

**Environmental
Geotechnical
Specialists**



PHASE 2 GEO-ENVIRONMENTAL REPORT

GEO-TECHNICAL
ENVIRONMENTAL

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Report on a Phase 2 Geo-environmental Investigation

Location: Pentlands,
New Mill Road, Holmfirth, HD9 7LN

For: Priestroyd Construction Limited

Report No. C406/19/E/610

Report date: August 2020

For and on behalf of **Rogers Geotechnical Services Ltd**

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Environmental Engineer

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Report Summary¹

| Item | Comments | Section |
|---------------------|--|---------|
| Development | Construction of seventeen new residential properties with associated garden areas and access roads. | 1. |
| Geology | Superficial geology – None. Solid geology – Huddersfield White Rock and Marsden Formation. | 5. |
| Strata Conditions | Limited areas of made ground overlying the weathered fraction of the underlying Huddersfield White Rock (Western section of the site) and Marsden Formation (Eastern section of the site). | 6. |
| Groundwater | Groundwater encountered at the position of TP1A. | 6.2 |
| Foundation Design | Shallow foundation solution. | 10.1 |
| Effect of Sulphates | DC-1 concrete. | 10.5 |
| Contamination | No significant contamination observed. However, Characteristic Situation Level 2 should be adopted with respect to ground gasses. | 11. |

¹ This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.



1. Introduction

It is understood that the land at Pentlands off New Mill Road, Holmfirth, HD9 7LN is to be developed by the construction of seventeen new residential properties with associated garden areas and access roads. Consequently, a site investigation has been undertaken in accordance with the instruction from the client. This work was required in order to determine the nature of the underlying soils, to assess their engineering properties and to assist in the design of safe and economical foundations for the proposed development. This investigation also takes into consideration the risk of any contamination present. This report describes the work undertaken, presents the data obtained and discusses the ground conditions in relation to the proposed works.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Desk Study

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services (RGS) and the results were presented as report number C406/19/E/611.rev1 in March 2020.

4. Fieldworks

The fieldworks were undertaken on the 2nd and 3rd July 2020 and included the following:

- Four windowless sample boreholes.
- Standard penetration tests within one borehole.
- Four dynamic probes.
- Three gas monitoring standpipes.
- Eight trial pits, four of which were utilised for soakaway testing.

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report.



4.1 Windowless Sample Boreholes

These boreholes were sunk using a drive-in windowless sampler. The cores were undertaken in 1m lengths and generally reduced in diameter from 90mm for the first 1m through 80mm, 70mm and 60mm for subsequent 1m increments. The recovered cores were sealed and returned to the laboratory for logging and subsequent testing. The soils were described in general accordance with BS5930: 2015 +A1: 2020 and full descriptions are given on the windowless sample records which are presented in Appendix 2. Also included on these records are the core diameters and percentages of core recovered.

4.2 Standard Penetration Tests

Standard penetration tests (SPT) were undertaken at regular depth increments within windowless sample borehole WS4. The SPT was conducted in accordance with the procedures given in BS EN ISO 22476: Part 3: 2005 +A1: 2011, and the results are summarised on the borehole record. During this work an automatic trip hammer of 63.5kg falling through 750mm was employed to drive either a cone or split barrel sampler assembly into the ground and the recovered barrel samples were retained in air tight plastic containers. It may be appreciated that the approximate cohesion of clay soils may be obtained by multiplying the equivalent SPT value by approximately 4.5 (after Stroud, 1975).

4.3 Dynamic Probes

Dynamic penetration tests were undertaken adjacent to the windowless sample boreholes in accordance with the procedure given in BS EN ISO 22476: Part 2: 2005 +A1: 2011, using the super heavy penetrometer (DPSH). This probe consists of a 63.5kg mass falling through 750mm onto an anvil, which drives a 50mm diameter cone into the ground. The number of blows required to drive the cone through successive 100mm increments are recorded as the N_{100} values. The results of the dynamic penetration tests are tabulated and presented as bar charts of N_{100} values versus depth in Appendix 3.

4.4 Gas Monitoring Standpipes

Gas monitoring standpipes were installed between 2.0m and 4.4m depth in all of the boreholes and the installation details are shown on the appropriate borehole records. In all cases, the monitoring standpipe consisted of a perforated pipe from the base of the borehole to 1.0m below surface, with a non-perforated pipe to ground level. The response zone was filled with pea gravel, with a bentonite seal above, and the installation was capped with a stop box cover in a concrete surround.

4.5 Trial Pit Soakaways

Five trial pits were excavated in order to undertake soakaway testing, the positions of which are shown in Appendix 1. However, only four of these pits were actually utilised for the soakaway tests, as a shallow water strike was encountered within TP1A, which was subsequently relocated to TP1B. The soakaway tests were undertaken at the base of the pit at depths rational to the construction of



soakaways. The soils exposed in the trial pits were logged on site in general accordance with BS5930: 2015 +A1: 2020, and full descriptions are given on the trial pit records which are presented in Appendix 4.

Once excavations were completed, the trial pits were carefully re-instated with the arisings. Whilst every care was taken during the infilling process, including compacting of the infill at regular intervals with the back acting arm of the excavator, it should be appreciated that some mounding of the surface may have resulted. Moreover, the infilled soils may be subjected to settlement over time, such that a depression in the surface may also occur. Therefore, the locations of any pits undertaken in this investigation should be conveyed to the current site user, as the mounds or depressions associated with the pits may present a risk to current site operations e.g. livestock or agricultural plant equipment. Furthermore, it must be realised that the infilled pits represent an area of disturbance within the site soils, thus the soils at the pit locations may vary characteristically compared to the undisturbed ground. As such, foundations placed in this disturbed material may not perform as anticipated.

4.6 PID Headspace Testing

In order to assess any Volatile Organic Compounds (VOCs) present within the soils, a PID was employed to undertake headspace testing of all bulk bag samples obtained at regular intervals from the boreholes. Prior to each measurement, the PID was left for several minutes sampling the ambient air and a check was made that a null result was being displayed.

The collected sample bags were sealed and left for several minutes in order for any volatiles present to accumulate within the headspace above the sample soil. The probe of the PID was then inserted into the sample bags, without making contact with the soil, and the bag resealed around the shaft of the probe. A measurement of the VOCs present was then undertaken with the PID for a minimum of 1 minute and the peak result over that time recorded. The results of this work are tabulated in the report below.

5. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

Table 1: Geological Data for the Site

| BGS MAPPING DATA | | | |
|------------------|--------------------------|----------------------------|---|
| Strata Type | Strata Name ² | Previous Name ⁴ | Description ³ |
| Made Ground/Fill | Made Ground (Undivided) | N/A | Made ground is an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the made ground is unspecified. Variable composition. |

² Sources: British Geological Survey (NERC) Map Sheets 86; Glossop; Solid and Drift Edition, and Geology of Britain Viewer [online resource from www.bgs.ac.uk]

³ Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [online resource from www.bgs.ac.uk]



| | | | |
|---------------------|--|-----|--|
| Superficial Geology | N/A | N/A | Not indicated to underlie the site. |
| Solid Geology | Huddersfield White Rock (West and centre of site) | - | The Huddersfield White Rock is a medium- to coarse-grained, massive to flaggy, cross-bedded, micaceous sandstone. |
| | Marsden Formation (East of site) | - | Fine- to very coarse-grained and pebbly feldspathic sandstone, interbedded with grey siltstone and mudstone, and subordinate marine black shales, thin coals and seatearths. |

6. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

Table 2: Generalised Strata Profile

| Depth m below ground level to underside of layer | Strata Type | Positions Encountered | Groundwater Strikes m below ground level |
|--|---|--------------------------|--|
| 0.1 – 0.25 | TOPSOIL | ALL | None |
| 0.3 – 1.0 | MADE GROUND. | WS3 TP4 | None |
| 0.5 – 1.9 | Locally sandy, CLAY [Weathered fraction of the underlying bedrock]. | ALL | None |
| +1.0 – +1.7 | Yellowish brown clayey sandy GRAVEL of sandstone [Weathered fraction of Huddersfield White Rock]. | WS3 TP2, TP3 | None |
| 1.4 – 2.5 | Gravelly CLAY [Weathered fraction of Marsden Formation]. | WS1, WS2, WS4 TP1B | None |
| 2.5 – 2.55 | CLAY [Weathered fraction of Marsden Formation]. | WS2, WS4 | None |
| 2.6+ - 3.4 | Clayey interbedded GRAVEL of mudstone and sandstone [Weathered fraction of Marsden Formation]. | WS1, WS2, WS4 TP4 | None |
| 4.4+ | Gravel of sandstone [Weathered fraction of Marsden Formation]. | WS4 | None |

'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated

6.1 General Strata

In general, the borehole records indicate that beneath a 0.1m to 0.25m capping of topsoil at all positions, made ground was revealed to depths of between 0.3m and 1.0m below ground level at positions WS3 and TP4.

Below the made ground, soft to firm, locally sandy clays were then revealed to depths of between 0.5m and 1.9m bgl at all positions.

Eastern Section of the Site

On the eastern section of the site, below the locally sandy clays, soft to firm gravelly clays were then revealed to depths of between 1.4m and 2.5m at positions WS1, WS2, WS4 and TP1B. Beneath the gravelly clays firm clay was then revealed to depths of between 2.5m and 2.55m bgl at positions WS2 and WS4.



Underlying the gravelly clays and clays, clayey interbedded gravels of mudstone and sandstone were then revealed to the termination depth of WS1, WS2, WS4 and TP4. It is anticipated that these strata are representative of the weathered fraction of the underlying Marsden Formation which is anticipated to be present below the eastern section of the site.

Western Section of the Site

On the western section of the site, beneath the locally sandy clays, generally medium dense to dense yellowish brownish clayey gravels of sandstone were encountered to the termination depths of WS3, TP2 and TP3. With respect to the published geological data for the site, it is considered that these soils represent the weathered fraction of the underlying Huddersfield White Rock, which is anticipated to be present below the western section of the site.

6.2 Groundwater

Very shallow groundwater was encountered at TP1A, this was observed at 0.15m bgl and thus is assumed to be shallow perched/surface water sitting within the topsoil above the clay layer below. No other groundwater strikes were observed during the site investigation. However, it should be appreciated that the normal rate of boring does not permit the recording of an equilibrium water level for any one strike, moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions.

7. Insitu Testing

7.1 Standard Penetration Tests

The standard penetration tests carried out in WS4 are summarised in the following table:

Table 3: Summary of Standard Penetration Tests

| Strata | Depth Range (m) | SPT 'N' (Blows/300mm) | | Comments |
|---------------------|-----------------|-----------------------|----------------|--|
| | | Granular soils | Cohesive soils | |
| Slightly sandy CLAY | 1 to 1.45 | – | 7 | SPT's indicate a soft in-situ condition |
| CLAY | 2 to 2.45 | – | 26 | SPT's indicate a firm in-situ condition |
| Gravelly CLAY | 3 to 3.45 | – | 17 | SPT's indicate a firm in-situ condition |
| Clayey GRAVEL | 1.5m to 2.5m | 63 | – | SPT's indicate granular material is in a dense in-situ condition |

7.2 Dynamic Penetration Tests

Dynamic penetration tests were undertaken adjacent to the windowless sample borehole positions. A summary of the results is presented below:

**Table 4: Summary of Dynamic Penetration Tests**

| Position | Blows/100mm | | | Refusal type (Effective/ Abrupt) ⁴ | Comments |
|----------|--|------------|-----|---|--|
| | 0 - 2 | 3 - 10 | 10+ | | |
| | Depth to which blow count range was observed (m) | | | | |
| DP1 | 1.6 | 2.4 | 2.8 | Effective | Initial low results to 1.6m, followed by a gradual increase in blow counts to 2.4m. Then high and increasing results until refusal at 2.8m. |
| DP2 | 2.6 | 2.7 | 2.8 | Effective | Initial low results to 2.6m, followed by an abrupt increase before refusal at 2.8m. |
| DP3 | 0.4 0.9 | 0.6 1.3 | 1.4 | Effective | Initial low results to 0.9m, followed by a gradual increase in blow counts to 1.3m. Then abrupt increase in results at 1.4m. |
| DP4 | 2.3 | 4.4 | 4.6 | Effective | Initial low results to 2.5m, followed by blow counts of generally between 4 and 10 to 4.4m. Then abrupt increase in results until refusal at 4.6m. |

7.3 Gas and Water Level Monitoring

The standpipes were monitored between the 16th July and the 7th August 2020. The results of the gas monitoring undertaken to date are tabulated below.

Table 5: Gas Monitoring

| Location | Date | CH ₄ (%) | CO ₂ (%) | O ₂ (%) | Flow (l/h) | Barometric Pressure (mb) | Water Level (m) | Standpipe Depth (m) |
|----------|----------|------------------------|------------------------|-----------------------|---------------|--------------------------------|-----------------------|------------------------|
| WS1 | 16.07.20 | 0.0 | 1.9 | 19.5 | 0.1 | 1001↔ | 1.50 | 2.0 |
| | 23.07.20 | 0.1 | 1.9 | 20.1 | 0.1 | 992↓ | 2.00 | |
| | 31.07.20 | 0.1 | 2.7 | 18.2 | 0.1 | 992↓ | 2.00 | |
| | 07.08.20 | 0.0 | 2.2 | 19.2 | 0.1 | 998↑ | 2.00 | |
| WS2 | 16.07.20 | 0.0 | 4.6 | 15.3 | 0.1 | 1001↔ | - | 2.5 |
| | 23.07.20 | 0.0 | 4.3 | 16.9 | 0.1 | 992↓ | - | |
| | 31.07.20 | 0.0 | 5.5 | 13.3 | 0.1 | 992↓ | - | |
| | 07.08.20 | 0.1 | 4.7 | 14.1 | 0.1 | 998↑ | - | |
| WS3 | 16.07.20 | 0.0 | 2.3 | 19.0 | 0.1 | 1001↔ | - | 1.0 |
| | 23.07.20 | 0.0 | 2.3 | 20.1 | 0.1 | 992↓ | - | |
| | 31.07.20 | 0.0 | 2.5 | 19.2 | 0.1 | 992↓ | - | |
| | 07.08.20 | 0.0 | 1.9 | 19.5 | 0.1 | 998↑ | - | |
| WS4 | 16.07.20 | 0.0 | 3.9 | 16.2 | 0.1 | 1001↔ | - | 4.5 |
| | 23.07.20 | 0.0 | 3.5 | 16.4 | 0.1 | 992↓ | - | |
| | 31.07.20 | 0.0 | 3.0 | 18.2 | 0.1 | 992↓ | - | |
| | 07.08.20 | 0.0 | 2.0 | 16.3 | 0.1 | 999↑ | - | |

↑ - rising pressure ↓ - falling pressure ↔ -steady pressure

The above work was undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 18th May 2020.

⁴ Abrupt refusal: obstruction or bedrock encountered. Effective refusal: +25 blows/100mm.



7.4 Soakaway Testing

On reaching the elected soakaway test depth, the trial pits were trimmed and squared as much as practicable. Water was then introduced into the pit at a controlled rate to prevent collapse of the sides and the level monitored at time intervals relative to a reference bar at ground level. The results obtained from the soakaway tests are presented at Appendix 5 and are summarised below:

Table 6: Soakaway Test Results

| Location | Soakage Area Dimensions (average) (m) | Depths of soaked strata (m) | Soil Description (of soaked strata) | Infiltration Rate (m/sec) | *Drainage Characteristics |
|----------|---------------------------------------|-----------------------------|---|---------------------------|---------------------------|
| TP1B | 0.4 x 1.8 | 1.7 to 2.4 | Side – Slightly sandy CLAY Base – Gravelly CLAY | 6.6 x 10 ⁻⁶ | Poor |
| TP2 | 0.4 x 1.7 | 0.8 to 1.3 | Side – Sandy CLAY and clayey GRAVEL Base – Clayey GRAVEL | N/A ⁺ | Practically impermeable |
| TP3 | 0.4 x 1.5 | 0.8 to 1.3 | Side – Sandy CLAY and clayey GRAVEL Base – Clayey GRAVEL | N/A ⁺ | Practically impermeable |
| TP4 | 0.4 x 1.3 | 1.2 to 1.6 | Side – Clayey GRAVEL Base – Clayey GRAVEL | N/A ⁺ | Practically impermeable |

*Based on the most onerous results for each test.

+Movement ceased during observation.

During the soakaway tests the water level did not achieve a fall from 75% to 25% of the effective depth of the storage volume in both trialpits. In three of the four tests, the water level movement ceased at before 50% effective depth. It is considered that the initial movement was observed as water filled any gaps and fissures within the made ground at the side of the pit. On this basis, the tests could not be completed within the scope of the method provided in BRE Digest 365 due to the poor soakage rate of the exposed soils. Due to the negligible water movement it was not possible to extrapolate the results obtained within TP2, TP3 and TP4, however for TP1B, the soakage rate has been extrapolated in order to obtain an estimated soil infiltration rate.

8. Laboratory Testing - Geotechnical

The following programme of laboratory testing has been undertaken on samples obtained during this investigation:

- | | |
|-----------------------------------|------------------------------------|
| ▪ Moisture content determinations | BS 1377: 1990: Pt2: 3.2 |
| ▪ Index properties (1 point) | BS 1377: 1990: Pt2: 4.4, 5.3 & 5.4 |
| ▪ Linear shrinkage | BS 1377: 1990: Pt2: 6.3 |
| ▪ Soluble sulphate content | BS 1377: 1990: Pt3: 5 |
| ▪ pH value | BS 1377: 1990: Pt3: 9 |
| ▪ Lab based CBR's | BS1377 : Pt 4: 7 |



The test results are presented in Appendix 6 and are summarised below:

| Table 7: Summary of Geotechnical Test Results | | | |
|--|-----------------|------------------|-------------------------------------|
| Test type | Number of tests | Range of results | Comments |
| Moisture content determinations | 3 | 34% to 44% | Brown CLAY |
| | 1 | 29% | Orange and dark grey clayey GRAVEL. |
| Index properties (1 Point) | 3 | LL | 59 to 79% |
| | | PL | 31 to 35% |
| | | PI | 28 to 44% |
| | | LS | 14 to 18% |
| | 1 | LL | 45% |
| | | PL | 30% |
| | | PI | 15% |
| | | LS | 5 % |
| Soluble sulphate & pH | 3 | SO ₄ | <190mg/l |
| | | pH | 5.4 to 8.0 |
| Lab based CBR's | Range of values | 1.3 to 5.1% | Brown CLAY |

8.1 Geotechnical Properties

The idealised geotechnical properties employed in design are summarised below.

| Table 8: Summary of Geotechnical Properties | | |
|--|-----------------|---|
| Property | Range of values | Comments |
| Volume change potential (NHBC) | High | Brown CLAY |
| Concrete classification | DC1 | Natural ground locations (Static water) |

9. Laboratory Testing - Environmental

A suite of testing was conducted on samples from across the site and the following regime was undertaken.

- Metals – Cd, Cr(VI), Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN⁻ and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total/soluble SO₄²⁻.
- Asbestos screen.

This testing was undertaken by Chemtest Ltd and the results of all of the chemical testing are presented in Appendix 6 of this report.



10. Discussion of Ground Conditions - Geotechnical

It is understood that the site is to be developed by the construction of seventeen new residential properties with associated garden areas and access roads. At the time of writing this report the precise layout and method of construction is not known, thus the discussion below is of a generalised nature.

It cannot be recommended that foundations be constructed directly within the made ground or weak near surface soils at the site. These soils in a weak and variable condition such that excessive total and or differential settlement could occur under moderately light surface loading.

10.1 Eastern Section of the Site (WS1, WS2, WS4, TP1A, TP1B)

On the eastern section of the site where the weathered fraction of the underlying Marsden Formation which is anticipated to be present the results of this investigation indicate that generally medium dense to dense clayey gravels and firm gravelly clays will be revealed from depths ranging typically between 1.6m and 2.5m.

It is considered that these soils will provide a suitable bearing stratum, provided that the foundations are placed within soil generally described as being present in a firm or medium dense insitu condition. However, it cannot be recommended that footings be founded on a mixture of cohesive soil and rock due to the potential for differential settlements to occur across the structure.

Due to slight variability of ground conditions and rockhead level encountered on the eastern section of the site, it is recommended that a pragmatic approach be taken to the foundations for the proposed development. In broad terms, it is considered that the foundation solutions could include the provision of strip and spread footings at depths of around 2.0m, although in some areas, for instance WS1, these could be reduced to shallower depths where firm clays are present. Such foundations could be designed assuming an allowable increase in stress given in the following table:

Table 9: Allowable Increase in Stress

| Foundation type | | Strip Footings | | | Spread Footings | | |
|------------------------------|----------------------|----------------|-----|-----|-----------------|-----|-----|
| Foundation Breadth | B (m) | 0.6 | 0.9 | 1.2 | 1.0 | 2.0 | 3.0 |
| Foundation Depth | D (m) | | 2.0 | | | 2.0 | |
| Allowable Increase in Stress | (kN/m ²) | 100 | 95 | 90 | 110 | 100 | 95 |

The allowable increase in stress given above assumes a factor of safety of 3 against general shear failure, with cohesion of 40kN/m² at the foundation depths. Settlements at the above loading intensities should remain within tolerable limits for the type of structure proposed provided that the underlying soils are carefully inspected immediately final trimming has taken place. It should be appreciated that in order to limit settlements (total and/or differential) the cohesion has been limited. Thus, if a higher bearing pressure is required it may be necessary deepen the foundations. Furthermore, if possible, foundations should be placed wholly on either cohesive or granular, as placing on a mixture of these soil types can lead to differential movement. In any event, it is



recommended that such movement would be tolerable in this instance, provided that the above mentioned depths are adhered to.

Should any soft or weak material be encountered they should be locally removed and replaced with lean-mix concrete or compacted granular soil. In addition, if the excavations are required to stand open for any period of time then a blinding layer of lean-mix concrete should be placed in the excavation bases. This expedient will reduce softening or loosening of the sub-grade due to the ingress of surface water.

10.2 Western Section of the Site (WS3, TP2, TP3)

The results of this investigation indicate that, on the eastern section of the site extremely weak sandstone, understood to be the Weathered fraction of Huddersfield White Rock, will be revealed at depths of between 0.5m and 1.0m. This material would possess a significant bearing capacity, probably being in excess of 250kN/m². Therefore, at a typical foundation load for a house the factor of safety against general shear failure will be high, probably exceeding 10. In addition, it is considered that nominal settlements will occur under the action of the proposed increase in load.

Should any soft or weak material be encountered they should be locally removed and replaced with lean-mix concrete or compacted granular soil. In addition, if the excavations are required to stand open for any period of time then a blinding layer of lean-mix concrete should be placed in the excavation bases. This expedient will reduce softening or loosening of the sub-grade due to the ingress of surface water.

10.3 General Comments for Excavations

The stability of excavation faces cannot be guaranteed thus temporary support to the excavation faces may become necessary unless the foundations are constructed using trench-fill techniques. In this method the foundation trenches should be excavated, inspected and backfilled with concrete as a continuous operation. Under no circumstances should operatives be allowed to enter unsupported excavations.

Should the excavations be required to stand open, it is considered that a blinding layer of lean-mixed concrete be placed over the sub-grade. This expedient will reduce loosening or softening of the underling soil due to both physical disturbance and the ingress of surface water.

Should seepage of groundwater be encountered it is considered that it could be dealt with using a simple form of de-watering. Such a system could include the excavation of sumps from which the water could be pumped.

10.4 Ground-floors

In light of the weak near surface soils, it is not recommended that ground bearing ground floor slabs be employed. In this instance it would be necessary to suspend floors between foundation positions, such that the floor loads are transmitted via the foundations to competent soils at depth.



Further to the above, due to the medium to high volume change potential at the site, should the floor be placed within the zone of influence of any existing, or proposed, trees and shrubs, an allowance for soil volume change should be included. Further guidance is available in the NHBC standards, however, soil volume change can typically be catered for by providing a suitable void or utilise proprietary materials beneath the floor slab.

10.5 Hard-standing Areas

It is considered that any hard-standing at the site could be constructed employing traditional pavement design. A design California Bearing Ratio (CBR) of 3% could be employed in the pavement design⁵. However, it is recommended that proof rolling of the sub-grade be undertaken to establish the suitability of the soils, to expose any soft or weak ground and to ensure the sub-grade is well compacted prior to construction. Any areas of soft or weak ground should be remediated by increasing the sub-base thickness. Alternatively, weak material could be locally removed and replaced with a compacted granular capping layer. If construction were to be undertaken during the winter or after periods of prolonged rainfall, it may be prudent to employ a geotextile and/or a geogrid between the sub-base and sub-grade.

10.6 Effect of Sulphates

In view of the nature of the underlying soils it is considered that the design sulphate class be assessed with reference to Table C2⁶, which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance with Class DS-1 requirements. Assuming static groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1s.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1⁷, which can be found in Part D, *Specifying concrete for general cast-in-situ use*, of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-1 is required.

10.7 Soakaways

In this instance, the infiltration testing has revealed that the clays and gravelly clays revealed at the site have poor to practically impermeable drainage characteristics. Furthermore, whilst the made ground included gravel, these soils cannot be recommended as a soakage stratum due to the potential for collapse compression. Therefore, soakaways cannot be recommended at this site and an alternative form of drainage should be adopted.

⁵ Table 11.1, *Reproduction of TRRL Report LR1132 (1984)*, Smith (2006), Smith's Elements of Soil Mechanics, 8th ed.

⁶ Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*

⁷ Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete.*



11. Discussion of Ground Conditions - Environmental

11.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of seventeen new residential properties with associated garden areas and access roads. Consequently, the site may be classified as residential with plant uptake.

11.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. With respect to the results it should be appreciated that the soil organic matter (SOM) content for the samples tested was found to range between 0.7% and 14%. On this basis, it is considered that the screening values associated with 1% SOM should be adopted. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website⁸ and these include many local authorities. A comparison of the results of the testing, together with the data given above, can be found within Appendix 6. These results indicate the following:

Table 10: Summary of Contaminated Areas

| Location | Depth (m) | Contaminants found to be exceeding SSVs (Residential with plant uptake) |
|----------|-----------|---|
| WS1 | 0.4 | None. |
| WS2 | 0.1 | None. |
| WS3 | 0.8 | PAHs (Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene) |
| WS4 | 0 – 0.4 | None. |

Concentrations of chromium(VI), free cyanide, phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C35; aromatic C5 to C21) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values. In addition, no asbestos was detected within the soils samples tested.

It should be appreciated that the soil screening values for PAHs and TPHs (where appropriate) represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure, which is unlikely to significantly affect the combined assessment criterion⁹. In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion if free product is not observed, the values for which are also provided on the summary of contamination analysis. It is therefore considered that the criteria for no free product should be adopted for the PAHs and TPHs at this site. The results of the contaminants found to exceed these screening values are tabulated below:

⁸ <http://www.atrisksoil.co.uk/pages/general/subscribers.asp>

⁹ Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 1% SOM, Residential with home grown produce land use, 23.06.17.

**Table 11: Summary of Areas Contaminated by PAHs & TPHs**

| Location | Depth (m) | Contaminants found to be exceeding SSVs (Residential with Plant Uptake) |
|----------|-----------|---|
| WS1 | 0.4 | None. |
| WS2 | 0.1 | None. |
| WS3 | 0.8 | None. |
| WS4 | 0 – 0.4 | None. |

On the basis of the above information, the results of the investigation have concluded that the site is generally uncontaminated with respect to the proposed end use.

11.1.2 Gas Concentrations

With respect to ground gas, the results of the monitoring visits undertaken indicated a maximum of 0.1% methane. Concentrations of carbon dioxide ranging between 0.9% and 5.5% were recorded, in association with oxygen levels of between 13.3% and 20.1%. It should be appreciated that on non-contaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide. In addition, a maximum flow rate of 0.1 litres per hour was recorded and will be employed in the following calculations.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of between 992mb and 1001mb, and included periods of falling pressure.

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case 0.1% (0.001) methane was recorded along with 5.5% (0.055) carbon dioxide, in association with a maximum flow rate of 0.1 l/hr. This results in a GSV of 0.0001 for methane and a GSV of 0.0055 l/hr for carbon dioxide.

Thus, in accordance with Table 8.5, *Modified Wilson and Card classification* of the CIRIA report C665, *Assessing risks posed by ground gasses to building*, the site may be classified as *Characteristic Situation Level 1*. However, as levels of carbon dioxide exceeded 5%, the site should be upgraded to *Characteristic Situation Level 2*. Therefore, it is considered that there is a low risk of harm to end users and some protection measures are required.

The sufficiency of gas monitoring data is considered in BS 8576: 2013: *Guidance on investigations for ground gas – Permanent gasses and Volatile Organic Compounds (VOC's)*. In this standard Table F3, *Assessing sufficiency of data* has been employed to justify the curtailment of monitoring. In this context it should be noted that the gas screening value threshold for Characteristic Situation level 2 is <0.7 l/hr. Assuming the flow rate remains constant at 0.1l/hr the gas concentration of carbon dioxide would need to exceed 700% to move into the next risk band, which is not reasonable. Moreover, by keeping the concentration constant, the flow rate would need to increase to 12.7l/hr to move into the next band, which is in excess of a 120 fold increase. We consider that



these increases are not feasible given the flow rates encountered. In view of the above it is considered that the site is fully characterised as *Characteristic Situation Level 2*.

11.1.3 VOC Concentrations

PID readings taken within the ambient background air at the site ranged between 0ppm and 0.4ppm. Readings taken from bulk bags of made ground and natural strata fell between 0.1ppm and 0.5ppm, i.e. within or close to the range of ambient background. In light of the above the site is not considered to be at risk from VOC contamination.

Furthermore, the PID readings detailed above also serve to reinforce the soil testing results, indicating that the site soils are generally uncontaminated.

11.2 Site Specific Risk Assessment

11.2.1 Approach

The presence of contamination hazards and the risks associated with them should be assessed in accordance with industry practice and the 'suitable for use' approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency¹⁰ advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.¹¹ This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'¹²

11.2.2 Conceptual Ground Model and Risk Assessment

In view of the results of the chemical testing undertaken the conceptual site model is presented accordingly as Table 12. Sources of contamination include the following:

On-site – Ground Gasses (CO₂).

The preliminary risk assessment has been evaluated with reference to the following ratings and definitions:

¹⁰ R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.

¹¹ The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.

¹² See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.



- N/A -** A source-pathway-receptor linkage is not considered to exist and therefore a risk assessment is not required.
- Low -** A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence.
- Moderate -** The linkage exists but the likelihood of harm occurring is not considered to be significant although remedial action may be necessary
- High -** The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary.

The results of the risk assessment are presented in Table 12.



Table 12: Conceptual Site Model and Site Specific Risk Assessment [Contamination: CO2]

| Conceptual Site Model | | | Site Specific Risk Assessment | |
|--|------------|---|-------------------------------|--|
| Pathways | Receptor | Linkage Present? | Risk Rating | Notes |
| Direct contact/dermal absorption/soil ingestion | Operative | No – no significant contamination found to be present at the site. | N/A | |
| | End User | | N/A | |
| | Neighbours | | N/A | |
| Inhalation of Dust/Vapours | Operative | No – no significant contamination found to be present at the site. | N/A | |
| | End User | | N/A | |
| | Neighbours | | N/A | |
| Ingestion of fruit/vegetables and/or waters | Operative | No – no significant contamination found to be present at the site. | N/A | |
| | End User | | N/A | |
| | Neighbours | | N/A | |
| Migration of hazardous gases via permeable strata or shallow mining activity | Operative | Yes – some levels of carbon dioxide revealed and site is characterised as Characteristic Situation Level 2. | High | Precautionary measures will be required during the groundworks and construction phase in order to protect site operatives and the end users. |
| | End User | | High | |



| | | | | |
|---|-----------------------|---|------------------------|---|
| | Neighbours | Yes – however, as no significant made ground was found on site it is considered unlikely that the site itself would be generating significant volumes of gas such that it would pose a significant risk to neighbouring properties. | Low | |
| Spillage/loss/run off direct to receiving water | Controlled Waters | | N/A | |
| Migration via permeable unsaturated strata | Controlled Waters | No – no significant contamination found to be present at the site. | N/A | |
| Run off via drainage/sewers etc | Controlled Waters | | N/A | |
| Direct contact with contaminated soils | | | N/A | |
| Uptake via root system | Plants | No – no significant contamination found to be present at the site. | N/A | |
| Direct contact with contaminated soils | Building Materials | Yes – however, no significant contamination found to be present at the site. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1. | Low (plastic services) | Please see section 11.3.3 for information on good building practice. |
| Direct contact with contaminated groundwater | | | Low (buried concrete) | |
| Exposure to Radon | Operative End User | Yes – the site is in a lower risk radon affected area. | Low | The publication BR211 states that no protection measures are necessary. |



11.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that remediation will be required at this site. Such a strategy should include the following main elements.

11.3.1 Remediation Objectives

Based on the site specific risk assessment the object of the remediation is likely to be as follows;

- To protect site operatives and end users from elevated levels of carbon dioxide.

11.3.2 Development Requirements

Whilst the precise nature of this development has not been finalised it is understood that it is to be developed by the construction of seventeen new residential properties with associated garden areas and access roads. In view of the above a site specific remediation strategy should be undertaken after the proposed development has been finalised. However, for preliminary design and costing the following remediation proposals are offered.

11.3.3 Outline Strategy

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be included in the contractor's Health and Safety Plan and site specific Method Statements. These documents should include the following main elements.

- Site operatives at all levels should be made aware of the hazards of working in an area where accumulations of bulk ground gasses (carbon dioxide) could occur.
- Site operatives at all levels should be made aware of the fundamental principles of identifying potentially contaminated soils and the hazards of working with such soils not identified by the ground investigation.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives encouraged to use them.



- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition, dust masks must be provided to all site operatives for use in dry weather.
- Where vehicles are transferring soil to landfill site they should be covered to prevent any potential contamination of the surrounding area by dust.
- Any stockpiles of contaminated soil that maybe subsequently be found on site should be sheeted over to prevent excessive amounts of airborne dust and may require Waste Assessment Criteria (WAC) testing before transfer to an appropriate licensed landfill site.
- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer any potential contamination to surrounding areas.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the project, it is recommended that beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.

11.3.4 Gas Protection Measures

In order to assess the protection measures required BS8485: 2015 +A1: 2019: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* has been employed. In accordance with Table 3, *Building types*, of the code, the development may be considered to conform to Type A. Therefore, on the basis of Table 4 *Gas protection score by CS and type of building*, the minimum gas protection score (points) is 3.5. The gas protection system should consist of at least two different elements. The elements work independently and collaboratively, and a single element should not be used because there would be no redundancy to allow for defects in the component.

In order to achieve this score, the following shall be undertaken.

| Table 13: Combination of Protection Elements (BS8485: 2015) for CS2 | | |
|---|--|--------------------------|
| Reference | Protection Element | Score |
| Table 5 | <i>Precast suspended segmental sub-floor (i.e. beam and block).</i> | 0 |
| | <i>Cast insitu ground-bearing floor slab (with only nominal mesh reinforcement).</i> | 0.5 |
| | <i>Cast insitu monolithic reinforced ground bearing raft or reinforced cast insitu suspended floor slab with minimal penetrations.</i> | 1.0 or 1.5 ¹³ |

¹³ To achieve a score of 1.5, the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in.



| | | |
|-----------------------|--|-----------------|
| Table 6 ¹⁴ | Pressure relief pathway ¹⁵ (usually formed of low fines gravel with a thin geocomposite blanket or strips terminating in a gravel trench external to the building) | 0.5 |
| | Passive sub-floor dispersal layer (Note 1): | |
| Table 7 | Good Performance | 1.5 |
| | Very good performance | 2.5 |
| | Gas resistant membrane complying with the requirements given in Table 7 (Note 2) | 2 |
| Total Score | | Min: 3.5 |

Note 1:

Dispersal layers could include:

- Clear void.
- Polystyrene void former blanket.
- Geocomposite void former blanket.
- No-fines gravel layer with gas drains.
- No-fines gravel layer.

Note 2:

The gas resistant membrane shall meet the following criteria (from Table 7, BS 8485: 2015):

- Sufficiently impervious (methane gas transmission rate <40.0ml/day/m²/atm (average) BS ISO 15105-1 manometric method).
- Sufficiently durable and strong to remain serviceable for the anticipated life of the building, to withstand in-service stresses and installation process.
- Capable, after installation, of providing a complete barrier to the entry of the relevant gas.
- Verified in accordance with CIRIA C735: 2014: *Good practice on the testing and verification of protection systems of buildings against hazardous ground gasses.*
- Chemically resistant to degradation by other contamination that might be present.

It should be appreciated that if the membrane installed does not meet all the criteria above, then the score for the membrane is considered to be zero.

In addition to the above, the following points shall be considered.

- Technical drawings of the incorporation of the gas protection measures into the sub-structure will be provided by a suitably qualified engineer/architect and produced in accordance with the guidance given in BRE 414.
- The sequence of construction indicating when the gas protection system will be installed will be included with the remediation statement. Where possible the installation of membranes will take place as a unique activity on site and shall not take place until sub-structure construction is complete.

¹⁴ For details on the criteria for good and very good performance see Annex B of BS84845: 2015.

¹⁵ If the layer has a low permeability and/or is not terminated in a venting trench (or similar), then the score is zero.



- During and following the installation of the membrane, all parties in attendance at the site shall be made aware that a gas protection system is to be employed within the construction. Such communications should include, but not be limited to, the CDM documentation for the site and site inductions.
- The installation of the membrane shall be carried out only by suitable personnel and the qualifications or experience/training will be included as part of the remediation statement. The suitability of personnel will be assessed in accordance with Annex 1 of CIRIA C735.
- The installation shall be in strict accordance with manufacturer specifications and recommendations, which shall also be included as part of the remediation statement.
- The membrane system employed will not be an ensemble (i.e. a system comprising a mixture of products from different manufacturers will not be employed).
- Membranes shall be supplied to site on a single wound roll, creased product will not be accepted or employed.
- Whilst membranes are exposed, signage will be provided to indicate the access to the installation area is prohibited unless authorised. Footwear will be checked prior to accessing the membrane surface to ensure no sharp objects are apparent, such as stones caught in treads. The use of sharp objects or hot-works around the exposed membrane will be strictly prohibited unless the risk of damaging the membrane has been fully assessed and mitigated.
- Non-conformance of manufacturer recommendations shall be discussed and agreed as acceptable, in writing, with a suitably qualified person from the manufacturer.

11.4 Fill Materials

It should also be appreciated that any fill material, either site-won or imported, to be employed at the site should be subjected to the following assessment to determine its suitability.

Fill materials should be initially screened, by a suitably qualified engineer to establish that:

- It is a suitable growing media if it is to be employed as such, including compliance with BS3883 (2007)
- It is free from obvious contamination i.e. visual or olfactory evidence
- It has not come from areas where Japanese Knotweed or other invasive or injurious plants are suspected to be growing
- It is not a statutory nuisance, such as being odorous
- It is free from unsuitable material i.e. whole bricks, brick ties, timber or glass.

It should also be appreciated that any fill should be subjected to validation testing to assess its suitability. The following table has been taken from YALPAG¹⁶ documentation and may be used as a guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

¹⁶ YALPAG *Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V3.3* Appendix 1a, October 2016.

**Table 14: Validation Sampling and Testing**

| Fill Type | Frequency | Minimum Determinands |
|-----------------------------------|---|---|
| Virgin Quarried Material | 1 or 2 depending on the type of stone (to confirm the inert nature of the material) | Standard metals/metalloids (As, Cd, Cr, Cr(VI), Cu, Hg, Ni, Pb, Se, Zn) |
| Crushed Hardcore, Stone, Brick | Minimum 1 per 1000m ³ | Standard metals/metalloids as above plus PAH (16 USEPA) and Asbestos |
| Greenfield/ Manufactured Soils | The greater of a minimum of 3 or 1 per 250m ³ | Standard metals/metalloids as above plus PAH (16 USEPA) and Asbestos |
| Brownfield/ Screened Soils | The greater of a minimum of 6 or 1 per 100m ³ | Standard metals/metalloids as above plus PAH (16 USEPA), TPH (CWG banded) and Asbestos Any additional analysis dependant on the history of the donor site. |

The screening values for the above regime should also be agreed with any regulatory bodies; however, the following is recommended in the first instance.

Table 15: Fill Screening Values

| Contaminant | Screening Value (Residential with Plant Uptake) (mg/kg) | | Reference |
|-------------|---|--------|-----------------------------|
| | 1% SOM | 6% SOM | |
| As | 37 | 37 | Atrisk ^{SOIL} SSVs |
| Cd | 22.1 | 22.1 | Atrisk ^{SOIL} SSVs |
| Cr(VI) | 3.62 | 3.63 | Atrisk ^{SOIL} SSVs |
| Cu | 4730 | 4790 | Atrisk ^{SOIL} SSVs |
| Hg | 8.81 | 15.8 | Atrisk ^{SOIL} SSVs |
| Ni | 136 | 136 | Atrisk ^{SOIL} SSVs |
| Pb | 200 | 200 | Atrisk ^{SOIL} SSVs |
| V | 136 | 138 | Atrisk ^{SOIL} SSVs |
| Zn | 20000 | 20300 | Atrisk ^{SOIL} SSVs |

Please see summary sheet within Appendix 7 for full screening values including PAHs & TPHs.

The above screening values should be considered with respect to the Soil Organic Matter (SOM) of the subject material i.e. 1% SOM would be typical for granular fill and 6% SOM for topsoil. Testing should comply with UKAS and MCERTS, where applicable, and undertaken by an accredited laboratory.

Where the material has been derived from a commercial company, certificates or other industry quality protocol compliance i.e. WRAP should be obtained. However, it will be necessary to ensure that this documentation specifically related to the material being imported, it is no more than two months old and complies with the screening and frequency requirements given above.

Suitable fill materials should be either placed immediately or sufficiently quarantined to prevent cross-contamination. If it is necessary, the quarantined material should be placed on appropriate sheeting and covered to prevent it becoming mixed with contaminated soils or dust, or penetrated by mobile contaminants.



11.5 Verification Report

In order to demonstrate that the remedial works and provision of clean cover has been sufficiently carried out where applicable, it will be necessary to produce a verification report for submission to any statutory authorities.

Ground Gas Protection System

In order to assess the performance of the ground gas protection, verification of the system will be carried out throughout the installation process and the following will be included in a report to be produced at the end of the construction process:

- The qualifications or relevant experience/training of the persons carrying out the installation.
- The independence of the person carrying out the verification, along with evidence of their qualifications or relevant experience/training.
- Details of the verification process including the dates of inspections and findings.
- Signed statements to confirm that protection measures were constructed as agreed. These statements shall also include confirmation that:
 - Membranes were free from tears and punctures, and installed in accordance within manufacturer guidelines.
 - Underfloor voids were clear and free from debris.
- Clear photographic evidence of the construction of membranes and/or underfloor voids, which should include key details such as air vents, membrane penetrations etc.
- Details of non-conformances and how they were rectified.
- A declaration that remedial objectives set out in the conceptual site model have been achieved.

Imported Fill

- Characterisation of the suitability of the clean material including the derivation of the material, comments from a visual screen, the tests results of chemical screening, delivery tickets where appropriate and the conditions by which the clean material has been stored and handled on site.

The report detailed above should be produced by a suitably qualified engineer. The number of verification areas for the development should be confirmed with any statutory authorities for the site.



12. Recommendations for Further Work

- This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
- Discussions with contractors in relation to the suitability of materials and installation methods for gas protection measures.
- Produce a validation report to demonstrate that the geo-environmental risks discussed in this report have been mitigated.
- Detailed design of the sub-structure.

Clearly Rogers Geotechnical Services Ltd would be happy to offer advice with respect to the above and assist where necessary.

13. References

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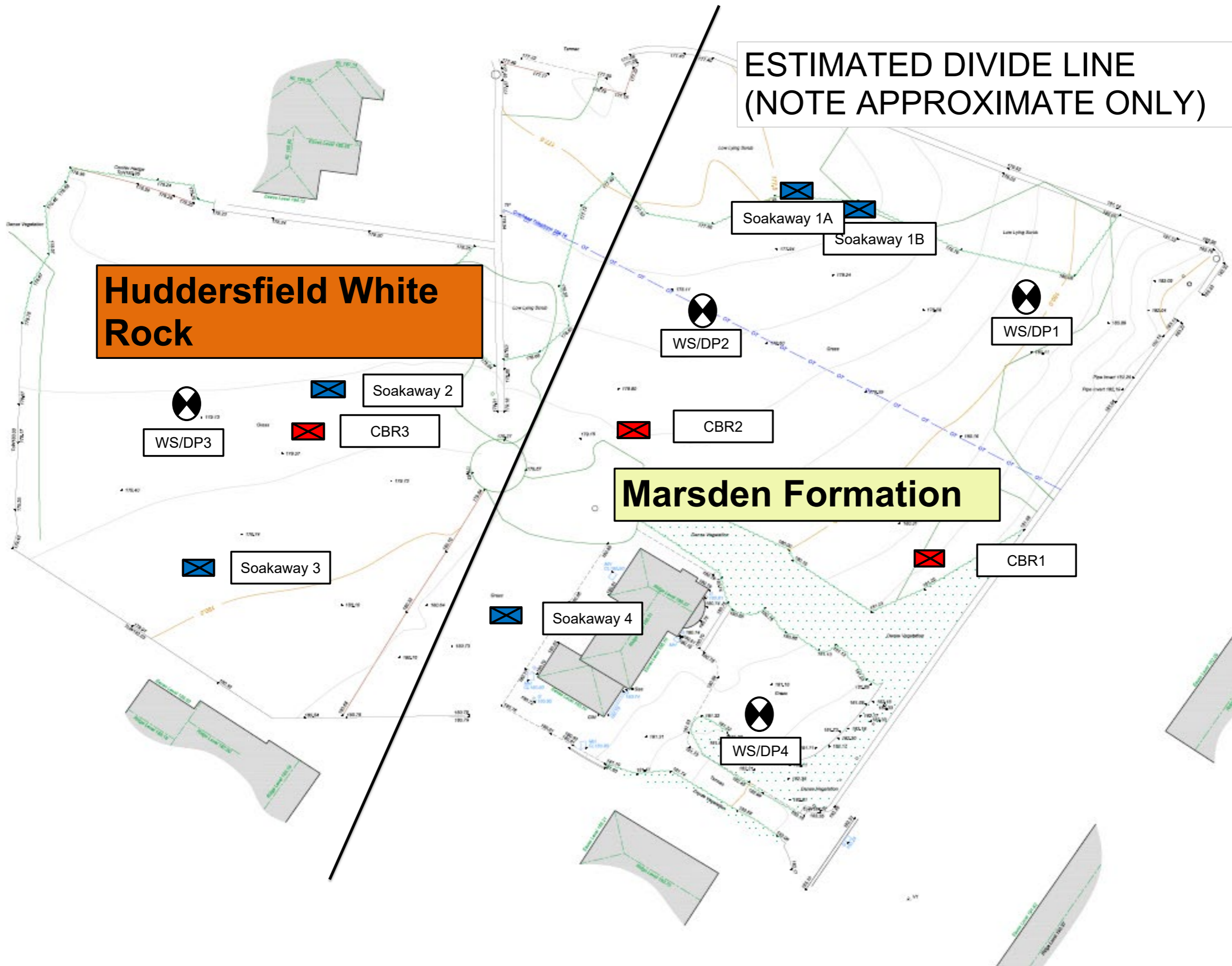


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- Wilson S, Oliver S, Mallet H, Hutchings H, Card G, *Assessing risks posed by ground gasses to buildings*, CIRIA Report C665.



Appendix 1

Site Plan



**ESTIMATED DIVIDE LINE
(NOTE APPROXIMATE ONLY)**

**Huddersfield White
Rock**

Marsden Formation

Notes:
Investigation positions approximated from site operative's notes.



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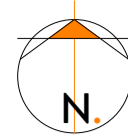
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Priestroyd Construction Limited

Job Number:
C/406/19/E/610

Project Details:
Pentlands, New Mill Road,
Holmfirth HD9 7LN

Scale: Not to scale - reference only

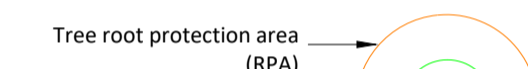
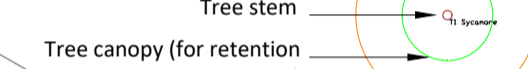

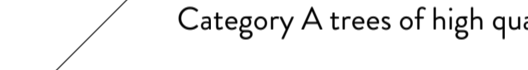




ground investigation drilling & excavation in situ testing
 laboratory testing & gas monitoring engineering consultancy
 surveying & flood risk assessments training, CPD & expert witness
 ... delivered using our own drilling rigs / crews / soils lab / engineers



LANDSCAPE KEY.

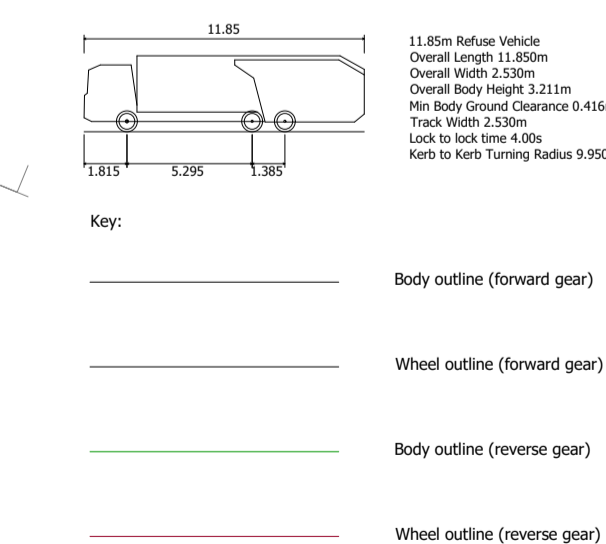
-  **Grassed Area**
-Established from Seed or Turf
-  **Decorative Stone Wall**
Wall Height Specified
-  **Back to Back Timber Fence**
1.8m Fence Height
Vertical Feathered Edge Timber
-  **Metal Feature Railings**
1.0m Fence Height
Horizontal Estate Railings
-  **Block Paving**
Marshalls Piora Permeable Paving
Colour - Harvest
-  **Block Paving**
Marshalls Piora Permeable Paving
Colour - Grey
-  **Indian Stone Paving**
Colour - Green Grey
-  **Tarmacadam Highway**
Permeable Water Run Off
Level Specific Gulleys
-  **LED Street Light**
3.0m 60 Watt
-  **Proposed Road Signage**
'Share Space' Sign
TSRGD 2016 Diag. 886
-  **Bin Storage & Presentation**
-  **EV** Electric Vehicle Charging point

TREE IDENTIFICATION KEY.

-  Tree root protection area (RPA)
-  Tree stem
-  Tree canopy (for retention categories see below)
-  Category A trees of high quality
-  Category B trees of moderate quality
-  Category C trees of low quality
-  Removed Tree
-  Replanted Trees
See Tree Schedule
Bagshaw Ecology



Bin Storage
Three Bin Provision
Treated Timber PSE
Openable Top Hatch
Openable Fronts
Width - 1950mm
Depth - 900mm
Height - 1200mm



| REVISION | DESCRIPTION | DATE | NOTES |
|----------|--|----------|-------|
| A | ALTERATIONS TO PLANNERS COMMENTS | 10/09/20 | |
| B | ALTERATIONS TO PLANNERS COMMENTS | 01/10/20 | |
| C | ALTERATIONS TO CLIENT COMMENTS | 5/10/20 | |
| D | ALTERATIONS TO HIGHWAY COMMENTS | 15/10/20 | |
| E | ALTERATIONS TO BIN STORAGE POINTS, STREET LIGHTING, BOUNDARY TREATMENTS ANNOTATED, VP ON-STREET ADDED FOR REFUSE | 12/11/20 | |
| F | ALTERATIONS TO BIN STORAGE POINTS, STREET LIGHTING, BOUNDARY TREATMENTS ANNOTATED, VP ON-STREET ADDED FOR REFUSE | 18/1/21 | |

STATUS: **PLANNING DRAWING**

ORANGE DESIGN STUDIO.
ARCHITECTURAL PRACTICE

PROJECT TITLE: **NEW MILL ROAD**

DRAWING TITLE: **PROPOSED SITE PLAN**

SCALE: **1:200**

DRAWN: **JH** | CHECKED: **JH** | PROJECT REFERENCE: **ODS_19-77**

PAPER SIZE: **A1** | DWG NUMBER: **(20)001** | DATE: **22/1/20** | REVISION: **F**

CLIENT: **PRIESTROYD CONSTRUCTION**

CONTACT: hello@orangedesignstudio.co.uk
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Appendix 2

Borehole Records



Borehole Log

Borehole No.

WS1

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610

Co-ords:

Hole Type
WLS

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Level:

Scale
1:50

Client: Priestroyd Construction Limited

Dates: 03/07/2020

Logged By
MC

| Well | Water Strikes | Samples and In Situ Testing | | | | Depth (m) | Level (m) | Legend | Stratum Description | |
|------|---------------|-----------------------------|------|-----------|---------|-----------|-----------|--|---------------------|--|
| | | Depth (m) | Type | Dia. (mm) | TCR (%) | | | | | |
| | | | | | | | | TOPSOIL (Brown organic CLAY) | | |
| | | | | 90 | 95 | 0.15 | | Soft orangish brown slightly sandy silty CLAY. | | |
| | | 1.20 | D | 80 | 60 | 0.50 | | Soft to dark grey and orange gravelly CLAY. Gravel is subangular fine to medium of mudstone (friable). | 1 | |
| | | | | | | 1.60 | | <i>1.0m: Becomes firm</i> | | |
| | | | | | | 2.00 | | Medium dense dark grey clayey subangular fine and medium GRAVEL of interbedded mudstone and sandstone. | 2 | |
| | | | | | | | | End of Borehole at 2.00m | | |
| | | | | | | | | | 3 | |
| | | | | | | | | | 4 | |
| | | | | | | | | | 5 | |
| | | | | | | | | | 6 | |
| | | | | | | | | | 7 | |
| | | | | | | | | | 8 | |
| | | | | | | | | | 9 | |
| | | | | | | | | | 10 | |

Remarks





Borehole Log

Borehole No.

WS2

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610

Co-ords:

Hole Type
WLS

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Level:

Scale
1:50

Client: Priestroyd Construction Limited

Dates: 03/07/2020

Logged By
MC

| Well | Water Strikes | Samples and In Situ Testing | | | | Depth (m) | Level (m) | Legend | Stratum Description | |
|------|---------------|-----------------------------|------|-----------|---------|-----------|-----------|---|---------------------|----|
| | | Depth (m) | Type | Dia. (mm) | TCR (%) | | | | | |
| | | | | | | | | | | |
| | | 0.15 | | | | | | TOPSOIL (Brown organic CLAY) | | |
| | | 0.60 | D | 90 | 95 | 0.70 | | Soft orangish brown slightly sandy silty CLAY. | | 1 |
| | | 1.50 | D | 80 | 100 | 1.40 | | Soft to firm dark grey and orange very gravelly silty CLAY. Gravel is subangular fine of mudstone (Friable). | | 2 |
| | | | | 70 | 85 | 2.55 | | Soft and soft to firm dark brown mottled orange silty CLAY. | | 3 |
| | | | | | | 2.60 | | Interbedded SANDSTONE and MUDSTONE recovered as orangish yellow subangular fine to medium gravel. End of Borehole at 2.60m | | 4 |
| | | | | | | | | | | 5 |
| | | | | | | | | | | 6 |
| | | | | | | | | | | 7 |
| | | | | | | | | | | 8 |
| | | | | | | | | | | 9 |
| | | | | | | | | | | 10 |

Remarks





Borehole Log

Borehole No.

WS3

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610

Co-ords:

Hole Type
WLS

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Level:

Scale
1:50

Client: Priestroyd Construction Limited

Dates: 03/07/2020

Logged By
MC

| Well | Water Strikes | Samples and In Situ Testing | | | | Depth (m) | Level (m) | Legend | Stratum Description | |
|------|---------------|-----------------------------|------|-----------|---------|-----------|-----------|--------|---|----|
| | | Depth (m) | Type | Dia. (mm) | TCR (%) | | | | | |
| | | | | 90 | 95 | 0.25 | | | TOPSOIL (Brown organic CLAY). | |
| | | | | | | 0.30 | | | MADE GROUND (Reddish brown slightly sandy subangular COBBLES of brick). | |
| | | | | | | 0.50 | | | Firm brownish yellow sandy silty CLAY. | |
| | | | | | | 1.00 | | | Yellowish brown sandy subangular fine to medium GRAVEL of sandstone. | 1 |
| | | | | | | | | | End of Borehole at 1.00m | |
| | | | | | | | | | | 2 |
| | | | | | | | | | | 3 |
| | | | | | | | | | | 4 |
| | | | | | | | | | | 5 |
| | | | | | | | | | | 6 |
| | | | | | | | | | | 7 |
| | | | | | | | | | | 8 |
| | | | | | | | | | | 9 |
| | | | | | | | | | | 10 |

Remarks





Borehole Log

Borehole No.

WS4

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610

Co-ords:

Hole Type
WLS

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Level:

Scale
1:50

Client: Priestroyd Construction Limited

Dates: 03/07/2020

Logged By
MC

| Well | Water Strikes | Samples and In Situ Testing | | | | Depth (m) | Level (m) | Legend | Stratum Description | |
|------|---------------|-----------------------------|------|-----------|---------|------------------------|-----------|--|---------------------|--|
| | | Depth (m) | Type | Dia. (mm) | TCR (%) | | | | | |
| | | | | | | | | TOPSOIL (Brown organic CLAY). | | |
| | | 0.25 | | 90 | 85 | | | Soft orangish brown slightly sandy silty CLAY. | | |
| | | 1.00 | SPT | | | N=7 (1,1/2,2,2,1) | | | 1 | |
| | | 1.30 | | 80 | 90 | | | Soft to firm black and orange very gravelly silty CLAY. Gravel is friable of mudstone. | | |
| | | 1.40 | | | | | | Soft becoming soft to firm dark brown mottled orange silty CLAY. | | |
| | | 1.80 | D | | | | | <i>Becomes slightly sand</i> | | |
| | | 2.00 | SPT | | | N=26 (2,5/3,5,9,9) | | | 2 | |
| | | 2.50 | | 70 | 80 | | | Firm black and orange clayey subangular fine GRAVEL of sandstone and mudstone. | | |
| | | 3.00 | SPT | | | N=17 (6,4/6,4,3,4) | | | 3 | |
| | | 3.40 | | 60 | 85 | | | Orange and greyish brown clayey GRAVEL of sandstone. | | |
| | | 4.00 | SPT | | | 63 (8,10/63 for 265mm) | | | 4 | |
| | | 4.40 | | | | | | End of Borehole at 4.40m | 5 | |
| | | | | | | | | | 6 | |
| | | | | | | | | | 7 | |
| | | | | | | | | | 8 | |
| | | | | | | | | | 9 | |
| | | | | | | | | | 10 | |

Remarks





Appendix 3

Trial Pit





Trial Pit Log

Trialpit No
TP1A
Sheet 1 of 1

Project Name: Pentlands Project No. C406/19/E/610 Co-ords: -
Level: Date 02/07/2020

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN Dimensions (m): Scale 1:50

Client: Priestroyd Construction Limited Depth 1.10 Logged

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|---|-------------------------------|
| | Depth | Type | Results | | | | |
| | | | | 0.15 | |  | TOPSOIL (Brown organic CLAY). |
| | | | | | |  | Orangish brown CLAY. |
| | | | | 1.10 | | | End of pit at 1.10 m |



Remarks:
Stability:





Trial Pit Log

Trialpit No
TP1B
Sheet 1 of 1

Project Name: Pentlands Project No. C406/19/E/610 Co-ords: - Date 02/07/2020
Level: Level:

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN Dimensions (m): Scale 1:50

Client: Priestroyd Construction Limited Depth 2.40 Logged

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|--------|--|
| | Depth | Type | Results | | | | |
| | | | | 0.30 | | | TOPSOIL (Brown organic CLAY). |
| | | | | | | | Soft orangish brown slightly sandy CLAY. |
| | | | | | | | 1.0: Becomes greysih brown |
| | | | | 1.90 | | | Firm orangish brown mottled dark grey gravelly silty CLAY. Gravel is subangular fine and medium of mudstone and sandstone. |
| | | | | 2.40 | | | End of pit at 2.40 m |



Remarks:
Stability:





Trial Pit Log

Trialpit No

TP2

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610Co-ords: -
Level:Date
02/07/2020

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Dimensions
(m):Scale
1:50

Client: Priestroyd Construction Limited

Depth
1.30

Logged

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|-----------------|-----------------------------|------|---------|--------------|--------------|--------|--|
| | Depth | Type | Results | | | | |
| | | | | 0.25 | | | TOPSOIL (Dark brown organic sandy CLAY) |
| | | | | | | | Firm yellowish brown slightly sandy silty CLAY. |
| | | | | 1.00 | | | Yellowish brown clayey subangular fine and medium GRAVEL of sandstone. |
| | | | | 1.30 | | | End of pit at 1.30 m |



Remarks:

Stability:





Trial Pit Log

Trialpit No

TP3

Sheet 1 of 1

| | | | |
|-------------------------|---------------------------|----------------------|--------------------|
| Project Name: Pentlands | Project No. C406/19/E/610 | Co-ords: - Level: | Date 02/07/2020 |
|-------------------------|---------------------------|----------------------|--------------------|

| | | |
|---|-------------------------------|-------------------------|
| Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN | Dimensions (m): Depth 1.30 | Scale 1:50 Logged |
| Client: Priestroyd Construction Limited | | |

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|--------|--|
| | Depth | Type | Results | | | | |
| | | | | 0.25 | | | TOPSOIL (Dark brown organic sandy CLAY) |
| | | | | | | | Soft to firm yellowish brown slightly sandy silty CLAY. |
| | | | | 0.75 | | | Yellowish brown stained red clayey subangular fine and medium GRAVEL of sandstone. |
| | | | | 1.30 | | | End of pit at 1.30 m |



Remarks:

Stability:





Trial Pit Log

Trialpit No

TP4

Sheet 1 of 1

| | | | |
|-------------------------|---------------------------|----------------------|--------------------|
| Project Name: Pentlands | Project No. C406/19/E/610 | Co-ords: - Level: | Date 02/07/2020 |
|-------------------------|---------------------------|----------------------|--------------------|

| | | |
|---|-------------------------------|-------------------------|
| Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN | Dimensions (m): Depth 1.60 | Scale 1:50 Logged |
| Client: Priestroyd Construction Limited | | |

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|--------|---|
| | Depth | Type | Results | | | | |
| | | | | 0.10 | | | TOPSOIL (Dark brown organic CLAY with grass roots). |
| | | | | 0.40 | | | MADE GROUND (Light brown sandy subangular firm to medium GRAVEL of sandstone). (Reworked). |
| | | | | 1.00 | | | MADE GROUND (Light brown sandy gravelly CLAY). Gravel is subangular of sandstone and rare concrete). (Reworked). |
| | | | | 1.60 | | | Yellowish brown clayey subangular fine and medium GRAVEL of mudstone and sandstone with rare fragments of clinker. (Possibly reworked). |
| | | | | | | | End of pit at 1.60 m |

Remarks:

Stability:





Trial Pit Log

Trialpit No
CBR1
Sheet 1 of 1

Project Name: Pentlands Project No. C406/19/E/610 Co-ords: - Date 02/07/2020
Level:

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN Dimensions (m): Scale 1:50

Client: Priestroyd Construction Limited Depth 0.50 Logged

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|--------|---|
| | Depth | Type | Results | | | | |
| | | | | 0.15 | | | TOPSOIL (Dark brown organic slightly sandy CLAY). Soft rown slightly sandy CLAY. |
| | 0.50 | D | | 0.50 | | | |
| | | | | | | | End of pit at 0.50 m |
| | | | | | | | 1 |
| | | | | | | | 2 |
| | | | | | | | 3 |
| | | | | | | | 4 |
| | | | | | | | 5 |
| | | | | | | | 6 |
| | | | | | | | 7 |
| | | | | | | | 8 |
| | | | | | | | 9 |
| | | | | | | | 10 |

Remarks:

Stability:





Trial Pit Log

Trialpit No
CBR2
Sheet 1 of 1

Project Name: Pentlands Project No. C406/19/E/610 Co-ords: - Date 02/07/2020
Level: Level:

Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN Dimensions (m): Scale 1:50

Client: Priestroyd Construction Limited Depth 0.50 Logged

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|--------|---|
| | Depth | Type | Results | | | | |
| | 0.50 | D | | 0.25 | | | TOPSOIL (Light brown slightly organic CLAY). |
| | | | | 0.50 | | | Soft to firm light brown mottled orange CLAY. |
| | | | | | | | ----- End of pit at 0.50 m |



Remarks:

Stability:





Trial Pit Log

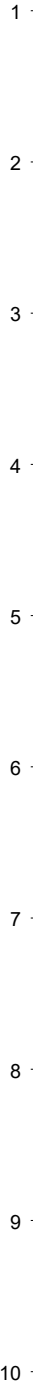
Trialpit No
CBR3
Sheet 1 of 1

| | | | |
|-------------------------|---------------------------|----------------------|--------------------|
| Project Name: Pentlands | Project No. C406/19/E/610 | Co-ords: - Level: | Date 02/07/2020 |
|-------------------------|---------------------------|----------------------|--------------------|

| | | |
|---|-----------------|---------------|
| Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN | Dimensions (m): | Scale 1:50 |
|---|-----------------|---------------|

| | | |
|---|---------------|--------|
| Client: Priestroyd Construction Limited | Depth 0.50 | Logged |
|---|---------------|--------|

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|--------|--|
| | Depth | Type | Results | | | | |
| | | | | 0.10 | | | TOPSOIL (Brown organic sandy CLAY). |
| | 0.50 | D | | 0.50 | | | Soft to firm light brown mottled orange slightly sandy CLAY. |
| | | | | | | | End of pit at 0.50 m |



Remarks:

Stability:





Appendix 4

Dynamic Probing Records



Probe Log

Probe No.

DP1

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610

Co-ords:

Hole Type
DCP

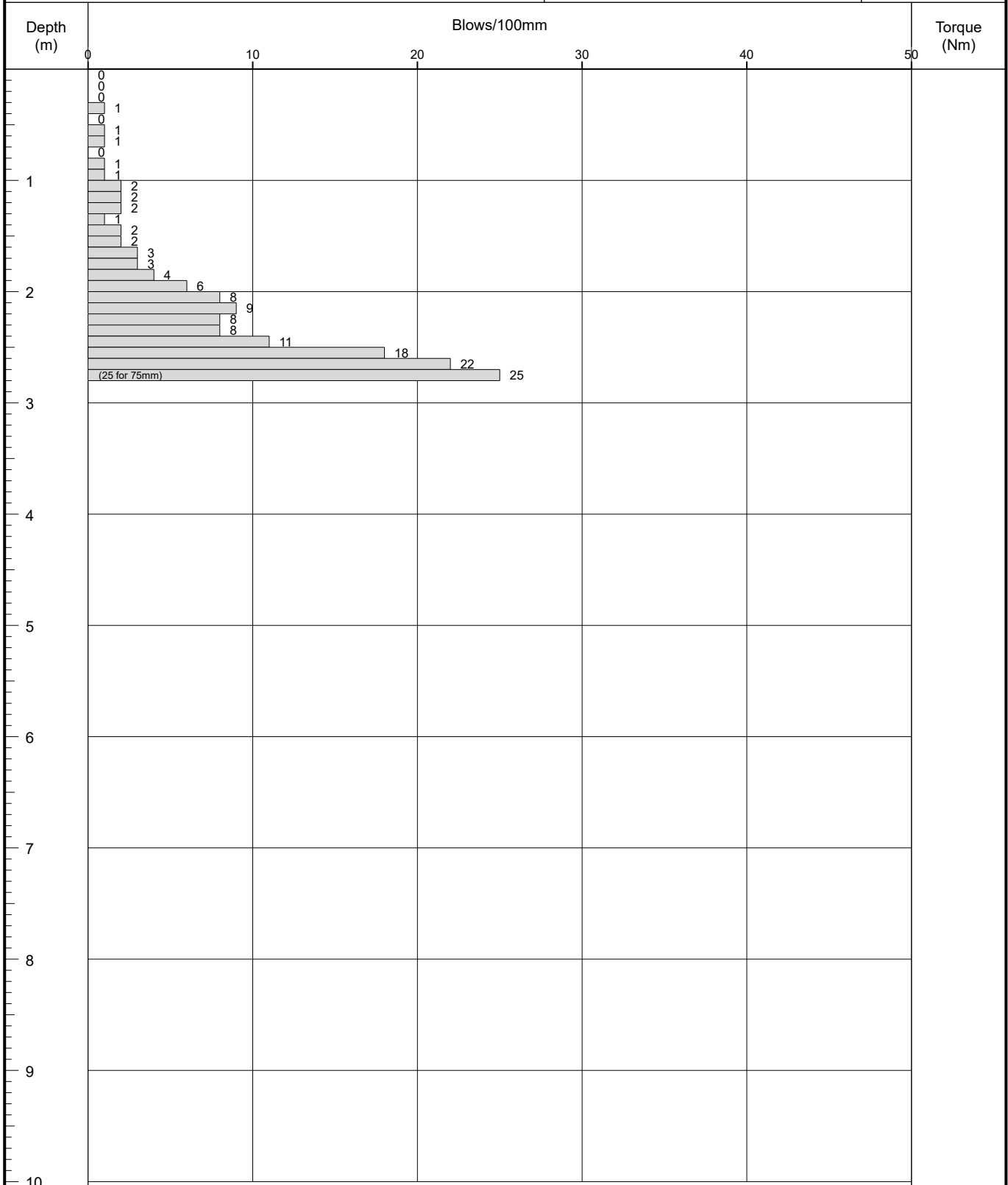
Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Level:

Scale
1:50

Client: Priestroyd Construction Limited

Dates: 03/07/2020

Logged By
MC

Remarks:

Fall Height 750mm

Cone Base Diameter 50.5mm

Hammer Wt 63.5kg

Final Depth 2.75m

Probe Type DPSH-B





Probe Log

Probe No.

DP2

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610

Co-ords:

Hole Type
DCP

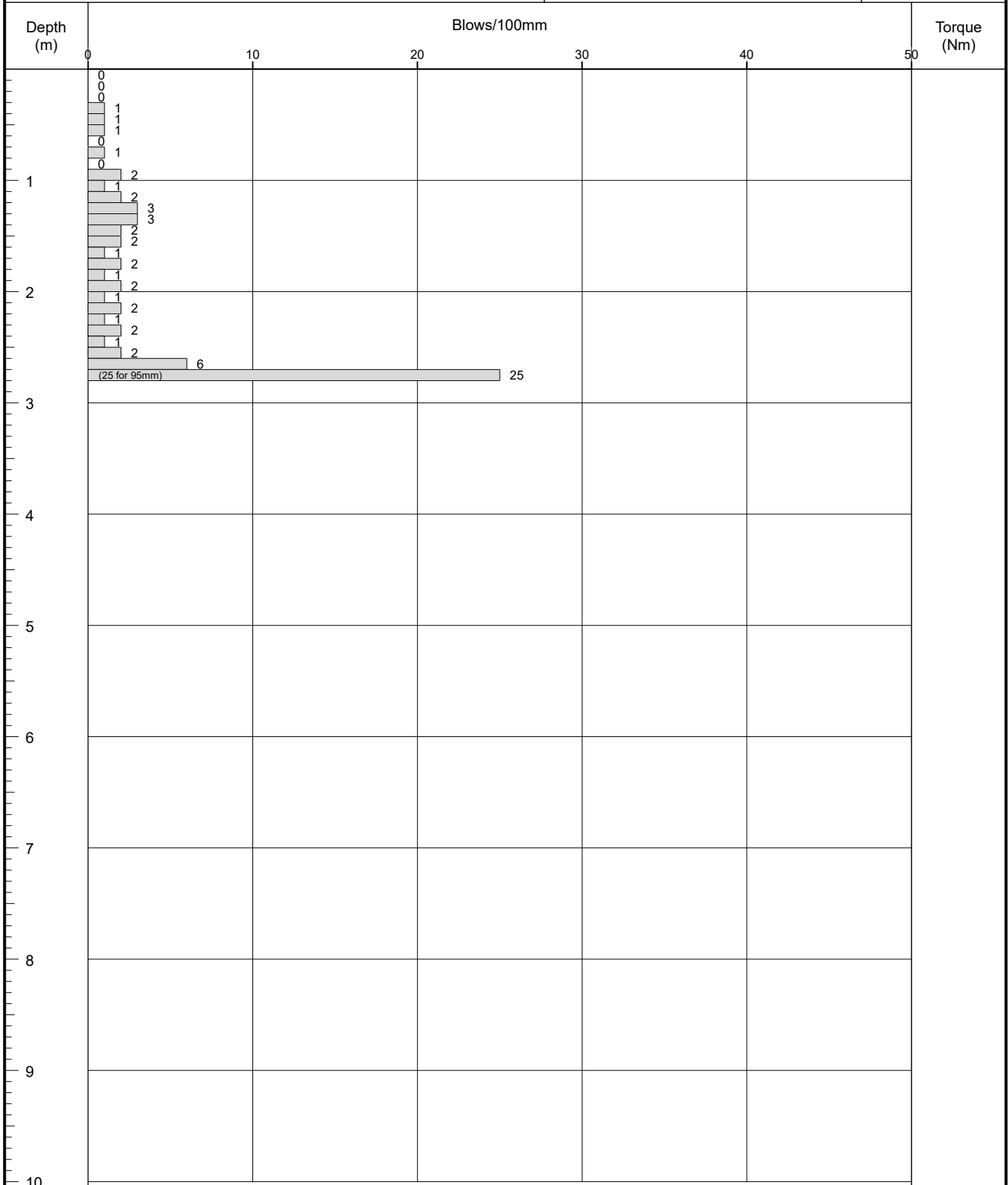
Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Level:

Scale
1:50

Client: Priestroyd Construction Limited

Dates: 03/07/2020

Logged By
MC

Remarks:

Fall Height 750mm

Cone Base Diameter 50.5mm

Hammer Wt 63.5kg

Final Depth 2.75m

Probe Type DPSH-B





Probe Log

Probe No.

DP3

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610

Co-ords:

Hole Type
DCP

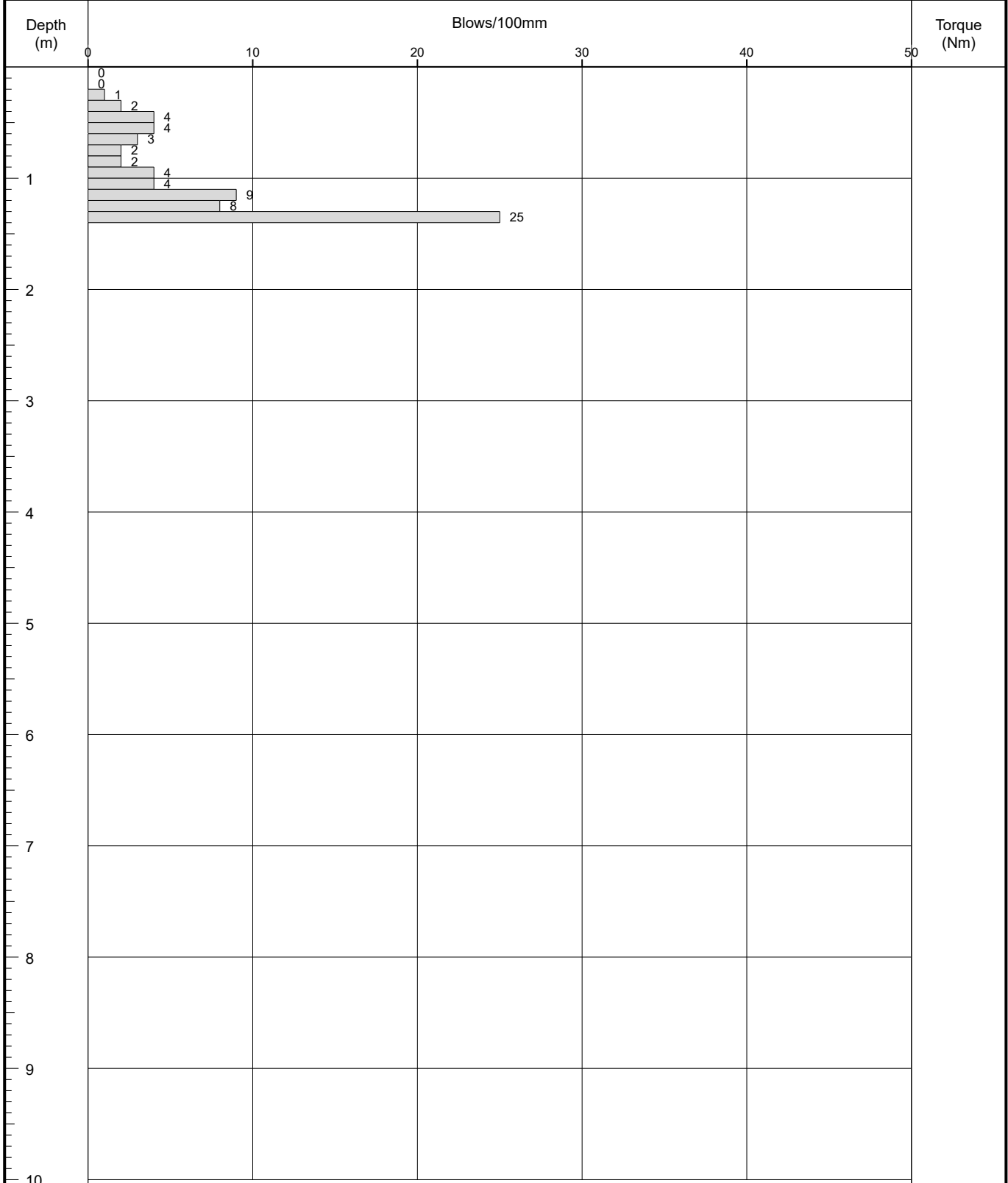
Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Level:

Scale
1:50

Client: Priestroyd Construction Limited

Dates: 03/07/2020

Logged By
MC

Remarks:

Fall Height 750mm

Cone Base Diameter 50.5mm

Hammer Wt 63.5kg

Final Depth 1.4m

Probe Type DPSH-B





Probe Log

Probe No.

DP4

Sheet 1 of 1

Project Name: Pentlands

Project No.
C406/19/E/610

Co-ords:

Hole Type
DCP

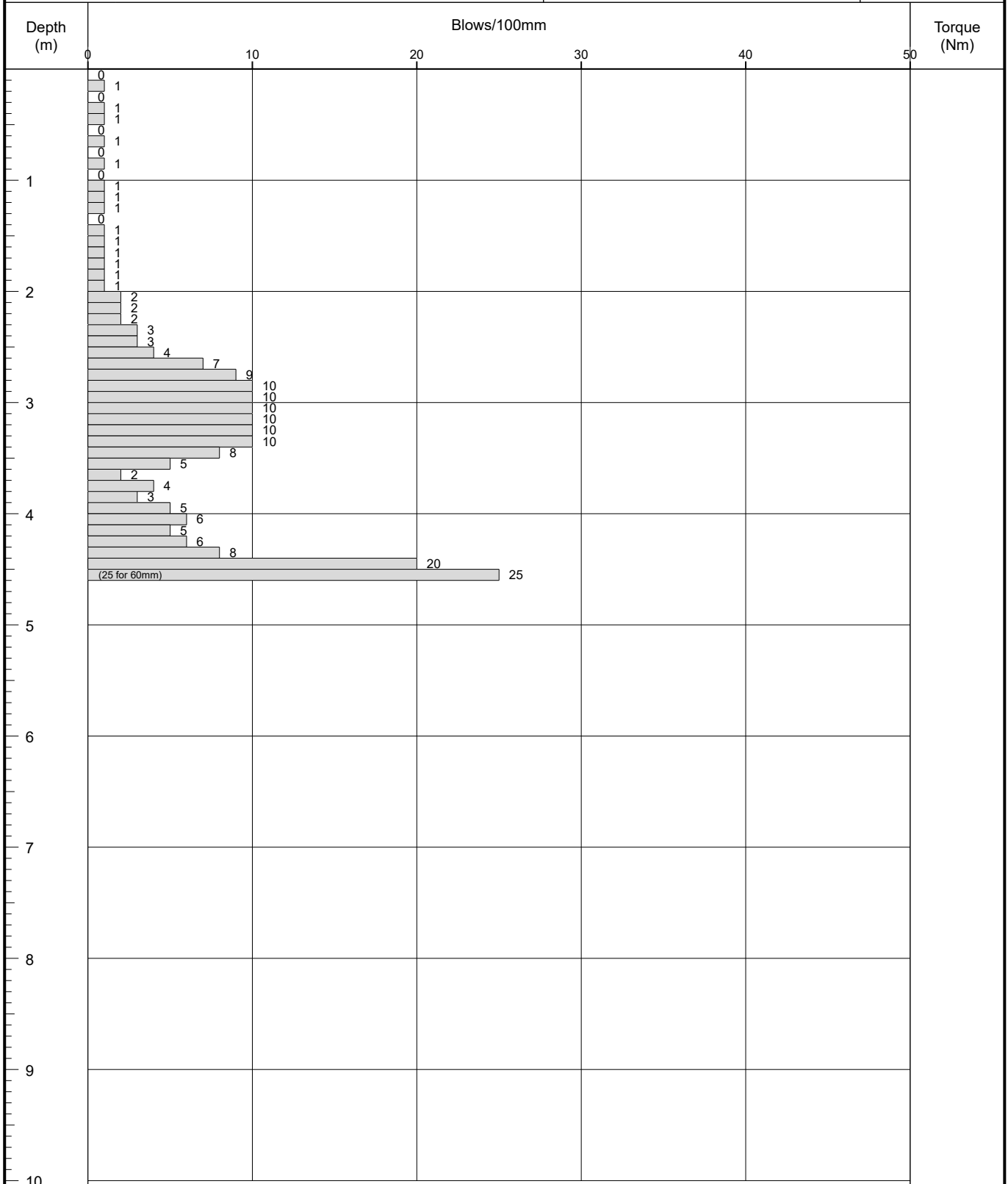
Location: New Mill Road, Holmfirth, Huddersfield, HD9 7LN

Level:

Scale
1:50

Client: Priestroyd Construction Limited

Dates: 03/07/2020

Logged By
MC

Remarks:

Fall Height 750mm

Cone Base Diameter 50.5mm

Hammer Wt 63.5kg

Final Depth 4.55m

Probe Type DPSH-B





Appendix 5

Soakaway Testing

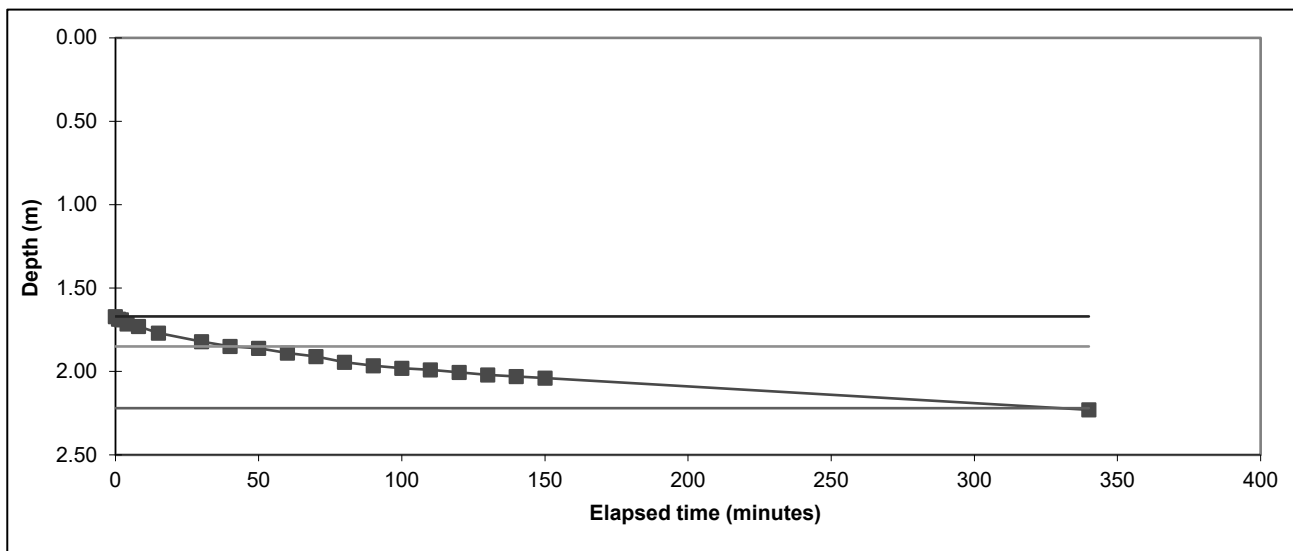
Rogers Geotechnical Services Ltd

Soakaway Test

| | | | | | |
|---------------|-------|---------------------|------|------------|------------|
| Trial Pit No: | TP1 | Test No: | 1 | Date: | 26/11/2019 |
| Length (m): | 1.800 | Datum Height: | | 0.00 m agl | |
| Width (m): | 0.40 | Granular infill: | None | | |
| Depth (m): | 2.40 | Porosity of infill: | 1 | (assumed) | |

| Elapsed time (minutes) | Water Depth (m below datum) | Elapsed time (minutes) | Water Depth (m below datum) |
|------------------------|-----------------------------|------------------------|-----------------------------|
| 0 | 1.670 | 110 | 1.990 |
| 1 | 1.685 | 120 | 2.005 |
| 2 | 1.690 | 130 | 2.020 |
| 4 | 1.715 | 140 | 2.030 |
| 8 | 1.730 | 150 | 2.040 |
| 15 | 1.770 | 340 | 2.230 |
| 30 | 1.820 | | |
| 40 | 1.850 | | |
| 50 | 1.860 | | |
| 60 | 1.890 | | |
| 70 | 1.910 | | |
| 80 | 1.945 | | |
| 90 | 1.965 | | |
| 100 | 1.980 | | |

(Extrapolated)



| | | | |
|---|------|----------------------|-------|
| Start water depth for analysis (mbgl): | 1.67 | Elapsed time (mins): | |
| 75% effective depth (mbgl): | 1.85 | Elapsed time (mins): | 40.0 |
| 50% effective depth (mbgl): | 2.04 | Elapsed time (mins): | 330.0 |
| 25% effective depth (mbgl): | 2.22 | | |
| Base of soakage zone (mbgl): | 2.40 | | |
| Volume outflow between 75% and 25% effective depth (m ³): | | | 0.266 |
| Mean surface area of outflow (m ²): | | | 2.30 |
| (side area at 50% effective depth + base area) | | | |
| Time for outflow between 75% and 25% effective depth (mins): | | | 290.0 |

| | |
|--------------------------------------|---------------|
| Soil infiltration rate (m/s): | 6.6E-6 |
|--------------------------------------|---------------|

| | |
|----------------|---|
| Remarks | Results processed following BRE 365 (2007). |
|----------------|---|

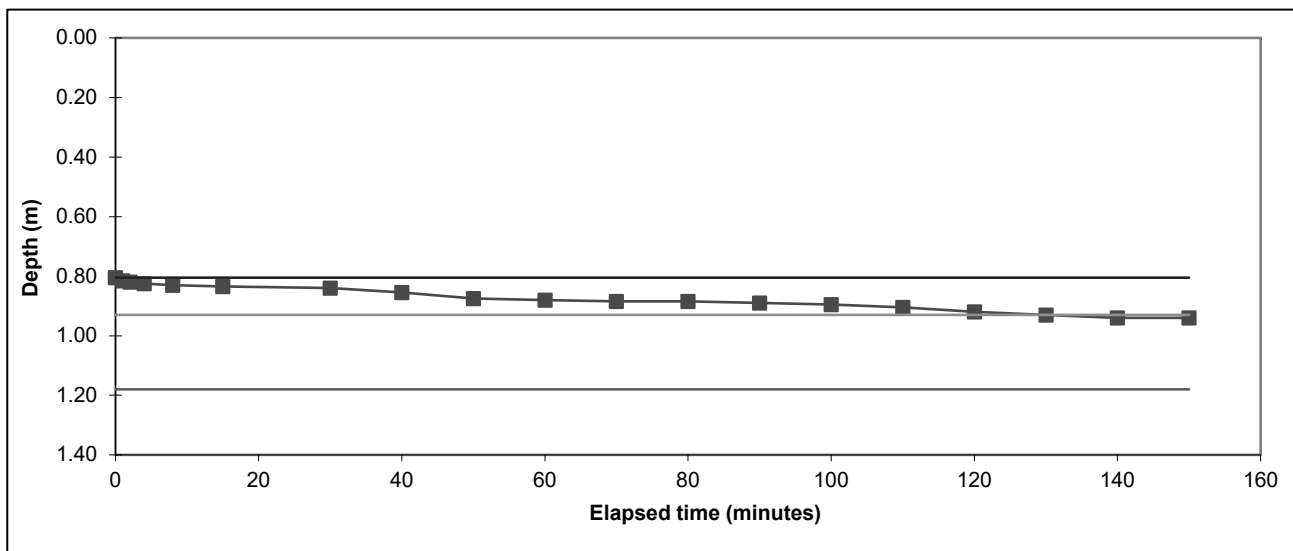
| | | | |
|----------------|-------------------------------------|----------------|---------------|
| Client: | Priestroyd Construction Limited | Job No: | C406/19/E/610 |
| Site: | Pentlands, New Mill Road, Holmfirth | | |

Rogers Geotechnical Services Ltd

Soakaway Test

| | | | | | |
|---------------|-------|---------------------|------|-----------|------------|
| Trial Pit No: | TP2 | Test No: | 1 | Date: | 26/11/2019 |
| Length (m): | 1.700 | Datum Height: | | | 0.00 m agl |
| Width (m): | 0.40 | Granular infill: | None | | |
| Depth (m): | 1.30 | Porosity of infill: | 1 | (assumed) | |

| Elapsed time (minutes) | Water Depth (m below datum) | Elapsed time (minutes) | Water Depth (m below datum) |
|------------------------|-----------------------------|------------------------|-----------------------------|
| 0 | 0.805 | 110 | 0.905 |
| 1 | 0.815 | 120 | 0.920 |
| 2 | 0.820 | 130 | 0.930 |
| 4 | 0.825 | 140 | 0.940 |
| 8 | 0.830 | 150 | 0.940 |
| 15 | 0.835 | | |
| 30 | 0.840 | | |
| 40 | 0.855 | | |
| 50 | 0.875 | | |
| 60 | 0.880 | | |
| 70 | 0.885 | | |
| 80 | 0.885 | | |
| 90 | 0.890 | | |
| 100 | 0.895 | | |



| | | | |
|---|------|----------------------|-------|
| Start water depth for analysis (mbgl): | 0.81 | | |
| 75% effective depth (mbgl): | 0.93 | Elapsed time (mins): | 130.0 |
| 50% effective depth (mbgl): | 1.05 | | |
| 25% effective depth (mbgl): | 1.18 | Elapsed time (mins): | #N/A |
| Base of soakage zone (mbgl): | 1.30 | | |
| Volume outflow between 75% and 25% effective depth (m ³): | | | |
| Mean surface area of outflow (m ²): | | | 1.73 |
| (side area at 50% effective depth + base area) | | | |
| Time for outflow between 75% and 25% effective depth (mins): | | | |

| | |
|--------------------------------------|--|
| Soil infiltration rate (m/s): | Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate. |
|--------------------------------------|--|

| | |
|----------------|---|
| Remarks | Results processed following BRE 365 (2007). |
|----------------|---|

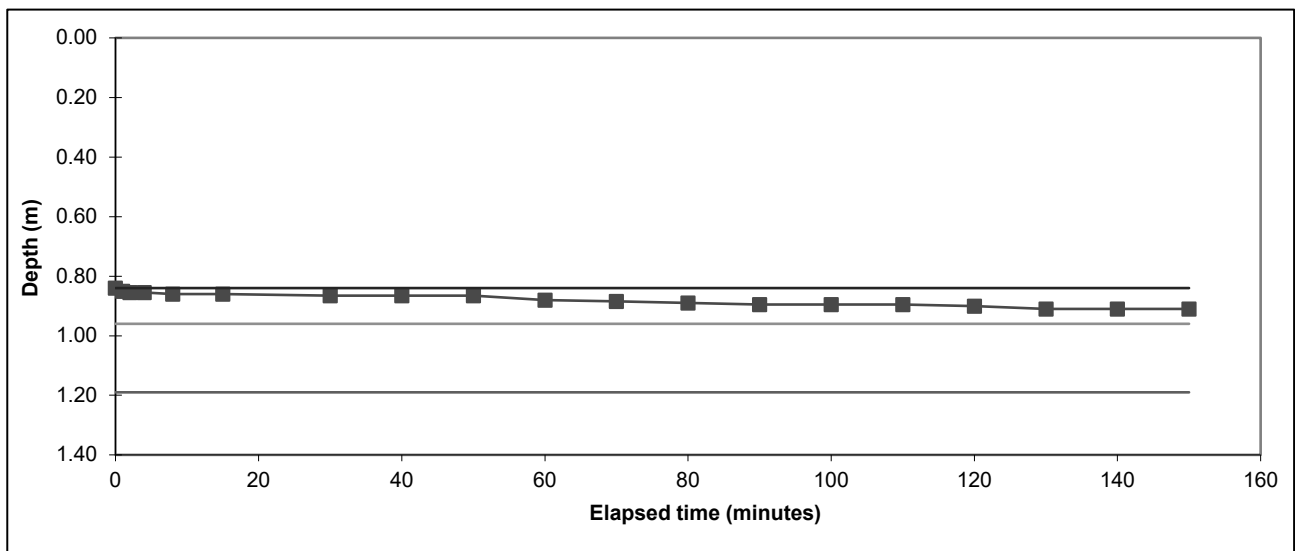
| | | | |
|----------------|-------------------------------------|----------------|---------------|
| Client: | Priestroyd Construction Limited | Job No: | C406/19/E/610 |
| Site: | Pentlands, New Mill Road, Holmfirth | | |

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Soakaway Test

| | | | | | |
|---------------|-------|---------------------|------|-----------|------------|
| Trial Pit No: | TP3 | Test No: | 1 | Date: | 26/11/2019 |
| Length (m): | 1.500 | Datum Height: | | | 0.00 m agl |
| Width (m): | 0.40 | Granular infill: | None | | |
| Depth (m): | 1.30 | Porosity of infill: | 1 | (assumed) | |

| Elapsed time (minutes) | Water Depth (m below datum) | Elapsed time (minutes) | Water Depth (m below datum) |
|------------------------|-----------------------------|------------------------|-----------------------------|
| 0 | 0.840 | 110 | 0.895 |
| 1 | 0.850 | 120 | 0.900 |
| 2 | 0.855 | 130 | 0.910 |
| 4 | 0.855 | 140 | 0.910 |
| 8 | 0.860 | 150 | 0.910 |
| 15 | 0.860 | | |
| 30 | 0.865 | | |
| 40 | 0.865 | | |
| 50 | 0.865 | | |
| 60 | 0.880 | | |
| 70 | 0.885 | | |
| 80 | 0.890 | | |
| 90 | 0.895 | | |
| 100 | 0.895 | | |



| | | | |
|---|------|----------------------|------|
| Start water depth for analysis (mbgl): | 0.84 | Elapsed time (mins): | #N/A |
| 75% effective depth (mbgl): | 0.96 | Elapsed time (mins): | #N/A |
| 50% effective depth (mbgl): | 1.07 | | |
| 25% effective depth (mbgl): | 1.19 | Elapsed time (mins): | #N/A |
| Base of soakage zone (mbgl): | 1.30 | | |
| Volume outflow between 75% and 25% effective depth (m ³): | | | |
| Mean surface area of outflow (m ²): | | | 1.47 |
| (side area at 50% effective depth + base area) | | | |
| Time for outflow between 75% and 25% effective depth (mins): | | | |

| | |
|--------------------------------------|--|
| Soil infiltration rate (m/s): | Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate. |
|--------------------------------------|--|

| | |
|----------------|---|
| Remarks | Results processed following BRE 365 (2007). |
|----------------|---|

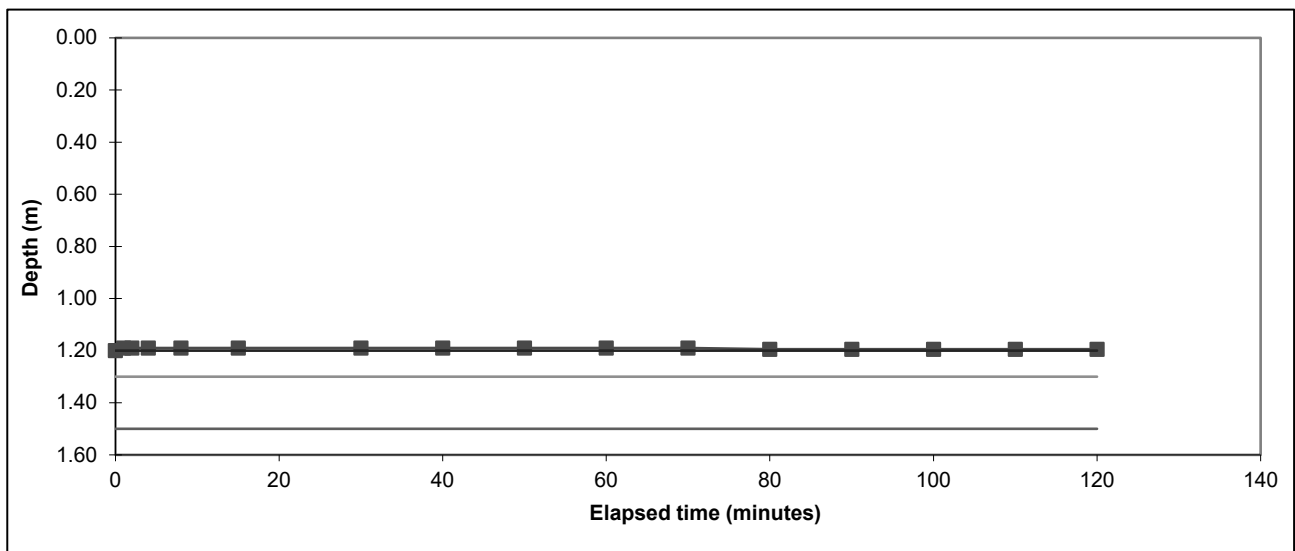
| | | | |
|----------------|-------------------------------------|----------------|---------------|
| Client: | Priestroyd Construction Limited | Job No: | C406/19/E/610 |
| Site: | Pentlands, New Mill Road, Holmfirth | | |

Rogers Geotechnical Services Ltd

Soakaway Test

| | | | | | |
|---------------|-------|---------------------|------|-----------|------------|
| Trial Pit No: | TP4 | Test No: | 1 | Date: | 26/11/2019 |
| Length (m): | 1.300 | Datum Height: | | | 0.00 m agl |
| Width (m): | 0.40 | Granular infill: | None | | |
| Depth (m): | 1.60 | Porosity of infill: | 1 | (assumed) | |

| Elapsed time (minutes) | Water Depth (m below datum) | Elapsed time (minutes) | Water Depth (m below datum) |
|------------------------|-----------------------------|------------------------|-----------------------------|
| 0 | 1.200 | 110 | 1.195 |
| 1 | 1.190 | 120 | 1.195 |
| 2 | 1.190 | | |
| 4 | 1.190 | | |
| 8 | 1.190 | | |
| 15 | 1.190 | | |
| 30 | 1.190 | | |
| 40 | 1.190 | | |
| 50 | 1.190 | | |
| 60 | 1.190 | | |
| 70 | 1.190 | | |
| 80 | 1.195 | | |
| 90 | 1.195 | | |
| 100 | 1.195 | | |



| | | | |
|---|------|----------------------|------|
| Start water depth for analysis (mbgl): | 1.20 | Elapsed time (mins): | #N/A |
| 75% effective depth (mbgl): | 1.30 | Elapsed time (mins): | #N/A |
| 50% effective depth (mbgl): | 1.40 | Elapsed time (mins): | #N/A |
| 25% effective depth (mbgl): | 1.50 | Elapsed time (mins): | #N/A |
| Base of soakage zone (mbgl): | 1.60 | | |
| Volume outflow between 75% and 25% effective depth (m ³): | | | |
| Mean surface area of outflow (m ²): | | 1.20 | |
| (side area at 50% effective depth + base area) | | | |
| Time for outflow between 75% and 25% effective depth (mins): | | | |

| | |
|--------------------------------------|--|
| Soil infiltration rate (m/s): | Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate. |
|--------------------------------------|--|

Remarks Results processed following BRE 365 (2007).

| | | | |
|----------------|-------------------------------------|----------------|---------------|
| Client: | Priestroyd Construction Limited | Job No: | C406/19/E/610 |
| Site: | Pentlands, New Mill Road, Holmfirth | | |



Appendix 6

Laboratory Testing

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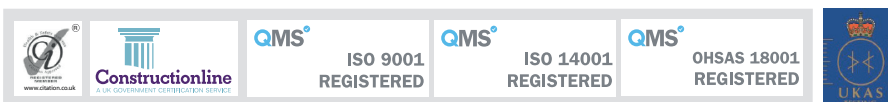


LABORATORY REPORT

GEOTECHNICAL
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| | |
|----------------|----------------|
| job number | client ref |
| site address | client address |
| consultant | |
| date scheduled | date issued |
| issued by | job title |

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**Schedule of UKAS
Accredited Laboratory Tests**

| | | Accredited (A) | Unaccredited (U) |
|--|-----------------------|-----------------------|------------------|
| 1. CLASSIFICATION OF SOIL | | BS 1377-2:1990 | |
| 1.1 Moisture content determination | | | |
| i) Oven drying | Pt 2 : 3.2 | A | |
| ii) Saturation m/c of chalk | Pt 2 : 3.3 | | U |
| 1.2 Index Properties | | | |
| i) Liquid limit – cone penetrometer | Pt 2 : 4.3 | A | |
| ii) Plastic limit | Pt 2 : 5.3 | A | |
| iii) Shrinkage limit | Pt 2 : 6.3 | | U |
| iv) Linear shrinkage | Pt 2 : 6.5 | A | |
| 1.3 Particle Density | | | |
| i) Gas jar | Pt 2 : 8.2 | | U |
| ii) Large pyknometer | Pt 2 : 8.3 | | U |
| iii) Small pyknometer | Pt 2 : 8.4 | | U |
| 1.4 Density Tests | | | |
| i) Linear measurement | Pt 2 : 7.2 | A | |
| ii) Immersion in water | Pt 2 : 7.3 | | U |
| iii) Water displacement | Pt 2 : 7.4 | | U |
| iv) Sand replacement | Pt 9 : 2.1, 2.2 | | U |
| v) Core cutter | Pt 9 : 2.4 | | U |
| 1.5 Particle Size Distribution | | | |
| i) Dry Sieve | Pt 2 : 9.2 | A | |
| ii) Wet Sieve | Pt 2 : 9.3 | A | |
| iii) Sedimentation by pipette | Pt 2 : 9.4 | A | |
| iv) Sedimentation by hydrometer | Pt 2 : 9.5 | | U |
| 2. CHEMICAL TESTS | | BS 1377-3:2018 | |
| ii) Mass loss on ignition | Pt 3 : 4 | | U |
| 3. COMPACTION RELATED TESTS | | BS 1377-4:1990 | |
| 3.1 Dry density/moisture relationship | | | |
| i) 2.5kg rammer – 1 litre mould | Pt 4 : 3 | | U |
| - CBR mould | Pt 4 : 3 | | U |
| ii) 4.5kg rammer – 1 litre mould | Pt 4 : 3 | | U |
| - CBR mould | Pt 4 : 3 | | U |
| 3.2 Moisture Condition Value | | | |
| i) Single point test | Pt 4 : 5.4 | | U |
| ii) MCV/moisture content relationship | Pt 4 : 5.5 | | U |
| 3.3 California Bearing Ratio | | | |
| i) Undisturbed sample | Pt 5 : 7 | | U |
| ii) Recompacted sample | Pt 5 : 7 | | U |
| iii) Soaked, inc measurement of swell | Pt 5 : 7 | | U |
| 4. COMPRESSIBILITY OF SOIL | | BS 1377-5:1990 | |
| i) One dimensional consolidation | Pt 5 : 3 | | U |
| ii) Swelling pressure test | Pt 5 : 3 | | U |
| 5. SHEAR STRENGTH OF SOIL | | BS 1377-7:1990 | |
| i) Hand shear vane | Makers instructions | | U |
| ii) Shear box (100mm square sample) | BS 1377 : Pt 7 : 4 | | U |
| iii) Triaxial – quick undrained | BS 1377 : Pt 7 : 8, 9 | | U |
| 6. PERMEABILITY | | | |
| i) Falling head | K. H. Head Vol 2 | | U |
| ii) Constant head | BS 1377 : Pt 6 : 6 | | U |
| iii) Triaxial cell | BS 1377 : Pt 6 : 6 | | U |
| 7. ROCK TESTS | | | |
| 7.1 Classification Tests | | | |
| i) Natural moisture content | - | | U |
| ii) Saturated moisture content | - | | U |
| iii) Natural density | - | | U |
| iv) Porosity | - | | U |
| 7.2 Strength Tests | | | |
| i) Point load index | ISRM '85 | | U |
| ii) Uniaxial compression test | ISRM '81 | | U |

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GEOTECHNICAL LAB RESULTS

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Classification of Index Properties

C406/19/E/610

Project Name: Pentlands

B.S 1377: Part 2: 1990: 3.2, 4 and 5

Fig. 3 Sheet. 1

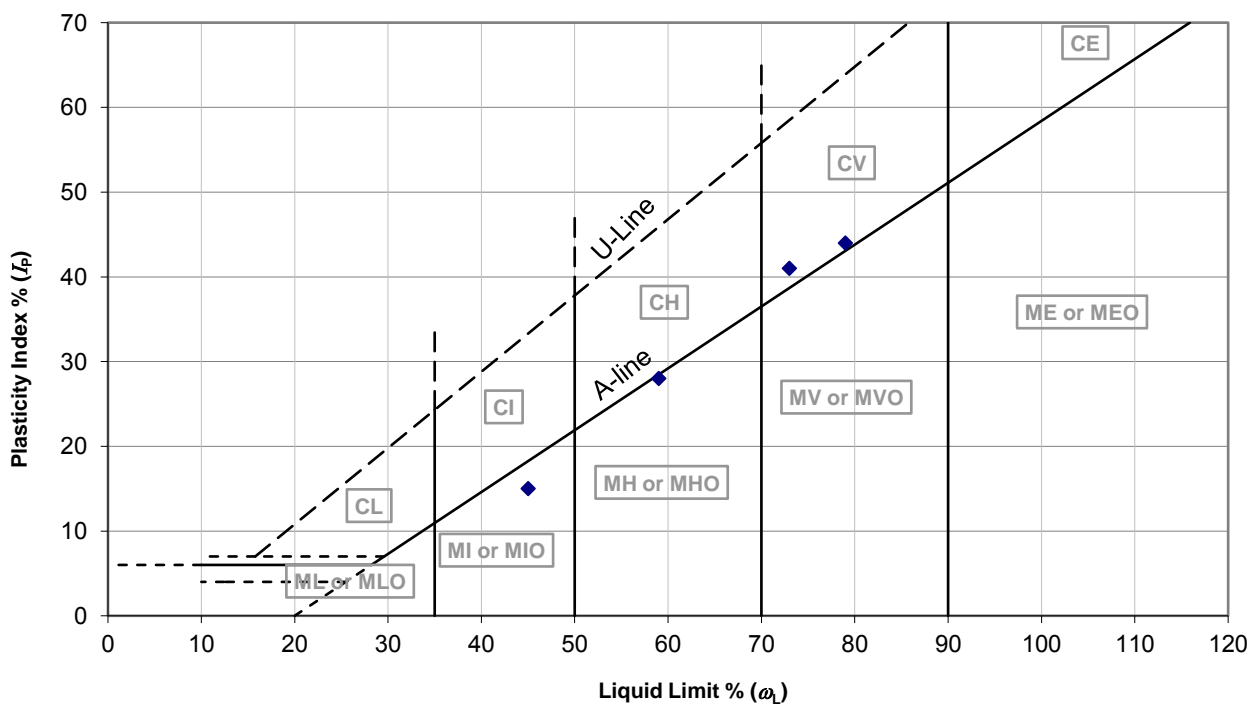
Location:

Input By: Jude

Client:

Check By: Jude

| Location | Depth (m) | Moisture Content (w) (%) | Liquid Limit (wL) (%) | Plastic Limit (wP) (%) | Plasticity Index (IP) (%) | Retained by 0.425mm (%) | Modified (w) (w') (%) | Modified (IP) (IP') (%) | Liquidity/Consistency | | Casagrande Class | N.H.B.C Class (%) |
|----------|-----------|--------------------------|-----------------------|------------------------|---------------------------|-------------------------|-----------------------|-------------------------|-----------------------|----------|------------------|-------------------|
| | | | | | | | | | (IL) (%) | (IC) (%) | | |
| WS1 | 1.20 | 29 | 45 | 30 | 15 | 56 | 66 | 7 | -0.1 | 1.1 | M I | * |
| WS2 | 0.60 | 36 | 73 | 32 | 41 | 1 | 36 | 41 | 0.1 | 0.9 | C V | HIGH |
| WS2 | 1.50 | 44 | 79 | 35 | 44 | 0 | 44 | 44 | 0.2 | 0.8 | C V | HIGH |
| WS4 | 1.80 | 34 | 59 | 31 | 28 | 0 | 34 | 28 | 0.1 | 0.9 | M H | MEDIUM |

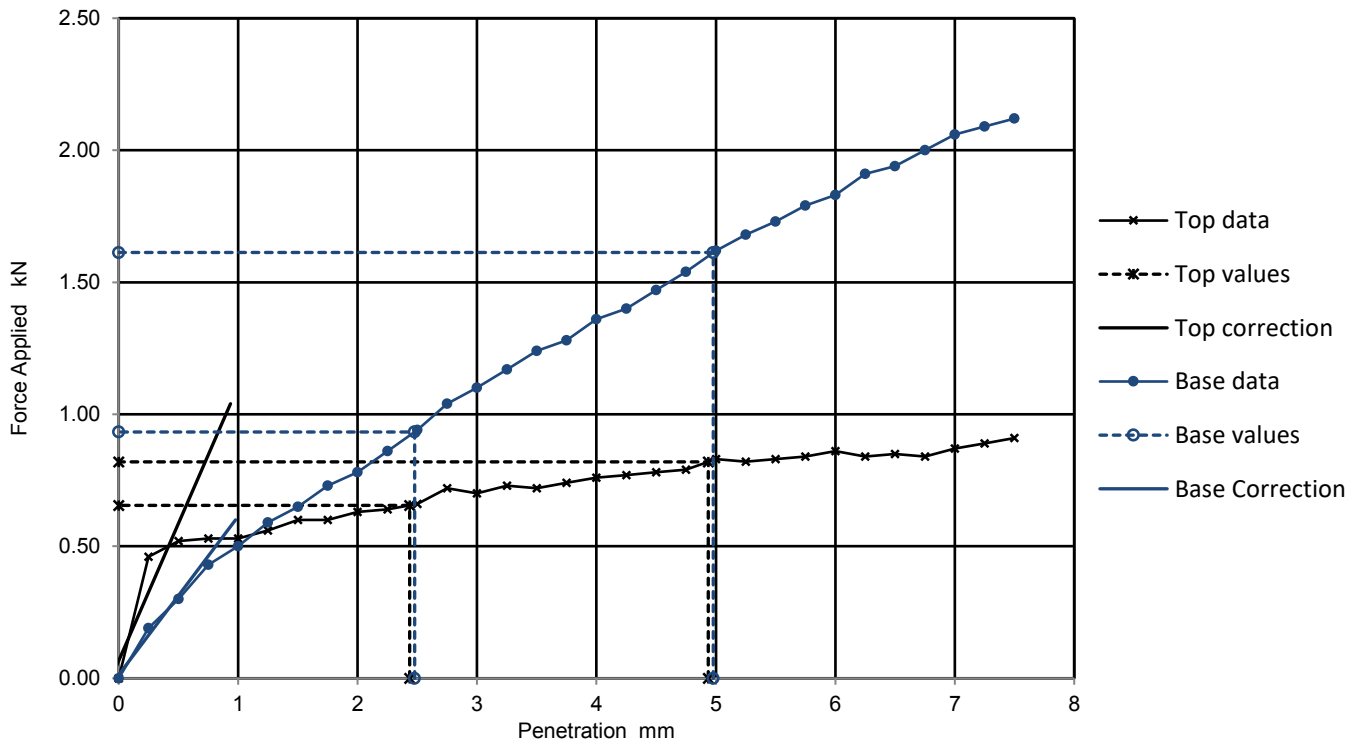


| | | | | | |
|---|----------------------------------|------------------|-----------------|---------------|---|
| California Bearing Ratio (CBR) | | Job Ref | C406/19/E/610 | | |
| | | Borehole/Pit No. | CBR1 | | |
| Site Name | Pentlands | | Sample No. | 1 | |
| Soil Description | Brown CLAY | | Depth m | 0.50 | |
| Specimen Reference | D1 | Specimen Depth | 0.50 m | Sample Type | D |
| Specimen Description | Brown CLAY | | KeyLAB ID | RGS_202007146 | |
| Test Method | BS1377 : Part 4 : 1990, clause 7 | | CBR Test Number | 1 | |

Specimen Preparation

| | | | | |
|---|---|---------------------------|-------------------|-------|
| Condition | REMOULDED | Soaking details | Not soaked | |
| Details | Recompacted to specified density using 2.5kg rammer | Period of soaking | days | |
| | | Time to surface | days | |
| | | Amount of swell recorded | mm | |
| Material retained on 20mm sieve removed | 1 % | Dry density after soaking | Mg/m3 | |
| Initial Specimen details | Bulk density | 2.04 Mg/m3 | Surcharge applied | 2 kg |
| | Dry density | 1.82 Mg/m3 | | 1 kPa |
| | Moisture content | 12.2 % | | |

Force v Penetration Plots



Results

| Curve correction applied | CBR Values, % | | | | Moisture Content % |
|--------------------------|---------------|-----|---------|---------|--------------------|
| | 2.5mm | 5mm | Highest | Average | |
| TOP | 5.0 | 4.1 | 5.0 | | 22.7 |
| BASE | 7.1 | 8.1 | 8.1 | | 23.4 |

| | | |
|-----------------|-----------------------|----------|
| General remarks | Test specific remarks | Approved |
| | | Jude |

| | |
|----------|---|
| Fig No. | 5 |
| Sheet No | 1 |

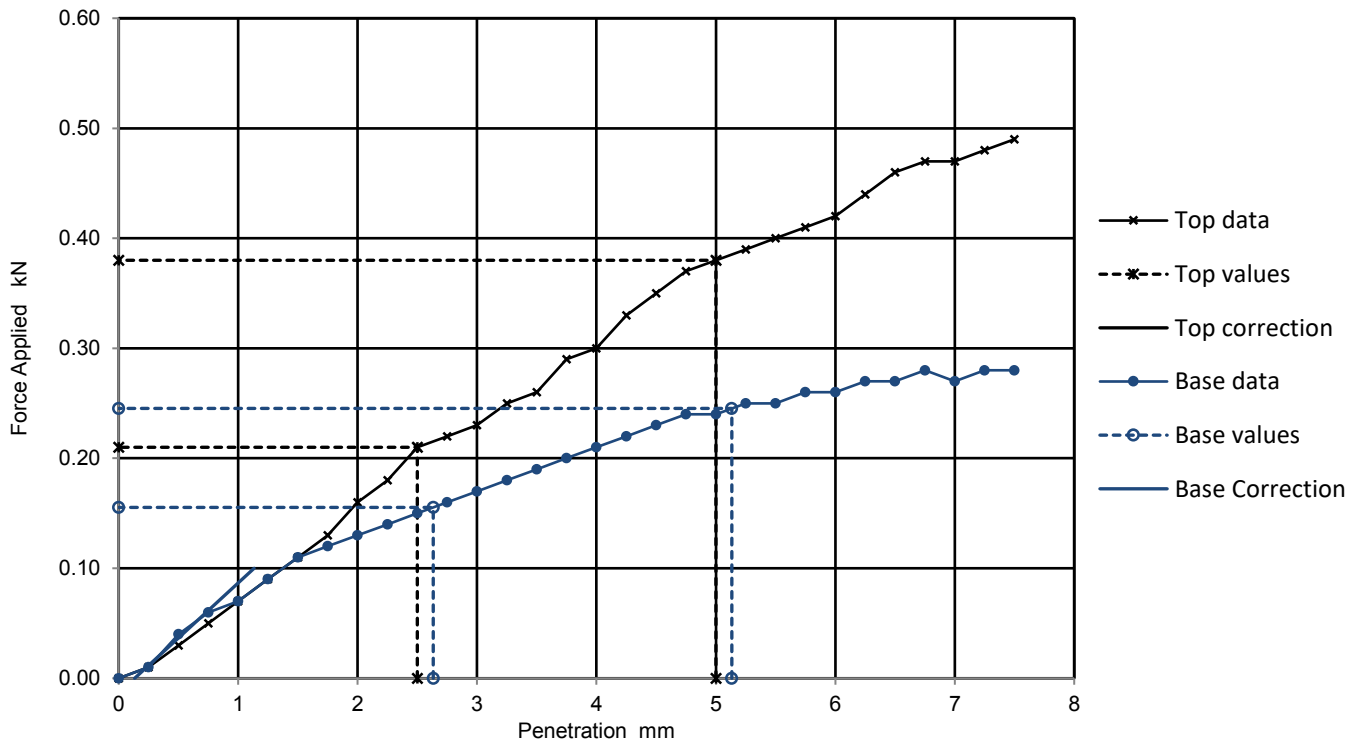
Lab Sheet Reference :

| | | | |
|---|----------------------------------|------------------|---------------|
| California Bearing Ratio (CBR) | | Job Ref | C406/19/E/610 |
| | | Borehole/Pit No. | CBR2 |
| Site Name | Pentlands | Sample No. | 1 |
| Soil Description | Brown CLAY | Depth m | 0.50 |
| Specimen Reference | D1 | Specimen Depth | 0.50 m |
| Specimen Description | Brown CLAY | Sample Type | D |
| Test Method | BS1377 : Part 4 : 1990, clause 7 | KeyLAB ID | RGS_202007147 |
| | | CBR Test Number | 1 |

Specimen Preparation

| | | | |
|---|---|---------------------------|-------------------|
| Condition | REMOULDED | Soaking details | Not soaked |
| Details | Recompacted to specified density using 2.5kg rammer | Period of soaking | days |
| | | Time to surface | days |
| | | Amount of swell recorded | mm |
| Material retained on 20mm sieve removed | 0 % | Dry density after soaking | Mg/m3 |
| Initial Specimen details | Bulk density | 1.80 Mg/m3 | Surcharge applied |
| | Dry density | 1.24 Mg/m3 | 2 kg |
| | Moisture content | 45.0 % | 1 kPa |

Force v Penetration Plots



Results

| | Curve correction applied | CBR Values, % | | | | Moisture Content % |
|------|--------------------------|---------------|-----|---------|---------|--------------------|
| | | 2.5mm | 5mm | Highest | Average | |
| TOP | No | 1.6 | 1.9 | 1.9 | | 31.2 |
| BASE | Yes | 1.2 | 1.2 | 1.2 | | 31.0 |

| | | |
|-----------------|-----------------------|----------|
| General remarks | Test specific remarks | Approved |
| | | Jude |

| | |
|----------|---|
| Fig No. | 5 |
| Sheet No | 2 |

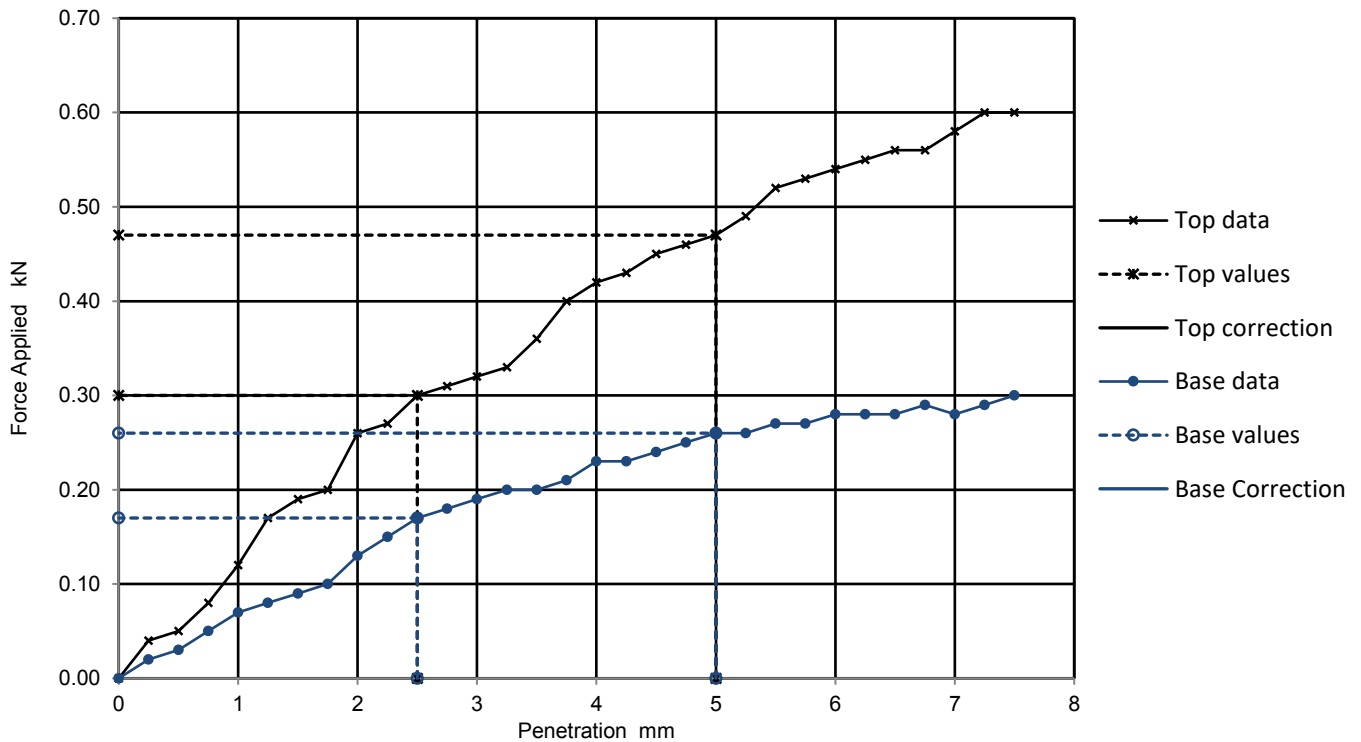
Lab Sheet Reference :

| | | | | | |
|---|----------------------------------|------------------|-----------------|---------------|---|
| California Bearing Ratio (CBR) | | Job Ref | C406/19/E/610 | | |
| | | Borehole/Pit No. | CBR3 | | |
| Site Name | Pentlands | | Sample No. | 1 | |
| Soil Description | Brown CLAY | | Depth m | 0.50 | |
| Specimen Reference | D1 | Specimen Depth | 0.50 m | Sample Type | D |
| Specimen Description | Brown CLAY | | KeyLAB ID | RGS_202007148 | |
| Test Method | BS1377 : Part 4 : 1990, clause 7 | | CBR Test Number | 1 | |

Specimen Preparation

| | | | | |
|---|---|---------------------------|-------------------|-------|
| Condition | REMOULDED | Soaking details | Not soaked | |
| Details | Recompacted to specified density using 2.5kg rammer | Period of soaking | days | |
| | | Time to surface | days | |
| | | Amount of swell recorded | mm | |
| Material retained on 20mm sieve removed | 17 % | Dry density after soaking | Mg/m3 | |
| Initial Specimen details | Bulk density | 1.88 Mg/m3 | Surcharge applied | 2 kg |
| | Dry density | 1.58 Mg/m3 | | 1 kPa |
| | Moisture content | 19.0 % | | |

Force v Penetration Plots



Results

| Curve correction applied | CBR Values, % | | | | Moisture Content % |
|--------------------------|---------------|-----|---------|---------|--------------------|
| | 2.5mm | 5mm | Highest | Average | |
| TOP | No | 2.3 | 2.4 | 2.4 | 23.8 |
| BASE | No | 1.3 | 1.3 | 1.3 | 24.7 |

| | | |
|-----------------|-----------------------|----------|
| General remarks | Test specific remarks | Approved |
| | | Jude |

| | |
|----------|---|
| Fig No. | 5 |
| Sheet No | 3 |

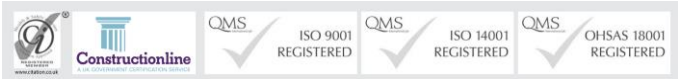
Lab Sheet Reference :

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Company No: 5130864

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

| Rogers Geotechnical Services Ltd | | | | Soil Screening Value (SSV) Comparison Sheet | | | | | | | | | | | |
|-------------------------------------|-----------------------------|-----|-------|--|-------------|----------------------|----------------------|--|----------------------|-----|-----|--|--|--|--|
| Job Number | C40619/E/610 | | | A = WS Atkins PLC, Atrisk Soil Screening Values. A* = Values updated June 2017. A* = Atrisk's SSV is lower than Chemtest's detectable limit for this compound. B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report. C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter. D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a | | | | KEY <div style="display: flex; justify-content: space-around; font-size: 0.7em;"> <div style="width: 15px; height: 10px; background-color: #F08080; border: 1px solid black; display: inline-block;"></div> Exceeds SSV <div style="width: 15px; height: 10px; background-color: #FFFF00; border: 1px solid black; display: inline-block;"></div> Exceeds 2017, Below 2015 <div style="width: 15px; height: 10px; background-color: #90EE90; border: 1px solid black; display: inline-block;"></div> Below limit of detection (LOD) </div> | | | | | | | |
| Job Name | New Mill Road | | | | | | | | | | | | | | |
| Date | 30/07/2020 | | | Sample Location | | | | WS1 | WS2 | WS3 | WS4 | | | | |
| Client | Priestroyd Construction Ltd | | | Depth Top | | 0.4 | 0.1 | 0.8 | 0.0 | | | | | | |
| | | | | Depth Base | | | | | 0.4 | | | | | | |
| Determinand | Units | Ref | LOD | Residential With Plant Uptake 1% | | | | | | | | | | | |
| | | | | Atrisk 2015 (No Free Product) | Atrisk 2017 | | | | | | | | | | |
| Cadmium | mg/kg | C | 0.10 | | 22.1 | < 0.10 | 0.33 | 0.29 | 0.15 | | | | | | |
| Chromium (Hexavalent) | mg/kg | B/C | 0.5 | 20.5 | 3.62 | < 0.50 | < 0.50 | < 0.50 | < 0.50 | | | | | | |
| Copper | mg/kg | A+ | 0.50 | | 4730 | 38 | 46 | 25 | 38 | | | | | | |
| Mercury | mg/kg | A/D | 0.10 | | 8.81 | < 0.10 | 0.25 | < 0.10 | 0.10 | | | | | | |
| Nickel | mg/kg | A+ | 0.50 | | 136 | 13 | 18 | 40 | 10 | | | | | | |
| Lead | mg/kg | C | 0.50 | | 200 | 22 | 120 | 21 | 27 | | | | | | |
| Zinc | mg/kg | A+ | 0.50 | | 20000 | 28 | 77 | 95 | 19 | | | | | | |
| Vanadium | mg/kg | A+ | 5.0 | | 136 | 34 | 36 | 30 | 18 | | | | | | |
| Arsenic | mg/kg | C | 1.0 | | 37 | 15 | 21 | 1.1 | 27 | | | | | | |
| Selenium | mg/kg | A | 0.20 | | 375 | 1.8 | 0.63 | < 0.20 | 0.38 | | | | | | |
| Cyanide (Free) | mg/kg | A | 0.50 | | 34 | < 0.50 | < 0.50 | < 0.50 | < 0.50 | | | | | | |
| Total Phenols | mg/kg | A | 0.30 | | 267 | < 0.30 | < 0.30 | < 0.30 | < 0.30 | | | | | | |
| Naphthalene | mg/kg | A+ | 0.10 | | 0.829 | < 0.10 | 0.20 | < 0.10 | < 0.10 | | | | | | |
| Acenaphthylene | mg/kg | | 0.10 | | | < 0.10 | 0.13 | < 0.10 | < 0.10 | | | | | | |
| Acenaphthene | mg/kg | A+ | 0.10 | 608 | 157 | < 0.10 | 0.10 | < 0.10 | < 0.10 | | | | | | |
| Fluorene | mg/kg | A+ | 0.10 | | 735 | < 0.10 | 0.15 | < 0.10 | < 0.10 | | | | | | |
| Phenanthrene | mg/kg | | 0.10 | | | < 0.10 | 0.85 | < 0.10 | < 0.10 | | | | | | |
| Anthracene | mg/kg | A+ | 0.10 | | 10200 | < 0.10 | 0.49 | < 0.10 | < 0.10 | | | | | | |
| Fluoranthene | mg/kg | A+ | 0.10 | | 983 | < 0.10 | 4.3 | 0.61 | < 0.10 | | | | | | |
| Pyrene | mg/kg | A+ | 0.10 | | 668 | < 0.10 | 4.7 | 0.79 | < 0.10 | | | | | | |
| Benzo[a]anthracene | mg/kg | A | 0.10 | 4.52 | 1.71 | < 0.10 | 3.4 | < 0.10 | < 0.10 | | | | | | |
| Chrysene | mg/kg | A | 0.10 | 585 | 0.44 | < 0.10 | 2.8 | < 0.10 | < 0.10 | | | | | | |
| Benzo[b]fluoranthene | mg/kg | A | 0.10 | 7.72 | 1.22 | < 0.10 | 4.1 | < 0.10 | < 0.10 | | | | | | |
| Benzo[k]fluoranthene | mg/kg | A | 0.10 | 84.4 | 0.686 | < 0.10 | 2.2 | < 0.10 | < 0.10 | | | | | | |
| Benzo[a]pyrene | mg/kg | B/C | 0.10 | 4.95 | 1.51 | < 0.10 | 3.3 | < 0.10 | < 0.10 | | | | | | |
| Indeno(1,2,3-c,d)Pyrene | mg/kg | A* | 0.10 | 7.31 | 0.0614 | < 0.10 | 2.1 | < 0.10 | < 0.10 | | | | | | |
| Dibenz(a,h)Anthracene | mg/kg | A | 0.10 | 0.838 | 0.00393 | < 0.10 | 0.68 | < 0.10 | < 0.10 | | | | | | |
| Benzo[g,h,i]perylene | mg/kg | A | 0.10 | 96.2 | 0.0187 | < 0.10 | 2.0 | < 0.10 | < 0.10 | | | | | | |
| Total Of 16 PAH's | mg/kg | | 2.0 | | | < 2.0 | 32 | < 2.0 | < 2.0 | | | | | | |
| Aliphatic TPH >C5-C6 | mg/kg | A+ | 1.0 | | 42.7 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aliphatic TPH >C6-C8 | mg/kg | A+ | 1.0 | | 99.3 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aliphatic TPH >C8-C10 | mg/kg | A+ | 1.0 | | 13.9 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aliphatic TPH >C10-C12 | mg/kg | A+ | 1.0 | 81.7 | 49.9 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aliphatic TPH >C12-C16 | mg/kg | A+ | 1.0 | 385 | 20.9 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aliphatic TPH >C16-C21 | mg/kg | A+ | 1.0 | | 210000 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aliphatic TPH >C21-C35 | mg/kg | A+ | 1.0 | | 210000 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aliphatic TPH >C35-C44 | mg/kg | | 1.0 | | | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Total Aliphatic Hydrocarbons | mg/kg | | 5.0 | | | < 5.0 | < 5.0 | < 5.0 | < 5.0 | | | | | | |
| Aromatic TPH >C5-C7 | mg/kg | A+ | 1.0 | | 0.137 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aromatic TPH >C7-C8 | mg/kg | A+ | 1.0 | | 113 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aromatic TPH >C8-C10 | mg/kg | A+ | 1.0 | | 20.5 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aromatic TPH >C10-C12 | mg/kg | A+ | 1.0 | | 70 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aromatic TPH >C12-C16 | mg/kg | A+ | 1.0 | 165 | 155 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aromatic TPH >C16-C21 | mg/kg | A+ | 1.0 | | 319 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Aromatic TPH >C21-C35 | mg/kg | A+ | 1.0 | | 1120 | < 1.0 | 110 | < 1.0 | < 1.0 | | | | | | |
| Aromatic TPH >C35-C44 | mg/kg | | 1.0 | | | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | |
| Total Aromatic Hydrocarbons | mg/kg | | 5.0 | | | < 5.0 | 110 | < 5.0 | < 5.0 | | | | | | |
| Total Petroleum Hydrocarbons | mg/kg | | 10.0 | | | < 10 | 110 | < 10 | < 10 | | | | | | |
| pH | | | N/A | | | 6.7 | 5.4 | 8.0 | 7.0 | | | | | | |
| Sulphate (2:1 Water Soluble) as SO4 | g/l | | 0.010 | | | < 0.010 | < 0.010 | < 0.010 | < 0.010 | | | | | | |
| ACM Type | | | N/A | | | - | - | - | - | | | | | | |
| Asbestos Identification | % | | 0.001 | | | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected | | | | | | |
| ACM Detection Stage | | | N/A | | | - | - | - | - | | | | | | |

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

| | | | | | | | | | | | | | | |
|------------------|---|--|-------|--|--|-------|-----------|-------------|--------|--|--|--|--|--|
| Moisture | % | | 0.020 | | | 25 | 28 | 4.9 | 11 | | | | | |
| Soil Colour | | | N/A | | | Brown | Brown | Brown | Brown | | | | | |
| Other Material | | | N/A | | | None | Roots | None | Stones | | | | | |
| Soil Texture | | | N/A | | | Clay | Sand | Sand | Clay | | | | | |
| Sulphate (Total) | % | | 0.010 | | | 0.055 | 0.12 | < 0.010 | 0.12 | | | | | |
| Organic Matter | % | | 0.40 | | | 2.2 | 14 | 0.67 | 13 | | | | | |



Final Report

Report No.: 20-18265-1

Initial Date of Issue: 24-Jul-2020

Client: Rogers Geotechnical Services Ltd

Client Address: Unit 4, Barncliffe Business Park
Near Bank
Shelley
Huddersfield
West Yorkshire
HD8 8LU

Contact(s): Jude Norcliffe

Project: C406/19/E New Mill Road


Quotation No.: **Date Received:** 16-Jul-2020

Order No.: PO-0793 **Date Instructed:** 16-Jul-2020

No. of Samples: 4

Turnaround (Wkdays): 7 **Results Due:** 24-Jul-2020

Date Approved: 24-Jul-2020

Approved By:


Details: Glynn Harvey, Technical Manager

Results - Soil

Project: C406/19/E New Mill Road

| Client: Rogers Geotechnical Services Ltd | Chemtest Job No.: | | | | 20-18265 | 20-18265 | 20-18265 | 20-18265 |
|--|----------------------|------|-------|------|-------------|-------------|-------------|-------------|
| Quotation No.: | Chemtest Sample ID.: | | | | 1032575 | 1032576 | 1032577 | 1032578 |
| | Client Sample ID.: | | | | D1 | D1 | D1 | D1 |
| | Sample Location: | | | | WS1 | WS2 | WS3 | WS4 |
| | Sample Type: | | | | SOIL | SOIL | SOIL | SOIL |
| | Top Depth (m): | | | | 0.4 | 0.1 | 0.8 | 0.0 |
| | Bottom Depth (m): | | | | | | | 0.4 |
| | Date Sampled: | | | | 10-Jul-2020 | 10-Jul-2020 | 10-Jul-2020 | 10-Jul-2020 |
| | Asbestos Lab: | | | | COVENTRY | COVENTRY | COVENTRY | COVENTRY |
| Determinand | Accred. | SOP | Units | LOD | | | | |
| Cadmium | M | 2450 | mg/kg | 0.10 | < 0.10 | 0.33 | 0.29 | 0.15 |
| Chromium (Hexavalent) | N | 2490 | mg/kg | 0.50 | < 0.50 | < 0.50 | < 0.50 | < 0.50 |
| Copper | M | 2450 | mg/kg | 0.50 | 38 | 46 | 25 | 38 |
| Mercury | M | 2450 | mg/kg | 0.10 | < 0.10 | 0.25 | < 0.10 | 0.10 |
| Nickel | M | 2450 | mg/kg | 0.50 | 13 | 18 | 40 | 10 |
| Lead | M | 2450 | mg/kg | 0.50 | 22 | 120 | 21 | 27 |
| Zinc | M | 2450 | mg/kg | 0.50 | 28 | 77 | 95 | 19 |
| Vanadium | U | 2450 | mg/kg | 5.0 | 34 | 36 | 30 | 18 |
| Arsenic | M | 2450 | mg/kg | 1.0 | 15 | 21 | 1.1 | 27 |
| Selenium | M | 2450 | mg/kg | 0.20 | 1.8 | 0.63 | < 0.20 | 0.38 |
| Cyanide (Free) | M | 2300 | mg/kg | 0.50 | < 0.50 | < 0.50 | < 0.50 | < 0.50 |
| Total Phenols | M | 2920 | mg/kg | 0.30 | < 0.30 | < 0.30 | < 0.30 | < 0.30 |
| Naphthalene | M | 2700 | mg/kg | 0.10 | < 0.10 | 0.20 | < 0.10 | < 0.10 |
| Acenaphthylene | M | 2700 | mg/kg | 0.10 | < 0.10 | 0.13 | < 0.10 | < 0.10 |
| Acenaphthene | M | 2700 | mg/kg | 0.10 | < 0.10 | 0.10 | < 0.10 | < 0.10 |
| Fluorene | M | 2700 | mg/kg | 0.10 | < 0.10 | 0.15 | < 0.10 | < 0.10 |
| Phenanthrene | M | 2700 | mg/kg | 0.10 | < 0.10 | 0.85 | < 0.10 | < 0.10 |
| Anthracene | M | 2700 | mg/kg | 0.10 | < 0.10 | 0.49 | < 0.10 | < 0.10 |
| Fluoranthene | M | 2700 | mg/kg | 0.10 | < 0.10 | 4.3 | 0.61 | < 0.10 |
| Pyrene | M | 2700 | mg/kg | 0.10 | < 0.10 | 4.7 | 0.79 | < 0.10 |
| Benzo[a]anthracene | M | 2700 | mg/kg | 0.10 | < 0.10 | 3.4 | < 0.10 | < 0.10 |
| Chrysene | M | 2700 | mg/kg | 0.10 | < 0.10 | 2.8 | < 0.10 | < 0.10 |
| Benzo[b]fluoranthene | M | 2700 | mg/kg | 0.10 | < 0.10 | 4.1 | < 0.10 | < 0.10 |
| Benzo[k]fluoranthene | M | 2700 | mg/kg | 0.10 | < 0.10 | 2.2 | < 0.10 | < 0.10 |
| Benzo[a]pyrene | M | 2700 | mg/kg | 0.10 | < 0.10 | 3.3 | < 0.10 | < 0.10 |
| Indeno(1,2,3-c,d)Pyrene | M | 2700 | mg/kg | 0.10 | < 0.10 | 2.1 | < 0.10 | < 0.10 |
| Dibenz(a,h)Anthracene | M | 2700 | mg/kg | 0.10 | < 0.10 | 0.68 | < 0.10 | < 0.10 |
| Benzo[g,h,i]perylene | M | 2700 | mg/kg | 0.10 | < 0.10 | 2.0 | < 0.10 | < 0.10 |
| Total Of 16 PAH's | M | 2700 | mg/kg | 2.0 | < 2.0 | 32 | < 2.0 | < 2.0 |
| Aliphatic TPH >C5-C6 | N | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aliphatic TPH >C6-C8 | N | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aliphatic TPH >C8-C10 | M | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aliphatic TPH >C10-C12 | M | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aliphatic TPH >C12-C16 | M | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aliphatic TPH >C16-C21 | M | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aliphatic TPH >C21-C35 | M | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

Results - Soil

Project: C406/19/E New Mill Road

| Client: Rogers Geotechnical Services Ltd | Chemtest Job No.: | | | | 20-18265 | 20-18265 | 20-18265 | 20-18265 |
|--|----------------------|------|-------|-------|----------------------|----------------------|----------------------|----------------------|
| Quotation No.: | Chemtest Sample ID.: | | | | 1032575 | 1032576 | 1032577 | 1032578 |
| | Client Sample ID.: | | | | D1 | D1 | D1 | D1 |
| | Sample Location: | | | | WS1 | WS2 | WS3 | WS4 |
| | Sample Type: | | | | SOIL | SOIL | SOIL | SOIL |
| | Top Depth (m): | | | | 0.4 | 0.1 | 0.8 | 0.0 |
| | Bottom Depth (m): | | | | | | | 0.4 |
| | Date Sampled: | | | | 10-Jul-2020 | 10-Jul-2020 | 10-Jul-2020 | 10-Jul-2020 |
| | Asbestos Lab: | | | | COVENTRY | COVENTRY | COVENTRY | COVENTRY |
| Determinand | Accred. | SOP | Units | LOD | | | | |
| Aliphatic TPH >C35-C44 | N | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Total Aliphatic Hydrocarbons | N | 2680 | mg/kg | 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Aromatic TPH >C5-C7 | N | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aromatic TPH >C7-C8 | N | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aromatic TPH >C8-C10 | M | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aromatic TPH >C10-C12 | M | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aromatic TPH >C12-C16 | M | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aromatic TPH >C16-C21 | U | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Aromatic TPH >C21-C35 | M | 2680 | mg/kg | 1.0 | < 1.0 | 110 | < 1.0 | < 1.0 |
| Aromatic TPH >C35-C44 | N | 2680 | mg/kg | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Total Aromatic Hydrocarbons | N | 2680 | mg/kg | 5.0 | < 5.0 | 110 | < 5.0 | < 5.0 |
| Total Petroleum Hydrocarbons | N | 2680 | mg/kg | 10.0 | < 10 | 110 | < 10 | < 10 |
| pH | M | 2010 | | 4.0 | 6.7 | 5.4 | 8.0 | 7.0 |
| Sulphate (2:1 Water Soluble) as SO4 | M | 2120 | g/l | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| ACM Type | U | 2192 | | N/A | - | - | - | - |
| Asbestos Identification | U | 2192 | % | 0.001 | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected |
| ACM Detection Stage | U | 2192 | | N/A | - | - | - | - |
| Moisture | N | 2030 | % | 0.020 | 25 | 28 | 4.9 | 11 |
| Soil Colour | N | 2040 | | N/A | Brown | Brown | Brown | Brown |
| Other Material | N | 2040 | | N/A | None | Roots | None | Stones |
| Soil Texture | N | 2040 | | N/A | Clay | Sand | Sand | Clay |
| Sulphate (Total) | M | 2430 | % | 0.010 | 0.055 | 0.12 | < 0.010 | 0.12 |
| Organic Matter | M | 2625 | % | 0.40 | 2.2 | 14 | 0.67 | 13 |

Test Methods

| SOP | Title | Parameters included | Method summary |
|------|---|--|--|
| 2010 | pH Value of Soils | pH | pH Meter |
| 2030 | Moisture and Stone Content of Soils(Requirement of MCERTS) | Moisture content | Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C. |
| 2040 | Soil Description(Requirement of MCERTS) | Soil description | As received soil is described based upon BS5930 |
| 2120 | Water Soluble Boron, Sulphate, Magnesium & Chromium | Boron; Sulphate; Magnesium; Chromium | Aqueous extraction / ICP-OES |
| 2192 | Asbestos | Asbestos | Polarised light microscopy / Gravimetry |
| 2300 | Cyanides & Thiocyanate in Soils | Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate | Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser. |
| 2430 | Total Sulphate in soils | Total Sulphate | Acid digestion followed by determination of sulphate in extract by ICP-OES. |
| 2450 | Acid Soluble Metals in Soils | Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc | Acid digestion followed by determination of metals in extract by ICP-MS. |
| 2490 | Hexavalent Chromium in Soils | Chromium [VI] | Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide. |
| 2625 | Total Organic Carbon in Soils | Total organic Carbon (TOC) | Determined by high temperature combustion under oxygen, using an Eltra elemental analyser. |
| 2680 | TPH A/A Split | Aliphatics: >C5-C6, >C6-C8,>C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35, >C35- C44Aromatics: >C5-C7, >C7-C8, >C8- C10, >C10-C12, >C12-C16, >C16- C21, >C21- C35, >C35- C44 | Dichloromethane extraction / GCxGC FID detection |
| 2700 | Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID | Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene | Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds) |
| 2920 | Phenols in Soils by HPLC | Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded. | 60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection. |

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

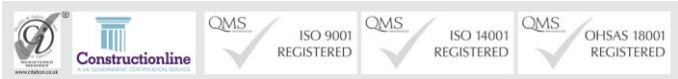
customerservices@chemtest.com

Environmental
Geotechnical
Specialists



End of Report

GEOTECHNICAL
ENVIRONMENTAL



Rogers Geotechnical Services Ltd
Office 1 & 2 Barncliffe Business Park,
Near Bank, Shelley, Huddersfield, HD8 8LU

Telephone 01484 607977
Company No: 5130864



Appendix 7

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Residential With Plant Uptake Landuse

| Tox Data Report No. | Compound | Residential with Homegrown Produce Landuse (mg/kg) | | | | Reference |
|--|--------------------------|--|-----------------|--------------|-----------------|-----------|
| | | SOM: 1% | | SOM: 6% | | |
| <i>Metals</i> | | | | | | |
| 3 | Cadmium | 22.1 | | 22.1 | | C |
| 4 | Chromium VI | 3.62 | 20.5 | 3.62 | 20.5 | B/C |
| | Copper | 4730 | | 4790 | | A+ |
| 7 | Mercury | 8.81 | | 15.80 | | A/D |
| 8 | Nickel | 136 | | 136 | | A+ |
| | Lead | 200 | | 200 | | C |
| | Zinc | 20000 | | 20300 | | A+ |
| | Vanadium | 136 | | 138 | | A+ |
| <i>Semi and Non Metals</i> | | | | | | |
| 1 | Arsenic | 37 | | 37 | | C |
| 10 | Selenium | 375 | | 375 | | A |
| | Free Cyanide | 34 | | 34 | | A |
| 9 | Phenols (total) | 267 | | 1200 | | A |
| <i>Poly Aromatic Hydrocarbons</i> | | | | | | |
| | | Free product | No free product | Free product | No free product | |
| 20 | Napthalene | 0.829 | | 12.2 | | A+ |
| | Acenaphthene | 157 | 608 | 2760 | | A+ |
| | Fluorene | 735 | | 2610 | | A+ |
| | Anthracene | 10200 | | 26200 | | A+ |
| | Fluoranthene | 983 | | 2980 | | A+ |
| | Pyrene | 668 | | 2120 | | A+ |
| | Benzo(a)anthracene | 1.71 | 4.52 | 8.54 | | A |
| 2 | Chrysene | 0.44 | 585 | 2.64 | 927 | A |
| 2 | Benzo(b)fluoranthene | 1.22 | 7.72 | 7.29 | 9.86 | A |
| 2 | Benzo(k)fluoranthene | 0.686 | 84.4 | 4.12 | 100 | A |
| 2 | Benzo(a)pyrene | 1.51 | 4.95 | 0.998 | 5 | B/C |
| 2 | Dibenzo(a,h)anthracene | 0.00393 | 0.838 | 2.05 | 4.95 | A* |
| 2 | Indeno(1,2,3-cd)pyrene | 0.0614 | 7.31 | 0.368 | 9.75 | A |
| 2 | Benzo(g,h,i)perylene | 0.0187 | 96.2 | 0.112 | 103 | A |
| <i>Petroleum Hydrocarbons</i> | | | | | | |
| | Aliphatic C5-C6 | 42.7 | | 369 | | A+ |
| | Aliphatic C6-C8 | 99.3 | | 768 | 1240 | A+ |
| | Aliphatic C8-C10 | 13.9 | | 204 | | A+ |
| | Aliphatic C10-C12 | 49.9 | 81.7 | 297 | 1180 | A+ |
| | Aliphatic C12-C16 | 20.9 | 385 | 125 | 4130 | A+ |
| | Aliphatic C16-C21 | 210000 | | 210100 | | A+ |
| | Aliphatic C21-C35 | 210000 | | 210100 | | A+ |
| | Aromatic C5-C7 (Benzene) | 0.137 | | 0.871 | | A+ |
| | Aromatic C7-C8 (Toluene) | 113 | | 780 | | A+ |
| | Aromatic C8-C10 | 20.5 | | 232 | | A+ |
| | Aromatic C10-C12 | 70 | | 468 | | A+ |
| | Aromatic C12-C16 | 155 | 165 | 830 | | A+ |
| | Aromatic C16-C21 | 319 | | 1040 | | A+ |
| | Aromatic C21-C35 | 1120 | | 1710 | | A+ |
| A+ = Values update June 2017. | | | | | | |
| A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound. | | | | | | |
| B = Health Criterion Values (available from toxicological reviews published in the C4SL project methodology report). | | | | | | |
| C = Category 4 Screening Levels (C4SLs). | | | | | | |
| D = SSV provided is for Methyl Mercury. | | | | | | |