7 | 2 | 9 | 9 | 8 | mg/kg | 1 | A-T-024s |
| Boron (water soluble)$_D^{M\#}$ | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | mg/kg | 1 | A-T-027s |
| Cadmium$_D^{M\#}$ | 1.3 | 1.5 | 0.8 | <0.5 | 1.3 | 1.5 | 1.3 | mg/kg | 0.5 | A-T-024s |
| Copper$_D^{M\#}$ | 31 | 33 | 28 | 12 | 26 | 29 | 26 | mg/kg | 1 | A-T-024s |
| Chromium$_D^{M\#}$ | 26 | 22 | 11 | 7 | 24 | 21 | 23 | mg/kg | 1 | A-T-024s |
| Chromium (hexavalent)$_D$ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | mg/kg | 1 | A-T-040s |
| Lead$_D^{M\#}$ | 75 | 81 | 69 | 29 | 70 | 87 | 77 | mg/kg | 1 | A-T-024s |
| Mercury$_D$ | <0.17 | <0.17 | 1.82 | 1.90 | <0.17 | <0.17 | <0.17 | mg/kg | 0.17 | A-T-024s |
| Nickel$_D^{M\#}$ | 20 | 21 | 17 | 6 | 19 | 20 | 20 | mg/kg | 1 | A-T-024s |
| Selenium$_D^{M\#}$ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | mg/kg | 1 | A-T-024s |
| Zinc$_D^{M\#}$ | 200 | 246 | 177 | 108 | 215 | 213 | 202 | mg/kg | 5 | A-T-024s |

**Envirolab Job Number: 23/09777**

**Client Project Name: Crows Nest, Chatburn**

**Client Project Ref: N/A**

| Lab Sample ID | 23/09777/1 | 23/09777/2 | 23/09777/3 | 23/09777/4 | 23/09777/5 | 23/09777/6 | 23/09777/7 | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | TP6 | TP11 | TP1 | TP2 | TP4 | TP8 | WS1 | | | |
| Depth to Top | 0.10 | 0.15 | 0.25 | 0.15 | 0.10 | 0.15 | 0.10 | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 03-Oct-23 | | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | | |
| Sample Matrix Code | 6AE | 6AE | 4A | 6AE | 6AE | 6AE | 6AE | | | |
| **PAH-16MS** | | | | | | | | | | |
| Acenaphthene$_A^{M\#}$ | <0.01 | <0.01 | <0.10 | 0.04 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-019s |
| Acenaphthylene$_A^{M\#}$ | <0.01 | <0.01 | <0.10 | 0.05 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-019s |
| Anthracene$_A^{M\#}$ | <0.02 | <0.02 | 0.22 | 0.12 | 0.03 | <0.02 | <0.02 | mg/kg | 0.02 | A-T-019s |
| Benzo(a)anthracene$_A^{M\#}$ | 0.32 | 0.20 | 4.74 | 1.08 | 0.29 | 0.15 | <0.04 | mg/kg | 0.04 | A-T-019s |
| Benzo(a)pyrene$_A^{M\#}$ | 0.42 | 0.23 | 9.25 | 1.85 | 0.37 | 0.18 | <0.04 | mg/kg | 0.04 | A-T-019s |
| Benzo(b)fluoranthene$_A^{M\#}$ | 0.53 | 0.33 | 11.8 | 1.90 | 0.46 | 0.25 | <0.05 | mg/kg | 0.05 | A-T-019s |
| Benzo(ghi)perylene$_A^{M\#}$ | 0.31 | 0.17 | 5.44 | 2.01 | 0.28 | 0.15 | <0.05 | mg/kg | 0.05 | A-T-019s |
| Benzo(k)fluoranthene$_A^{M\#}$ | 0.17 | <0.07 | 4.40 | 0.64 | 0.15 | <0.07 | <0.07 | mg/kg | 0.07 | A-T-019s |
| Chrysene$_A^{M\#}$ | 0.38 | 0.25 | 5.80 | 1.17 | 0.35 | 0.19 | <0.06 | mg/kg | 0.06 | A-T-019s |
| Dibenzo(ah)anthracene$_A$ | <0.04 | <0.04 | 0.91 | 0.25 | <0.04 | <0.04 | <0.04 | mg/kg | 0.04 | A-T-019s |
| Fluoranthene$_A^{M\#}$ | 0.42 | 0.28 | 3.82 | 1.44 | 0.41 | 0.23 | <0.08 | mg/kg | 0.08 | A-T-019s |
| Fluorene$_A^{M\#}$ | <0.01 | <0.01 | <0.10 | 0.03 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-019s |
| Indeno(123-cd)pyrene$_A^{M\#}$ | 0.35 | 0.19 | 6.37 | 2.04 | 0.32 | 0.16 | <0.03 | mg/kg | 0.03 | A-T-019s |
| Naphthalene $_A^{M\#}$ | <0.03 | <0.03 | <0.30 | <0.03 | <0.03 | <0.03 | <0.03 | mg/kg | 0.03 | A-T-019s |
| Phenanthrene$_A^{M\#}$ | 0.11 | 0.09 | 0.69 | 0.46 | 0.13 | 0.07 | <0.03 | mg/kg | 0.03 | A-T-019s |
| Pyrene$_A^{M\#}$ | 0.42 | 0.28 | 5.72 | 1.42 | 0.37 | 0.21 | <0.07 | mg/kg | 0.07 | A-T-019s |
| Total PAH-16MS$_A$ | 3.43 | 2.02 | 59.2 | 14.5 | 3.16 | 1.59 | <0.08 | mg/kg | 0.01 | A-T-019s |

**Envirolab Job Number: 23/09777**

**Client Project Name: Crows Nest, Chatburn**

**Client Project Ref: N/A**

| Lab Sample ID | 23/09777/1 | 23/09777/2 | 23/09777/3 | 23/09777/4 | 23/09777/5 | 23/09777/6 | 23/09777/7 | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | TP6 | TP11 | TP1 | TP2 | TP4 | TP8 | WS1 | | | |
| Depth to Top | 0.10 | 0.15 | 0.25 | 0.15 | 0.10 | 0.15 | 0.10 | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 03-Oct-23 | | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | | |
| Sample Matrix Code | 6AE | 6AE | 4A | 6AE | 6AE | 6AE | 6AE | | | |
| **Speciated PCB-WHO12** | | | | | | | | | | |
| PCB BZ $81_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $105_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $114_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $118_A^{M\#}$ | <0.007 | <0.007 | - | - | - | - | - | mg/kg | 0.007 | A-T-004s |
| PCB BZ $123_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $126_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $156_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $157_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $167_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $169_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $189_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| PCB BZ $77_A^{M\#}$ | <0.005[U] | <0.005[U] | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |
| Total Speciated PCB-WHO12$_A^{M\#}$ | <0.007 | <0.007 | - | - | - | - | - | mg/kg | 0.005 | A-T-004s |

**Envirolab Job Number: 23/09777**

**Client Project Name: Crows Nest, Chatburn**

**Client Project Ref: N/A**

| Lab Sample ID | 23/09777/1 | 23/09777/2 | 23/09777/3 | 23/09777/4 | 23/09777/5 | 23/09777/6 | 23/09777/7 | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | TP6 | TP11 | TP1 | TP2 | TP4 | TP8 | WS1 | | | |
| Depth to Top | 0.10 | 0.15 | 0.25 | 0.15 | 0.10 | 0.15 | 0.10 | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 02-Oct-23 | 03-Oct-23 | | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | | |
| Sample Matrix Code | 6AE | 6AE | 4A | 6AE | 6AE | 6AE | 6AE | | | |
| **TPH CWG with Clean Up** | | | | | | | | | | |
| Ali >C5-C6$_A$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| Ali >C6-C8$_A$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| Ali >C8-C10$_A$ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | mg/kg | 1 | A-T-055s |
| Ali >C10-C12$_A^{M\#}$ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | mg/kg | 1 | A-T-055s |
| Ali >C12-C16$_A^{M\#}$ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | mg/kg | 1 | A-T-055s |
| Ali >C16-C21$_A^{M\#}$ | <1 | <1 | 2 | <1 | 1 | <1 | <1 | mg/kg | 1 | A-T-055s |
| Ali >C21-C35$_A^{M\#}$ | 4 | 12 | 16 | 8 | 11 | 7 | 3 | mg/kg | 1 | A-T-055s |
| Total Aliphatics$_A$ | 4 | 12 | 18 | 8 | 12 | 7 | 3 | mg/kg | 1 | Calc-As Recd |
| Aro >C5-C7$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| Aro >C7-C8$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| Aro >C8-C10$_A$ | <2 | <2 | <2 | <2 | <2 | <2 | <2 | mg/kg | 1 | A-T-055s |
| Aro >C10-C12$_A$ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | mg/kg | 1 | A-T-055s |
| Aro >C12-C16$_A^{M\#}$ | <1 | <1 | 3 | <1 | 1 | <1 | <1 | mg/kg | 1 | A-T-055s |
| Aro >C16-C21$_A^{M\#}$ | 3 | 5 | 24 | 5 | 13 | 4 | <1 | mg/kg | 1 | A-T-055s |
| Aro >C21-C35$_A^{M\#}$ | 17 | 14 | 177 | 40 | 66 | 12 | 3 | mg/kg | 1 | A-T-055s |
| Total Aromatics$_A$ | 20 | 19 | 203 | 45 | 81 | 16 | 3 | mg/kg | 1 | Calc-As Recd |
| TPH (Ali & Aro >C5-C35)$_A$ | 24 | 31 | 222 | 53 | 93 | 23 | 6 | mg/kg | 1 | Calc-As Recd |
| BTEX - Benzene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| BTEX - Toluene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| BTEX - Ethyl Benzene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| BTEX - m & p Xylene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| BTEX - o Xylene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |
| MTBE$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | mg/kg | 0.01 | A-T-022s |

**Envirolab Job Number: 23/09777**

**Client Project Name: Crows Nest, Chatburn**

**Client Project Ref: N/A**

| Lab Sample ID | 23/09777/8 | | | | | | | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | WS2 | | | | | | | | | |
| Depth to Top | 0.15 | | | | | | | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 03-Oct-23 | | | | | | | | | |
| Sample Type | SOIL | | | | | | | | | |
| Sample Matrix Code | 6AE | | | | | | | | | |
| % Stones >10mm$_A$ | 12.5 | | | | | | | % w/w | 0.1 | A-T-044 |
| Asbestos in soil$_D^{\#}$ | NAD | | | | | | | | | A-T-045 |
| Asbestos Matrix (visual)$_D$ | - | | | | | | | | | A-T-045 |
| Asbestos Matrix (microscope)$_D$ | - | | | | | | | | | A-T-045 |
| Asbestos ACM - Suitable for Water Absorption Test?$_D$ | N/A | | | | | | | | | A-T-045 |
| pH$_D^{M\#}$ | 8.06 | | | | | | | pH | 0.01 | A-T-031s |
| Sulphate (water sol 2:1)$_D^{M\#}$ | <0.01 | | | | | | | g/l | 0.01 | A-T-026s |
| Sulphate (acid soluble)$_D^{M\#}$ | 480 | | | | | | | mg/kg | 200 | A-T-028s |
| Cyanide (total)$_A^{M\#}$ | <1 | | | | | | | mg/kg | 1 | A-T-042sTCN |
| Phenols - Total by HPLC$_A$ | <0.2 | | | | | | | mg/kg | 0.2 | A-T-050s |
| Organic Matter$_D^{M\#}$ | 6.1 | | | | | | | % w/w | 0.1 | A-T-032s |
| Arsenic$_D^{M\#}$ | 6 | | | | | | | mg/kg | 1 | A-T-024s |
| Boron (water soluble)$_D^{M\#}$ | <1.0 | | | | | | | mg/kg | 1 | A-T-027s |
| Cadmium$_D^{M\#}$ | 0.7 | | | | | | | mg/kg | 0.5 | A-T-024s |
| Copper$_D^{M\#}$ | 19 | | | | | | | mg/kg | 1 | A-T-024s |
| Chromium$_D^{M\#}$ | 14 | | | | | | | mg/kg | 1 | A-T-024s |
| Chromium (hexavalent)$_D$ | <1 | | | | | | | mg/kg | 1 | A-T-040s |
| Lead$_D^{M\#}$ | 60 | | | | | | | mg/kg | 1 | A-T-024s |
| Mercury$_D$ | 1.43 | | | | | | | mg/kg | 0.17 | A-T-024s |
| Nickel$_D^{M\#}$ | 18 | | | | | | | mg/kg | 1 | A-T-024s |
| Selenium$_D^{M\#}$ | <1 | | | | | | | mg/kg | 1 | A-T-024s |
| Zinc$_D^{M\#}$ | 121 | | | | | | | mg/kg | 5 | A-T-024s |

| Lab Sample ID | 23/09777/8 | | | | | | | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | WS2 | | | | | | | | | |
| Depth to Top | 0.15 | | | | | | | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 03-Oct-23 | | | | | | | | | |
| Sample Type | SOIL | | | | | | | | | |
| Sample Matrix Code | 6AE | | | | | | | | | |
| PAH-16MS | | | | | | | | | | |
| Acenaphthene$_A^{M\#}$ | 0.25 | | | | | | | mg/kg | 0.01 | A-T-019s |
| Acenaphthylene$_A^{M\#}$ | 0.02 | | | | | | | mg/kg | 0.01 | A-T-019s |
| Anthracene$_A^{M\#}$ | 0.76 | | | | | | | mg/kg | 0.02 | A-T-019s |
| Benzo(a)anthracene$_A^{M\#}$ | 3.24 | | | | | | | mg/kg | 0.04 | A-T-019s |
| Benzo(a)pyrene$_A^{M\#}$ | 2.86 | | | | | | | mg/kg | 0.04 | A-T-019s |
| Benzo(b)fluoranthene$_A^{M\#}$ | 3.18 | | | | | | | mg/kg | 0.05 | A-T-019s |
| Benzo(ghi)perylene$_A^{M\#}$ | 1.53 | | | | | | | mg/kg | 0.05 | A-T-019s |
| Benzo(k)fluoranthene$_A^{M\#}$ | 1.13 | | | | | | | mg/kg | 0.07 | A-T-019s |
| Chrysene$_A^{M\#}$ | 3.08 | | | | | | | mg/kg | 0.06 | A-T-019s |
| Dibenzo(ah)anthracene$_A$ | 0.28 | | | | | | | mg/kg | 0.04 | A-T-019s |
| Fluoranthene$_A^{M\#}$ | 6.92 | | | | | | | mg/kg | 0.08 | A-T-019s |
| Fluorene$_A^{M\#}$ | 0.14 | | | | | | | mg/kg | 0.01 | A-T-019s |
| Indeno(123-cd)pyrene$_A^{M\#}$ | 1.87 | | | | | | | mg/kg | 0.03 | A-T-019s |
| Naphthalene $_A^{M\#}$ | <0.03 | | | | | | | mg/kg | 0.03 | A-T-019s |
| Phenanthrene$_A^{M\#}$ | 2.84 | | | | | | | mg/kg | 0.03 | A-T-019s |
| Pyrene$_A^{M\#}$ | 5.88 | | | | | | | mg/kg | 0.07 | A-T-019s |
| Total PAH-16MS$_A$ | 34 | | | | | | | mg/kg | 0.01 | A-T-019s |

**Envirolab Job Number: 23/09777**

**Client Project Name: Crows Nest, Chatburn**

**Client Project Ref: N/A**

| Lab Sample ID | 23/09777/8 | | | | | | | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | WS2 | | | | | | | | | |
| Depth to Top | 0.15 | | | | | | | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 03-Oct-23 | | | | | | | | | |
| Sample Type | SOIL | | | | | | | | | |
| Sample Matrix Code | 6AE | | | | | | | | | |
| **TPH CWG with Clean Up** | | | | | | | | | | |
| Ali >C5-C6$_A$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| Ali >C6-C8$_A$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| Ali >C8-C10$_A$ | <1 | | | | | | | mg/kg | 1 | A-T-055s |
| Ali >C10-C12$_A^{M\#}$ | <1 | | | | | | | mg/kg | 1 | A-T-055s |
| Ali >C12-C16$_A^{M\#}$ | <1 | | | | | | | mg/kg | 1 | A-T-055s |
| Ali >C16-C21$_A^{M\#}$ | <1 | | | | | | | mg/kg | 1 | A-T-055s |
| Ali >C21-C35$_A^{M\#}$ | 7 | | | | | | | mg/kg | 1 | A-T-055s |
| Total Aliphatics$_A$ | 7 | | | | | | | mg/kg | 1 | Calc-As Recd |
| Aro >C5-C7$_A^{\#}$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| Aro >C7-C8$_A^{\#}$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| Aro >C8-C10$_A$ | <2 | | | | | | | mg/kg | 1 | A-T-055s |
| Aro >C10-C12$_A$ | <1 | | | | | | | mg/kg | 1 | A-T-055s |
| Aro >C12-C16$_A^{M\#}$ | 2 | | | | | | | mg/kg | 1 | A-T-055s |
| Aro >C16-C21$_A^{M\#}$ | 11 | | | | | | | mg/kg | 1 | A-T-055s |
| Aro >C21-C35$_A^{M\#}$ | 67 | | | | | | | mg/kg | 1 | A-T-055s |
| Total Aromatics$_A$ | 80 | | | | | | | mg/kg | 1 | Calc-As Recd |
| TPH (Ali & Aro >C5-C35)$_A$ | 87 | | | | | | | mg/kg | 1 | Calc-As Recd |
| BTEX - Benzene$_A^{\#}$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| BTEX - Toluene$_A^{\#}$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| BTEX - Ethyl Benzene$_A^{\#}$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| BTEX - m & p Xylene$_A^{\#}$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| BTEX - o Xylene$_A^{\#}$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |
| MTBE$_A^{\#}$ | <0.01 | | | | | | | mg/kg | 0.01 | A-T-022s |

## Report Notes

**General**
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received within the same delivery, will be disposed of **six weeks** after the initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of **six months** after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and Interpretations expressed are outside our scope of accreditation.
The client Sample No, Client Sample ID, Depth to top, Depth to Bottom and Date Sampled are all provided by the client.
A deviating sample report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

**Key**

| | |
|---|---|
| Superscript "#" | Accredited to ISO 17025 |
| Superscript "M" | Accredited to MCertS |
| Superscript "U" | Individual result not accredited |
| None of the above symbols | Analysis unaccredited |
| Subscript "A" | Analysis performed on as-received Sample |
| Subscript "D" | Analysis performed on the dried sample, crushed to pass 2mm sieve. |
| Subscript "^" | Analysis has dependant options against results. Details appear in the comments of your Sample receipt |
| IS | Insufficient Sample for analysis |
| US | Unsuitable Sample for analysis |
| NDP | No Determination Possible |
| NAD | No Asbestos Detected |
| N/A | Not applicable |

**Asbestos**
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing, and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

**Assigned Matrix Codes**

| | | | | | |
|---|---|---|---|---|---|
| 1 | SAND | 6 | CLAY/LOAM | A | Contains Stones |
| 2 | LOAM | 7 | OTHER | B | Contains Construction Rubble |
| 3 | CLAY | 8 | Asbestos Bulk (Only Asbestos ID accredited) | C | Contains visible hydrocarbons |
| 4 | LOAM/SAND | 9 | Incinerator Ash (some Metals accredited) | D | Contains glass / metal |
| 5 | SAND/CLAY | | | E | Contains roots / twigs |
| **Note: 7,8,9 matrices are not covered by our ISO 17025 or MCertS accreditation, unless stated above.** | | | | | |

**Soil Chemical Analysis:**
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

**TPH by method A-T-007:**
For waters, free and visible oils are excluded from the sample used for analysis, so the reported result represents the dissolved phase only.
Results "with Clean up" indicates samples cleaned up with Silica during extraction.

**EPH CWG (method A-T-055) from TPH CWG:**
EPH CWG results have humics mathematically subtracted through instrument calculation.
Where these humic substances have been identified in any IDs from "TPH CWG with clean up" please note that the concentration is **NOT** included in the quantified results but present in the ID for information.

**Electrical Conductivity of water by method A-T-037:**
Results greater than 12900µS/cm @ 25$^{o}$C / 11550µS/cm @ 20$^{o}$C fall outside the accreditation range and as such are unaccredited.

Please contact your client manager if you require any further information.

# Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

**Client:** BEK Enviro Ltd, 2 Landwick Court, Metcalfe Drive, Altham Business Park, Altham, Lancashire , BB5 5GY

**Project:** Crows Nest, Chatburn

**Clients Project No:** N/A

**Project No:** 23/09777

**Date Received:** 04/10/2023 (am)

**Cool Box Temperatures (°C):** 14.6

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

# Envirolab Analysis Dates

| Lab Sample ID | 23/09777/1 | 23/09777/2 | 23/09777/3 | 23/09777/4 | 23/09777/5 | 23/09777/6 | 23/09777/7 | 23/09777/8 |
|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | |
| Client Sample ID/Depth | TP6 0.10m | TP11 0.15m | TP1 0.25m | TP2 0.15m | TP4 0.10m | TP8 0.15m | WS1 0.10m | WS2 0.15m |
| Date Sampled | 02/10/23 | 02/10/23 | 02/10/23 | 02/10/23 | 02/10/23 | 02/10/23 | 03/10/23 | 03/10/23 |
| A-T-004s | 10/10/2023 | 10/10/2023 | | | | | | |
| A-T-019s | 09/10/2023 | 09/10/2023 | 10/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 |
| A-T-022s | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 |
| A-T-024s | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 |
| A-T-026s | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 |
| A-T-027s | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 |
| A-T-028s | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 |
| A-T-031s | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 |
| A-T-032s | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 |
| A-T-040s | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 |
| A-T-042sTCN | 16/10/2023 | 16/10/2023 | 16/10/2023 | 16/10/2023 | 16/10/2023 | 16/10/2023 | 16/10/2023 | 16/10/2023 |
| A-T-044 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 |
| A-T-045 | 05/10/2023 | 05/10/2023 | 05/10/2023 | 05/10/2023 | 05/10/2023 | 05/10/2023 | 05/10/2023 | 05/10/2023 |
| A-T-050s | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 | 09/10/2023 |
| A-T-055s | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 |
| Calc-As Recd | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 | 10/10/2023 |

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

**End of Report**

# APPENDIX C

Geotechnical Test Results

MURRAY RIX
CONSULTANCY, SITE INVESTIGATION
CONSTRUCTION MATERIALS TESTING

# TEST REPORT

**Client** BEK Enviro Ltd

**Address** Suite One
No. 3 Mitton Road Business Park
Mitton Road
Whalley
Lancashire
BB7 9YE

**Contract** Crows Nest,
Chatburn

**Job Number** MRN 4627/47
**Date of Issue** 17 October 2023


Approved Signatories

S J Hutchings, O P Davies

Notes

1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.

2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.

3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.

4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted.

5 The results included within the report are representative of the samples submitted for analysis.

6 This certificate should not be reproduced, except in full, without the express permission of the laboratory.

# MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

**TEST CERTIFICATE**

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD
PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5
WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

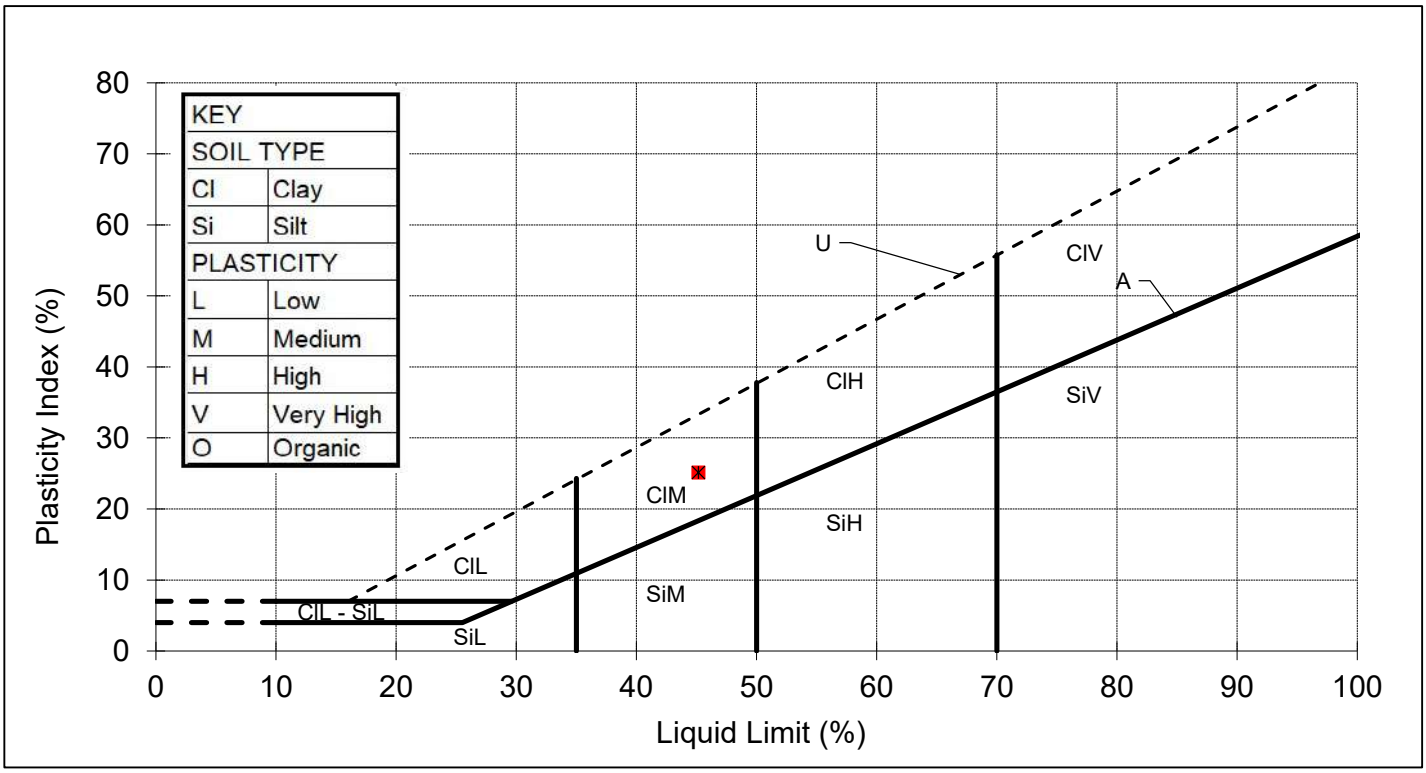
| | |
|---|---|
| CLIENT | BEK Enviro Ltd |
| SITE | Crows Nest, Chatburn |
| JOB NUMBER | MRN 4627/47 |

| | | | |
|---|---|---|---|
| SAMPLE LABEL | TP6 (1.6m) | DATE SAMPLED | 02-Oct-23 |
| SAMPLE No. | 132193 | DATE RECEIVED | 05-Oct-23 |
| DATE TESTED | 06-Oct-23 | SAMPLED BY | Client |

| | | | |
|---|---|---|---|
| MATERIAL | Brown silty slightly sandy slightly gravelly CLAY | | |
| ADVISED SOURCE | Site Investigation Sample | WATER CONTENT | Increasing |
| SAMPLE HISTORY | Natural State | % RET. 425um BY | Wet Sieved |

| Test Readings mm (average) | | Moisture Content % | Correction Factor | Correction factor from Clayton and Jukes 1978 |
|---|---|---|---|---|
| Determination 1 (avg) | 19.2 | 44.5 | 1.018 | |
| Determination 2 (avg) | 19.0 | 44.2 | | |

| Natural Moisture Content (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | Passing 425 micron (%) |
|---|---|---|---|---|
| 30.9 | 45 | 20 | 25 | 98 |




REMARKS

SIGNED

NAME O.P. Davies BA (Hons) (Laboratory Manager) DATE 17-Oct-23

# MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

**TEST CERTIFICATE**

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD
PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5
WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

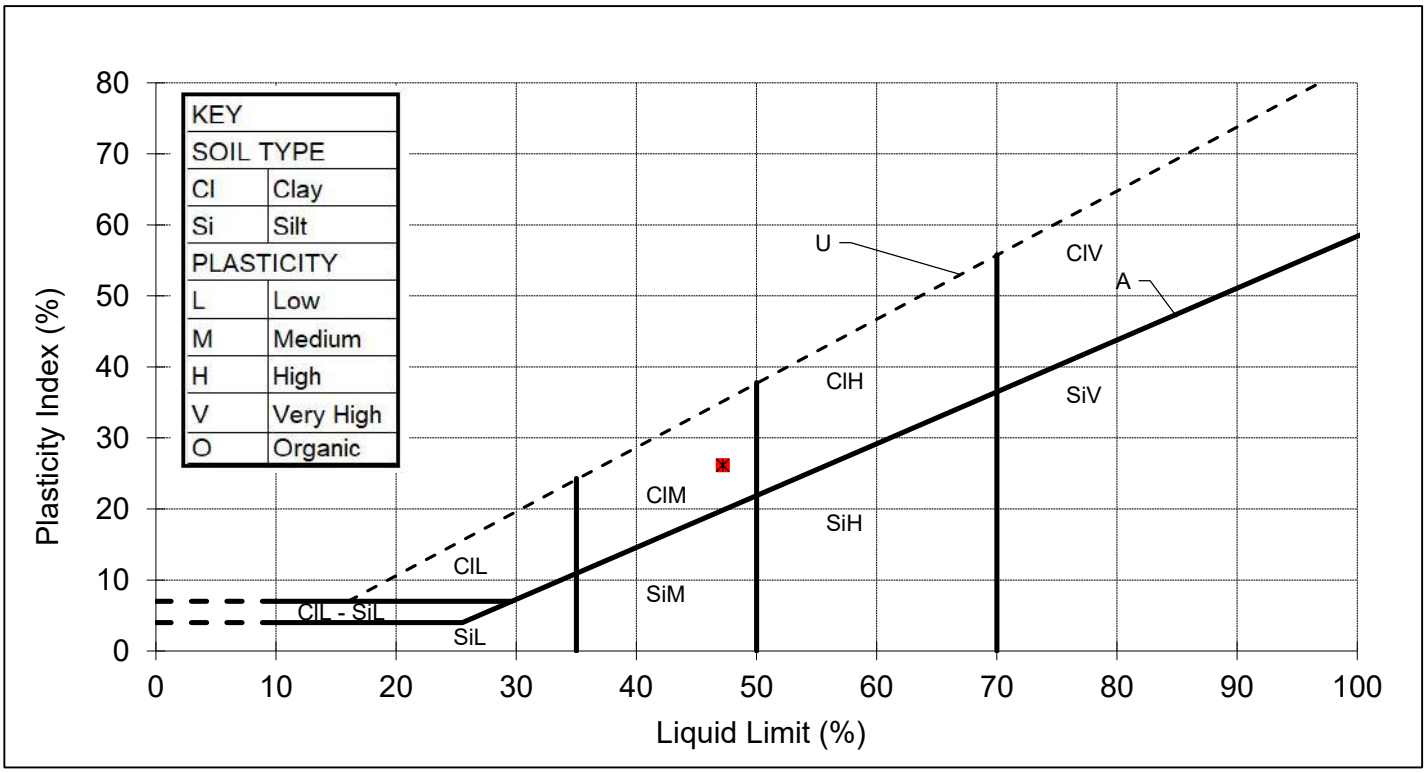
| | |
|---|---|
| CLIENT | BEK Enviro Ltd |
| SITE | Crows Nest, Chatburn |
| JOB NUMBER | MRN 4627/47 |

| | | | |
|---|---|---|---|
| SAMPLE LABEL | TP9 (1.5m) | DATE SAMPLED | 02-Oct-23 |
| SAMPLE No. | 132194 | DATE RECEIVED | 05-Oct-23 |
| DATE TESTED | 06-Oct-23 | SAMPLED BY | Client |

| | | | |
|---|---|---|---|
| MATERIAL | Brown silty slightly sandy slightly gravelly CLAY | | |
| ADVISED SOURCE | Site Investigation Sample | WATER CONTENT | Increasing |
| SAMPLE HISTORY | Natural State | % RET. 425um BY | Wet Sieved |

| Test Readings mm (average) | | Moisture Content % | Correction Factor | Correction factor from Clayton and Jukes 1978 |
|---|---|---|---|---|
| Determination 1 (avg) | 18.6 | 46.2 | 1.026 | |
| Determination 2 (avg) | 18.5 | 45.8 | | |

| Natural Moisture Content (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | Passing 425 micron (%) |
|---|---|---|---|---|
| 27.1 | 47 | 21 | 26 | 99 |




REMARKS

SIGNED

NAME O.P. Davies BA (Hons) (Laboratory Manager) DATE 17-Oct-23

# MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

**TEST CERTIFICATE**

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD
PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5
WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

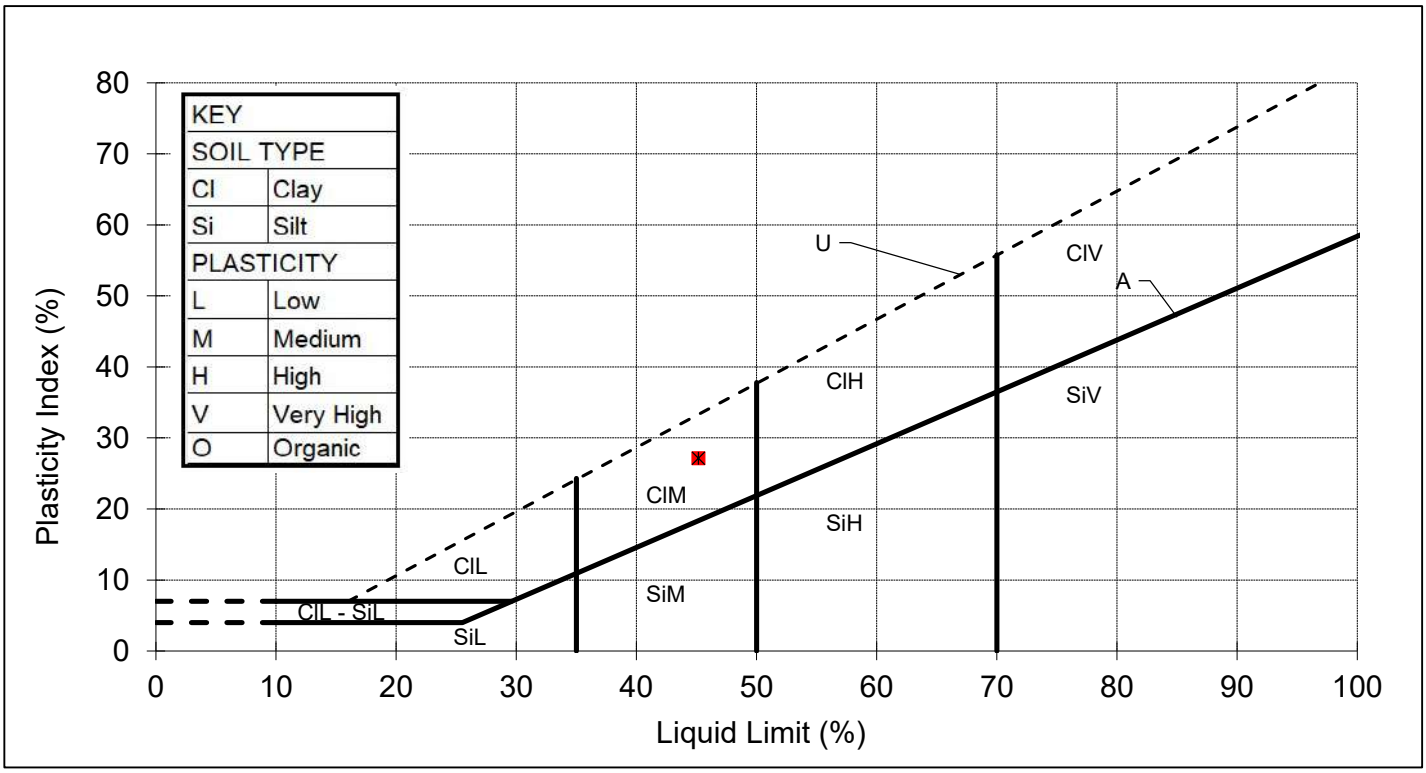
| | |
|---|---|
| CLIENT | BEK Enviro Ltd |
| SITE | Crows Nest, Chatburn |
| JOB NUMBER | MRN 4627/47 |

| | | | |
|---|---|---|---|
| SAMPLE LABEL | TP10 (1.0m) | DATE SAMPLED | 02-Oct-23 |
| SAMPLE No. | 132195 | DATE RECEIVED | 05-Oct-23 |
| DATE TESTED | 06-Oct-23 | SAMPLED BY | Client |

| | | | |
|---|---|---|---|
| MATERIAL | Brown silty slightly sandy slightly gravelly CLAY | | |
| ADVISED SOURCE | Site Investigation Sample | WATER CONTENT | Increasing |
| SAMPLE HISTORY | Natural State | % RET. 425um BY | Wet Sieved |

| Test Readings mm (average) | | Moisture Content % | Correction Factor | Correction factor from Clayton and Jukes 1978 |
|---|---|---|---|---|
| Determination 1 (avg) | 20.0 | 45.1 | 1.001 | |
| Determination 2 (avg) | 20.0 | 45.1 | | |

| Natural Moisture Content (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | Passing 425 micron (%) |
|---|---|---|---|---|
| 27.9 | 45 | 18 | 27 | 95 |




REMARKS

SIGNED

NAME O.P. Davies BA (Hons) (Laboratory Manager) DATE 17-Oct-23

# APPENDIX D

Infiltration Test Results

BEK
GEO-ENVIRONMENTAL CONSULTING

| Soakaway Testing | | | |
|---|---|---|---|
| Project Name | Crow Trees Brow, Chatburn | Location Reference: | TP3 |
| Project Number | 23127 | Test Number: | 1 |
| Test Date | 02/10/2023 | Weather: | Cloudy |

## FIELD MEASUREMENTS

| Elapsed Time, t (m) | Water Level (mBGL) |
|---|---|
| 0 | 0.80 |
| 1 | 0.80 |
| 2 | 0.80 |
| 3 | 0.80 |
| 4 | 0.80 |
| 5 | 0.80 |
| 6 | 0.80 |
| 7 | 0.80 |
| 8 | 0.80 |
| 9 | 0.80 |
| 10 | 0.81 |
| 20 | 0.81 |
| 30 | 0.82 |
| 60 | 0.82 |
| 90 | 0.83 |
| 120 | 0.83 |
| 150 | 0.84 |
| 180 | 0.84 |
| 210 | 0.84 |
| 240 | 0.85 |
| 270 | 0.85 |
| 300 | 0.85 |

## INFILTRATION CALCULATION

Calculation of Soil Infiltration Rate (f) as per BRE Digest 365 "Soakaway Design".

**Using:**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

**Where:**

| | | |
|---|---|---|
| $V_{p75-25}$ | The effective storage volume of water ($m^3$)in the trial pit between 75% and 25% effective depth | 0.54 |
| $a_{p50}$ | The internal surface area of the trial pit ($m^2$) up to 50% effective depth and including the base area | 3.42 |
| $t_{p75-25}$ | The time (s) for the water level to fall from 75% to 25% effective depth | 0 |

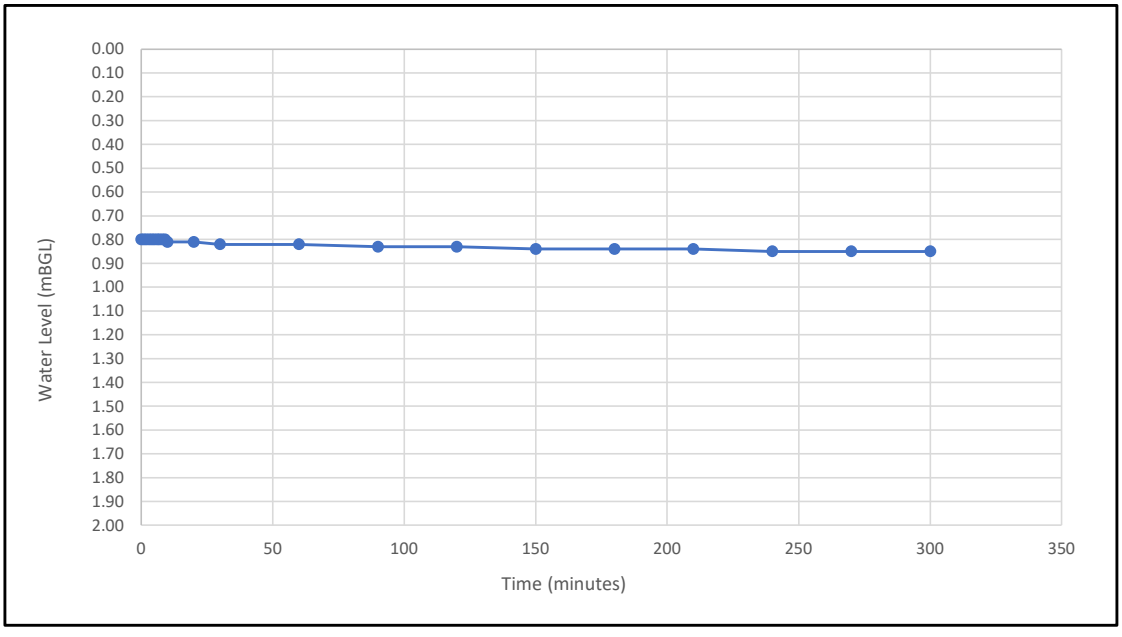
| | |
|---|---|
| Soakage Pit Length (m) | 1.50 |
| Soakage Pit Width (m) | 0.60 |
| Soakage Pit Depth (m) | 2.00 |
| Soakage Pit Area ($m^3$) | 1.80 |

| | |
|---|---|
| Start Water Level (mBGL) | 0.8 |
| Total Depth of Test (m) | 1.20 |
| **75%** Effective Depth (mBGL) | 1.10 |
| **50%** Effective Depth (m) | 0.60 |
| **25%** Effective Depth (mBGL) | 1.70 |

| | |
|---|---|
| Time at **75%** Effective Depth (minutes) | 0 |
| Time at **25%** Effective Depth (minutes) | 0 |

## INFILTRATION RATE

| | | |
|---|---|---|
| Soil Infiltration Rate ($f$) | | **Test Failed to Reach 25% Effective Depth** |
| | m/s | **Test Failed to Reach 25% Effective Depth** |
| | m/hour | **Test Failed to Reach 25% Effective Depth** |



GEO-ENVIRONMENTAL CONSULTING

| Soakaway Testing | | | |
|---|---|---|---|
| Project Name | Crow Trees Brow, Chatburn | Location Reference: | TP6 |
| Project Number | 23127 | Test Number: | 1 |
| Test Date | 02/10/2023 | Weather: | Cloudy |

## FIELD MEASUREMENTS

| Elapsed Time, t (m) | Water Level (mBGL) |
|---|---|
| 0 | 0.50 |
| 1 | 0.59 |
| 2 | 0.72 |
| 3 | 1.09 |
| 4 | 1.32 |
| 5 | 1.68 |
| 6 | 1.84 |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 20 | |
| 30 | |
| 60 | |
| 90 | |
| 120 | |
| 150 | |
| 180 | |
| 210 | |
| 240 | |
| 270 | |
| 300 | |

## INFILTRATION CALCULATION

Calculation of Soil Infiltration Rate (f) as per BRE Digest 365 "Soakaway Design".

**Using:**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

**Where:**

| | | |
|---|---|---|
| $V_{p75-25}$ | The effective storage volume of water ($m^3$)in the trial pit between 75% and 25% effective depth | 0.68 |
| $a_{p50}$ | The internal surface area of the trial pit ($m^2$) up to 50% effective depth and including the base area | 4.05 |
| $t_{p75-25}$ | The time (s) for the water level to fall from 75% to 25% effective depth | 150 |

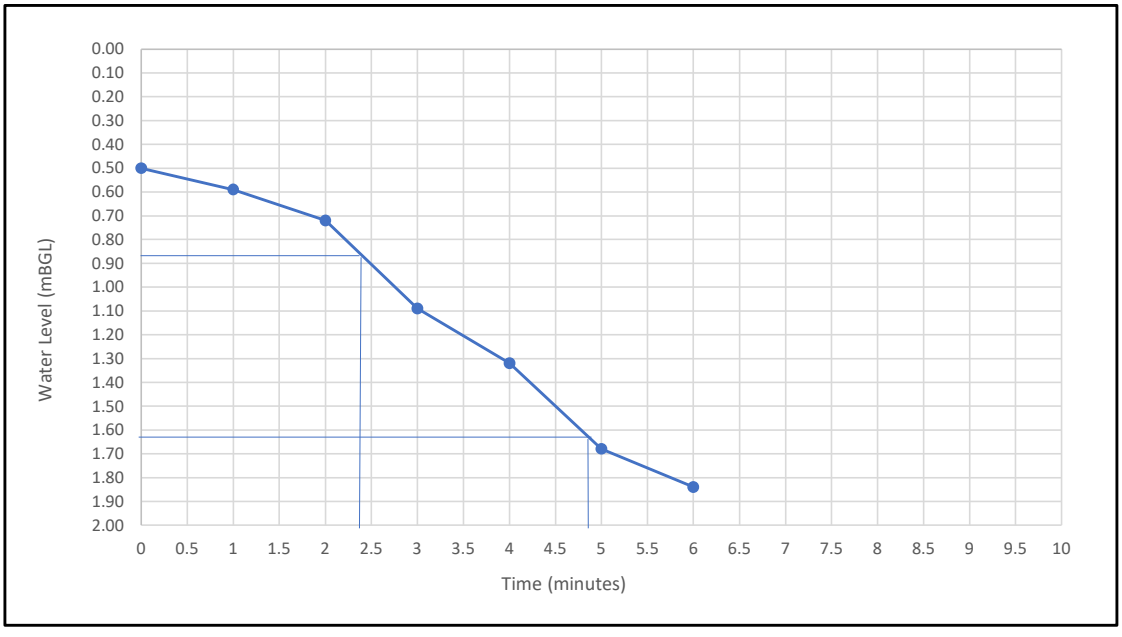
| | |
|---|---|
| Soakage Pit Length (m) | 1.50 |
| Soakage Pit Width (m) | 0.60 |
| Soakage Pit Depth (m) | 2.00 |
| Soakage Pit Area ($m^3$) | 1.80 |

| | |
|---|---|
| Start Water Level (mBGL) | 0.5 |
| Total Depth of Test (m) | 1.50 |
| **75%** Effective Depth (mBGL) | 0.88 |
| **50%** Effective Depth (m) | 0.75 |
| **25%** Effective Depth (mBGL) | 1.63 |

| | |
|---|---|
| Time at **75%** Effective Depth (minutes) | 2.4 |
| Time at **25%** Effective Depth (minutes) | 4.9 |

## INFILTRATION RATE

| | |
|---|---|
| Soil Infiltration Rate ($f$) | **1.11E-03** |
| m/s | **0.00111111** |
| m/hour | **4.0000** |



GEO-ENVIRONMENTAL CONSULTING

**Soakaway Testing**

| | | | |
|---|---|---|---|
| Project Name | Crow Trees Brow, Chatburn | Location Reference: | TP6 |
| Project Number | 23127 | Test Number: | 2 |
| Test Date | 02/10/2023 | Weather: | Cloudy |

## FIELD MEASUREMENTS

| Elapsed Time, t (m) | Water Level (mBGL) |
|---|---|
| 0 | 0.60 |
| 1 | 0.68 |
| 2 | 0.75 |
| 3 | 1.05 |
| 4 | 1.18 |
| 5 | 1.23 |
| 6 | 1.26 |
| 7 | 1.29 |
| 8 | 1.32 |
| 9 | 1.35 |
| 10 | 1.38 |
| 20 | 1.50 |
| 30 | 1.67 |
| 40 | 1.91 |
| 50 | |
| 60 | |
| 120 | |
| 180 | |
| 210 | |
| 240 | |
| 270 | |
| 300 | |

## INFILTRATION CALCULATION

Calculation of Soil Infiltration Rate (f) as per BRE Digest 365 "Soakaway Design".

**Using:**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

**Where:**

| | | |
|---|---|---|
| $V_{p75-25}$ | The effective storage volume of water ($m^3$)in the trial pit between 75% and 25% effective depth | 0.63 |
| $a_{p50}$ | The internal surface area of the trial pit ($m^2$) up to 50% effective depth and including the base area | 3.84 |
| $t_{p75-25}$ | The time (s) for the water level to fall from 75% to 25% effective depth | 1500 |

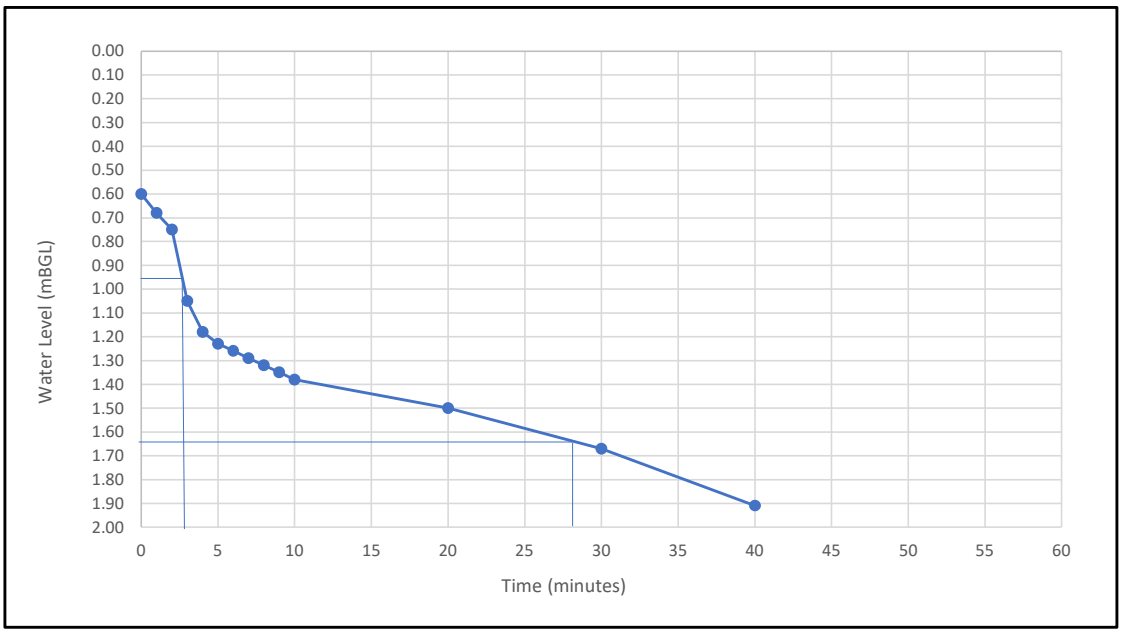
| | |
|---|---|
| Soakage Pit Length (m) | 1.50 |
| Soakage Pit Width (m) | 0.60 |
| Soakage Pit Depth (m) | 2.00 |
| Soakage Pit Area ($m^3$) | 1.80 |

| | |
|---|---|
| Start Water Level (mBGL) | 0.6 |
| Total Depth of Test (m) | 1.40 |
| **75%** Effective Depth (mBGL) | 0.95 |
| **50%** Effective Depth (m) | 0.70 |
| **25%** Effective Depth (mBGL) | 1.65 |

| | |
|---|---|
| Time at **75%** Effective Depth (minutes) | 3 |
| Time at **25%** Effective Depth (minutes) | 28 |

## INFILTRATION RATE

| | | |
|---|---|---|
| Soil Infiltration Rate ($f$) | | **1.09E-04** |
| | m/s | **0.00010938** |
| | m/hour | **0.3938** |



GEO-ENVIRONMENTAL CONSULTING

## Soakaway Testing

| | | | |
|---|---|---|---|
| Project Name | Crow Trees Brow, Chatburn | Location Reference: | TP6 |
| Project Number | 23127 | Test Number: | 3 |
| Test Date | 02/10/2023 | Weather: | Cloudy |

### FIELD MEASUREMENTS

| Elapsed Time, t (m) | Water Level (mBGL) |
|---|---|
| 0 | 0.70 |
| 1 | 0.70 |
| 2 | 0.80 |
| 3 | 0.95 |
| 4 | 1.10 |
| 5 | 1.22 |
| 6 | 1.23 |
| 7 | 1.24 |
| 8 | 1.26 |
| 9 | 1.27 |
| 10 | 1.29 |
| 20 | 1.33 |
| 30 | 1.41 |
| 40 | 1.48 |
| 50 | 1.69 |
| 60 | 1.80 |
| 120 | |
| 180 | |
| 210 | |
| 240 | |
| 270 | |
| 300 | |

### INFILTRATION CALCULATION

Calculation of Soil Infiltration Rate (f) as per BRE Digest 365 "Soakaway Design".

**Using:**

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

**Where:**

| | | |
|---|---|---|
| $V_{p75-25}$ | The effective storage volume of water ($m^3$)in the trial pit between 75% and 25% effective depth | 0.59 |
| $a_{p50}$ | The internal surface area of the trial pit ($m^2$) up to 50% effective depth and including the base area | 3.63 |
| $t_{p75-25}$ | The time (s) for the water level to fall from 75% to 25% effective depth | 2700 |

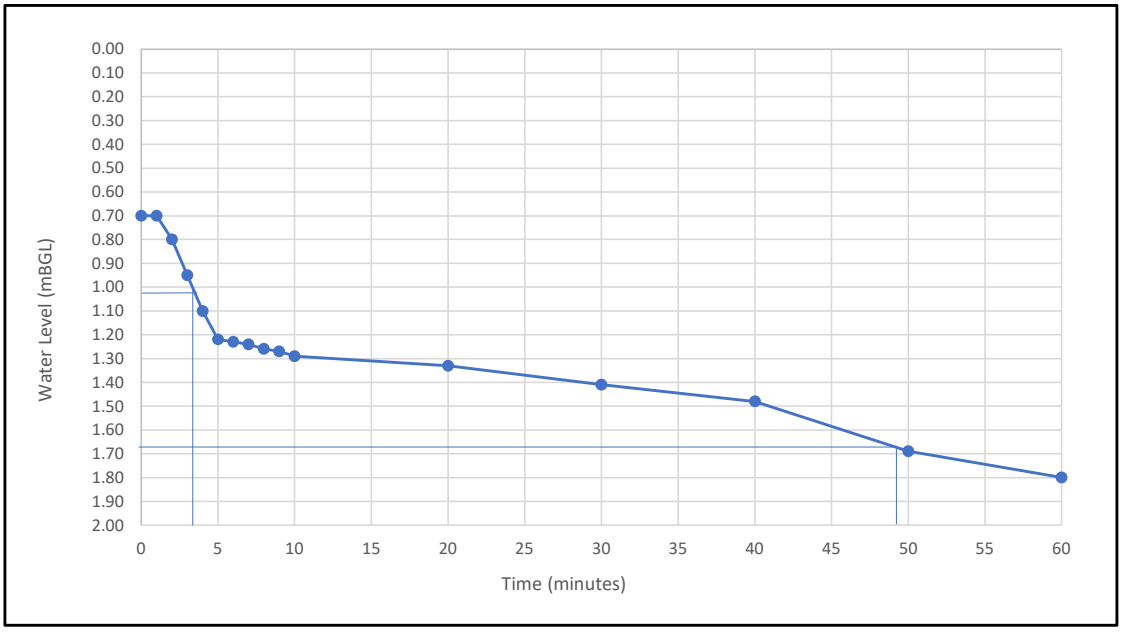
| | |
|---|---|
| Soakage Pit Length (m) | 1.50 |
| Soakage Pit Width (m) | 0.60 |
| Soakage Pit Depth (m) | 2.00 |
| Soakage Pit Area ($m^3$) | 1.80 |

| | |
|---|---|
| Start Water Level (mBGL) | 0.7 |
| Total Depth of Test (m) | 1.30 |
| **75%** Effective Depth (mBGL) | 1.03 |
| **50%** Effective Depth (m) | 0.65 |
| **25%** Effective Depth (mBGL) | 1.68 |

| | |
|---|---|
| Time at **75%** Effective Depth (minutes) | 4 |
| Time at **25%** Effective Depth (minutes) | 49 |

### INFILTRATION RATE

| | | |
|---|---|---|
| Soil Infiltration Rate (*f*) | | **5.97E-05** |
| | m/s | **0.00005969** |
| | m/hour | **0.2149** |



# APPENDIX E

Trial Pit Photographs

**P1:** Trial Pit No 1

**P2:** Trial Pit No 2

**P3:** Trial Pit No 3

**P4:** Trial Pit No 4

**P5:** Trial Pit No 5

**P6:** Trial Pit No 6

GEO-ENVIRONMENTAL CONSULTING

**Photographs 1 to 6**

| | | | | |
|---|---|---|---|---|
| **This appendix is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details adjacent. BEK accepts no liability for the misinterpretation or use of this illustration by any other parties.** | **Site:** Crow Trees Brow, Chatburn | **Project No:** 23127 | **Created By:** M Leigh-Monk | **Date:** October 2023 |
| | **Title:** Appendix E - Photographs | **Client:** Pringle Homes | | |


**P7:** Trial Pit No 7


**P8:** Trial Pit No 8

**P9:** Trial Pit No 9

**P10:** Trial Pit No 10


**P11:** Trial Pit No 11

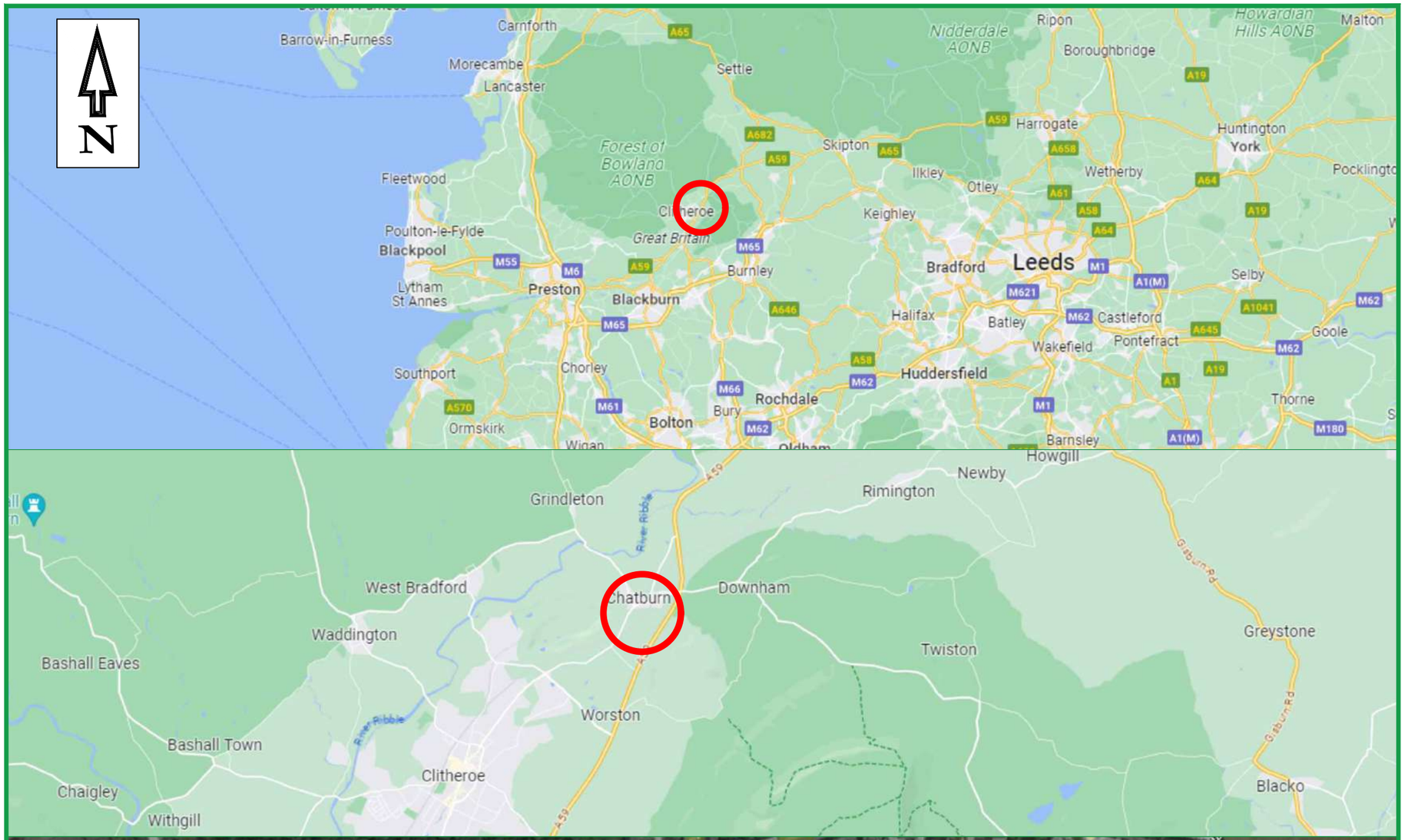
GEO-ENVIRONMENTAL CONSULTING

**Photographs 7 to 11**

| | | | | |
|---|---|---|---|---|
| **This appendix is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details adjacent. BEK accepts no liability for the misinterpretation or use of this illustration by any other parties.** | **Site:** Crow Trees Brow, Chatburn | **Project No:** 23127 | **Created By:** M Leigh-Monk | **Date:** October 2023 |
| | **Title:** Appendix E - Photographs | **Client:** Pringle Homes | | |

# APPENDIX F

Drawings




# LEGEND

SITE LOCATION

| REV | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | | | |
| | | | |

GEO-ENVIRONMENTAL CONSULTING
No 2 Landwick Court, Metcalf Drive, Altham Business Park, Lancashire
Tel: 01254 377622 Mob: 07906753583
Email: mbuckley@bekenviro.co.uk
Web: www.bekenviro.co.uk

CLIENT.
PRINGLE HOMES

JOB TITLE.
LAND AT CROWS TREE BROW, CHATBURN

DRAWING TITLE.
SITE LOCATION PLAN

| SCALE @ A3. | DRAWN BY. | APPROVED BY. | DATE. |
|---|---|---|---|
| NTS | D.E. | M.B. | 16/10/23 |

| DRAWING No. | REV. |
|---|---|
| 23127-1 | - |


## LEGEND

SITE FOOTPRINT

| REV | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | | | |
| | | | |

GEO-ENVIRONMENTAL CONSULTING
No 2 Landwick Court, Metcalf Drive, Altham Business Park, Lancashire, BB5 5GY
Tel: 01254 377622 Mob: 07906753583
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CLIENT.
PRINGLE HOMES

JOB TITLE.
LAND AT CROWS TREE BROW, CHATBURN

DRAWING TITLE.
SITE LAYOUT PLAN

| SCALE @ A3. | DRAWN BY. | APPROVED BY. | DATE. |
|---|---|---|---|
| NTS | D.E. | M.B. | 16/10/23 |

| DRAWING No. | REV. |
|---|---|
| 23127-2 | - |


# LEGEND

- WINDOW SAMPLE BOREHOLE
- WINDOW SAMPLE BOREHOLE (GAS/GROUNDWATER PROBES)
- TRIAL PIT
- TRIAL PIT (INFILTRATION TEST)

| REV | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | | | |
| | | | |

GEO-ENVIRONMENTAL CONSULTING
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CLIENT.
PRINGLE HOMES

JOB TITLE.
LAND AT CROWS TREE BROW, CHATBURN

DRAWING TITLE.
SITE INVESTIGATION PLAN

| SCALE @ A3. | DRAWN BY. | APPROVED BY. | DATE. |
|---|---|---|---|
| NTS | D.E. | M.B. | 16/10/23 |

| DRAWING No. | REV. |
|---|---|
| 23127-3 | - |

LB Chatburn Bridge

CROW TREES GDNS

Crow Trees Brow

Grade II Listed farm to be refurbished

Crow Trees Farm

extend outbuilding to form garage

The Rookery

Crow Trees Barn

6m sewer easement

6m

new detached garage

demolish extg. building

convert and extend barns to form a dwelling and ancillary accommodation

open space

bin collection point

B.A.

parking court 30-37

bin store 30-37

traffic calming speed hump

grub up length of existing private drive and hedgeline and form new access road

0.5m hard paved strip to edge of road

hatched area to be buff chipping tarmac suitable for vehicular access

form new 4.5m wide access to link into the existing driveway in black tarmac

existing private drive

retain extg. hedge

All floor levels indicated are indicative and subject to a detailed external works design

Existing trees to be retained with new 1.8m close boarded timber fence constructed along length of boundary

Path

Rosewood

sight lines 2.4m x 61.9m to the south & 63m to the north

Site Area (edged red) = 1.68ha (4.15acres)

Facing Materials
- (S) Stone
- (R) Render
- (P) Stone Plinth Render Above

| Pringle Homes - Crow Trees Farm, Chatburn<br>Accommodation Schedule | | | | | |
|---|---|---|---|---|---|
| **House Reference** | **Type** | **Bedroom** | **Floor Area (ft²)** | **Quantity** | **Total Floor Area (ft²)** |
| BRI - Bristow_GF | Apartment | 1 | 512 | 4 | 2048 |
| BRI - Bristow_FF | Apartment | 1 | 613 | 4 | 2452 |
| BU - Burton | Semi-Bungalow | 2 | 719 | 2 | 1438 |
| RU - Ruxton | Detached Bungalow | 2 | 719 | 1 | 719 |
| HA - Hastings | Semi-Bungalow | 2 | 744 | 2 | 1488 |
| MA - Marsden | Mews House | 2 | 795 | 2 | 1590 |
| MA - Marsden | Semi-House | 2 | 795 | 8 | 6360 |
| RA - Raleigh | Mews House | 3 | 927 | 1 | 927 |
| BRA - Bransfield | Mews House | 3 | 951 | 1 | 951 |
| BRA - Bransfield | Semi-House | 3 | 951 | 8 | 7608 |
| WA - Wainwright | Semi-House | 4 | 1079 | 4 | 4316 |
| **Total** | | **25** | **8805** | **37** | **29897** |

N

0m 25m 50m

Scale 1:500

Revision Notes:
- A: Finished floor levels adjusted, turning head increased, biodiversity area reduced — ASL 03/11/22
- B: Plots 2 and 24 corrected to RA reference — ASL 13/12/22
- C: General reworking of the layout and reduction in units from 39 to 37 — ASL 07/06/23
- D: Southern boundary proposed hedgerow replaced with 1.8m close boarded timber fence — JAL 10/08/23

| | | | | | |
|---|---|---|---|---|---|
| CLIENT | Pringle Homes | | | | |
| PROJECT | Proposed Residential Development at | | | | |
| | Crow Trees Farm, Crow Trees Brow, Chatburn, Clitheroe, Lancashire, BB7 4AA | | | | |
| DRAWING | Proposed Site Layout | | | | |
| DRAWN | ASL | DATE | 21/09/22 | NUMBER | 21/139/P01 |
| SCALE | 1:500 | SHEET | A1 | REVISION | D |

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