Environmental
Geotechnical
Specialists

RGS

PHASE 2

# GEO-ENVIRONMENTAL REPORT

| | |
|---|---|
| job number | C1772/21/E/4286 |
| date | 26/06/23 |
| site address | Gomersal Hall,<br>Oxford Road, Gomersal |
| written by | I. Sakoor |
| checked by | R. A. Palmer |
| issued by | I. Sakoor |

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# Report on a Phase 2 Geo-environmental Investigation

| | |
|---|---|
| Location: | Gomersal Hall,<br>Oxford Road, Gomersal |
| For: | Martin Walsh Architectural Ltd |
| Report No. | C1772/21/E/4286 Report date: June 2023 |

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


| | |
|---|---|
| **Imran Sakoor** BEng FGS<br>Geo-environmental Engineer | **Rob Palmer** MSc FGS ACIEH<br>Senior Geo-environmental Engineer |


## Report Summary[1]

| Item | Comments | Section |
|---|---|---|
| Development | Development plans have recently changed from a single large new property with basement and swimming pool to a number of residential dwellings with gardens and driveways. | 1. |
| Geology | Superficial geology: none.<br>Solid geology: Lepton Edge Rock. | 5. |
| Strata Conditions | Generally topsoil and localised made ground over loose to medium dense gravel. Variably weathered (residual to completely weathered sandstone) then encountered between 1.2m and 3.2m depth, over extremely weak sandstone over mudstone. No coal seams, mine workings or flush losses experienced. | 6. |
| Groundwater | Groundwater strikes encountered at 9.0m in RO1 and 10m in RO2. | 6.2 |
| Foundation Design | Shallow foundations onto rockhead. | 10.1 |
| Soakaways | May be possible as good drainage characteristics were demonstrated within soakaway tests. | 10.4 |
| Effect of Sulphates | DC-1 concrete. | 10.6 |
| Contamination | No significant contamination revealed. | 11. |
| Ground Gasses | Low levels of carbon dioxide revealed and site is CS1. No protection measures are required. | 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 associated with Gomersal Hall, off Oxford Road, Gomersal is to be developed for residential end use. Initial plans involved the demolition of the existing property and the construction of a significantly larger property incorporating a basement and swimming pool. A geo-environmental report was issued by Rogers Geotechnical Services Ltd in August 2021.

However, the development plans have now changed to the construction of 7No. detached residential plots, each with its own driveway and garden area. Additionally, a new access road is to be created which will not only maintain the original entrance on the corner of Oxford road but also create a new access of West Lane. Allotments are also proposed for NW corner of the site.

Consequently, in order to fill any gaps within the existing geo-environmental ground model (relative to the new plans), further 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 in relation to the updated plans This investigation also takes into consideration the risk of any contamination present. It should be appreciated that this report incorporates the findings of the previous investigation, and describes the most recent 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 C1772/21/E/2763 in June 2021. A Phase 2 Geo-environmental report was then undertaken by Rogers geotechnical Services Ltd in August 2021. Both reports have been extensively considered for this report.

# 4. Fieldworks

The first phase of fieldworks were undertaken on the 22nd and 23rd of June 2021 and included the following:

- Four windowless sample boreholes.
- Two rotary boreholes.
- Four dynamic probes.
- Two trial pits.
- Four TRL probes.
- Two soakaway tests.
- Three gas monitoring standpipes.

Subsequent from the revision of the development plans, the following works have also been undertaken between the 12th to the 23rd May 2023:

- Three hand-held windowless sample boreholes.
- Three TRL probes.
- Coal Authority License.
- Two rotary open-hole boreholes.
- Two gas monitoring standpipes.

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

## 4.1 Acquisition of Coal Authority Permit

In order to undertake the rotary probing aspect of this investigation, it was necessary to obtain permission to enter or disturb Coal Authority interests. This permission was granted on the 15th May 2023 as permit reference number 26664, which is presented in Appendix 2 to this report. In accordance with the joint Coal Authority and Health and Safety Executive positioning statement, and under the requirements of the permit, the works were undertaken employing water flush drilling techniques. Furthermore, the drillers wore gas detectors on their person throughout the works.

## 4.2 Boreholes

The overburden was drilled using a drive-in windowless sampling rig in the initial phase of investigation and with hand-held equipment on the second phase. The cores were undertaken in 1m lengths and reduced in diameter from 90mm for the first 1m through 80mm, 70mm and 60mm for subsequent 1m increments (57mm through to 47mm for the hand-held boreholes). The recovered cores were sealed and returned to the laboratory for logging and subsequent testing.

During the initial phase, two rotary boreholes were undertaken using a Commachio GEO 205 rotary drilling rig. At the locations indicated on the site plan, rotary open-hole drilling methods were employed through the overburden. Upon encountering the rockhead at 2.7m in BH1 and 3.2m in BH2, rotary coring was then undertaken, utilising air/mist flushing, and 85mm cores were recovered. For both boreholes, casing was installed through the overburden to support the sides of the bore. It

should be noted that as part of the rotary probing aspect of the works (second phase), two boreholes were drilled down to a depth of 30m below ground level utilising open-hole techniques to check for the presence of mine workings under the Coal Authority License outlined under Section 4.1.

The recovered cores were sealed and returned to the laboratory for logging and subsequent testing. The soils and rock were described in general accordance with BS5930: 2015 +A1: 2020 and full descriptions are given on the borehole records which are also presented in Appendix 3. Also included on these records are the sample depths, the percentages of *Total Core Recovery* (TCR), *Solid Core Recovery* (SCR), *Rock Quality Designation* (RQD) and *Fracture Indices (FI).*

## 4.3 Dynamic Probes

Dynamic penetration tests were undertaken adjacent to the windowless sample boreholes WS1 to WS4 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 4.

## 4.4 Trial Pits

Two trial pits were excavated using a JCB 3CX in order to reveal the nature of the near surface soils and to undertake soakaway testing. The soils 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 5.

Once excavations and soakaway testing 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 the 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. 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.

## 4.5 TRL Dynamic Cone Penetrometer Tests

Seven TRL Dynamic Cone Penetrometer tests were undertaken at the locations indicated on the site plan. The penetrometer consists of an 8kg slide hammer falling through 575mm onto an anvil, which drives a 20mm diameter 60° cone into the ground. The depth of the cone driven per blow of the hammer is recorded. The results of the dynamic penetration tests are presented as Appendix 6 and include graphs of penetration blows and CBR values versus depth. The percentage CBR value has been obtained from the correlation provided in TRRL Road Note 8 which is given below:

$$Log_{10}(CBR) = 2.48 – 1.057Log_{10}(mm/blow)$$

### 4.6 Soakaway Tests

Soakaway tests were conducted within both trial pits. At the elected test depths, the pit was trimmed and squared as much as practicable. Water was then pumped into the pit and the level monitored at timed intervals relative to a reference bar at ground level. These tests were conducted and calculated in general accordance with the method given by BRE Digest 365 and the results are presented in Appendix 7.

### 4.7 Gas Monitoring Standpipes

Gas monitoring standpipes were installed to 2.8m in WS1, 2.9m in WS2, 2.55m in WS4, 1.55m in WSA and 1.75m WSC. 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 between 0.5m and 1.0m below surface, with a non-perforated pipe to ground level. The response zone was filled with pea gravel, with a bentonite seal at above, and the installation was capped with a stop box cover in a concrete surround.

## 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**

| Strata Type | Strata Name[2] | Previous Name[3] | Description[3] |
|---|---|---|---|
| Superficial Geology | None recorded onsite. | | |
| Solid Geology | Lepton Edge Rock | Gomersal Rock | Regionally the Lepton Edge Rock (also referred to as the Gomersal Rock) is a fine-grained, cross-bedded flaggy sandstone that forms prominent features. Also, can be present as fine- to very fine-grained, thinly bedded to flaggy sandstone. |

[2] Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield; 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*]

# 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 |
|---|---|---|---|
| 0.2 – 0.60 | TOPSOIL. | All | None |
| 0.7 – 1.0 | MADE GROUND (Sandy GRAVEL). | WS1, BH2 | None |
| 1.10 | MADE GROUND (Very gravelly CLAY). | WS4 | None |
| 0.6 – 3.2 | Sandy gravelly CLAY. [RESIDUAL SANDSTONE]. | TP1, BH2, WSA, WSB, WSC, RO1 and RO2 | None |
| 1.2 – +1.9 | Very sandy GRAVEL. Occasional bands of gravelly sand. [COMPLETELY WEATHERED SANDSTONE]. | WS1, WS2, WS3, WS4, TP1, TP2, WSB | None |
| +2.0 – 2.7<br>5.0 – 5.6 | Extremely weak SANDSTONE. [HIGHLY WEATHERED SANDSTONE]. | WS2, BH1, WSB, RO1, RO2 | None |
| 1.90 – 1.95 | Silty CLAY. | WS1, WS4 | None |
| +1.65 – +2.90 | Extremely weak thinly laminated SILTSTONE. | WS1, WS2, WS4, WSA, WSC | None |
| +10.0 – 26.0 | Extremely weak thinly laminated clayey MUDSTONE. | BH1, BH2, RO1, RO2 | 9.0m (RO1), 10.0m (RO2) |
| +30.0 | Interbedded SANDSTONE and MUDSTONE. | RO1, RO2 | 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

Below the topsoil in WS1, BH2 and WS4, made ground described as sandy gravel and very gravelly clay was revealed to between 0.7m and 1.1m depth. The granular fill included brick and mortar, whilst the cohesive made ground was found to be representative of reworked natural soils.

Underlying the made ground and topsoil within the remainder of the site, weathered sandstone, generally in the form of a medium dense, locally loose sandy gravel was encountered to depths of between 1.42m and 1.9m. Within TP1, BH2 WSA to WSC, RO1 and RO2, sandy gravelly clay was encountered to 0.8m and 3.2m depth. Extremely weak sandstone was encountered to between 2.0m and 2.7m depth in WS2, BH1, and WSB. Within RO1 and RO2, the sandstone was revealed to between 5.0m and 5.6m depth. With respect to the local geology, it is considered that this material is representative of the Lepton Edge Rock, present in a residual to completely weathered insitu condition.

Generally, below the weathered Lepton Edge Rock, stiff silty brown silty clay was revealed to around 1.9m depth, over extremely weak light grey clayey mudstones and siltstones which continued to the base of the BH1, BH2, 26m depth in RO1 and 20m in RO2. From 26m in RO1 and 26m in RO2, interbedded sandstone and mudstone units were encountered. It is considered that this material represents weathered undifferentiated units of the Pennine Lower Measures Formation.

It should be appreciated that during the progression of the rotary boreholes, no coal seams, broken ground or losses of flush were encountered.

### 6.2 Groundwater

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. Notwithstanding this, it should be appreciated that water strikes were encountered at 9.0m in RO1 and 10m in RO2

## 7. Insitu Testing

### 7.1 Dynamic Penetration Tests

Dynamic penetration tests were undertaken adjacent to WS1 to WS4. A summary of the results is presented below:

**Table 3: 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 | 1.1 | 0.6<br>2.3 | 3.2 | Abrupt | Results generally poor to around 1.1m depth, followed by blow counts in the range 3 to 6 to 2.3m bgl. Then rapid increase in results with depth. |
| DP2 | 0.5 | 1.8<br>2.7 | 2.2<br>3.3 | Abrupt | Initial poor results, followed by blow counts generally in the range 3 to 6 to 2.7m bgl. Then rapid increase in results with depth. |
| DP3 | 0.2 | 1.8 | 2.2 | Abrupt | Blow counts varying between 2 and 4 to around 1.8m depth. Followed by abrupt refusal at 2.2m depth. |
| DP4 | 0.8 | 2.3 | 2.8 | Abrupt | Poor results to 0.8m, followed by blow counts in the range 5 to 6 to 2.3m depth, with a stronger zone present at 1.5m. Followed by a rapid increase in strength with depth. |

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

## 7.2 Soakaway Tests

Soakaway tests were undertaken within both TP1 and TP2. A summary of the results is presented below:

**Table 4: Soakaway Test Results**

| Location | Soakage Area Dimensions (average) (m) | Test Depth (m) | Soil Description (base of pit) | Infiltration Rate (m/s) | Drainage Characteristics |
|---|---|---|---|---|---|
| TP1 | 1.9 x 0.6 | 1.42 | Sandy GRAVEL | $1.1 \times 10^{-4}$<br>$8.1 \times 10^{-5}$<br>$5.6 \times 10^{-5}$ | Good |
| TP2 | 2.2 x 0.6 | 1.55 | Sandy GRAVEL. | $2.8 \times 10^{-3}$<br>$1.6 \times 10^{-3}$<br>$8.9 \times 10^{-4}$ | Good |

It should be appreciated that for TP2, the infiltration was so efficient that the pit could not be filled with water quick enough to allow a test to commence. Therefore, the infiltration rate has been estimated by assuming the inflow of water into the pit is equal to the flow through the base.

## 7.3 TRL DCP Tests

TRL Dynamic Cone Penetrometer tests have been undertaken at the locations indicated on the site plan. The results are summarised below:

**Table 5: CBR Test Results**

| Location | Depth (m) | Average CBR (%) | Comments |
|---|---|---|---|
| TRL 1 | 0.15 – 0.32<br>0.34 – 0.40<br>0.41 – 0.66<br>0.72 – 0.82<br>0.83 – 0.88<br>0.89 – 0.90 | 7<br>13<br>15<br>6<br>10<br>75 | CBR values noted to be variable but generally increasing with depth. |
| TRL 2 | 0.20 – 0.46<br>0.48 – 0.83 | 3<br>33 | High CBR values noted from around 0.5m depth. |
| TRL 3 | 0.07 – 0.15<br>0.16 – 0.18<br>0.62 – 0.65<br>0.66 – 0.80<br>0.85 – 0.88<br>0.89 – 0.92 | 10<br>29<br>5<br>15<br>11<br>26 | Variable but generally high CBR values throughout. |
| TRL 4 | 0.16 – 0.56<br>0.57 – 0.59<br>0.70 – 0.91 | 6<br>23<br>11 | High CBR values from 0.5m depth. |
| TRL A | 0.15 – 0.32<br>0.33 – 0.48<br>0.50 – 0.66<br>0.68 – 0.74<br>0.76 – 0.81<br>0.82 – 0.87<br>0.91 – 0.96 | 3<br>8<br>19<br>36<br>35<br>37<br>39 | CBR values steadily increasing with depth. |

| | | | |
|---|---|---|---|
| TRL B | 0.20 – 0.46<br>0.47 – 0.53<br>0.60 – 0.64<br>0.65 – 0.76<br>0.77 – 0.80<br>0.81 – 0.91<br>0.94 – 0.96 | 5<br>17<br>27<br>34<br>70<br>19<br>8 | High CBR values throughout. Drop in values noted from 0.9m depth. |
| TRL C | 0.25 – 0.35<br>0.36 – 0.45<br>0.46 – 0.48<br>0.50 – 0.58<br>0.59 – 0.62<br>0.68 – 0.86<br>0.84 – 0.96 | 6<br>13<br>28<br>39<br>14<br>52<br>35 | Variable but generally high CBR values throughout. |

## 7.4 Gas and Water Level Monitoring

The standpipes within WS1, WS2 and WS4 were monitored between the 29th June to the 8th September 2021. WSA to WSC have been monitored between the 23rd May to the 13th June 2023. The results of the gas monitoring undertaken to date are tabulated below:

**Table 6: Gas Monitoring**

| Location | Date | $CH_4$ (%) | $CO_2$ (%) | $O_2$ (%) | Flow (l/hr) | Barometric Pressure (mb) | Water Level (m) | Standpipe Depth (m) |
|---|---|---|---|---|---|---|---|---|
| WS1 | 29.06.21 | 0.1 | 1.1 | 20.1 | 0.1 | 1001↓ | - | 2.8 |
| | 06.07.21 | 0.1 | 1.2 | 19.7 | 0.1 | 977↓ | - | |
| | 13.07.21 | 0.1 | 1.3 | 18.9 | 0.1 | 1000↔ | 2.31 | |
| | 21.07.21 | 0.0 | 1.4 | 19.4 | 0.1 | 1008↓ | 2.19 | |
| | 25.08.21 | 0.0 | 1.6 | 19.7 | 0.1 | 1010↔ | 2.77 | |
| | 08.09.21 | 0.1 | 1.5 | 19.7 | 0.1 | 998↔ | - | |
| WS2 | 29.06.21 | 0.0 | 2.4 | 19.8 | 0.1 | 1001↓ | - | 2.9 |
| | 06.07.21 | 0.0 | 2.5 | 19.8 | 0.1 | 977↓ | - | |
| | 13.07.21 | 0.0 | 2.6 | 19.3 | 0.1 | 1000↔ | 2.36 | |
| | 21.07.21 | 0.0 | 2.7 | 19.3 | 0.1 | 1009↓ | 2.44 | |
| | 25.08.21 | 0.0 | 2.9 | 19.8 | 0.1 | 1010↔ | - | |
| | 08.09.21 | 0.0 | 2.7 | 19.6 | 0.1 | 998↔ | - | |
| WS4 | 29.06.21 | 0.0 | 2.0 | 19.5 | 0.1 | 1002↓ | - | 2.55 |
| | 06.07.21 | 0.0 | 2.2 | 18.3 | 0.1 | 977↓ | 0.89 | |
| | 13.07.21 | 0.0 | 2.9 | 16.3 | 0.0 | 1001↔ | 0.98 | |
| | 21.07.21 | 0.0 | 4.1 | 16.2 | 0.1 | 1009↓ | 1.39 | |
| | 25.08.21 | 0.0 | 3.6 | 19.0 | 0.1 | 1010↔ | 1.85 | |
| | 08.09.21 | 0.1 | 3.3 | 18.6 | 0.1 | 998↔ | 2.41 | |
| **2023 Results** | | | | | | | | |
| WSA | 23.05.23 | 0.1 | 3.0 | 16.5 | 0.0 | 1012↔ | - | 1.55 |
| | 30.05.23 | 0.0 | 2.7 | 18.1 | 0.0 | 1017↔ | - | |
| | 06.06.23 | 0.1 | 2.8 | 18.7 | 0.0 | 1011↔ | - | |
| | 13.06.23 | 0.0 | 2.8 | 19.3 | 0.0 | 1002↔ | - | |
| WSC | 23.05.23 | 0.1 | 4.7 | 17.6 | 0.0 | 1012↔ | - | 1.75 |
| | 30.05.23 | 0.1 | 4.6 | 18.3 | 0.0 | 1018↔ | - | |
| | 06.06.23 | 0.1 | 4.4 | 19.1 | 0.0 | 1011↔ | - | |
| | 13.06.23 | 0.1 | 4.7 | 19.0 | 0.0 | 1003↔ | - | |

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

The visits undertaken in 2021 were undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was calibrated on the 5th May 2021. Visits undertaken in 2023, within WSA and WSC, were undertaken using the same gas monitor, which was most recently calibrated on the 1st February 2023. Full results and calibration documents are included in Appendix 8.

# 8. Laboratory Testing - Geotechnical

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

- Determination of water content — BS EN ISO 17892-1:2014
- Linear Shrinkage — BS 1377: 1990: Pt2: 6.5
- Determination of liquid and plastic limits — BS EN ISO 17892-12:2018
- Soluble sulphate content — BS 1377: 1990: Pt3: 5
- pH value — BS 1377: 1990: Pt3: 9

The test results are presented in Appendix 9 and are summarised below:

**Table 7: Summary of Geotechnical Test Results**

| Test type | Number of tests | Range of results | | Comments |
|---|---|---|---|---|
| Water content determinations | 2 | 15% & 16% | | |
| Index properties (1 Point) | 2 | LL<br>PL<br>PI<br>LS | 32% & 34%<br>18% & 19%<br>14% & 15%<br>6% | Clay of predominantly low plasticity.<br>Consistency index: 1.2.<br>NHBC Class – Low. |
| Soluble sulphate & pH | 8 | $SO_4$<br>pH | <10 to 15mg/l<br>6.7 to 8.7 | |

## 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) | Low | Silty CLAY. |
| Concrete classification | DC-1 | Brownfield locations (static water). |

On the basis of the soil descriptions and laboratory test results, the following parameters have been derived.

**Table 9: Assumed Effective Stress Parameters**

| Strata | Description | Bulk unit weight ($kN/m^3$) | Angle of friction $\phi'$ (°) | Effective cohesion c' ($kN/m^2$) |
|---|---|---|---|---|
| 1 | MADE GROUND (Granular) | 18 | 26 | 0 |
| 2 | MADE GROUND (Cohesive) | 19 | 27 | 0 |
| 3 | Sandy gravelly CLAY [Residual Sandstone] | 19 | 27 | 0 |
| 4 | Silty CLAY. | 20 | 28 | 0 |
| 5 | Very sandy GRAVEL [Completely weathered Sandstone] | 21 | 30 | 0 |
| 6 | SANDSTONE/SILTSTONE/MUDSTONE | 22 | 38 | 0 |

# 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 $SO_4^{2-}$.
- Asbestos.

For the intrusive works undertaken in 2021, this testing was undertaken by Eurofins Chemtest Ltd. The testing for the samples obtained in 2023 was undertaken by i2 Analytical Ltd. All of the results are presented within Appendix 9 of this report.

# 10. Discussion of Ground Conditions - Geotechnical

It is understood that the plans for the site have changed from the construction of a large single property incorporating a basement and swimming pool, to the development of 7No. discrete residential plots with driveways, gardens and a new access road. The development details have been taken from drawing reference: HMOR-MWA-XX-XX-DR-A-0010, revision P4, by Martin Walsh Architectural Ltd.

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

## 10.1 Foundations

The windowless sample boreholes indicate that siltstone/sandstone rockhead will generally be revealed at around 2m below ground level, although the bedrock has been observed to around 2.6m locally. On this basis it is considered that strip or spread foundations for the proposed house

could be constructed directly onto the rock head, assuming an allowable increase in stress probably in excess of 250kN/m$^2$. It should be appreciated that all of the foundations extend to bear onto the rockhead, as the weathered materials above will possess dissimilar settlement characteristics to the bedrock.

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.

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.

## 10.2 Ground-floors

In light of the made ground and weak near surface soils, it is not recommended that ground bearing ground floor slabs (apart from the area of the basement/pool) 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.

## 10.3 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 10% could be employed in the pavement design[5]. 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.

## 10.4 Soakaways

The results of the soakaway testing indicate that the weathered sandstone possesses good drainage characteristics. Therefore, it is considered that soakaways could be utilised at this site.

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

Notwithstanding this, it should be appreciated that this type of material is prone to siltation over time, thereby reducing soakage rates. Therefore, it is recommended that the most onerous result of 5.6 x $10^{-5}$ m/s be used in the design in this instance. It should also be noted that soakaways should be positioned at least 5m away from any foundations.

### 10.5 Coal Mining Legacy

It should be appreciated that the Phase 1 Desk Study indicates the Middle Little Coal to be present at shallow depth below the site, with the Middleton Main coal being indicated at around 30m depth. However, the rotary boreholes have not found any coal or workings below the site. It is possible that the Middleton Little Coal is absent below the development area. Additionally, it is possible that the Middleton Main could be present beyond 30m depth. However, even if present and worked, it is considered that sufficient competent cover will be present such that the risk to surface structures will be mitigated in the event of a collapse. Therefore, it is considered that a low risk is present from underground coal workings.

### 10.6 Effects 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 C2[6], 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 mobile groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[7], 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.

## 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 7No. detached residential plots with driveways, gardens and a new access road. 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 0.64% and 1.2%. On this basis, it is considered that the screening values associated with 1% SOM should be adopted. These values have been

[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.*

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 website[8] 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 9. 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 | 0.8 | None. |
| WS2 | 0.5 | None. |
| WS3 | 0.5 | None. |
| WS4 | 0.6 | None. |
| WSA | 0.6 | None. |
| WSB | 0.5 | None. |
| WSC | 0.65 | None. |

Concentrations of chromium(VI), mercury, free cyanide, phenols (total), polyaromatic hydrocarbons (US EPA 16) and total petroleum hydrocarbons (aliphatic C5 to C21; aromatic C5 to C35) 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.

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 residential end use.

### 11.1.2 Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated a maximum concentration of 0.1% methane, with concentrations of carbon dioxide ranging between 1.1% and 4.7%, in association with oxygen levels of between 16.2% 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 977mb and 1018mb.

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 4.7% (0.047) carbon dioxide, in association with a

[8] http://www.atrisksoil.co.uk/pages/general/subscribers.asp

maximum flow rate of 0.1 l/hr. This results in a GSV of 0.0001 l/hr for methane and a GSV of 0.0041 l/hr for carbon dioxide.

In accordance with Table 2 of BS8485: 2015*, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* the site may be characterised as *Characteristic Situation Level 1*. It is therefore considered that there is a very low risk of harm to end users and site operatives and no special precautionary measures are required in accordance to Table 8.6, *Typical scope of gas protection measures,* of CIRIA report C665.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)[9]. Accepting that the proposed development is of high sensitivity and that the generation potential is very low, these tables suggest that 6 readings could be undertaken over a period of 3 months. However, C665 notes that *not all sites will require gas monitoring for the period and frequency indicated in Tables 5.5a and 5.5b.*

In this case, the original investigation in 2021 included a total of 6 monitoring visits over an 11-week time period and fully classified as Characteristic Situation Level 1.

On this note, the four further visits undertaken in 2023[10] (WSA and WSC) do not indicate any notable increases in ground gasses, which remain within the limits for Characteristic Situation Level 1. Therefore, it is considered that the original assessment of the site being Characteristic Situation Level 1 remains valid.

## 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 Agency[11] advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.[12] 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.'[13]

[9] Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings, p60.*
[10] By 2023, the standpipes installed as part of the 2021 investigation had been removed, thus have not been monitored alongside WSA and WSC, during the current investigation.
[11] 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'.
[12] 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.
[13] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

### 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 11. Sources of contamination include the following:

**On-site** – none.

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

| | |
|---|---|
| **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 11.

| Table 11: Conceptual Site Model and Site-Specific Risk Assessment [Contamination: none] | | | | |
|---|---|---|---|---|
| **Conceptual Site Model** | | | **Site Specific Risk Assessment** | |
| **Pathways** | **Receptor** | **Linkage Present?** | **Risk Rating** | **Notes** |
| Direct contact/dermal absorption/soil ingestion | Operative | Yes – whilst some contamination has been revealed, the concentrations are not significant. Indeed, the majority of determinands are below detection limits. | Low | No further action required. |
| | End User | Yes – whilst some contamination has been revealed, the concentrations are not significant. Indeed, the majority of determinands are below detection limits. | Low | |
| | Neighbours | Yes – whilst some contamination has been revealed, the concentrations are not significant. Indeed, the majority of determinands are below detection limits. | Low | |
| Inhalation of Dust/Vapours | Operative | Yes – whilst some contamination has been revealed, the concentrations are not significant. Indeed the majority of determinands are below detection limits. | Low | No further action required. |
| | End User | Yes – whilst some contamination has been revealed, the concentrations are not significant. Indeed the majority of determinands are below detection limits. | Low | |
| | Neighbours | Yes – whilst some contamination has been revealed, the concentrations are not significant. Indeed, the majority of determinands are below detection limits. | Low | |
| Ingestion of fruit/vegetables and/or waters | Operative | No – no edible plants or contained water sources in the area of the proposed new works. | N/A | No further action required. |
| | End User | Yes – whilst some contamination has been revealed, the concentrations are not significant. Indeed, the majority of determinands are below detection limits. | Low | |
| | Neighbours | Yes – whilst some contamination has been revealed, the concentrations are not significant. Indeed, the majority of determinands are below detection limits. | Low | |
| Migration of hazardous gases via permeable strata or shallow mining activity | Operative | Yes – low concentrations of methane and carbon dioxide have been found to be present (site is *Characteristic Situation Level 1*). | Low | Low concentrations of harmful gases (methane and carbon dioxide) were detected at the site. No special precautionary measures are deemed to be required. |
| | End User | | Low | |
| | Neighbours | No – whilst low concentrations of ground gas have been found to be present at the site (considering *Characteristic Situation Level 1*), no structures directly adjoin the site, therefore gases migrating from the site would vent to atmosphere before reaching neighbouring structures. | N/A | |

| | | | | |
|---|---|---|---|---|
| Spillage/loss/run off direct to receiving water | Controlled Waters | Yes – whilst some controlled waters are present within 250m no significant contamination has been revealed. Indeed, the majority of determinands are below detection limits. | Low | No further action required. |
| Migration via permeable unsaturated strata | Controlled Waters | Yes – whilst there is a Secondary A aquifer within the solid geology, no significant contamination has been revealed. Indeed, the majority of determinands are below detection limits. | Low | |
| Run off via drainage/sewers etc | Controlled Waters | Yes – old services may be present on site. However, no significant contamination has been revealed. Moreover, the majority of determinands were below detection limits. | Low | |
| Direct contact with contaminated soils | Plants | Yes – whilst some contamination is present, the concentrations revealed are not significant. Moreover, the majority of determinands are below detection limits. | Low | No further action required. |
| Uptake via root system | | | Low | |
| Direct contact with contaminated soils | Building Materials | Yes – whilst some contamination is present, the concentrations revealed are not significant. Moreover, the majority of determinands are below detection limits. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1s. | Moderate (plastic services)<br>Low (buried concrete) | Please see section 11.3.3 for information on good building practice. |
| Direct contact with contaminated groundwater | | | | |
| Exposure to Radon | Operative | No – not in an area affected by radon. | N/A | Less than 1% of properties are above the action level. No radon protection measures required. |
| | End User | | | |
| UXO Risk | Operative | Yes – the Zetica[14] online maps indicate that the site is at low risk from UXO. | Low | No further action required. |
| | End User | | Low | |

[14] Pre-desk study assessment [*online resource from www.zeticauxo.com*].

## 11.3 Indicative Remediation Strategy

Whilst no significant chemical contamination was revealed, good practices should still be maintained. However, careful inspection of the sub-grade should be made during the ground-works. Should areas of contamination be detected then further testing may become necessary.

### 11.3.1 General Approach to Construction

#### 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 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 be 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.
- addition, dust masks must be provided to all site operatives for use in dry weather.
- In order for contaminated soils to be disposed of to an appropriate landfill, it may be necessary to carry out Waste Acceptance Criteria (WAC) testing in accordance with BS EN 12457.
- Any stockpiles of contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust and cross contamination of imported fill.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by dust.
- 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 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.

## 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 BS3882 (2015)
- 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 YALPAG[15] 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).

**Table 12: Validation Sampling and Testing**

| Fill Type | Frequency | Minimum Determinands |
|---|---|---|
| Virgin Quarried Material | 1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material. | Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn) |
| Crushed Hardcore, Stone, Brick | Minimum 1 per 500m³ | Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH. Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE). |
| Greenfield/ Manufactured Soils | Minimum 3<br><br>Dependent on source and receptor, between 1 per 50m$^3$ and 1 per 250m$^3$ | Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)). |
| Brownfield/ Screened Soils | Minimum 6<br><br>Dependent on source and receptor, between 1 per 50m$^3$ and 1 per 100m$^3$ | Standard metals/ metalloids (as above), PAH (16 USEPA speciation), TPH (CWG banded), asbestos, pH and SOM (or calculated from TOC). Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).. |

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 13: 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 10 for full screening values including PAHs & TPHs.

[15] *YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V4 .1* Appendix 1a, June 2021

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.

## 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 ground work contractors in relation to the requirement for testing of materials to be disposed off-site (Waste Acceptance Criteria) and the suitability of imported materials.
- Discussions with service providers regarding suitable materials for pipe work given the nature of chemical determinands found within the soils on site.
- 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


- British Geological Survey (NERC) (2023), BGS, Keyworth.
  - Geology of Britain Viewer: (*http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html)*
  - Lexicon of Named Rock Units:
  - (*http://www.bgs.ac.uk/lexicon/)*
- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-2: *Geotechnical investigation and testing – Field testing, Part 2: Dynamic Probing,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-3: *Geotechnical investigation and testing – Field testing, Part 3: Standard penetration test,* B.S.I., London.
- British Standards Institution (2015 +A1: 2020) BS 5930: *Code of practice for ground investigations,* B.S.I., London.
- British Standards Institution (2011), BS 10175: *Investigation of potentially contaminated sites – Code of Practice,* British Standards Institute.
- British Standards Institution (2015 +A1:2019) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* B.S.I., London.
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- British Standards Institution (2017) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil*, B.S.I., London.
- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: Concrete in aggressive ground, BRE Press, Garston.
  - Part C: *Assessing the aggressive chemical environment.*
  - Part D: *Specifying concrete for general cast-in-situ use.*
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.
- 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




**Notes:**

Investigation positions approximated from site operative's notes. Locations greyed from 2021 geo-environmental investigation.


Environmental Geotechnical Specialists

RGS

Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe Business Park,
Near Bank,
Shelley,
Huddersfield,
HD8 8LU

**Telephone:** 0843 50 66 87
**www.rogersgeotech.co.uk**


**Client:**

Martin Walsh Architectural

**Job Number:**

C1772/22/E/4286

**Project Details:**

Gomersal Hall, Oxford Road, Cleckheaton

**Scale:** Not to scale - reference only

# Appendix 2

## Coal Authority License

The Coal Authority

# Permit to Enter or Disturb Coal Authority Interests

**Permit 26664**

**Name and Address of Permit Holder:**

*Jonathan Haigh*
*Valley View*
*Drub Lane*
*Drighlington*
*BD19 4BX*

**Site Location:**

*Gomersal Hall*
*Oxford Road*
*Cleckheaton*
*BD19 4AT*

**This certificate hereby grants the above named Permit Holder a Permit to carry out:-**

***Ground investigation by two boreholes to 30m.***

within the Authority's interests at the identified site location above as shown on the Grant Permit Boundary (overleaf) for the period of **12 months** from the granted date shown below. *The granting of this Permit does not constitute advice given by the Authority in relation to the proposed operations. It is the Permit Holder's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.*

**Conditions:**

- *Manned entry (i.e.) into mine entries/workings) is strictly prohibited.*
- *Water flush*
- *Gas Monitoring CO, $CH_4$, $CO_2$, $O_2$ at borehole and rig*
- *Operators undertaking the work must be in possession of this certificate and the Permit boundary plan at the time of works*
- *Appropriate borehole sealing without delay and to withstand site level changes*

Signed: Helen Day Granted Date: ***15 May 2023***

For and on behalf of The Coal Authority

*Nominated Representative: Helen Day, Permitting Manager;*
*The Coal Authority, Permitting Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG*
*Tel: 01623 637450; E-Mail: permissions@coal.gov.uk*

The Coal Authority

# Granted Permit Boundary

## Permit Ref: 26664

Permit Boundary:




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# Appendix 3

## Borehole Records

# Borehole Log

Environmental Geotechnical Specialists

Borehole No. **RO1**

Sheet 1 of 3

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type RO |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/05/2023 | Logged By AB |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.30 | | | TOPSOIL. (Driller's description). |
| | | | | | 1.00 | | | Light brown CLAY. (Driller's description). |
| | | | | | 5.60 | | | Light brown SANDSTONE. (Driller's description). |
| | ▼ | 9.00 | | | 9.00 | | | Light grey MUDSTONE. (Driller's description). |
| | | | | | | | | Dark grey MUDSTONE. (Driller's description). |
| | | | | | | | | Continued on Next Sheet |

Remarks

Cased to 3.0m depth

AGS

# Borehole Log

Borehole No. **RO1**

Sheet 2 of 3

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type RO |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/05/2023 | Logged By AB |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | 14.00 | | | Light grey MUDSTONE. (Driller's description). |
| | | | | | | | | Continued on Next Sheet |

11 12 13 14 15 16 17 18 19 20

Remarks

Cased to 3.0m depth

# Borehole Log

Environmental Geotechnical Specialists

Borehole No. **RO1**

Sheet 3 of 3

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type RO |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/05/2023 | Logged By AB |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | 26.00 | | | Light brownish grey SANDSTONE. (Driller's description). |
| | | | | | 30.00 | | | End of Borehole at 30.00m |

21 22 23 24 25 26 27 28 29 30

Remarks

Cased to 3.0m depth

AGS

# Borehole Log

Environmental Geotechnical Specialists

Borehole No. **RO2**

Sheet 1 of 3

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type RO |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 23/05/2023 | Logged By AB |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.20 | | | TOPSOIL. (Driller's description). |
| | | | | | | | | Dark orangish brown CLAY. (Driller's description). |
| | | | | | 1.00 | | | Light brown SANDSTONE. (Driller's description). |
| | | | | | 5.00 | | | Light grey MUDSTONE. (Driller's description). |
| | | | | | 8.00 | | | Dark grey MUDSTONE. (Driller's description). |
| | ▼ | 10.00 | | | 10.00 | | | Continued on Next Sheet |

1 2 3 4 5 6 7 8 9 10

Remarks

Cased to 3.0m depth.

AGS

# Borehole Log

Borehole No. **RO2**

Sheet 2 of 3

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type RO |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 23/05/2023 | Logged By AB |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Light grey MUDSTONE. (Driller's description). |
| | | | | | 20.00 | | | Continued on Next Sheet |

Remarks

Cased to 3.0m depth.

# Borehole Log

Borehole No. **RO2**

Sheet 3 of 3

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type RO |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 23/05/2023 | Logged By AB |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Dark grey MUDSTONE and SANDSTONE. (Driller's description). |
| | | | | | 30.00 | | | End of Borehole at 30.00m |

21 22 23 24 25 26 27 28 29 30

Remarks

Cased to 3.0m depth.

# Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WSA**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type WLS |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 12/05/2023 | Logged By IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Dia. (mm) | TCR (%) | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.60 | ES | 57 | 100 | | 0.45 | | | TOPSOIL (Dark brown slightly gravelly silty SAND with frequent rootlets. Gravel is sub-angular to sub-rounded, fine of sandstone). |
| | | | | | | | | | | Light brown slightly clayey very sandy sub-angular to sub-rounded, fine to medium GRAVEL of sandstone. |
| | | | | 57 | 100 | | 1.20 | | | Soft to firm light brown very gravelly very sandy CLAY. Gravel is sub-angular to sub-rounded, fine to medium of sandstone. |
| | | | | | | | 1.55 | | | Extremely weak thinly laminated brown SILTSTONE. |
| | | | | | | | 1.65 | | | End of Borehole at 1.60m |

Remarks

AGS

# Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WSB**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type WLS |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 12/05/2023 | Logged By IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Dia. (mm) | TCR (%) | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.50 | ES | 57 | 95 | | 0.45 | | | TOPSOIL (Dark brown silty gravelly CLAY with frequent rootlets. Gravel is sub-angular to sub-rounded, fine to medium of sandstone). |
| | | | | | | | 0.60 | | | Soft brown slightly gravelly sandy CLAY. Gravel is sub-angular to sub-rounded, fine to medium of sandstone. |
| | | | | 47 | 90 | | 1.55 | | | Light brown slightly clayey very sandy, sub-angular to sub-rounded, fine to medium GRAVEL of sandstone. |
| | | | | | | | 2.00 | | | Extremely weak thinly laminated light brown fine to medium grained SANDSTONE with rare carbonaceous staining. |
| | | | | | | | | | | End of Borehole at 2.00m |

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

# Borehole Log

Borehole No. **WSC**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type WLS |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 12/05/2023 | Logged By IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Dia. (mm) | TCR (%) | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.65 | ES | 57 | 85 | | 0.60 | | | TOPSOIL (Soft dark brown silty very gravelly CLAY with frequent rootlets. Gravel is sub-angular to sub-rounded, fine to medium of sandstone). |
| | | | | 47 | 100 | | | | | Soft light brown sandy very gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of sandstone. |
| | | | | | | | 1.80 | | | Extremely weak thinly laminated brown clayey SILTSTONE. |
| | | | | | | | 1.85 | | | End of Borehole at 1.85m |

Remarks

# Borehole Log

Environmental Geotechnical Specialists

Borehole No. **BH1**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type RO+RC |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 23/06/2021 | Logged By DG+IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.30 | | | TOPSOIL. (Driller's description). |
| | | | | | | | | Weathered clayey SANDSTONE. (Driller's description). |
| | | | | 90 100 81 62 — 4 3 10 | 2.70 | | | Extremely weak thinly laminated light brownish grey, clayey MUDSTONE with frequent ferruginous staining. Discontinuities are closed, sub-horizontal, very closely to closely spaced, planar, rough, locally infilled with clayey silt. |
| | | | | 90 80 50 0 — 8 | 4.35 | | | Extremely weak thinly laminated light grey, clayey MUDSTONE with occasional ferruginous staining. Discontinuities are closed, sub-horizontal, very closely spaced, planar, rough, locally infilled with clayey silt. |
| | | | | 90 60 44 0 | | | | |
| | | | | 90 46 20 0 | 7.00 | | | Extremely weak thinly laminated light grey, clayey MUDSTONE with rare ferruginous staining. Discontinuities are closed, sub-horizontal, very closely spaced, planar, rough, locally infilled with gravelly silty clay. |
| | | | | 90 100 73 24 — 6 | 10.00 | | | End of Borehole at 10.00m |
| | | | | Dia. (mm) TCR (%) SCR (%) RQD (%) FI | | | | |

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

# Borehole Log

RGS Environmental Geotechnical Specialists

Borehole No. **BH2**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type RO+RC |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 23/06/2021 | Logged By IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Results | | | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 0.30 | | | TOPSOIL. (Driller's description). |
| | | | | | | | | | 1.00 | | | MADE GROUND (Brick and rubble). |
| | | | | | | | | | | | | Yellow CLAY. |
| | | 4.80 | D | 90 | 46 | 15 | 0 | 6 | 3.20 | | | Extremely weak thinly laminated light brownish grey, clayey MUDSTONE with frequent ferruginous staining. Discontinuities are closed, sub-horizontal, closely spaced, planar, rough, infilled with clayey gravel. |
| | | | | 90 | 26 | 6 | 0 | | 4.70 | | | Extremely weak thinly laminated light brownish grey, clayey MUDSTONE with frequent ferruginous staining, recovered as very gravelly CLAY with occasional corestones. |
| | | | | 90 | 46 | 36 | 0 | 23 | 6.20 | | | Extremely weak thinly laminated light grey, clayey MUDSTONE with rare ferruginous staining. Discontinuities are closed, sub-horizontal, extremely closely to very closely spaced, planar, rough, locally infilled with gravelly silty clay. |
| | | | | 90 | 46 | 13 | 0 | | 8.60 | | | Extremely weak lightly grey MUDSTONE, recovered as very gravelly silty CLAY with occasional corestones. |
| | | | | 90 | 100 | 37 | 0 | 5 | 9.20 | | | Extremely weak thinly laminated light grey, clayey MUDSTONE. Discontinuities are closed, sub-horizontal, closely spaced, planar, rough, locally infilled with gravelly silty clay. |
| | | | | Dia. (mm) | TCR (%) | SCR (%) | RQD (%) | FI | 10.00 | | | End of Borehole at 10.00m |

Remarks

AGS

RGS Environmental Geotechnical Specialists

# Borehole Log

Borehole No. **WS1**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type WLS |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/06/2021 | Logged By IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Dia. (mm) | TCR (%) | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0.25 | | | TOPSOIL (Dark brown silty clayey SAND with frequent rootlets). |
| | | | | 85 | 100 | | 0.70 | | | MADE GROUND (Light grey very sandy sub-angular to angular, fine to coarse GRAVEL with partial brick fragments. Gravel is of brick and mortar). |
| | | 0.80 | D | | | | | | | |
| | | | | 75 | 90 | | | | | Loose becoming medium dense light brown very sandy silty, sub-angular to sub-rounded, fine to coarse GRAVEL of sandstone. [Weathered Sandstone]. |
| | | 1.80 | D | | | | 1.70 | | | Very stiff brown silty CLAY with occasional orangish staining. |
| | | | | 65 | 100 | | 1.95 | | | Extremely weak thinly laminated light brownish grey SILTSTONE with occasional ferruginous and carbonaceous staining. |
| | | | | | | | 2.80 | | | End of Borehole at 2.80m |

Remarks

AGS

# Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS2**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type WLS |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/06/2021 | Logged By IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Dia. (mm) | TCR (%) | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.50 | D | 85 | 100 | | 0.35 | | | TOPSOIL (Dark brown clayey silty SAND with frequent rootlets). |
| | | | | | | | 0.60 | | | Soft brown very gravelly sandy CLAY. Gravel is sub-angular to sub-rounded, fine to medium of sandstone. |
| | | | | 75 | 100 | | 1.70 | | | Medium dense light brown silty very sandy, sub-angular to sub-rounded, fine to coarse GRAVEL of sandstone. Becomes orangish brown towards base. [Weathered sandstone]. |
| | | | | 55 | 100 | | 2.10 | | | Extremely weak thinly laminated light grey SANDSTONE. |
| | | | | | | | 2.55 | | | Loose to medium dense thinly laminated orangish brown silty fine SAND with occasional medium gravel sized corestones of sandstone. |
| | | | | | | | 2.90 | | | Extremely weak thinly laminated brown SILTSTONE with occasional ferruginous staining. |
| | | | | | | | | | | End of Borehole at 2.90m |

Remarks

AGS

# Borehole Log

Borehole No. **WS3**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type WLS |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/06/2021 | Logged By IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Dia. (mm) | TCR (%) | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.50 | D | 85 | 100 | | 0.45 | | | TOPSOIL (Dark brown silty SAND with frequent rootlets). |
| | | | | 75 | 100 | | 1.10 | | | Loose to medium dense light brown silty very sandy, sub-angular to sub-rounded, fine to coarse GRAVEL of sandstone. [Weathered Sandstone]. |
| | | | | | | | 1.60 | | | Loose light brown slightly clayey very gravelly silty SAND. Gravel is sub-angular to sub-rounded, fine to coarse of sandstone. |
| | | | | | | | 1.90 | | | Medium dense light brown very sandy, sub-angular to sub-rounded, medium to coarse, and occasionally fine GRAVEL of sandstone. |
| | | | | | | | | | | End of Borehole at 1.90m |

Remarks

# Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS4**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type WLS |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/06/2021 | Logged By IMY |

| Well | Water Strikes | Samples and In Situ Testing: Depth (m) | Type | Dia. (mm) | TCR (%) | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.60 | D | 85 | 100 | | 0.30 | | | TOPSOIL (Dark brown slightly gravelly silty SAND with frequent rootlets. Gravel is sub-angular to sub-rounded, fine of sandstone). |
| | | | | | | | 1.10 | | | MADE GROUND (Soft light brown very sandy very gravelly CLAY. Gravel is sub-angular to sub-rounded, medium to coarse and occasionally fine of sandstone. Gravel noted to be randomly oriented). [REWORKED STRATA]. |
| | | 1.50 | D | 75 | 100 | | 1.50 | | | Medium dense to dense light brown silty very sandy, sub-angular to sub-rounded, fine to coarse GRAVEL of sandstone. [Weathered Sandstone]. |
| | | | | 65 | 100 | | 1.90 | | | Stiff thinly laminated brown silty CLAY. |
| | | | | | | | 2.55 | | | Extremely weak thinly laminated brownish grey clayey SILTSTONE with occasional orangish staining. |
| | | | | | | | | | | End of Borehole at 2.55m |

Remarks

AGS

# Appendix 4

## Dynamic Probe Records

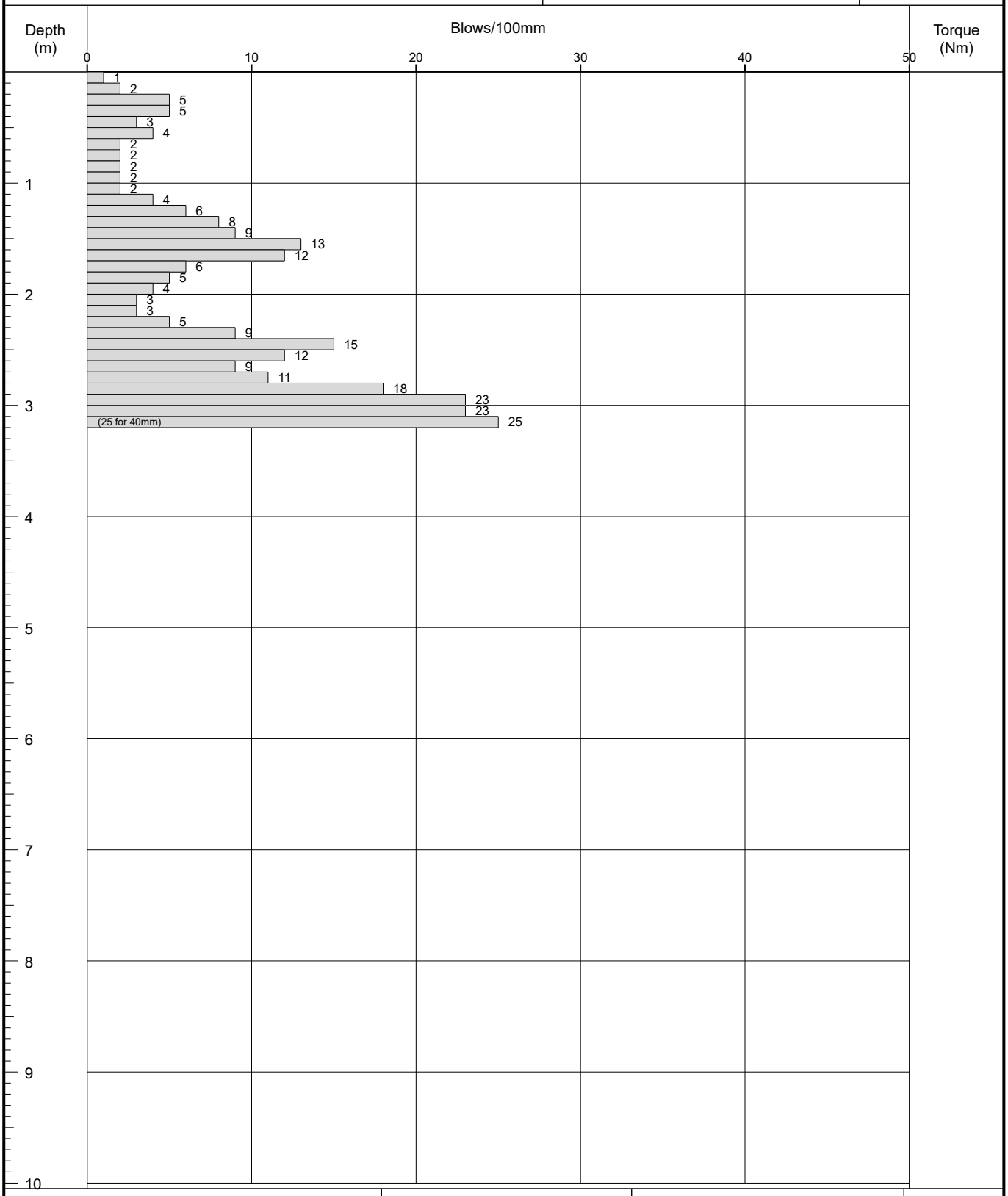
# Probe Log

Environmental Geotechnical Specialists

Probe No. **DP1**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type DCP |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/06/2021 | Logged By CG |




Remarks:

| | | | |
|---|---|---|---|
| Fall Height | 750mm | Cone Base Diameter | 50.5mm |
| Hammer Wt | 63.5kg | Final Depth | 3.2m |
| Probe Type | DPSH-B | | |

AGS

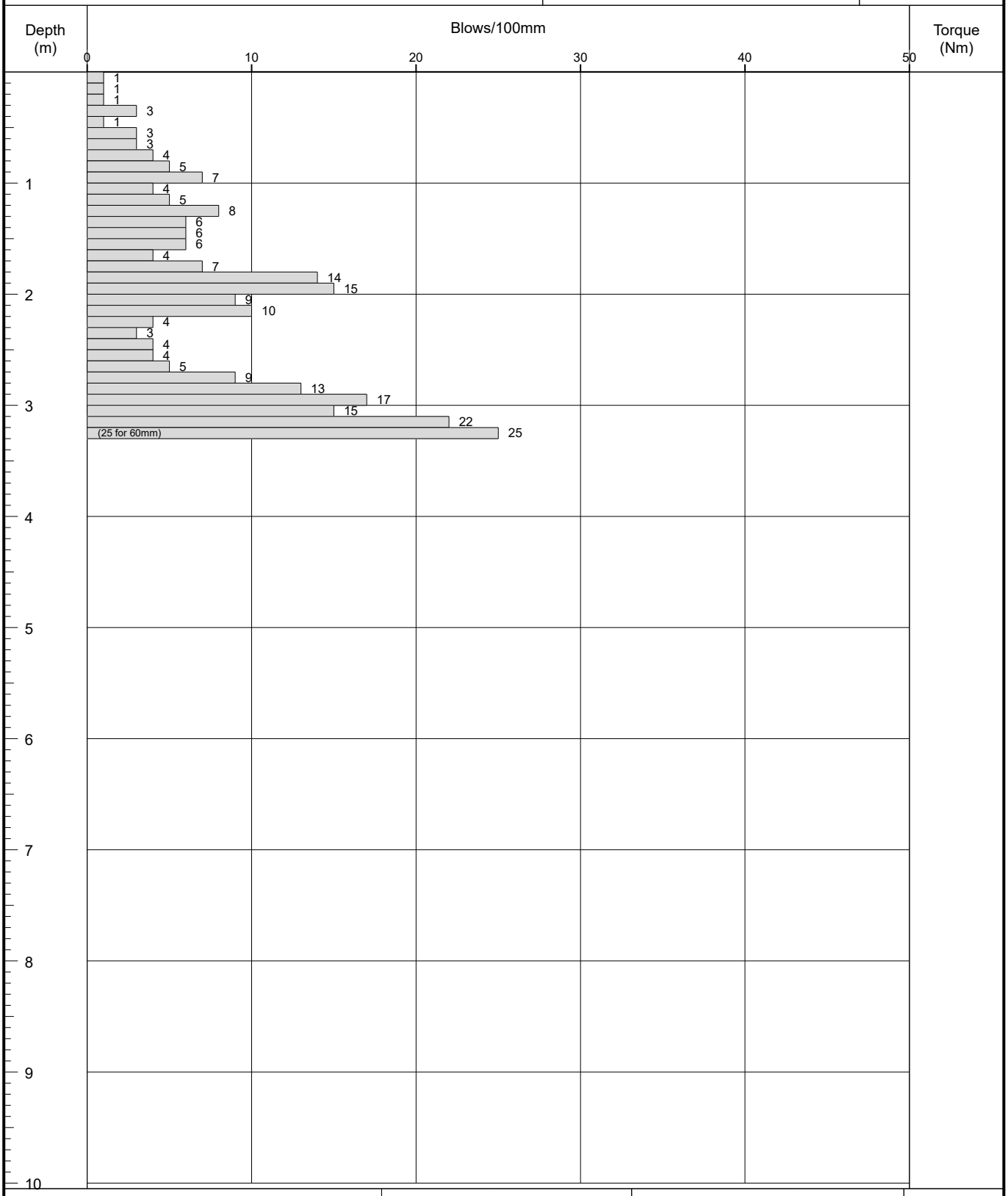
# Probe Log

Environmental Geotechnical Specialists

Probe No. **DP2**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type DCP |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/06/2021 | Logged By CG |




Remarks:

| | | | |
|---|---|---|---|
| Fall Height | 750mm | Cone Base Diameter | 50.5mm |
| Hammer Wt | 63.5kg | Final Depth | 3.3m |
| Probe Type | DPSH-B | | |

AGS

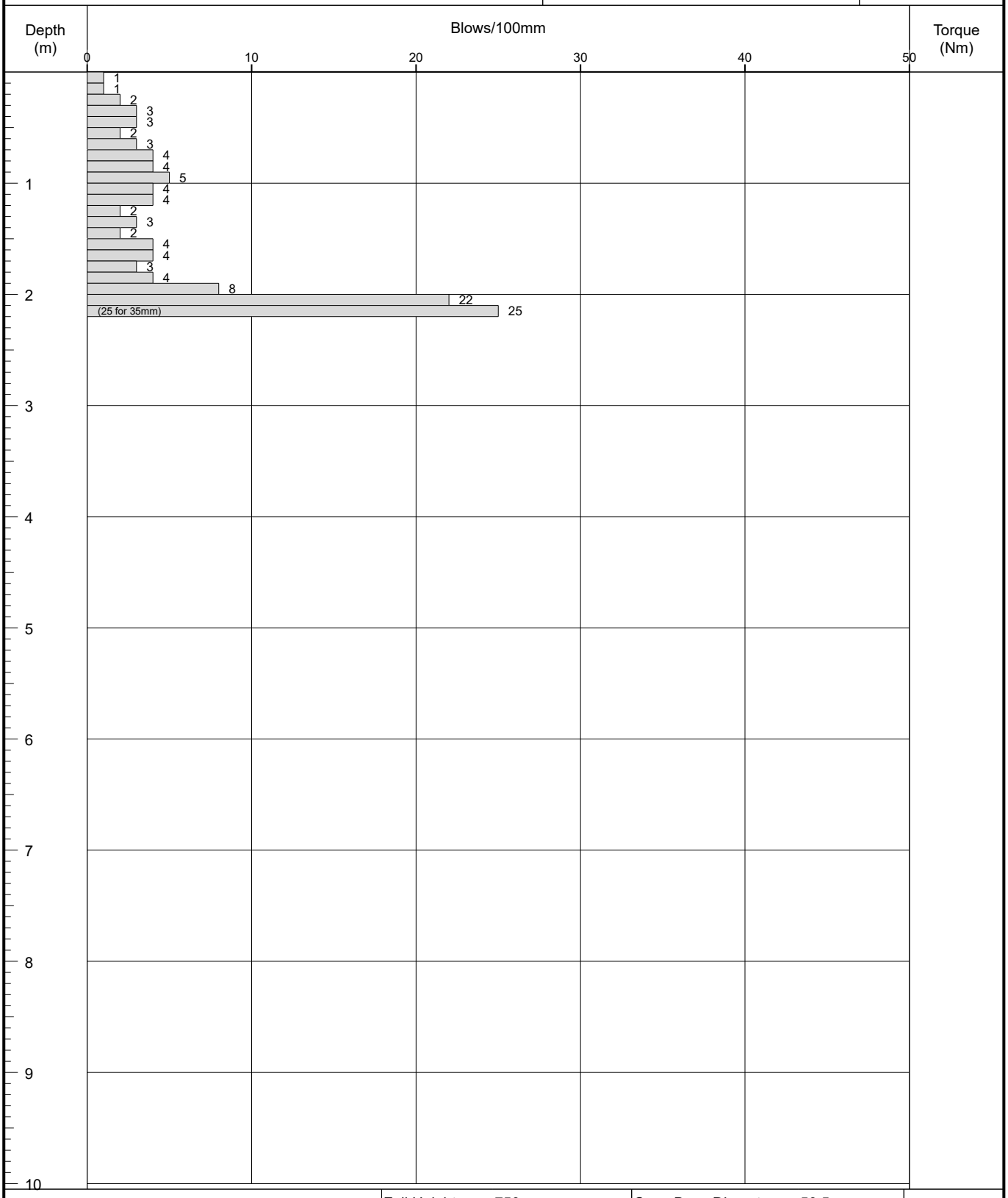
# Probe Log

Environmental Geotechnical Specialists

Probe No. **DP3**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type DCP |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/06/2021 | Logged By CG |




Remarks:

| | | | |
|---|---|---|---|
| Fall Height | 750mm | Cone Base Diameter | 50.5mm |
| Hammer Wt | 63.5kg | Final Depth | 2.2m |
| Probe Type | DPSH-B | | |

AGS

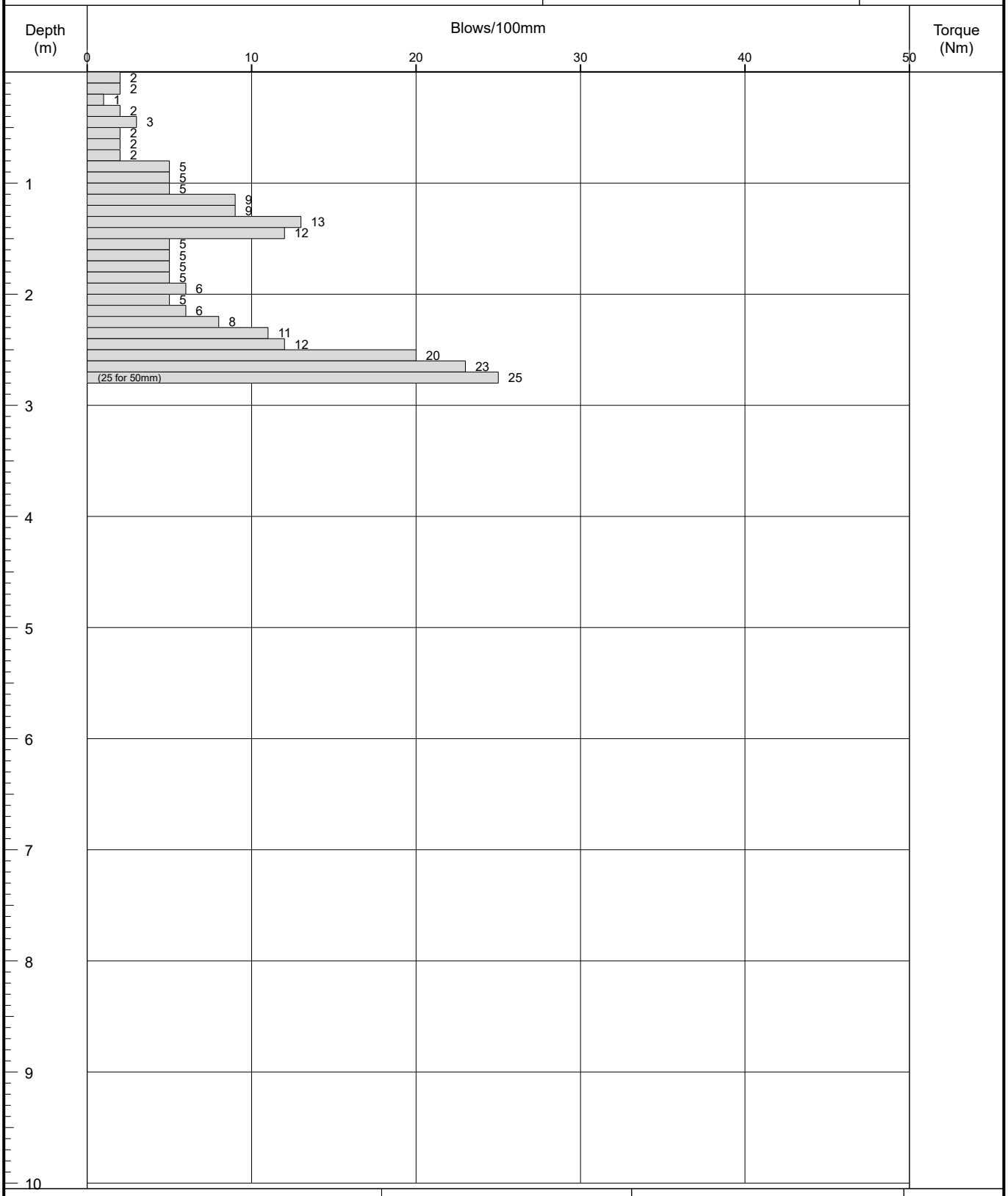
# Probe Log

Environmental Geotechnical Specialists

Probe No. **DP4**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: | Hole Type DCP |
| Location: Oxford Road, Gomersal | | Level: | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | Dates: 22/06/2021 | Logged By CG |




Remarks:

| | | | |
|---|---|---|---|
| Fall Height | 750mm | Cone Base Diameter | 50.5mm |
| Hammer Wt | 63.5kg | Final Depth | 2.8m |
| Probe Type | DPSH-B | | |

AGS

# Appendix 5

## Trial Pit Records

# Trial Pit Log

Trialpit No **TP1**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: | Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: - Level: | Date 22/06/2021 |
| Location: | Oxford Road, Gomersal | Dimensions (m): Depth 1.42 | 1.9 / 0.6 | Scale 1:50 |
| Client: | Martin Walsh Architectural Ltd | | | Logged IMY |

| Water Strike | Samples and In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.50 | | | TOPSOIL (Dark brown becoming brown slightly clayey silty SAND with frequent rootlets). |
| | | | | 0.80 | | | Firm yellowish brown sandy gravelly CLAY. Gravel is sub-angular to sub-rounded, tabular, fine to coarse of sandstone. |
| | | | | 1.42 | | | Light brown silty very sandy, sub-angular to sub-rounded, tabular, fine to coarse GRAVEL of sandstone. End of pit at 1.42 m |

Remarks:

Stability:

# Trial Pit Log

Trialpit No **TP2**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Gomersal Hall | Project No. C1772/21/E/4286 | Co-ords: - Level: | Date 22/06/2021 |
| Location: Oxford Road, Gomersal | | Dimensions (m): Depth 1.55 — 2.2 × 0.6 | Scale 1:50 |
| Client: Martin Walsh Architectural Ltd | | | Logged IMY |

| Water Strike | Samples and In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.20 | | | TOPSOIL (Dark brown sandy CLAY with frequent rootlets). |
| | | | | 0.50 | | | Brown slightly clayey silty SAND. |
| | | | | | | | Light brown silty sandy, sub-angular to sub-rounded, tabular, fine to coarse GRAVEL with high cobble content. Cobbles and gravel are of sandstone. |
| | | | | 1.55 | | | End of pit at 1.55 m |

Remarks:

Stability:

# Appendix 6

## TRL Probe Records

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

www.rogersgeotech.co.uk

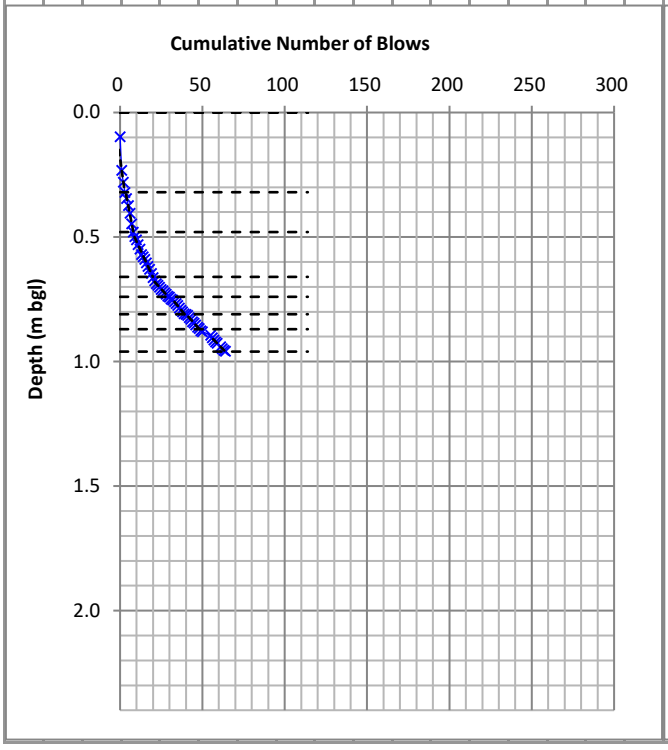
**Tel : 0843 50 66687** **Fax : 0843 51 59930**

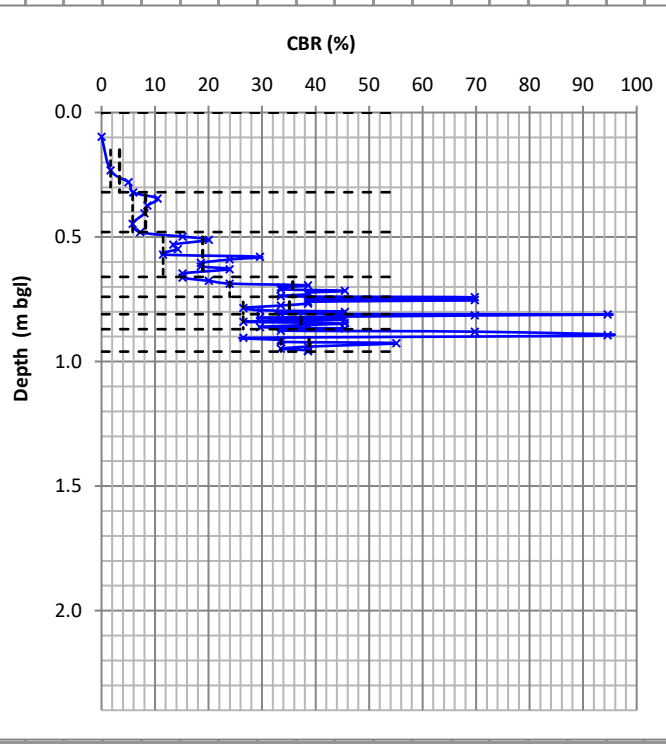
| Job No: | Location: |
|---|---|
| **C1772/21/E/4286** | TRL A |
| Site: | Client: |
| Gomersal Hall | Martin Walsh Architectural |
| Test Date: | Tested By: |
| 02/05/2023 | AG |

# IMPACT (TRL) Dynamic Cone Penetrometer

**SL970, TRL Road Note 8, 60° cone.**

| Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 97 | - | 1 | 20 | 663 | 15 | 1 | 40 | 811 | 95 |
| 1 | 1 | 232 | 2 | 1 | 21 | 676 | 20 | 1 | 41 | 815 | 70 |
| 1 | 2 | 280 | 5 | 1 | 22 | 687 | 24 | 1 | 42 | 824 | 30 |
| 1 | 3 | 321 | 6 | 1 | 23 | 694 | 39 | 1 | 43 | 830 | 45 |
| 1 | 4 | 345 | 10 | 1 | 24 | 702 | 34 | 1 | 44 | 840 | 26 |
| 1 | 5 | 374 | 9 | 1 | 25 | 710 | 34 | 1 | 45 | 846 | 45 |
| 1 | 6 | 405 | 8 | 1 | 26 | 716 | 45 | 1 | 46 | 853 | 39 |
| 1 | 7 | 447 | 6 | 1 | 27 | 723 | 39 | 1 | 47 | 862 | 30 |
| 1 | 8 | 481 | 7 | 1 | 28 | 730 | 39 | 1 | 48 | 868 | 45 |
| 1 | 9 | 498 | 15 | 1 | 29 | 738 | 34 | 1 | 49 | 876 | 34 |
| 1 | 10 | 511 | 20 | 1 | 30 | 742 | 70 | 1 | 50 | 880 | 70 |
| 1 | 11 | 530 | 13 | 1 | 31 | 749 | 39 | 5 | 55 | 895 | 95 |
| 1 | 12 | 548 | 14 | 1 | 32 | 753 | 70 | 1 | 56 | 905 | 26 |
| 1 | 13 | 570 | 12 | 1 | 33 | 760 | 39 | 1 | 57 | 913 | 34 |
| 1 | 14 | 579 | 30 | 1 | 34 | 767 | 39 | 1 | 58 | 921 | 34 |
| 1 | 15 | 590 | 24 | 1 | 35 | 775 | 34 | 1 | 59 | 926 | 55 |
| 1 | 16 | 604 | 19 | 1 | 36 | 785 | 26 | 2 | 61 | 940 | 39 |
| 1 | 17 | 618 | 19 | 1 | 37 | 794 | 30 | 1 | 62 | 948 | 34 |
| 1 | 18 | 629 | 24 | 1 | 38 | 800 | 45 | 1 | 63 | 955 | 39 |
| 1 | 19 | 646 | 15 | 1 | 39 | 808 | 34 | 1 | 64 | 959 | 39 |



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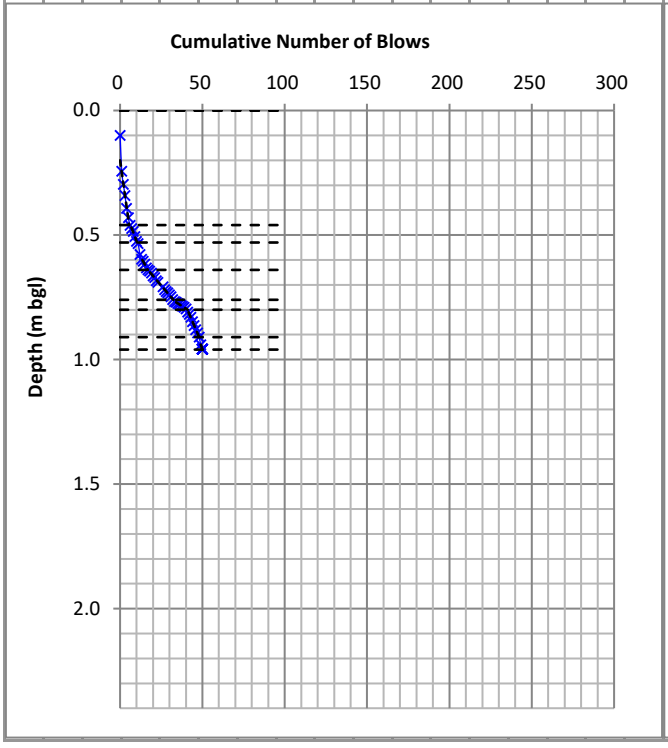
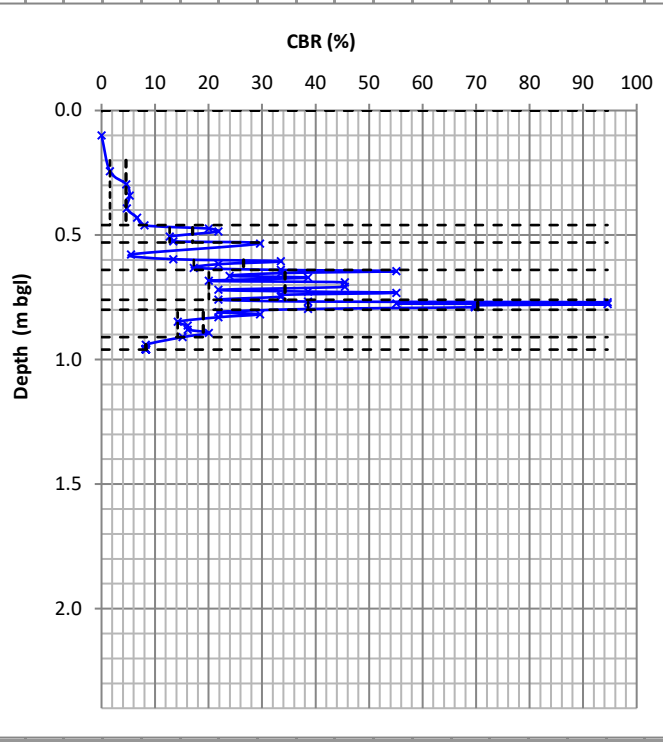
| Job No: | Location: |
|---|---|
| **C1772/21/E/4286** | TRL B |
| Site: | Client: |
| Gomersal Hall | Martin Walsh Architectural |
| Test Date: | Tested By: |
| 02/05/2023 | AG |

# IMPACT (TRL) Dynamic Cone Penetrometer

**SL970, TRL Road Note 8, 60° cone.**

| Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 100 | - | 1 | 20 | 664 | 24 | 1 | 42 | 818 | 30 |
| 1 | 1 | 244 | 2 | 1 | 21 | 671 | 39 | 1 | 43 | 830 | 22 |
| 1 | 2 | 296 | 5 | 1 | 22 | 684 | 20 | 1 | 44 | 848 | 14 |
| 1 | 3 | 342 | 5 | 1 | 23 | 690 | 45 | 1 | 45 | 864 | 16 |
| 1 | 4 | 393 | 5 | 3 | 26 | 708 | 45 | 1 | 46 | 880 | 16 |
| 1 | 5 | 430 | 7 | 1 | 27 | 720 | 22 | 1 | 47 | 893 | 20 |
| 1 | 6 | 461 | 8 | 1 | 28 | 727 | 39 | 1 | 48 | 910 | 15 |
| 1 | 7 | 474 | 20 | 1 | 29 | 732 | 55 | 1 | 49 | 940 | 8 |
| 1 | 8 | 486 | 22 | 1 | 30 | 740 | 34 | 1 | 50 | 959 | 8 |
| 1 | 9 | 506 | 13 | 1 | 31 | 748 | 34 | | | | |
| 1 | 10 | 525 | 13 | 1 | 32 | 760 | 22 | | | | |
| 1 | 11 | 534 | 30 | 1 | 33 | 767 | 39 | | | | |
| 1 | 12 | 578 | 6 | 1 | 34 | 770 | 95 | | | | |
| 1 | 13 | 597 | 13 | 1 | 35 | 775 | 55 | | | | |
| 1 | 14 | 605 | 34 | 1 | 36 | 778 | 95 | | | | |
| 1 | 15 | 617 | 22 | 1 | 37 | 782 | 70 | | | | |
| 1 | 16 | 632 | 17 | 1 | 38 | 786 | 70 | | | | |
| 1 | 17 | 640 | 34 | 1 | 39 | 790 | 70 | | | | |
| 1 | 18 | 645 | 55 | 1 | 40 | 797 | 39 | | | | |
| 1 | 19 | 653 | 34 | 1 | 41 | 809 | 22 | | | | |



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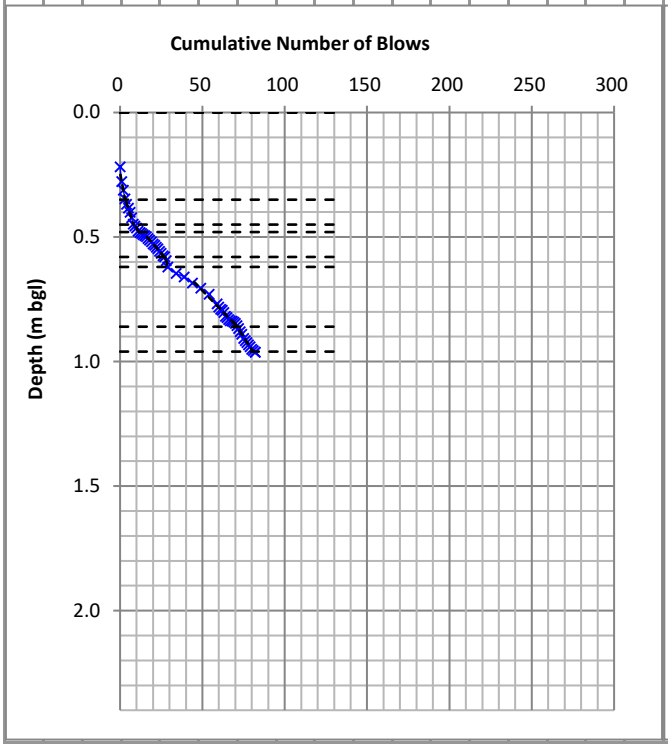
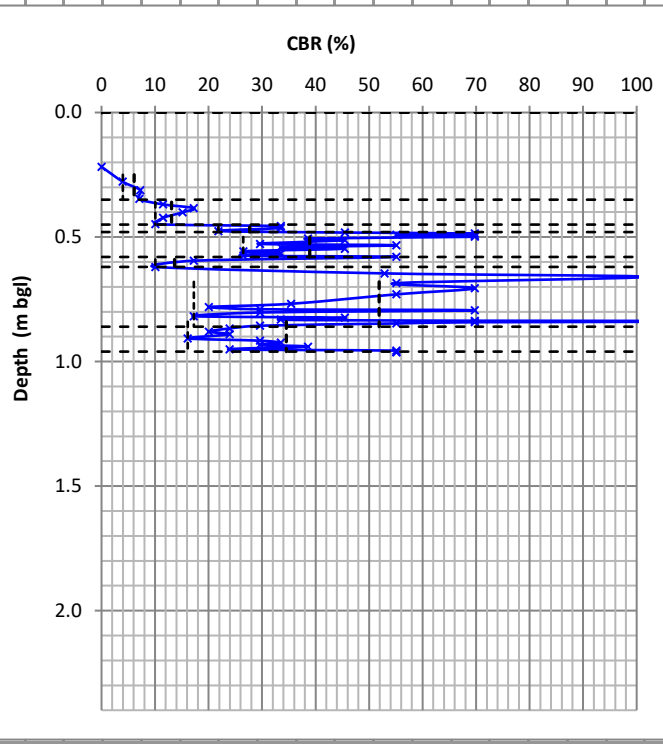
| Job No: | Location: |
|---|---|
| **C1772/21/E/4286** | TRL C |
| Site: | Client: |
| Gomersal Hall | Martin Walsh Architectural |
| Test Date: | Tested By: |
| 02/05/2023 | AG |

# IMPACT (TRL) Dynamic Cone Penetrometer

**SL970, TRL Road Note 8, 60° cone.**

| Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 218 | - | 1 | 20 | 528 | 30 | 1 | 64 | 818 | 17 |
| 1 | 1 | 278 | 4 | 1 | 21 | 533 | 55 | 1 | 65 | 824 | 45 |
| 1 | 2 | 312 | 7 | 1 | 22 | 541 | 34 | 1 | 66 | 832 | 34 |
| 1 | 3 | 347 | 7 | 1 | 23 | 547 | 45 | 1 | 67 | 836 | 70 |
| 1 | 4 | 369 | 12 | 1 | 24 | 557 | 26 | 1 | 68 | 838 | 145 |
| 1 | 5 | 384 | 17 | 1 | 25 | 565 | 34 | 1 | 69 | 842 | 70 |
| 1 | 6 | 401 | 15 | 1 | 26 | 575 | 26 | 1 | 70 | 847 | 55 |
| 1 | 7 | 423 | 12 | 1 | 27 | 580 | 55 | 1 | 71 | 856 | 30 |
| 1 | 8 | 448 | 10 | 1 | 28 | 595 | 17 | 1 | 72 | 867 | 24 |
| 1 | 9 | 456 | 34 | 1 | 29 | 620 | 10 | 1 | 73 | 880 | 20 |
| 1 | 10 | 464 | 34 | 5 | 34 | 646 | 53 | 1 | 74 | 891 | 24 |
| 1 | 11 | 476 | 22 | 5 | 39 | 660 | 102 | 1 | 75 | 907 | 16 |
| 1 | 12 | 482 | 45 | 5 | 44 | 685 | 55 | 1 | 76 | 916 | 30 |
| 1 | 13 | 486 | 70 | 5 | 49 | 705 | 70 | 1 | 77 | 924 | 34 |
| 1 | 14 | 491 | 55 | 5 | 54 | 730 | 55 | 1 | 78 | 933 | 30 |
| 1 | 15 | 495 | 70 | 5 | 59 | 768 | 35 | 1 | 79 | 940 | 39 |
| 1 | 16 | 499 | 70 | 1 | 60 | 781 | 20 | 1 | 80 | 951 | 24 |
| 1 | 17 | 506 | 39 | 1 | 61 | 790 | 30 | 1 | 81 | 956 | 55 |
| 1 | 18 | 512 | 45 | 1 | 62 | 794 | 70 | 1 | 82 | 962 | 55 |
| 1 | 19 | 519 | 39 | 1 | 63 | 803 | 30 | | | | |



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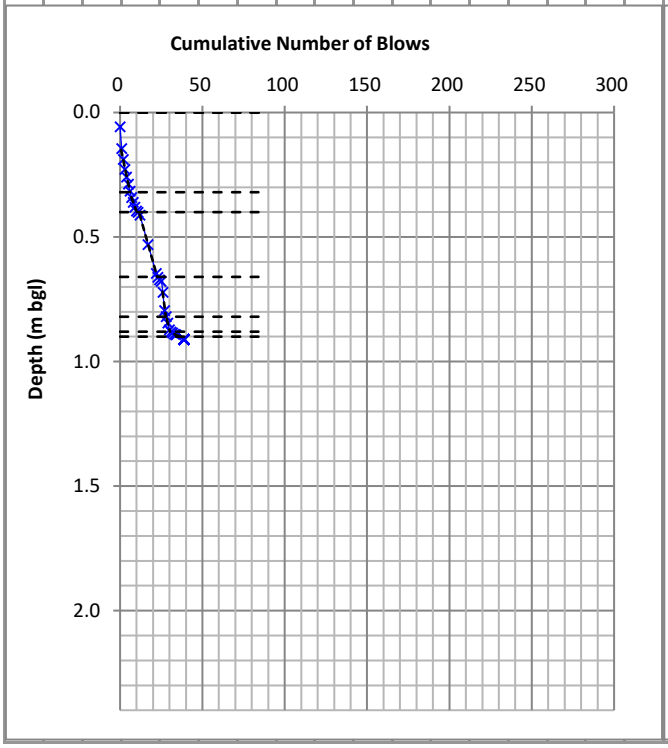
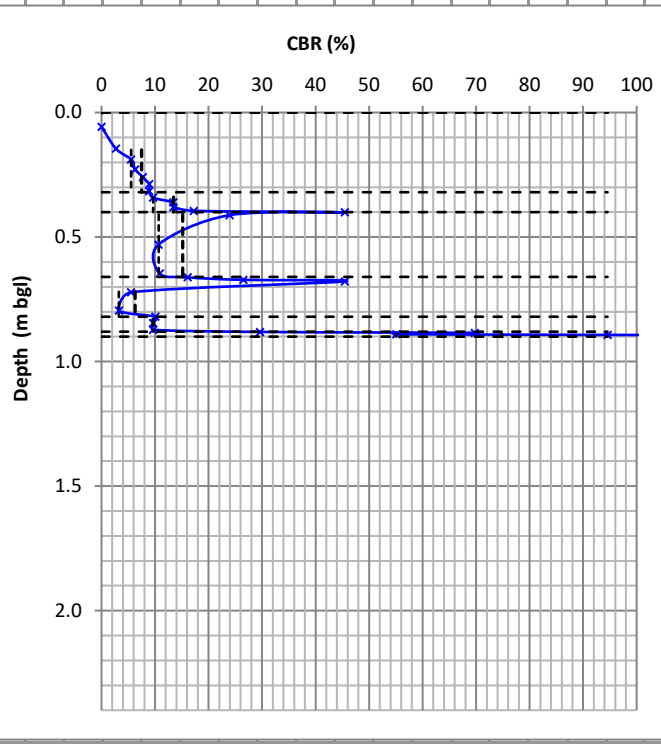
| Job No: | Location: |
|---|---|
| **C1772/21/E/4286** | TRL DCP 1 |
| Site: | Client: |
| Gomersal Hall | Martin Walsh Architectural |
| Test Date: | Tested By: |
| 22/06/2021 | RMc |

# IMPACT (TRL) Dynamic Cone Penetrometer

**SL970, TRL Road Note 8, 60° cone.**

| Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 58 | - | 1 | 28 | 820 | 10 | | | | |
| 1 | 1 | 145 | 3 | 1 | 29 | 846 | 10 | | | | |
| 1 | 2 | 189 | 6 | 1 | 30 | 872 | 10 | | | | |
| 1 | 3 | 228 | 6 | 1 | 31 | 881 | 30 | | | | |
| 1 | 4 | 260 | 8 | 1 | 32 | 885 | 70 | | | | |
| 1 | 5 | 288 | 9 | 1 | 33 | 890 | 55 | | | | |
| 1 | 6 | 316 | 9 | 1 | 34 | 893 | 95 | | | | |
| 1 | 7 | 342 | 10 | 5 | 39 | 911 | 518 | | | | |
| 1 | 8 | 361 | 13 | | | | | | | | |
| 1 | 9 | 380 | 13 | | | | | | | | |
| 1 | 10 | 395 | 17 | | | | | | | | |
| 1 | 11 | 401 | 45 | | | | | | | | |
| 1 | 12 | 412 | 24 | | | | | | | | |
| 5 | 17 | 530 | 11 | | | | | | | | |
| 5 | 22 | 646 | 11 | | | | | | | | |
| 1 | 23 | 662 | 16 | | | | | | | | |
| 1 | 24 | 672 | 26 | | | | | | | | |
| 1 | 25 | 678 | 45 | | | | | | | | |
| 1 | 26 | 722 | 6 | | | | | | | | |
| 1 | 27 | 795 | 3 | | | | | | | | |



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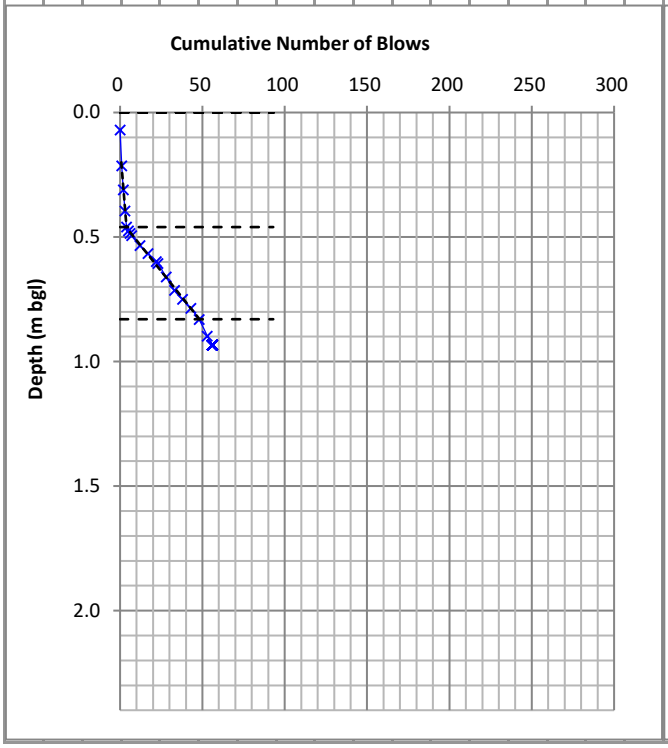
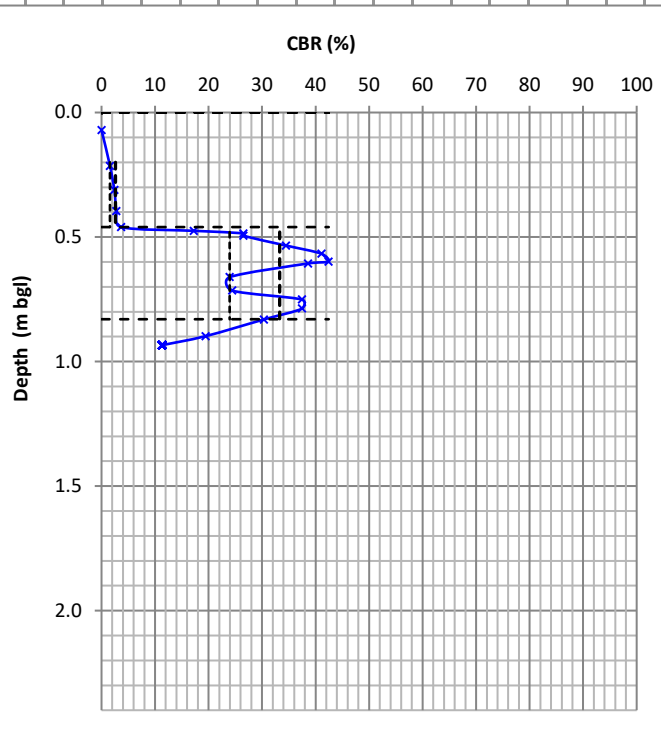
| Job No: | Location: |
|---|---|
| **C1772/21/E/4286** | TRL DCP 2 |
| Site: | Client: |
| Gomersal Hall | Martin Walsh Architectural |
| Test Date: | Tested By: |
| 22/06/2021 | RMc |

# IMPACT (TRL) Dynamic Cone Penetrometer

**SL970, TRL Road Note 8, 60° cone.**

| Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 70 | - | | | | | | | | |
| 1 | 1 | 214 | 2 | | | | | | | | |
| 1 | 2 | 311 | 2 | | | | | | | | |
| 1 | 3 | 395 | 3 | | | | | | | | |
| 1 | 4 | 460 | 4 | | | | | | | | |
| 1 | 5 | 475 | 17 | | | | | | | | |
| 1 | 6 | 485 | 26 | | | | | | | | |
| 1 | 7 | 495 | 26 | | | | | | | | |
| 5 | 12 | 534 | 34 | | | | | | | | |
| 5 | 17 | 567 | 41 | | | | | | | | |
| 5 | 22 | 599 | 42 | | | | | | | | |
| 1 | 23 | 606 | 39 | | | | | | | | |
| 5 | 28 | 661 | 24 | | | | | | | | |
| 5 | 33 | 715 | 24 | | | | | | | | |
| 5 | 38 | 751 | 37 | | | | | | | | |
| 5 | 43 | 787 | 37 | | | | | | | | |
| 5 | 48 | 831 | 30 | | | | | | | | |
| 5 | 53 | 898 | 19 | | | | | | | | |
| 3 | 56 | 934 | 11 | | | | | | | | |



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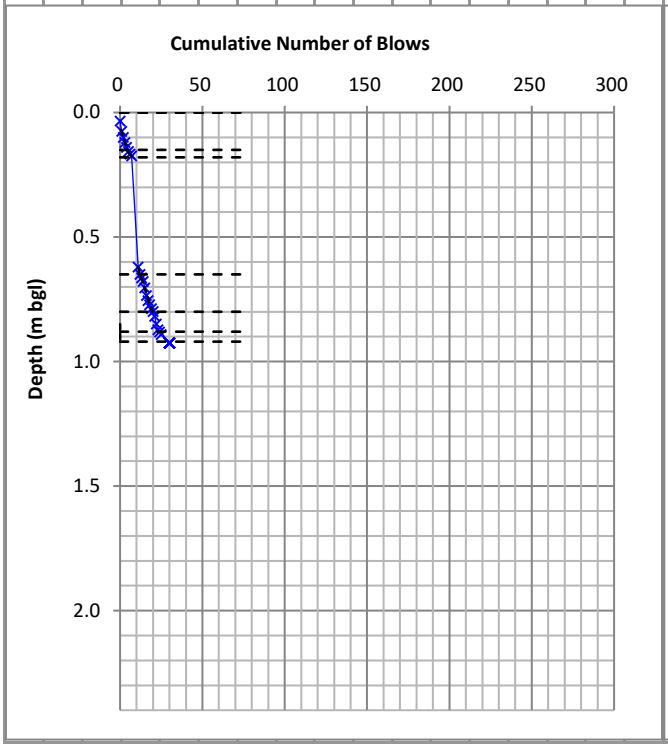
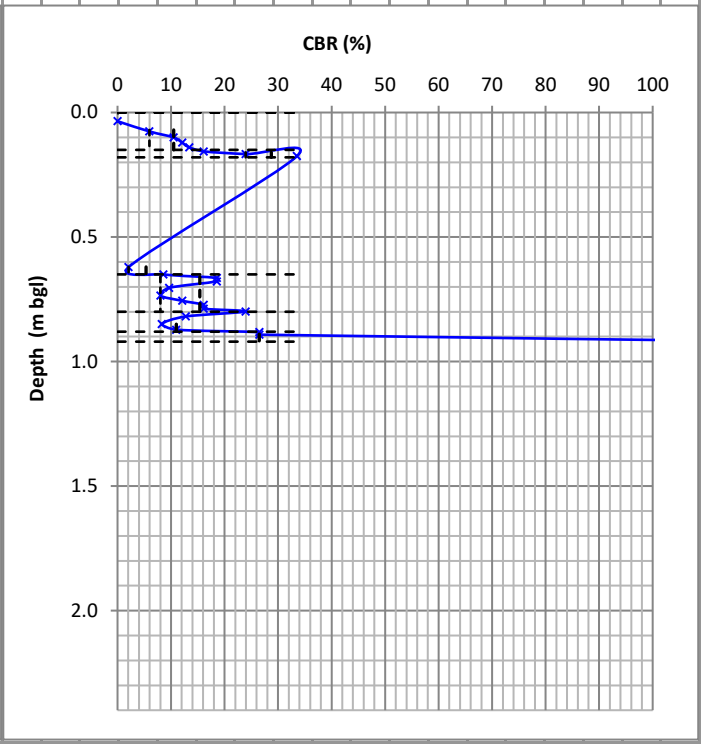
| Job No: | Location: |
|---|---|
| **C1772/21/E/4286** | TRL DCP 3 |
| Site: | Client: |
| Gomersal Hall | Martin Walsh Architectural |
| Test Date: | Tested By: |
| 22/06/2021 | RMc |

# IMPACT (TRL) Dynamic Cone Penetrometer

**SL970, TRL Road Note 8, 60° cone.**

| Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 35 | - | 1 | 23 | 872 | 11 | | | | |
| 1 | 1 | 76 | 6 | 1 | 24 | 882 | 26 | | | | |
| 1 | 2 | 100 | 10 | 1 | 25 | 892 | 26 | | | | |
| 1 | 3 | 121 | 12 | 5 | 30 | 925 | 145 | | | | |
| 1 | 4 | 140 | 13 | | | | | | | | |
| 1 | 5 | 156 | 16 | | | | | | | | |
| 1 | 6 | 167 | 24 | | | | | | | | |
| 1 | 7 | 175 | 34 | | | | | | | | |
| 4 | 11 | 621 | 2 | | | | | | | | |
| 1 | 12 | 650 | 9 | | | | | | | | |
| 1 | 13 | 664 | 19 | | | | | | | | |
| 1 | 14 | 678 | 19 | | | | | | | | |
| 1 | 15 | 704 | 10 | | | | | | | | |
| 1 | 16 | 735 | 8 | | | | | | | | |
| 1 | 17 | 756 | 12 | | | | | | | | |
| 1 | 18 | 772 | 16 | | | | | | | | |
| 1 | 19 | 788 | 16 | | | | | | | | |
| 1 | 20 | 799 | 24 | | | | | | | | |
| 1 | 21 | 819 | 13 | | | | | | | | |
| 1 | 22 | 849 | 8 | | | | | | | | |



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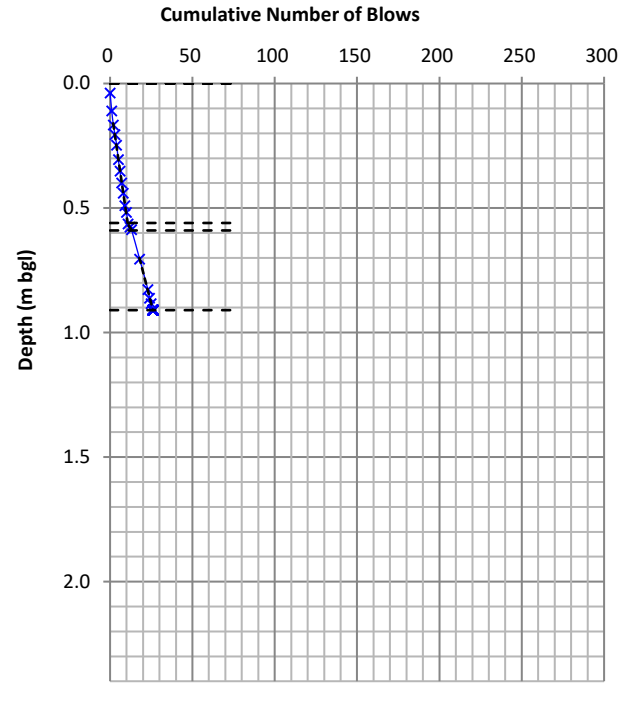
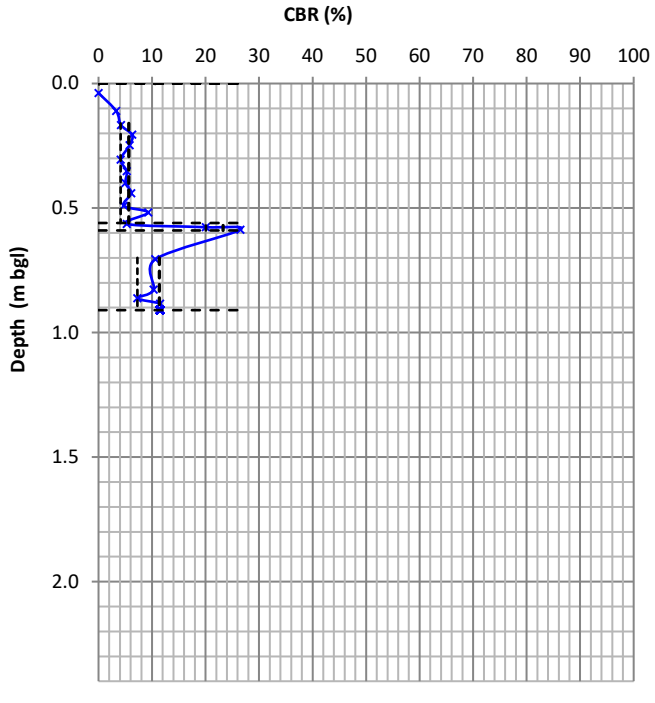
| Job No: | Location: |
|---|---|
| **C1772/21/E/4286** | TRL DCP 4 |
| Site: | Client: |
| Gomersal Hall | Martin Walsh Architectural |
| Test Date: | Tested By: |
| 22/06/2021 | RMc |

# IMPACT (TRL) Dynamic Cone Penetrometer

**SL970, TRL Road Note 8, 60° cone.**

| Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) | Blow Count | Total Blows | Depth (mm) | CBR (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 38 | - | | | | | | | | |
| 1 | 1 | 110 | 3 | | | | | | | | |
| 1 | 2 | 167 | 4 | | | | | | | | |
| 1 | 3 | 206 | 6 | | | | | | | | |
| 1 | 4 | 248 | 6 | | | | | | | | |
| 1 | 5 | 306 | 4 | | | | | | | | |
| 1 | 6 | 352 | 5 | | | | | | | | |
| 1 | 7 | 400 | 5 | | | | | | | | |
| 1 | 8 | 440 | 6 | | | | | | | | |
| 1 | 9 | 491 | 5 | | | | | | | | |
| 1 | 10 | 518 | 9 | | | | | | | | |
| 1 | 11 | 564 | 5 | | | | | | | | |
| 1 | 12 | 577 | 20 | | | | | | | | |
| 1 | 13 | 587 | 26 | | | | | | | | |
| 5 | 18 | 706 | 11 | | | | | | | | |
| 5 | 23 | 828 | 10 | | | | | | | | |
| 1 | 24 | 862 | 7 | | | | | | | | |
| 1 | 25 | 884 | 12 | | | | | | | | |
| 1 | 26 | 910 | 12 | | | | | | | | |



# Appendix 7

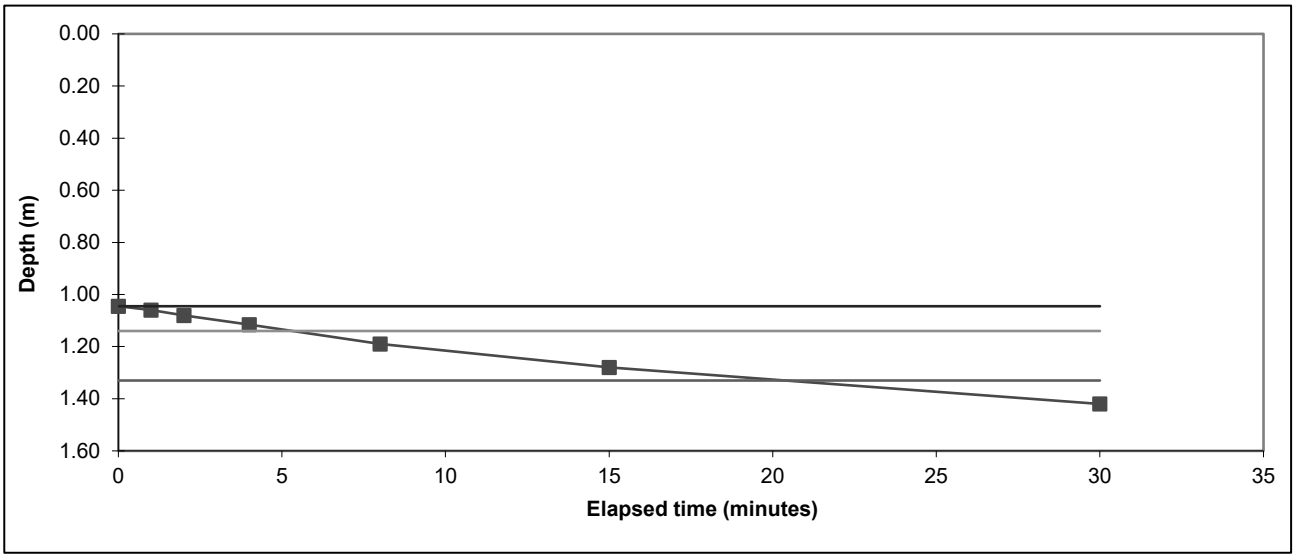
## Soakaway Test Results

# Rogers Geotechnical Services L

## Soakaway Test

| | | | | | |
|---|---|---|---|---|---|
| Trial Pit No: | TP1 | Test No: | 1 | Date: | 22/06/2021 |
| Length (m): | 1.900 | | Datum Height: | 0.00 | m agl |
| Width (m): | 0.60 | | Granular infill: | None | |
| Depth (m): | 1.42 | | Porosity of infill: | 1 | (assumed) |

| Elapsed time (minutes) | Water Depth (m below datum) | Elapsed time (minutes) | Water Depth (m below datum) |
|---|---|---|---|
| 0 | 1.045 | | |
| 1 | 1.060 | | |
| 2 | 1.080 | | |
| 4 | 1.115 | | |
| 8 | 1.190 | | |
| 15 | 1.280 | | |
| 30 | 1.420 | | |




| | | | |
|---|---|---|---|
| Start water depth for analysis (mbgl): | 1.05 | | |
| 75% effective depth (mbgl): | 1.14 | Elapsed time (mins): | 5.3 |
| 50% effective depth (mbgl): | 1.23 | | |
| 25% effective depth (mbgl): | 1.33 | Elapsed time (mins): | 20.4 |
| Base of soakage zone (mbgl): | 1.42 | | |

| | |
|---|---|
| Volume outflow between 75% and 25% effective depth ($m^3$): | 0.217 |
| Mean surface area of outflow ($m^2$): | 2.09 |
| (side area at 50% effective depth + base area) | |
| Time for outflow between 75% and 25% effective depth (mins): | 15.1 |

| **Soil infiltration rate (m/s):** | **1.1E-4** |
|---|---|

**Remarks** Results processed following BRE 365 (2007).

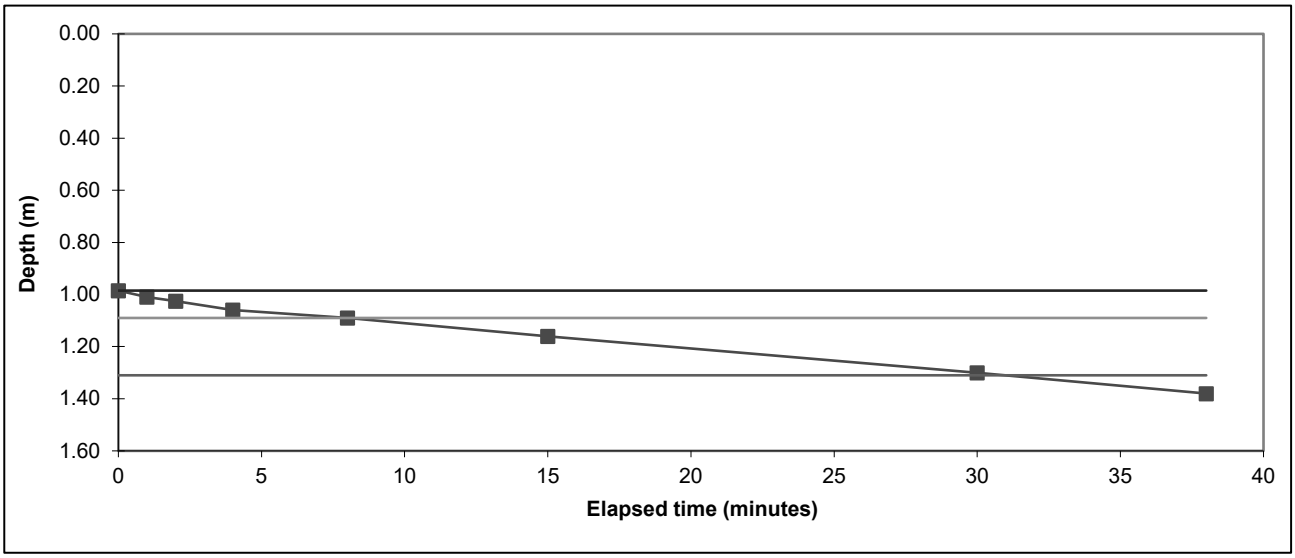
| | | |
|---|---|---|
| **Client:** | Martin Walsh Associates Ltd | **Job No:** |
| **Site:** | Gomersal Hall, Oxford Road, Gomersal | C1772/21/E/2766 |

# Rogers Geotechnical Services L

## Soakaway Test

| | | | | | |
|---|---|---|---|---|---|
| Trial Pit No: | TP1 | Test No: | 2 | Date: | 22/06/2021 |
| Length (m): | 1.900 | | Datum Height: | 0.00 | m agl |
| Width (m): | 0.60 | | Granular infill: | None | |
| Depth (m): | 1.42 | | Porosity of infill: | 1 | (assumed) |

| Elapsed time (minutes) | Water Depth (m below datum) | Elapsed time (minutes) | Water Depth (m below datum) |
|---|---|---|---|
| 0 | 0.985 | | |
| 1 | 1.010 | | |
| 2 | 1.025 | | |
| 4 | 1.060 | | |
| 8 | 1.090 | | |
| 15 | 1.160 | | |
| 30 | 1.300 | | |
| 38 | 1.380 | | |




| | | | |
|---|---|---|---|
| Start water depth for analysis (mbgl): | 0.99 | | |
| 75% effective depth (mbgl): | 1.09 | Elapsed time (mins): | 8.0 |
| 50% effective depth (mbgl): | 1.20 | | |
| 25% effective depth (mbgl): | 1.31 | Elapsed time (mins): | 31.0 |
| Base of soakage zone (mbgl): | 1.42 | | |

| | |
|---|---|
| Volume outflow between 75% and 25% effective depth ($m^3$): | 0.251 |
| Mean surface area of outflow ($m^2$): | 2.24 |
| (side area at 50% effective depth + base area) | |
| Time for outflow between 75% and 25% effective depth (mins): | 23.0 |

| **Soil infiltration rate (m/s):** | **8.1E-5** |
|---|---|

**Remarks** Results processed following BRE 365 (2007).

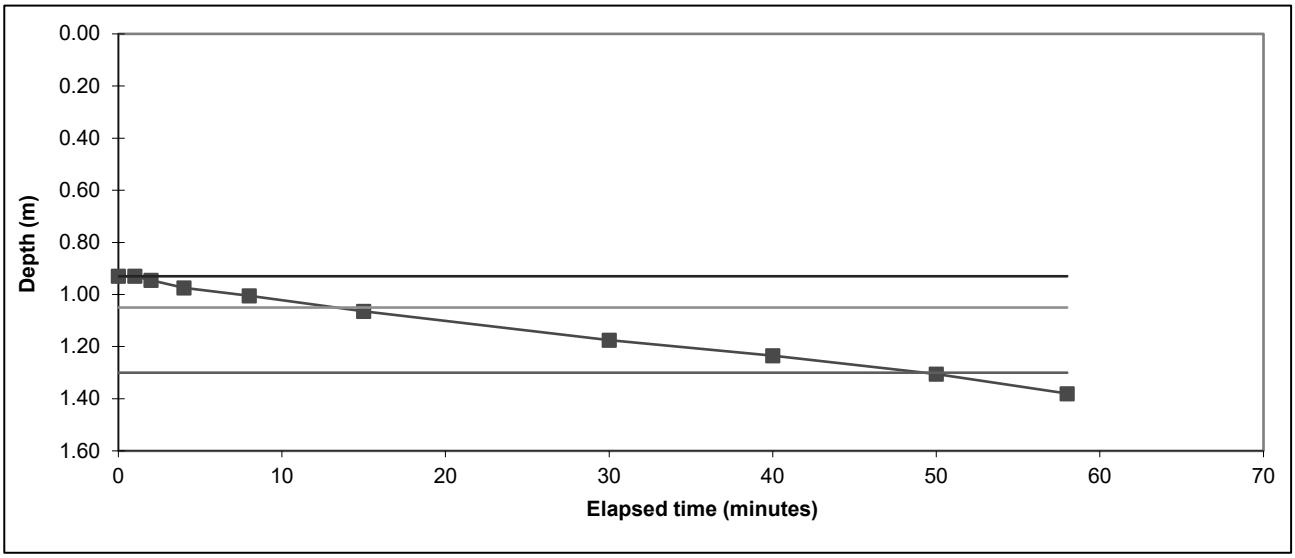
| | | |
|---|---|---|
| **Client:** | Martin Walsh Associates Ltd | **Job No:** |
| **Site:** | Gomersal Hall, Oxford Road, Gomersal | C1772/21/E/2766 |

# Rogers Geotechnical Services L

## Soakaway Test

| | | | | | |
|---|---|---|---|---|---|
| Trial Pit No: | TP1 | Test No: | 3 | Date: | 22/06/2021 |
| Length (m): | 1.900 | | Datum Height: | 0.00 | m agl |
| Width (m): | 0.60 | | Granular infill: | None | |
| Depth (m): | 1.42 | | Porosity of infill: | 1 | (assumed) |

| Elapsed time (minutes) | Water Depth (m below datum) | Elapsed time (minutes) | Water Depth (m below datum) |
|---|---|---|---|
| 0 | 0.930 | | |
| 1 | 0.930 | | |
| 2 | 0.945 | | |
| 4 | 0.975 | | |
| 8 | 1.005 | | |
| 15 | 1.065 | | |
| 30 | 1.175 | | |
| 40 | 1.235 | | |
| 50 | 1.305 | | |
| 58 | 1.380 | | |




| | | | |
|---|---|---|---|
| Start water depth for analysis (mbgl): | 0.93 | | |
| 75% effective depth (mbgl): | 1.05 | Elapsed time (mins): | 13.3 |
| 50% effective depth (mbgl): | 1.18 | | |
| 25% effective depth (mbgl): | 1.30 | Elapsed time (mins): | 49.3 |
| Base of soakage zone (mbgl): | 1.42 | | |

| | |
|---|---|
| Volume outflow between 75% and 25% effective depth ($m^3$): | 0.285 |
| Mean surface area of outflow ($m^2$): | 2.34 |
| (side area at 50% effective depth + base area) | |
| Time for outflow between 75% and 25% effective depth (mins): | 36.0 |

| **Soil infiltration rate (m/s):** | **5.6E-5** |
|---|---|

**Remarks** Results processed following BRE 365 (2007).

| | | |
|---|---|---|
| **Client:** | Martin Walsh Associates Ltd | **Job No:** |
| **Site:** | Gomersal Hall, Oxford Road, Gomersal | C1772/21/E/2766 |

# Appendix 8

## Gas Monitoring Sheets

**Rogers Geotechnical Services Ltd**

**GAS/WATER MONITORING - SITE RECORD**

**Client:** Martin Walsh Architectural Ltd
**Site:** Gomersal Hall, Gomersal

**Gas Monitor:** Geotech GA5000
Serial No. G503524
Calibration Date: 01.02.2023
Dip Meter: 003

*(If second monitor is used)*
**Gas Monitor:**
Serial No.
Calibration Date:
Dip Meter

Input by : M. Tuck

Date : 13.06.2023

| Borehole No | Date | $CH_4$ (%) | $CO_2$ (%) | $O_2$ (%) | Flow (l/hr) | Barometric Pressure (mb) | Water Level (m) | Standpipe Depth (m) | Depth During Visit | Atmospheric Conditions | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WSA | 23.05.2023 | **0.1** | 3.0 | **16.5** | **0.0** | 1012 | _ | | 1.77 | Sunny | Steady pressure CO 0 |
| | 30.05.2023 | **0.0** | **2.7** | 18.1 | **0.0** | 1017 | _ | | 1.77 | Overcast | Steady pressure CO 0 |
| | 06.06.2023 | **0.1** | 2.8 | 18.7 | **0.0** | 1011 | _ | | 1.77 | Overcast | Steady pressure CO 0 |
| | 13.06.2023 | **0.0** | 2.8 | **19.3** | **0.0** | **1002** | _ | | 1.77 | Sunny | Steady pressure CO 0 |
| WSC | 23.05.2023 | **0.1** | **4.7** | 17.6 | **0.0** | 1012 | _ | | 1.86 | Sunny | Steady pressure CO 1 |
| | 30.05.2023 | **0.1** | 4.6 | 18.3 | **0.0** | **1018** | _ | | 1.86 | Overcast | Steady pressure CO 0 |
| | 06.06.2023 | **0.1** | 4.4 | 19.1 | **0.0** | 1011 | _ | | 1.86 | Overcast | Steady pressure CO 0 |
| | 13.06.2023 | **0.1** | **4.7** | 19.0 | **0.0** | 1003 | _ | | 1.86 | Sunny | Stwady pressure CO 0 |

# CERTIFICATION OF CALIBRATION

4533

**Date Of Calibration:** 01-Feb-2023

**Certificate Number:** G503524_2/32095

Issued by: QED Environmental Systems Ltd.

**Customer:** **QED Environmental Systems Ltd (Lease)**
Barncliffe Mills Near Bank Shelley
HUDDERSFIELD HD8 8LU UNITED KINGDOM

**Description:** Gas Analyser

**Model:** GA5000

**Serial Number:** G503524

**UKAS Accredited results:**

Results after adjustment :

| Methane ($CH_4$) | | |
|---|---|---|
| **Certified Gas (%)** | **Instrument Reading (%)** | **Uncertainty (%)** |
| 5.0 | 4.9 | 0.072 |
| 15.0 | 15.0 | 0.13 |
| 60.0 | 59.7 | 0.42 |

| Carbon Dioxide ($CO_2$) | | |
|---|---|---|
| **Certified Gas (%)** | **Instrument Reading (%)** | **Uncertainty (%)** |
| 5.0 | 5.0 | 0.074 |
| 15.0 | 15.0 | 0.13 |
| 40.0 | 40.1 | 0.29 |

| Oxygen ($O_2$) | | |
|---|---|---|
| **Certified Gas (%)** | **Instrument Reading (%)** | **Uncertainty (%)** |
| 21.5 | 21.6 | 0.25 |

The inwards assessment was carried out 25-Jan-2023.
The maximum adjustment is larger than the specification limit.
Inwards assessment data is available if requested.

All concentrations are molar.

$CH_4$, $CO_2$ readings recorded at : 30.6 °C ± 2.5 °C

O2 readings recorded at : 22.1 °C ± 2.5 °C

Barometric Pressure : 1012 mbar ± 4 mbar

Method of Test : The analyser is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure LP004.

Instrument has passed calibration as the measurement result is within the specification limit. The specification limit takes into account the measurement uncertainty.
The results relate only to the item calibrated

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Calibration Instance:114 IGC Instance:114



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QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

# CERTIFICATION OF CALIBRATION

4533

**Date Of Calibration:** 01-Feb-2023

**Certificate Number:** G503524_2/32095

Issued by: QED Environmental Systems Ltd.

*The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.*

Calibrations marked 'Non-UKAS Accredited results' on this certificate have been included for completeness.

**Non-UKAS accredited results after adjustment:**

| Barometer (mbar) | |
|---|---|
| **Reference** | **Instrument Reading** |
| 1012 | 1012 |

| Additional Gas Cells | | |
|---|---|---|
| **Gas** | **Certified Gas (ppm)** | **Instrument Reading (ppm)** |
| CO | 505 | 505 |
| $H_2S$ | 258.8 | 259 |

**Date of Issue :** 09-Feb-2023 **Approved by Signatory** Keeley Knight

Laboratory Inspection

End of Certificate

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Calibration Instance:114 IGC Instance:114



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QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

# Instrument Service Report

| Unit Type: GA5000 | Part Number: | Date: | Next Service Due: | Customer Name: |
|---|---|---|---|---|
| Serial Number: G503524 | GA5KB0C0-301 | 09-Feb-2023 | 01-Aug-2023 | QED Environmental Systems Ltd (Lease) |

| Actions/Investigation Description | Result | Comments |
|---|---|---|
| Serial Number Check | Yes | |
| Battery Requires Replacing | Yes | Battery replaced |
| Internal Flow Calibrated | Yes | Internal flow calibrated – please reference calibration certificate |
| Full Automatic Calibration | Pass | |
| Serial Comms Test (USB) | Pass | |
| Service history of instrument reviewed | Yes | |
| Inwards gas check data reviewed | Yes | |
| Instrument turns on | Pass | |
| Backlight operates correctly | Yes | |
| External visual inspection performed | Pass | |
| Internal visual inspection performed | Pass | |
| All screws tightened to correct torque | Yes | |
| All connectors are secure | Pass | |
| Check diagnostic channels | Pass | |
| Case compression test | Pass | |
| Impact and stability test | Pass | |
| Pressure transducer test(s) as per user operation | Pass | |

# Instrument Service Report

| Unit Type: GA5000 | Part Number: | Date: | Next Service Due: | Customer Name: |
|---|---|---|---|---|
| Serial Number: G503524 | GA5KB0C0-301 | 09-Feb-2023 | 01-Aug-2023 | QED Environmental Systems Ltd (Lease) |

| Actions/Investigation Description | Result | Comments |
|---|---|---|
| Final visual inspection on instrument | Pass | |
| Case assembly closed and screws tightened to correct torque | Yes | |
| PTFE filters replaced | Yes | Filter saturated, replaced |
| Pump flow greater than 550 ml/min | Pass | |
| Automated instrument pressure system test (leak test) | Pass | |
| Pump vacuum greater than -400 mb and flow fails | Pass | |
| GPS function test | Pass | |
| Temperature probe tested | Pass | |
| Anemometer tested | Pass | |
| Chemical gas sensors calibrated – refer to Calibration Certificate | Pass | |
| Check main PCB and sensor PCB have the latest software | Yes | |
| Transducers calibrated | Pass | |
| As Received Chemical Cell Gas Assessment Performed (CAL16) | No | Possibly flooded or blocked |
| As Received Gas Assessment Performed (CAL01 or CAL02) | Yes | |
| Chemical sensor(s) replacement over 2yrs UK and 21mths overseas. | Yes | CO and H2S sensors replaced |
| O2 sensor replacement over 3yrs UK, 33mths overseas | Pass | |

# Instrument Service Report

| Unit Type: GA5000 | Part Number: | Date: | Next Service Due: | Customer Name: |
|---|---|---|---|---|
| Serial Number: G503524 | GA5KB0C0-301 | 09-Feb-2023 | 01-Aug-2023 | QED Environmental Systems Ltd (Lease) |

| Actions/Investigation Description | Result | Comments |
|---|---|---|
| Verification of Instrument | Pass | |

## Customer Comments

Returned for full service and calibration

| Accessory Test | Result | Comments |
|---|---|---|
| Charger | Pass | 5K Charger Voltage test box indicates charger voltage and current output are in spec. |
| Download Lead | Pass | Data transfer successful. |

## General Comments/Feedback

# Instrument Service Report

| Unit Type: GA5000 | Part Number: | Date: | Next Service Due: | Customer Name: |
|---|---|---|---|---|
| Serial Number: G503524 | GA5KB0C0-301 | 09-Feb-2023 | 01-Aug-2023 | QED Environmental Systems Ltd (Lease) |

"Thank you for returning your gas analyser to the QED Service Centre for full service and calibration. We are pleased to inform you that the analyser was received and fully assessed by one of our experienced Service Engineers and no significant faults or issues were observed during the assessment. Our extensive service was carried out, and any necessary components replaced.

We have replaced the internal inlet PTFE filter due to it being discoloured as a result of water being drawn into the analyser as part of its sample and caused the flow fail. Please ensure that when using the analyser that an inline water-trap assembly is used and the filters used are replaced at regular intervals.
The CO electrochemical sensor has been replaced due to it being over 2 years old in accordance with the manufacturer's recommendations, and also as a proactive measure based on our experience of the typical lifetime of this type of sensor.
The H2S electrochemical sensor has been replaced due to it being over 2 years old in accordance with the manufacturer's recommendations, and also as a proactive measure based on our experience of the typical lifetime of this type of sensor.
We have replaced the battery because it is over 2 years old. This is in accordance to the battery cell manufacturer's recommendation.

The analyser has successfully passed all of our rigorous testing and quality checks and has been calibrated using our bespoke, state of the art calibration facility.
For further information about how to get the best use from your instrument please visit our YouTube channel http://www.youtube.com/GeotechTV and on our Website https://qedenv.com

If you require any further assistance with your instrument please email our Technical Support Team at technical@qedenv.co.uk or call us on +44 (0) 333 800 0088 (Monday to Thursday 08.30 - 17.00 & Friday 08.30 - 15.30) UK time zone."

| Service Details: | | Service Engineer: | Calibration Engineer: | Approved By: | Signature: |
|---|---|---|---|---|---|
| Service Scheme | √ | Suk Balrey | Andy Townsend | Keeley Knight |  |
| Standard Service | | | | | |

**Rogers Geotechnical Services Ltd**

**GAS/WATER MONITORING - SITE RECORD**

**Client:** Martin Walsh Architectural Ltd
**Site:** Gomersall Hall, Gomersal

Input by : GSP/TBM

Date : 29.06.21

**Gas Monitor:** Geotech GA5000
Serial No. G503524
Calibration Date: 05.05.21
Dip Meter: 003

*(If second monitor is used)*
**Gas Monitor:**
Serial No.
Calibration Date:
Dip Meter

| Borehole No | Date | $CH_4$ (%) | $CO_2$ (%) | $O_2$ (%) | Flow (l/hr) | Barometric Pressure (mb) | Water Level (m) | Standpipe Depth (m) | Depth During Visit | Atmospheric Conditions | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WS1 | 29.06.21 | **0.1** | **1.1** | **20.1** | **0.1** | 1001 | _ | | 2.64 | Sunny | Falling Pressure |
| | 06.07.21 | **0.1** | 1.2 | 19.7 | **0.1** | **977** | _ | | 2.64 | Overcast | Falling Pressure |
| | 13.07.21 | **0.1** | 1.3 | 18.9 | **0.1** | 1000 | 2.31 | | 2.64 | Overcast | Steady Pressure |
| | 21.07.21 | **0.0** | 1.4 | 19.4 | **0.1** | 1008 | 2.19 | | 2.64 | Overcast | Falling Pressure |
| | 25.08.21 | **0.0** | 1.6 | 19.7 | **0.1** | **1010** | 2.77 | | 2.77 | Sunny | Steady Pressure |
| | 08.09.21 | **0.1** | 1.5 | 19.7 | **0.1** | 998 | _ | | 2.77 | Sunny | Steady Pressure |
| WS2 | 29.06.21 | **0.0** | 2.4 | 19.8 | **0.1** | 1001 | _ | | 2.50 | Sunny | Falling Pressure |
| | 06.07.21 | **0.0** | 2.5 | 19.8 | **0.1** | **977** | _ | | 2.50 | Overcast | Falling Pressure |
| | 13.07.21 | **0.0** | 2.6 | 19.3 | **0.1** | 1000 | 2.36 | | 2.50 | Overcast | Steady Pressure |
| | 21.07.21 | **0.0** | 2.7 | 19.3 | **0.1** | 1009 | 2.44 | | 2.50 | Overcast | Falling Pressure |
| | 25.08.21 | **0.0** | 2.9 | 19.8 | **0.1** | **1010** | _ | | 2.62 | Sunny | Steady Pressure |
| | 08.09.21 | **0.0** | 2.7 | 19.6 | **0.1** | 998 | _ | | 2.60 | Sunny | Steady Pressure |
| WS4 | 29.06.21 | **0.0** | 2.0 | 19.5 | **0.1** | 1002 | _ | | 2.19 | Sunny | Falling Pressure |
| | 06.07.21 | **0.0** | 2.2 | 18.3 | **0.1** | **977** | 0.89 | | 2.29 | Overcast | Falling Pressure |
| | 13.07.21 | **0.0** | 2.9 | 16.3 | 0.0 | 1001 | 0.98 | | 2.30 | Overcast | Steady Pressure |
| | 21.07.21 | **0.0** | **4.1** | **16.2** | **0.1** | 1009 | 1.39 | | 2.29 | Overcast | Falling Pressure |
| | 25.08.21 | **0.0** | 3.6 | 19.0 | **0.1** | **1010** | 1.85 | | 2.41 | Sunny | Steady Pressure |
| | 08.09.21 | **0.1** | 3.3 | 18.6 | **0.1** | 998 | 2.41 | | 2.41 | Sunny | Steady Pressure |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | |

# CERTIFICATION OF CALIBRATION

4533

**Date Of Calibration:** 05-May-2021

**Certificate Number:** G503524_1/28004

Issued by: QED Environmental Systems Ltd.

**Customer:** **QED Environmental Systems Ltd (Lease)**
Barncliffe Mills Near Bank Shelley
HUDDERSFIELD HD8 8LU UNITED KINGDOM

**Description:** Gas Analyser

**Model:** GA5000

**Serial Number:** G503524

**UKAS Accredited results:**

Results after adjustment :

| Methane ($CH_4$) | | |
|---|---|---|
| **Certified Gas (%)** | **Instrument Reading (%)** | **Uncertainty (%)** |
| 5.0 | 4.9 | 0.072 |
| 15.0 | 14.9 | 0.13 |
| 60.0 | 59.7 | 0.42 |

| Carbon Dioxide ($CO_2$) | | |
|---|---|---|
| **Certified Gas (%)** | **Instrument Reading (%)** | **Uncertainty (%)** |
| 5.0 | 5.0 | 0.074 |
| 15.0 | 15.0 | 0.13 |
| 40.0 | 40.1 | 0.29 |

| Oxygen ($O_2$) | | |
|---|---|---|
| **Certified Gas (%)** | **Instrument Reading (%)** | **Uncertainty (%)** |
| 21.4 | 21.5 | 0.25 |

The inwards assessment was carried out 27-Apr-2021.
The maximum adjustment is larger than the specification limit.
Inwards assessment data is available if requested.

All concentrations are molar.

$CH_4$, $CO_2$ readings recorded at : 31.3 °C ± 2.5 °C

O2 readings recorded at : 22.5 °C ± 2.5 °C

Barometric Pressure : 0998 mbar ± 4 mbar

Method of Test : The analyser is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure LP004.

Instrument has passed calibration as the measurement result is within the specification limit. The specification limit takes into account the measurement uncertainty.
The results relate only to the item calibrated

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



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Registered in England and Wales 1898734

# CERTIFICATION OF CALIBRATION

4533

**Date Of Calibration:** 05-May-2021

**Certificate Number:** G503524_1/28004

Issued by: QED Environmental Systems Ltd.

*The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.*

Calibrations marked 'Non-UKAS Accredited results' on this certificate have been included for completeness.

**Non-UKAS accredited results after adjustment:**

| Barometer (mbar) | |
|---|---|
| **Reference** | **Instrument Reading** |
| 998 | 997 |

| Additional Gas Cells | | |
|---|---|---|
| **Gas** | **Certified Gas (ppm)** | **Instrument Reading (ppm)** |
| CO | 486 | 486 |
| $H_2S$ | 250 | 250 |

| Internal Flow | |
|---|---|
| **Applied (l/hr)** | **Instrument Reading (l/hr)** |
| 5.00 | 4.90 |
| 10.00 | 10.00 |

**Date of Issue :** 12-May-2021 **Approved by Signatory**

Dawn Hemings

Laboratory Inspection

End of Certificate

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



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Registered in England and Wales 1898734

# SERVICE REPORT

Issued by: QED Environmental Systems Ltd.

**Customer Name:** QED Environmental Systems Ltd (Lease)

| | | | |
|---|---|---|---|
| **Model:** | GA5000 | **Date of Service:** | 12-May-2021 |
| **Part Number:** | GA5KB0C0-301 | **Service Engineer:** | David Edwards |
| **Serial Number:** | G503524 | **Calibration Engineer:** | Suk Balrey |

**Verification / Approved By:** Dawn Hemings **Signature:**

## Reason for Return (inc. Customer Comments):

Returned for full service and calibration

## Service Comments/Feedback:

Thank you for returning your gas analyser to the QED Service Centre for full service and calibration.

We are pleased to inform you that the analyser was received and fully assessed by one of our experienced Service Engineers and no significant faults or issues were observed during the assessment.

Our extensive service was carried out, and any necessary components replaced.

The analyser has successfully passed all of our rigorous testing and quality checks and has been calibrated using our bespoke, state of the art calibration facility.

For further information about how to get the best use from your instrument please visit our YouTube channel http://www.youtube.com/GeotechTV and on our Website https://qedenv.com

If you require any further assistance with your instrument please email our Technical Support Team at technical@qedenv.co.uk or call us on +44 (0) 333 800 0088 (Monday to Thursday 08.30 - 17.00 & Friday 08.30 - 15.30) UK time zone.

**Next Service Due:** 05-Nov-2021

| 17025 | 5 | 50 | 65 | 7,384 | 340 | 25 |
|---|---|---|---|---|---|---|
| Our ISO accreditation for our customised auto-calibration facilities | Number of days we aim to complete your service within | Number of checks instruments are subject to when serviced | Number of countries from which we service instruments /accessories each year | Number of calibrations completed in last 12 months | Minimum number of service instruments we process each month | Cost (in £) of fully insured analyser collection for our UK customers |

# SERVICE REPORT

Issued by: QED Environmental Systems Ltd.

| 17025 | 5 | 50 | 65 | 7,384 | 340 | 25 |
|---|---|---|---|---|---|---|
| Our ISO accreditation for our customised auto-calibration facilities | Number of days we aim to complete your service within | Number of checks instruments are subject to when serviced | Number of countries from which we service instruments /accessories each year | Number of calibrations completed in last 12 months | Minimum number of service instruments we process each month | Cost (in £) of fully insured analyser collection for our UK customers |

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# Appendix 9

## Laboratory Testing

Environmental
Geotechnical
Specialists




# LABORATORY REPORT

| | |
|---|---|
| job number C/1772/21/E/2766 | client ref |
| site address<br>Gomersal Hall,<br>Oxford Road,<br>Gomersal | client address<br>M Walsh Architectural Ltd<br>Firth Buildings,<br>99-103 Leeds Rd,<br>Dewsbury, WF12 7BU |
| consultant | |
| date scheduled 28/06/2021 | date issued 16/07/2021 |
| issued by H J Letch | job title Asst. Lab Manager |

**Rogers Geotechnical Services Ltd** **Telephone 01484 607 977**
**Email jude.norcliffe@rogersgeotech.co.uk** **www.rogersgeotech.co.uk**
Unit 4, Barncliffe Business Park, Near Bank, Shelley,
Huddersfield, West Yorkshire HD8 8LU.

Constructionline
QMS ISO 9001 REGISTERED
QMS ISO 14001 REGISTERED
QMS OHSAS 18001 REGISTERED
UKAS

GEOTECHNICAL ENVIRONMENTAL

8948

Environmental
Geotechnical
Specialists

# Schedule of UKAS Accredited Laboratory Tests

| 1. CLASSIFICATION OF SOIL | BS 1377-2:1990 | BS EN 150 17892 | Accredited (A) | Unaccredited (U) |
|---|---|---|---|---|
| **1.1 Moisture / Water content determination** | | | | |
| i. Oven drying | Pt 2 : 3.2 | Pt 1 : 2014 | 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 | Pt 12 : 2018 : 5.3 / 5.5 | 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 | Pt 3 : 2015 : 5.1 | | U |
| **1.4 Density Tests** | | | | |
| i. Linear measurement | Pt 2 : 7.2 | Pt 2 : 2014 : 5.1 | A | |
| ii. Immersion in water | Pt 2 : 7.3 | Pt 2 : 2014 : 5.2 | | U |
| iii. Fluid / Water displacement | Pt 2 : 7.4 | Pt 2 : 2014 : 5.3 | | 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 | Pt 4 : 2016 : 5.2 | A | |
| ii. Wet Sieve | Pt 2 : 9.3 | Pt 4 : 2016 : 5.2 | A | |
| iii. Sedimentation by pipette | Pt 2 : 9.4 | Pt 4 : 2016 : 5.3 / 5.4 | 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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**Rogers Geotechnical Services Ltd**
Office 1 & 2 Barncliffe Business Park,
Near Bank, Shelley, Huddersfield, HD8 8LU

**Telephone** 01484 607977
**Company No:** 5130864

# Summary of Classification Test Results

| Project No. | Project Name |
|---|---|
| C1772/21/E/2766 | Gomersal Hall |

| Hole No. | Sample | | | | Soil Description | Density | | *w* | Passing 425µm | LL | PL | PI | Particle density | Cone | Water | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ref | Top | Base | Type | | bulk | dry | | | | | | | 80g/30° | Increase | |
| | | | | | | Mg/m3 | | % | % | % | % | % | Mg/m3 | 60g/60° | Decrease | |
| WS1 | 2 | 1.80 | | D | Brown silty CLAY | | | 16.0 | 100 | 34 -1pt | 19 | 15 | | 80g/30deg | increacing | |
| WS4 | 2 | 1.50 | | D | Brown silty CLAY | | | 15.0 | 100 | 32 -1pt | 18 | 14 | | 80g/30deg | increacing | |

All tests performed in accordance with BS EN ISO 17892 unless specified otherwise

Key

Density test — Liquid Limit — Particle density

Linear measurement unless : — 4pt cone unless : — sp - small pyknometer

wd - water displacement — cas - Casagrande method — gj - gas jar

wi - immersion in water — 1pt - single point test

Date Printed: 16/07/2021

Approved By: Harry

Table 1

sheet 1

# Linear Shrinkage - Summary of Results

| Project No. | Project Name |
|---|---|
| C1772/21/E/2766 | Gomersal Hall |

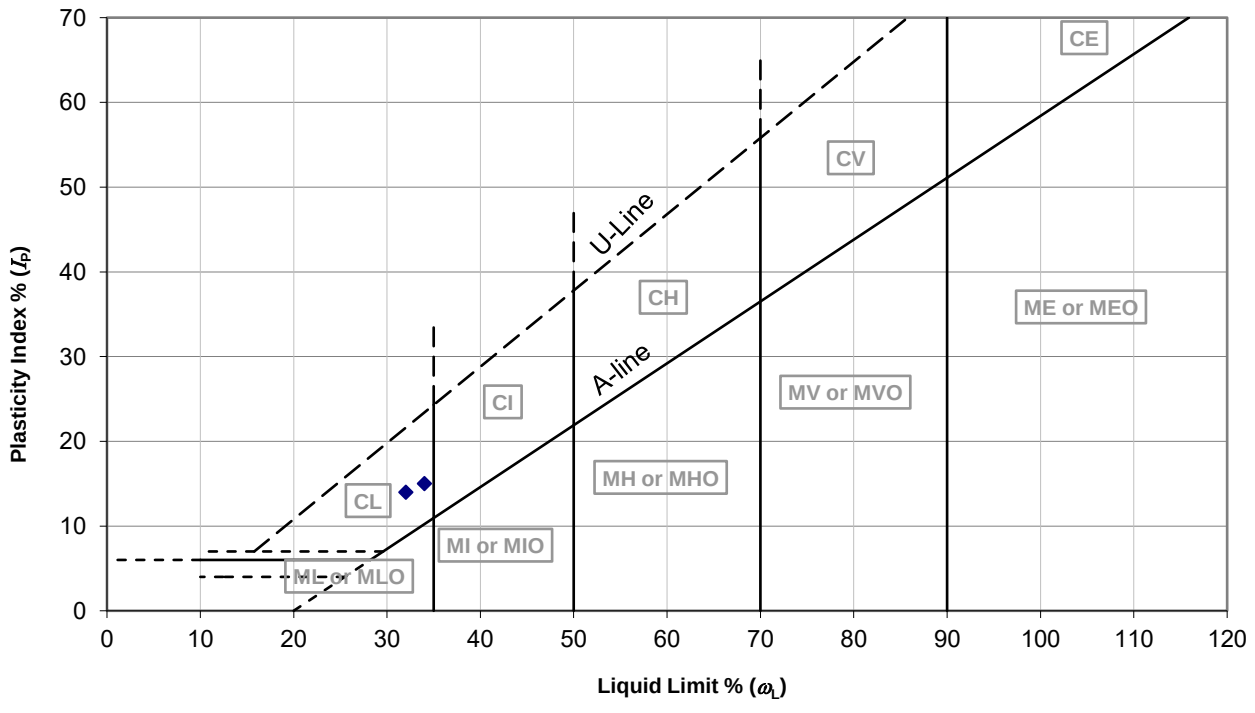
| Hole No. | Sample | | | | Soil Description | Material <425µm % | Preparation | Linear Shrinkage % | Date Tested |
|---|---|---|---|---|---|---|---|---|---|
| | Ref | Top | Base | Type | | | | | |
| WS1 | 2 | 1.80 | | D | Brown silty CLAY | 100 | Specimen prepared from natural material | 6 | 02/07/2021 |
| WS4 | 2 | 1.50 | | D | Brown thinly laminated silty CLAY | 100 | Specimen prepared from natural material | 6 | 02/07/2021 |

Remarks:

| Notes | Date Printed | Approved By | Table |
|---|---|---|---|
| Tests performed in accordance with BS 1377 : Part 2 : 1990, clause 6.5 unless annotated otherwise | 16/07/2021 | Harry | 2 |
| | | | Sheet 1 |

| | | | |
|---|---|---|---|
| Rogers Geotechnical Services Ltd.<br>Offices 1&2,<br>Barncliffe Business Park,<br>Near Bank, Shelley,<br>Huddersfield,<br>HD8 8LU | **Classification of Index Properties** | **C1772/21/E/2766** | |
| Project Name: Gomersal Hall | **BS EN ISO: 17892: Parts 1, 12** | Fig. 3 | Sheet. 1 |
| Location: | | Input By: | Harry |
| Client: Martin Walsh Architectural Ltd | | Check By: | Harry |

| 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 (IL) (%) | Liquidity/ Consistency (IC) (%) | Casagrande Class | N.H.B.C Class (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WS1 | 1.80 | 16.4 | 34 | 19 | 15 | 0 | 16 | 15 | -0.2 | 1.2 | C L | LOW |
| WS4 | 1.50 | 15.1 | 32 | 18 | 14 | 0 | 15 | 14 | -0.2 | 1.2 | C L | LOW |



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**Company No:** 5130864

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

# Final Report

| | | | |
|---|---|---|---|
| **Report No.:** | 21-23768-1 | | |
| **Initial Date of Issue:** | 15-Jul-2021 | | |
| **Client** | Rogers Geotechnical Services Ltd | | |
| **Client Address:** | Offices 1&2, Barncliffe Business Park<br>Near Bank<br>Shelley<br>Huddersfield<br>West Yorkshire<br>HD8 8LU | | |
| **Contact(s):** | Harry Letch | | |
| **Project** | Gomersal Hall | | |
| **Quotation No.:** | Q20-21658 | **Date Received:** | 12-Jul-2021 |
| **Order No.:** | | **Date Instructed:** | 12-Jul-2021 |
| **No. of Samples:** | 1 | | |
| **Turnaround (Wkdays):** | 5 | **Results Due:** | 16-Jul-2021 |
| **Date Approved:** | 15-Jul-2021 | | |
| **Approved By:** | | | |
| **Details:** | Glynn Harvey, Technical Manager | | |

# Results - Soil

**Project: Gomersal Hall**

| **Client: Rogers Geotechnical Services Ltd** | | | **Chemtest Job No.:** | | 21-23768 |
|---|---|---|---|---|---|
| Quotation No.: Q20-21658 | | | **Chemtest Sample ID.:** | | 1238263 |
| Order No.: | | | Client Sample Ref.: | | 1 |
| | | | Client Sample ID.: | | D1 |
| | | | Sample Type: | | SOIL |
| | | | Top Depth (m): | | 4.8 |
| | | | Date Sampled: | | 08-Jul-2021 |
| **Determinand** | **Accred.** | **SOP** | **Units** | **LOD** | |
| pH | M | 2010 | | 4.0 | 8.2 |
| Sulphate (2:1 Water Soluble) as SO4 | M | 2120 | g/l | 0.010 | < 0.010 |
| Moisture | N | 2030 | % | 0.020 | 13 |
| Soil Colour | N | 2040 | | N/A | Brown |
| Other Material | N | 2040 | | N/A | Stones |
| Soil Texture | N | 2040 | | N/A | Clay |

# 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 |

## 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" |
| SOP | Standard operating procedure |
| LOD | Limit of detection |

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 30 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

# End of Report

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

**Telephone** 01484 607977
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**Harry Letch**
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**t:** 01484 604354

**e:** harry.letch@rogersgeotech.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

**t:** 01923 225404
**f:** 01923 237404
**e:** reception@i2analytical.com

# Analytical Report Number : 23-35146

| | | | |
|---|---|---|---|
| **Project / Site name:** | Gomersal Hall, Gomersal | **Samples received on:** | 22/05/2023 |
| **Your job number:** | C1772 22 E 4286 | **Samples instructed on/ Analysis started on:** | 22/05/2023 |
| **Your order number:** | PO-2614 | **Analysis completed by:** | 30/05/2023 |
| **Report Issue Number:** | 1 | **Report issued on:** | 30/05/2023 |
| **Samples Analysed:** | 3 soil samples | | |

**Signed:**

Anna Goc
Junior Reporting Specialist
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 23-35146**
**Project / Site name: Gomersal Hall, Gomersal**
**Your Order No: PO-2614**

| Lab Sample Number | | | | 2687486 | 2687487 | 2687488 |
|---|---|---|---|---|---|---|
| Sample Reference | | | | WSA | WSB | WSC |
| Sample Number | | | | None Supplied | None Supplied | None Supplied |
| Depth (m) | | | | 0.60 | 0.50 | 0.65 |
| Date Sampled | | | | 18/05/2023 | 18/05/2023 | 18/05/2023 |
| Time Taken | | | | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Limit of detection** | **Accreditation Status** | | | |
| Stone Content | % | 0.1 | NONE | < 0.1 | < 0.1 | 21 |
| Moisture Content | % | 0.01 | NONE | 13 | 13 | 7.7 |
| Total mass of sample received | kg | 0.001 | NONE | 0.5 | 0.5 | 0.5 |
| Asbestos in Soil | Type | N/A | ISO 17025 | Not-detected | Not-detected | Not-detected |
| Asbestos Analyst ID | N/A | N/A | N/A | KWB | KWB | KWB |

**General Inorganics**

| | | | | | | |
|---|---|---|---|---|---|---|
| pH - Automated | pH Units | N/A | MCERTS | 7.1 | 6.7 | 7.6 |
| Free Cyanide | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 |
| Total Sulphate as SO4 | % | 0.005 | MCERTS | 0.016 | 0.021 | 0.01 |
| Water Soluble Sulphate as SO4 16hr extraction (2:1) | mg/kg | 2.5 | MCERTS | 9.2 | 14 | 30 |
| Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent) | g/l | 0.00125 | MCERTS | 0.0046 | 0.0068 | 0.015 |
| Organic Matter (automated) | % | 0.1 | MCERTS | 0.6 | 0.8 | 0.1 |

**Total Phenols**

| | | | | | | |
|---|---|---|---|---|---|---|
| Total Phenols (monohydric) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 |

**Speciated PAHs**

| | | | | | | |
|---|---|---|---|---|---|---|
| Naphthalene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthylene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Fluorene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Phenanthrene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Anthracene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Fluoranthene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Pyrene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Benzo(a)anthracene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Chrysene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Benzo(b)fluoranthene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Benzo(k)fluoranthene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Benzo(a)pyrene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Dibenz(a,h)anthracene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |
| Benzo(ghi)perylene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 | < 0.05 |

**Total PAH**

| | | | | | | |
|---|---|---|---|---|---|---|
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | NONE | < 0.80 | < 0.80 | < 0.80 |

**Heavy Metals / Metalloids**

| | | | | | | |
|---|---|---|---|---|---|---|
| Arsenic (aqua regia extractable) | mg/kg | 1 | MCERTS | 7.6 | 9.4 | 4.9 |
| Cadmium (aqua regia extractable) | mg/kg | 0.2 | MCERTS | < 0.2 | < 0.2 | < 0.2 |
| Chromium (hexavalent) | mg/kg | 1.8 | MCERTS | < 1.8 | < 1.8 | < 1.8 |
| Copper (aqua regia extractable) | mg/kg | 1 | MCERTS | 17 | 16 | 11 |
| Lead (aqua regia extractable) | mg/kg | 1 | MCERTS | 12 | 16 | 8 |
| Mercury (aqua regia extractable) | mg/kg | 0.3 | MCERTS | < 0.3 | < 0.3 | < 0.3 |
| Nickel (aqua regia extractable) | mg/kg | 1 | MCERTS | 27 | 29 | 22 |
| Selenium (aqua regia extractable) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 |
| Vanadium (aqua regia extractable) | mg/kg | 1 | MCERTS | 24 | 31 | 17 |
| Zinc (aqua regia extractable) | mg/kg | 1 | MCERTS | 86 | 82 | 45 |

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The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 23-35146**
**Project / Site name: Gomersal Hall, Gomersal**
**Your Order No: PO-2614**

| Lab Sample Number | | | | 2687486 | 2687487 | 2687488 |
|---|---|---|---|---|---|---|
| Sample Reference | | | | WSA | WSB | WSC |
| Sample Number | | | | None Supplied | None Supplied | None Supplied |
| Depth (m) | | | | 0.60 | 0.50 | 0.65 |
| Date Sampled | | | | 18/05/2023 | 18/05/2023 | 18/05/2023 |
| Time Taken | | | | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Limit of detection** | **Accreditation Status** | | | |
| **Monoaromatics & Oxygenates** | | | | | | |
| Benzene | µg/kg | 5 | NONE | < 5.0 | < 5.0 | < 5.0 |
| Toluene | µg/kg | 5 | NONE | < 5.0 | < 5.0 | < 5.0 |
| Ethylbenzene | µg/kg | 5 | NONE | < 5.0 | < 5.0 | < 5.0 |
| p & m-xylene | µg/kg | 5 | NONE | < 5.0 | < 5.0 | < 5.0 |
| o-xylene## | µg/kg | 5 | NONE | < 5.0 | < 5.0 | < 5.0 |
| MTBE (Methyl Tertiary Butyl Ether) | µg/kg | 5 | NONE | < 5.0 | < 5.0 | < 5.0 |
| **Petroleum Hydrocarbons** | | | | | | |
| TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$ | mg/kg | 0.001 | NONE | < 0.001 | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$ | mg/kg | 0.001 | NONE | < 0.001 | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$ | mg/kg | 0.001 | NONE | < 0.001 | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$ | mg/kg | 1 | NONE | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$ | mg/kg | 2 | NONE | < 2.0 | < 2.0 | < 2.0 |
| TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$ | mg/kg | 8 | NONE | < 8.0 | < 8.0 | < 8.0 |
| TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$ | mg/kg | 8 | NONE | < 8.0 | 18 | < 8.0 |
| TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$ | mg/kg | 10 | NONE | < 10 | 20 | < 10 |
| TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$ | mg/kg | 0.001 | NONE | < 0.001 | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$ | mg/kg | 0.001 | NONE | < 0.001 | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$ | mg/kg | 0.001 | NONE | < 0.001 | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$ | mg/kg | 1 | NONE | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$ | mg/kg | 2 | NONE | < 2.0 | < 2.0 | < 2.0 |
| TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$ | mg/kg | 10 | NONE | < 10 | < 10 | < 10 |
| TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$ | mg/kg | 10 | NONE | < 10 | < 10 | < 10 |
| TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$ | mg/kg | 10 | NONE | < 10 | < 10 | < 10 |

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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**Analytical Report Number : 23-35146**
**Project / Site name: Gomersal Hall, Gomersal**

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

| Lab Sample Number | Sample Reference | Sample Number | Depth (m) | Sample Description * |
|---|---|---|---|---|
| 2687486 | WSA | None Supplied | 0.6 | Brown clay and sand with gravel. |
| 2687487 | WSB | None Supplied | 0.5 | Brown clay and sand with gravel. |
| 2687488 | WSC | None Supplied | 0.65 | Brown sand with stones. |

**Analytical Report Number : 23-35146**
**Project / Site name: Gomersal Hall, Gomersal**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Metals in soil by ICP-OES | Determination of metals in soil by aqua-regia digestion followed by ICP-OES. | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil. | L038-PL | D | MCERTS |
| Sulphate, water soluble, in soil (16hr extraction) | Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent). | In house method. | L038-PL | D | MCERTS |
| Asbestos identification in soil | Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques. | In house method based on HSG 248 | A001-PL | D | ISO 17025 |
| Free cyanide in soil | Determination of free cyanide by distillation followed by colorimetry. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL | W | MCERTS |
| Moisture Content | Moisture content, determined gravimetrically. (30 oC) | In house method. | L019-UK/PL | W | NONE |
| Monohydric phenols in soil | Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar) | L080-PL | W | MCERTS |
| Speciated EPA-16 PAHs in soil | Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. | In-house method based on USEPA 8270 | L064-PL | D | NONE |
| pH in soil (automated) | Determination of pH in soil by addition of water followed by automated electrometric measurement. | In house method. | L099-PL | D | MCERTS |
| Stones content of soil | Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight. | In-house method based on British Standard Methods and MCERTS requirements. | L019-UK/PL | D | NONE |
| BTEX and MTBE in soil (Monoaromatics) | Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited | In-house method based on USEPA8260 | L073B-PL | W | NONE |
| TPHCWG (Soil) | Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID. | In-house method with silica gel split/clean up. | L088/76-PL | W | NONE |
| Organic matter (Automated) in soil | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate. | In house method. | L009-PL | D | MCERTS |
| Hexavalent chromium in soil | Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry. | In-house method | L080-PL | W | MCERTS |
| Total Sulphate in soil as % | Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES. | In house method. | L038-PL | D | MCERTS |

**Analytical Report Number : 23-35146**
**Project / Site name: Gomersal Hall, Gomersal**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Sulphate, water soluble, in soil | Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent). | In house method. | L038-PL | D | MCERTS |

**For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).**
**For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).**
**For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.**
**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**
**Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.**

## Information in Support of Analytical Results

### List of HWOL Acronyms and Operators

| Acronym | Descriptions |
|---|---|
| HS | Headspace Analysis |
| MS | Mass spectrometry |
| FID | Flame Ionisation Detector |
| GC | Gas Chromatography |
| EH | Extractable Hydrocarbons (i.e. everything extracted by the solvent(s)) |
| CU | Clean-up - e.g. by Florisil®, silica gel |
| 1D | GC - Single coil/column gas chromatography |
| 2D | GC-GC - Double coil/column gas chromatography |
| Total | Aliphatics & Aromatics |
| AL | Aliphatics |
| AR | Aromatics |
| #1 | EH_2D_Total but with humics mathematically subtracted |
| #2 | EH_2D_Total but with fatty acids mathematically subtracted |
| _ | Operator - understore to separate acronyms (exception for +) |
| + | Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total |

## - Quality control parameter has a high recovery (outside of limit); however the associated result is below the reporting limit, other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

# Sample Deviation Report

**Analytical Report Number : 23-35146**

**Project / Site name: Gomersal Hall, Gomersal**

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

| Sample ID | Other ID | Sample Type | Lab Sample Number | Sample Deviation | Test Name | Test Ref | Test Deviation |
|---|---|---|---|---|---|---|---|
| WSA | None Supplied | S | 2687486 | b | BTEX and MTBE in soil (Monoaromatics) | L073B-PL | b |
| WSA | None Supplied | S | 2687486 | b | TPHCWG (Soil) | L088/76-PL | b |
| WSB | None Supplied | S | 2687487 | b | BTEX and MTBE in soil (Monoaromatics) | L073B-PL | b |
| WSB | None Supplied | S | 2687487 | b | TPHCWG (Soil) | L088/76-PL | b |
| WSC | None Supplied | S | 2687488 | b | BTEX and MTBE in soil (Monoaromatics) | L073B-PL | b |
| WSC | None Supplied | S | 2687488 | b | TPHCWG (Soil) | L088/76-PL | b |

# Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

## Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

| | |
|---|---|
| Job Number | C1772/21//E/4286 |
| Job Name | Gomersal Hall, Gomersal |

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 limit of 102 should be used.

**KEY**
- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

| | |
|---|---|
| Date | 23/06/23 |
| Client | Martin Walsh Architectural Ltd |

| Determinand | Units | Ref | LOD | Residential With Plant Uptake 1% | | Sample Location | WSA | WSB | WSC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Atrisk 2015 (No Free Product | Atrisk 2017 | Depth Top | 0.60 | 0.50 | 0.65 | | | | | | | | |
| | | | | | | Depth Base | | | | | | | | | | | |
| Cadmium | mg/kg | C | 0.2 | | 22.1 | | < 0.2 | < 0.2 | < 0.2 | | | | | | | | |
| Chromium (Hexavalent) | mg/kg | B/C | 1.8 | 20.5 | 3.62 | | < 1.8 | < 1.8 | < 1.8 | | | | | | | | |
| Copper | mg/kg | A+ | 1.0 | | 4730 | | 17 | 16 | 11 | | | | | | | | |
| Mercury | mg/kg | A/D | 0.3 | | 8.81 | | < 0.3 | < 0.3 | < 0.3 | | | | | | | | |
| Nickel | mg/kg | A+ | 1.0 | | 136 | | 27 | 29 | 22 | | | | | | | | |
| Lead | mg/kg | C | 1.0 | | 200 | | 12 | 16 | 8 | | | | | | | | |
| Zinc | mg/kg | A+ | 1.0 | | 20000 | | 86 | 82 | 45 | | | | | | | | |
| Vanadium | mg/kg | A+ | 1.0 | | 136 | | 24 | 31 | 17 | | | | | | | | |
| Arsenic | mg/kg | C | 1.0 | | 37 | | 7.6 | 9.4 | 4.9 | | | | | | | | |
| Selenium | mg/kg | A | 1.0 | | 375 | | < 1.0 | < 1.0 | < 1.0 | | | | | | | | |
| Cyanide (Free) | mg/kg | A | 1.0 | | 34 | | < 1.0 | < 1.0 | < 1.0 | | | | | | | | |
| Total Phenols | mg/kg | A | 1.0 | | 267 | | < 1.0 | < 1.0 | < 1.0 | | | | | | | | |
| Naphthalene | mg/kg | A+ | 0.05 | 5 | 0.829 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Acenaphthylene | mg/kg | | 0.05 | | | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Acenaphthene | mg/kg | A+ | 0.05 | 608 | 157 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Fluorene | mg/kg | A+ | 0.05 | 9 | 735 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Phenanthrene | mg/kg | | 0.05 | | | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Anthracene | mg/kg | A+ | 0.05 | 9 | 10200 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Fluoranthene | mg/kg | A+ | 0.05 | | 983 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Pyrene | mg/kg | A+ | 0.05 | | 668 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Benzo[a]anthracene | mg/kg | A | 0.05 | 4.52 | 1.71 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Chrysene | mg/kg | A | 0.05 | 585 | 0.44 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Benzo[b]fluoranthene | mg/kg | A | 0.05 | 7.72 | 1.22 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Benzo[k]fluoranthene | mg/kg | A | 0.05 | 84.4 | 0.686 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Benzo[a]pyrene | mg/kg | B/C | 0.05 | 4.95 | 1.51 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Indeno(1,2,3-c,d)Pyrene | mg/kg | A* | 0.05 | 7.31 | 0.0614 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Dibenz(a,h)Anthracene | mg/kg | A | 0.05 | 0.838 | 0.00393 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Benzo[g,h,i]perylene | mg/kg | A | 0.05 | 96.2 | 0.0187 | | < 0.05 | < 0.05 | < 0.05 | | | | | | | | |
| Total Of 16 PAH's | mg/kg | | 0.8 | | | | < 0.80 | < 0.80 | < 0.80 | | | | | | | | |
| Aliphatic TPH >C5-C6 | mg/kg | A+ | 0.001 | 0 | 42.7 | | < 0.001 | < 0.001 | < 0.001 | | | | | | | | |
| Aliphatic TPH >C6-C8 | mg/kg | A+ | 0.001 | 0 | 99.3 | | < 0.001 | < 0.001 | < 0.001 | | | | | | | | |
| Aliphatic TPH >C8-C10 | mg/kg | A+ | 0.001 | 0 | 13.9 | | < 0.001 | < 0.001 | < 0.001 | | | | | | | | |
| Aliphatic TPH >C10-C12 | mg/kg | A+ | 1.0 | 81.7 | 49.9 | | < 1.0 | < 1.0 | < 1.0 | | | | | | | | |
| Aliphatic TPH >C12-C16 | mg/kg | A+ | 2.0 | 385 | 20.9 | | < 2.0 | < 2.0 | < 2.0 | | | | | | | | |
| Aliphatic TPH >C16-C21 | mg/kg | A+ | 8.0 | | 210000 | | < 8.0 | < 8.0 | < 8.0 | | | | | | | | |
| Aliphatic TPH >C21-C35 | mg/kg | A+ | 8.0 | | 210000 | | < 8.0 | 18 | < 8.0 | | | | | | | | |
| Aliphatic TPH >C35-C44 | mg/kg | | 10.0 | | | | | | | | | | | | | | |
| Total Aliphatic Hydrocarbons | mg/kg | | 10.0 | | | | | | | | | | | | | | |
| Aromatic TPH >C5-C7 | mg/kg | A+ | 0.001 | | 0.137 | | < 0.001 | < 0.001 | < 0.001 | | | | | | | | |
| Aromatic TPH >C7-C8 | mg/kg | A+ | 0.001 | 0 | 113 | | < 0.001 | < 0.001 | < 0.001 | | | | | | | | |
| Aromatic TPH >C8-C10 | mg/kg | A+ | 0.001 | 0 | 20.5 | | < 0.001 | < 0.001 | < 0.001 | | | | | | | | |
| Aromatic TPH >C10-C12 | mg/kg | A+ | 1.0 | 0 | 70 | | < 1.0 | < 1.0 | < 1.0 | | | | | | | | |

# Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

## Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

| | |
|---|---|
| Job Number | C1772/21//E/4286 |
| Job Name | Gomersal Hall, Gomersal |

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 limit of 102 should be used.

**KEY**

- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | 23/06/23 | | | **Sample Location** | | WSA | WSB | WSC | | | | | | | |
| Client | Martin Walsh Architectural Ltd | | | Depth Top | | 0.60 | 0.50 | 0.65 | | | | | | | |
| | | | | Depth Base | | | | | | | | | | | |
| **Determinand** | **Units** | **Ref** | **LOD** | **Residential With Plant Uptake 1%** | | | | | | | | | | | |
| Aromatic TPH >C12-C16 | mg/kg | A+ | 2.0 | 165 | 155 | < 2.0 | < 2.0 | < 2.0 | | | | | | | |
| Aromatic TPH >C16-C21 | mg/kg | A+ | 10.0 | | 319 | < 10 | < 10 | < 10 | | | | | | | |
| Aromatic TPH >C21-C35 | mg/kg | A+ | 10.0 | | 1120 | < 10 | < 10 | < 10 | | | | | | | |
| Aromatic TPH >C35-C44 | mg/kg | | 10.0 | | | | | | | | | | | | |
| Total Aromatic Hydrocarbons | mg/kg | | 10.0 | | | | | | | | | | | | |
| Total Petroleum Hydrocarbons | mg/kg | | 10.0 | | | | | | | | | | | | |
| pH | | | N/A | | | 7.1 | **6.7** | **7.6** | | | | | | | |
| Sulphate (2:1 Water Soluble) as SO4 | g/l | | 0.0013 | | | **0.0046** | 0.0068 | **0.015** | | | | | | | |
| ACM Type | | | N/A | | | - | - | - | | | | | | | |
| Asbestos Identification | % | | | | | None | None | None | | | | | | | |
| ACM Detection Stage | | | N/A | | | - | - | - | | | | | | | |
| Moisture | % | | 0.01 | | | 13 | 13 | 7.7 | | | | | | | |
| Soil Colour | | | N/A | | | | | | | | | | | | |
| Other Material | | | N/A | | | | | | | | | | | | |
| Soil Texture | | | N/A | | | | | | | | | | | | |
| Sulphate (Total) | % | | 0.005 | | | 0.016 | 0.021 | 0.01 | | | | | | | |
| Organic Matter | % | | 0.1 | | | 0.6 | **0.8** | **0.1** | | | | | | | |

# Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

| Rogers Geotechnical Services Ltd | | | | Soil Screening Value (SSV) Comparison Sheet | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Job Number | C1772/21/E/2766 | | | A = WS Atkins PLC, Atrisk Soil Screening Values.<br>A+ = Values updated June 2017.<br>A* = Atrisk's SSV is lower than Chemtest's detectable limit for this compound.<br>B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.<br>C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter.<br>D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used. | | | | | | |
| Job Name | Gomersal Hall, Oxford Road, Gomersal | | | **KEY**<br>Exceeds SSV<br>Exceeds 2017, Below 2015<br>Below limit of detection (LOD) | | | | | | |
| Date | 02.08.2021 | | | **Sample Location** | WS1 | WS2 | WS3 | WS4 | | |
| Client | Martin Walsh Architectural | | | Depth Top | 0.8 | 0.5 | 0.5 | 0.6 | | |
| | | | | Depth Base | | | | | | |
| **Determinand** | **Units** | **Ref** | **LOD** | **Residential With Plant Uptake 1%** | | | | | | |
| | | | | Atrisk 2015 (No Free Product | Atrisk 2017 | | | | | |
| Cadmium | mg/kg | C | 0.10 | | 22.1 | 0.13 | 0.18 | 0.22 | 0.23 | |
| 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 | 44 | 36 | 25 | 22 | |
| Mercury | mg/kg | A/D | 0.10 | | 8.81 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Nickel | mg/kg | A+ | 0.50 | | 136 | 30 | 43 | 35 | 46 | |
| Lead | mg/kg | C | 0.50 | | 200 | 20 | 29 | 17 | 14 | |
| Zinc | mg/kg | A+ | 0.50 | | 20000 | 70 | 99 | 110 | 110 | |
| Vanadium | mg/kg | A+ | 5.0 | | 136 | 24 | 33 | 25 | 31 | |
| Arsenic | mg/kg | C | 1.0 | | 37 | 17 | 13 | 9.6 | 15 | |
| Selenium | mg/kg | A | 0.20 | | 375 | 0.31 | 0.42 | 0.28 | 0.32 | |
| Cyanide (Free) | mg/kg | A | 0.50 | | 34 | < 0.50 | < 0.50 | < 0.50 | < 0.50 | |
| Total Phenols | mg/kg | A | 0.30 | | 267 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Naphthalene | mg/kg | A+ | 0.10 | 0 | 0.829 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Acenaphthylene | mg/kg | | 0.10 | | | < 0.10 | < 0.10 | < 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 | 0 | 735 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Phenanthrene | mg/kg | | 0.10 | | | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Anthracene | mg/kg | A+ | 0.10 | 0 | 10200 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Fluoranthene | mg/kg | A+ | 0.10 | | 983 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Pyrene | mg/kg | A+ | 0.10 | | 668 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Benzo[a]anthracene | mg/kg | A | 0.10 | 4.52 | 1.71 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Chrysene | mg/kg | A | 0.10 | 585 | 0.44 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Benzo[b]fluoranthene | mg/kg | A | 0.10 | 7.72 | 1.22 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Benzo[k]fluoranthene | mg/kg | A | 0.10 | 84.4 | 0.686 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Benzo[a]pyrene | mg/kg | B/C | 0.10 | 4.95 | 1.51 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Indeno(1,2,3-c,d)Pyrene | mg/kg | A* | 0.10 | 7.31 | 0.0614 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Dibenz(a,h)Anthracene | mg/kg | A | 0.10 | 0.838 | 0.00393 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Benzo[g,h,i]perylene | mg/kg | A | 0.10 | 96.2 | 0.0187 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | |
| Total Of 16 PAH's | mg/kg | | 2.0 | | | < 2.0 | < 2.0 | < 2.0 | < 2.0 | |
| Aliphatic TPH >C5-C6 | mg/kg | A+ | 1.0 | 0 | 42.7 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | |
| Aliphatic TPH >C6-C8 | mg/kg | A+ | 1.0 | 0 | 99.3 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | |
| Aliphatic TPH >C8-C10 | mg/kg | A+ | 1.0 | 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 | |

# Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

The Ground Investigation Specialists

| Rogers Geotechnical Services Ltd | | | | Soil Screening Value (SSV) Comparison Sheet | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Job Number | C1772/21/E/2766 | | | A = WS Atkins PLC, Atrisk Soil Screening Values.<br>A+ = Values updated June 2017.<br>A* = Atrisk's SSV is lower than Chemtest's detectable limit for this compound.<br>B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.<br>C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter.<br>D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used. | | | | | | | |
| Job Name | Gomersal Hall, Oxford Road, Gomersal | | | | | | | | | | |
| Date | 02.08.2021 | | | **Sample Location** | | WS1 | WS2 | WS3 | WS4 | | |
| Client | Martin Walsh Architectural | | | Depth Top | | 0.8 | 0.5 | 0.5 | 0.6 | | |
| | | | | Depth Base | | | | | | | |
| **Determinand** | **Units** | **Ref** | **LOD** | **Residential With Plant Uptake 1%** | | | | | | | |
| 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 | 16 | < 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 | 16 | < 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 | 0 | 113 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Aromatic TPH >C8-C10 | mg/kg | A+ | 1.0 | 0 | 20.5 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Aromatic TPH >C10-C12 | mg/kg | A+ | 1.0 | 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 | < 1.0 | < 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 | < 5.0 | < 5.0 | < 5.0 | | |
| Total Petroleum Hydrocarbons | mg/kg | | 10.0 | | | < 10 | 16 | < 10 | < 10 | | |
| pH | | | N/A | | | **8.7** | **7.2** | 7.6 | 8.0 | | |
| 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 | | | | | | | | |
| Moisture | % | | 0.020 | | | 11 | 13 | 13 | 14 | | |
| Soil Colour | | | N/A | | | Brown | Brown | Brown | Brown | | |
| Other Material | | | N/A | | | Stones | Stones | Stones | Stones | | |
| Soil Texture | | | N/A | | | Sand | Sand | Sand | Sand | | |
| Sulphate (Total) | % | | 0.010 | | | 0.068 | 0.035 | 0.028 | 0.013 | | |
| Organic Matter | % | | 0.40 | | | 0.69 | 1.2 | 0.64 | 0.43 | | |

**KEY**

- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

# Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

| Rogers Geotechnical Services Ltd | | | | KEY | | | |
|---|---|---|---|---|---|---|---|
| Job Number | C1772/21/E/2766 | | | Exceeds SSV | | | |
| Job Name | Gomersal Hall, Oxford Road, Gomersal | | | Exceeds 2017, Below 2015 | | | |
| | | | | Below limit of detection (LOD) | | | |
| Date | 02.08.2021 | | | | | | |
| Client | Martin Walsh Architectural | | | | | | |
| **Determinand** | **Units** | **Ref** | **LOD** | | | | |
| Cadmium | mg/kg | C | 0.10 | | | | |
| Chromium (Hexavalent) | mg/kg | B/C | 0.5 | | | | |
| Copper | mg/kg | A+ | 0.50 | | | | |
| Mercury | mg/kg | A/D | 0.10 | | | | |
| Nickel | mg/kg | A+ | 0.50 | | | | |
| Lead | mg/kg | C | 0.50 | | | | |
| Zinc | mg/kg | A+ | 0.50 | | | | |
| Vanadium | mg/kg | A+ | 5.0 | | | | |
| Arsenic | mg/kg | C | 1.0 | | | | |
| Selenium | mg/kg | A | 0.20 | | | | |
| Cyanide (Free) | mg/kg | A | 0.50 | | | | |
| Total Phenols | mg/kg | A | 0.30 | | | | |
| Naphthalene | mg/kg | A+ | 0.10 | | | | |
| Acenaphthylene | mg/kg | | 0.10 | | | | |
| Acenaphthene | mg/kg | A+ | 0.10 | | | | |
| Fluorene | mg/kg | A+ | 0.10 | | | | |
| Phenanthrene | mg/kg | | 0.10 | | | | |
| Anthracene | mg/kg | A+ | 0.10 | | | | |
| Fluoranthene | mg/kg | A+ | 0.10 | | | | |
| Pyrene | mg/kg | A+ | 0.10 | | | | |
| Benzo[a]anthracene | mg/kg | A | 0.10 | | | | |
| Chrysene | mg/kg | A | 0.10 | | | | |
| Benzo[b]fluoranthene | mg/kg | A | 0.10 | | | | |
| Benzo[k]fluoranthene | mg/kg | A | 0.10 | | | | |
| Benzo[a]pyrene | mg/kg | B/C | 0.10 | | | | |
| Indeno(1,2,3-c,d)Pyrene | mg/kg | A* | 0.10 | | | | |
| Dibenz(a,h)Anthracene | mg/kg | A | 0.10 | | | | |
| Benzo[g,h,i]perylene | mg/kg | A | 0.10 | | | | |
| Total Of 16 PAH's | mg/kg | | 2.0 | | | | |
| Aliphatic TPH >C5-C6 | mg/kg | A+ | 1.0 | | | | |
| Aliphatic TPH >C6-C8 | mg/kg | A+ | 1.0 | | | | |
| Aliphatic TPH >C8-C10 | mg/kg | A+ | 1.0 | | | | |
| Aliphatic TPH >C10-C12 | mg/kg | A+ | 1.0 | | | | |

# 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 |
|---|---|---|---|---|---|---|
| | *Metals* | **SOM: 1%** | | **SOM: 6%** | | |
| 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+ |
| | *Semi and Non Metals* | | | | | |
| 1 | Arsenic | 37 | | 37 | | C |
| 10 | Selenium | 375 | | 375 | | A |
| | Free Cyanide | 34 | | 34 | | A |
| 9 | Phenols (total) | 267 | | 1200 | | A |
| | *Poly Aromatic Hydrocarbons* | 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 |
| | *Petroleum Hydrocarbons* | | | | | |
| | 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 = Catergory 4 Screening Levels (C4SLs).

D = SSV provided is for Methyl Mercury.

# Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

| Rogers Geotechnical Services Ltd | | | | | | | |
|---|---|---|---|---|---|---|---|
| Job Number | C1772/21/E/2766 | | | | | | |
| Job Name | Gomersal Hall, Oxford Road, Gomersal | | | | | | |
| Date | 02.08.2021 | | | | | | |
| Client | Martin Walsh Architectural | | | | | | |

**KEY**

Exceeds SSV

Exceeds 2017, Below 2015

Below limit of detection (LOD)

| Determinand | Units | Ref | LOD | | | | |
|---|---|---|---|---|---|---|---|
| Aliphatic TPH >C12-C16 | mg/kg | A+ | 1.0 | | | | |
| Aliphatic TPH >C16-C21 | mg/kg | A+ | 1.0 | | | | |
| Aliphatic TPH >C21-C35 | mg/kg | A+ | 1.0 | | | | |
| Aliphatic TPH >C35-C44 | mg/kg | | 1.0 | | | | |
| Total Aliphatic Hydrocarbons | mg/kg | | 5.0 | | | | |
| Aromatic TPH >C5-C7 | mg/kg | A+ | 1.0 | | | | |
| Aromatic TPH >C7-C8 | mg/kg | A+ | 1.0 | | | | |
| Aromatic TPH >C8-C10 | mg/kg | A+ | 1.0 | | | | |
| Aromatic TPH >C10-C12 | mg/kg | A+ | 1.0 | | | | |
| Aromatic TPH >C12-C16 | mg/kg | A+ | 1.0 | | | | |
| Aromatic TPH >C16-C21 | mg/kg | A+ | 1.0 | | | | |
| Aromatic TPH >C21-C35 | mg/kg | A+ | 1.0 | | | | |
| Aromatic TPH >C35-C44 | mg/kg | | 1.0 | | | | |
| Total Aromatic Hydrocarbons | mg/kg | | 5.0 | | | | |
| Total Petroleum Hydrocarbons | mg/kg | | 10.0 | | | | |
| pH | | | N/A | | | | |
| Sulphate (2:1 Water Soluble) as SO4 | g/l | | 0.010 | | | | |
| ACM Type | | | N/A | | | | |
| Asbestos Identification | % | | 0.001 | | | | |
| ACM Detection Stage | | | N/A | | | | |
| Moisture | % | | 0.020 | | | | |
| Soil Colour | | | N/A | | | | |
| Other Material | | | N/A | | | | |
| Soil Texture | | | N/A | | | | |
| Sulphate (Total) | % | | 0.010 | | | | |
| Organic Matter | % | | 0.40 | | | | |

# Appendix 10

## Fill Screening Values