

# UPPER COLLIERS ROW, HEOLGERRIG, MERTHYR TYDFIL, CF48 1UN

## Ground Investigation Report

Report No. Q0558/GIR

July 2021

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## 0. FOREWORD

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The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

### General

Recommendations made and opinions expressed in the report are based on the strata observed in the excavations / recovered samples, together with the results of site and laboratory testing. No responsibility can be held for conditions which have not been revealed by the exploratory holes or which occur between exploratory holes. Whilst the report may suggest the likely configuration of strata, both between exploratory holes and below the maximum depth of investigation, this is only indicative and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

### Investigation Procedures

Intrusive techniques for ground investigation have been employed throughout the project. All intrusive operations, geotechnical / environmental sampling, logging of soils / rocks and in-situ testing complies with the recommendations of the British Code of Practice BS 5930:2015+A1:2020 'Site Investigations', British Code of Practice BS 10175: 2011+A2:2017 'Investigation of Potentially Contaminated Sites' and BS 1377:1990, 'Methods of Test for Soils for Engineering Purposes'.

### Routine Sampling

Representative bulk, disturbed and environmental samples of the different strata were taken. All samples are returned from site to Quantum Geotechnic Limited's controlled storage within 24 hours of sampling to await test scheduling / requirements.

### In-Situ Testing, Surveying & Instrumentation

No in-situ testing was carried out.

### Groundwater

Where possible, the depth of entry of any influx of groundwater is recorded during the course of excavation or boring operations. The rate of inflow into the excavation or borehole is monitored during the course of the excavation or during boring procedures. Upon encountering any water strikes, work is temporarily halted and the water levels monitored for a standard twenty-minute period recording the change in water level at the end of the twenty minutes.

Groundwater conditions observed in the excavations are those appertaining to the period of investigation. It should be noted, that groundwater levels are subject to diurnal, seasonal and climatic variations as well as affects caused by drainage conditions or other causes.

### Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded. Further to notifying the Client / Engineer with one week's notice, all soil and / or rock samples not tested will be discarded 28 days after submission of the approved final report.

## **1. INTRODUCTION**

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### **1.1 General**

Upon the instructions of our Client, Maxiom Developments Ltd, Quantum Geotechnic Ltd (QG) was commissioned to undertake a ground investigation at the residential development at upper Colliers Row, Heolgerrig, Merthyr Tydfil.

### **1.2 Purpose of Ground Investigation**

The purpose of the ground investigation was targeted to allow a geotechnical assessment of re-use of the site materials for any earthwork operations required; and to provide a human health risk assessment of the soils on site in relation to the development and end use.

### **1.3 Scope of Work**

The scope of work undertaken in the preparation of this assessment was as follows:

- Conduct a brief ground investigation with the aim of sampling the shallow soils as to their characteristics for re-use on site and for potential contamination levels.
- Carry out laboratory testing to obtain geotechnical and environmental data to inform interpretation.
- Provide an interpretative report presenting an analysis of the ground conditions and characteristic geotechnical parameters and an assessment of human health risks.

General notes on the techniques employed by Quantum Geotechnic Ltd are described in the Foreword together with the limitations inherent in carrying out ground investigation work.

## 2. SITE SETTING

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### 2.1 Site Description

The site is an area of undeveloped land west of Upper Colliers Row, in the Heolgerrig suburb of Merthyr Tydfil. The site topography rises westwards from Upper Colliers Row towards the exiting residences to the west. Some immature trees are still present on the site. The approximate National Grid Reference of the centre of the site is 303910E, 206265N. The approximate elevation of the site is c.210m.AOD. The nearest postcode is CF48 1UN.

The approximate extent of the site is shown in yellow highlight on a current aerial mapping extract presented below in Figure 1.

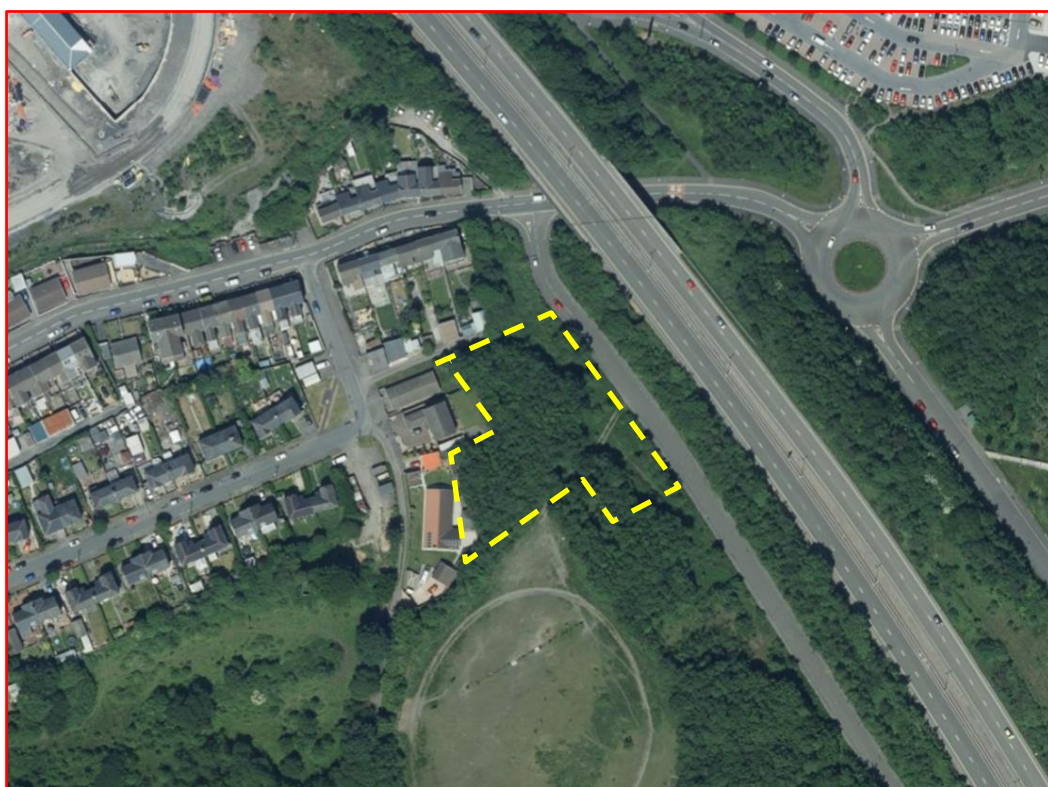


Figure 1: Site Location & Setting (not to scale) ©Apple Maps

### 2.2 Published Geology

The 1:10,560 scale British Geological Survey map of the area, Sheet SO 00 NW, shows the detailed geology of the site. An extract from the map is presented over page.

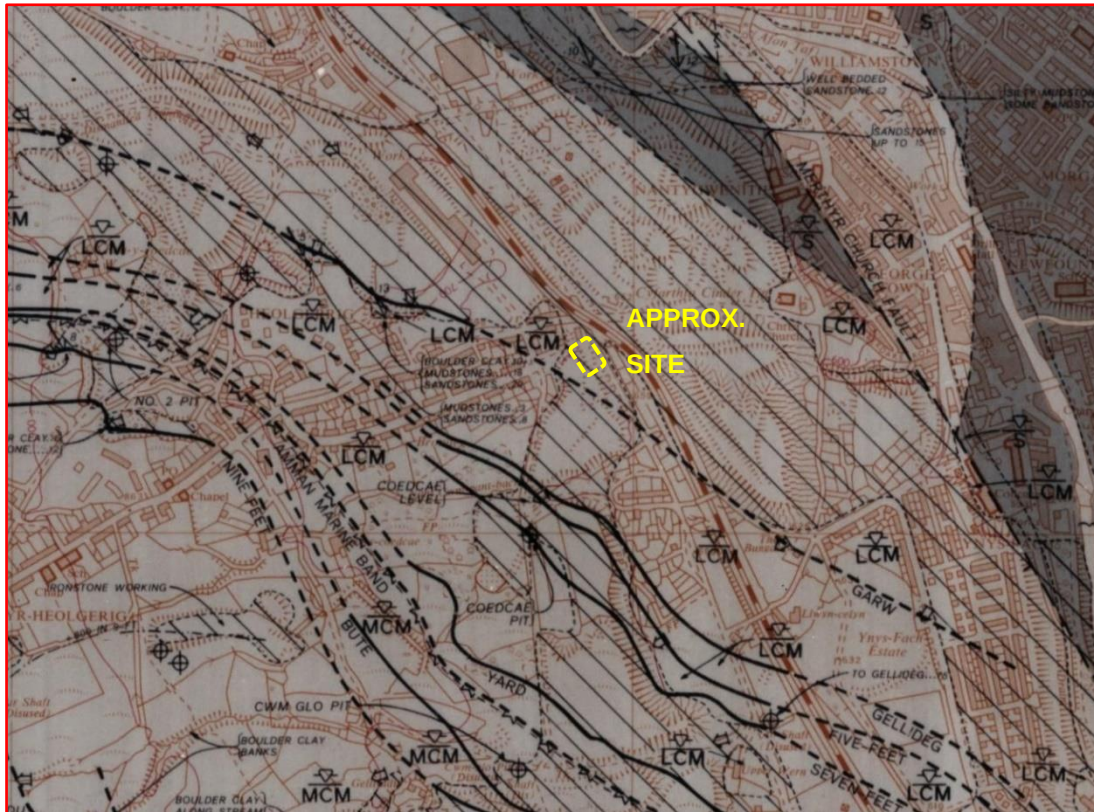


Figure 2: BGS sheet SO 00 NW Extract (Not to Scale) British Geological Survey © NERC

This edition map indicates the site to be mantled by superficial deposits comprising Made Ground (typically mine spoil), with Glacial Till (boulder clay) shown immediately west of the made ground.

The solid bedrock strata are mapped as the Lower Coal Measures. The *Garw* coal seam is shown to outcrop conjecturally to the south west of the site, dipping away from the site at a shallow angle towards the south west. No other coal seams are indicated in the local sequence on the geological map beneath the *Garw* seam, but a series of ironstone veins are recorded, as *Rosser Ironstone Veins*.

### 3. FIELDWORK

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The fieldwork was carried out on the 17<sup>th</sup> June 2021. The site operations were carried out with plant supplied by the Client.

The geotechnical supervision was provided by an experienced Chartered Engineering Geologist from Quantum. No incidents or near misses were recorded during the fieldworks. No deviations from standards and procedures adopted for the works were recorded.

The fieldworks comprised of five trial pits at the positions indicated on the plan in Appendix I. A summary of the trial pit depths and positions is tabulated below. The purpose of the trial pits was to sample the shallow soils for testing purposes.

*Table 1: Summary of Trial Holes.*

| <b>Trial Pit</b> | <b>Depth (m)</b> | <b>Comments</b>                        |
|------------------|------------------|----------------------------------------|
| A                | 1.00             | Plot 8/9; Terminated in Made Ground    |
| B                | 1.00             | Plot 6/7; Terminated in Made Ground    |
| C                | 1.00             | Plot 1/2/3; Terminated in Made Ground  |
| D                | 1.00             | Plot 3/5; Terminated in Made Ground    |
| E                | 1.00             | Plot 4/5/10; Terminated in Made Ground |

All site operations, sampling and logging, were undertaken in accordance with the relevant British Standards, namely: BS5930:2015+A1:2020 *Code of practice for ground investigation*; BS EN 1997-2:2007 *Eurocode 7. Geotechnical design. Ground investigation and testing*; BS1377-9:1999 *Method of test for soils for civil engineering purposes. In-situ testing*; BS EN ISO 14688-1:2018 *Geotechnical investigation and testing. Identification and classification of soil. Identification and description*; and BS EN ISO 14688-2:2018 *Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification*.

The relative positions of the trial holes are shown on the site plan included in Appendix I. The engineering logs of the boreholes are presented in Appendix II.

## 4. LABORATORY TESTING

### 4.1 General

The laboratory testing was scheduled by Quantum and comprised a combination of geotechnical testing to assess the compaction characteristics of the site material for re-use, and environmental testing on selected soil samples obtained from the investigation.

### 4.2 Geotechnical Laboratory Testing

All the geotechnical soil testing was carried out in accordance with the procedure stipulated in the various sections of BS 1377:1999 Parts 1 – 9 *Methods of test for soils for civil engineering purposes*. Table 2 details the tests undertaken.

Table 2: Summary of Scheduled Geotechnical Tests.

| Type of Test             | No. of Tests |
|--------------------------|--------------|
| Natural Moisture Content | 5            |
| Particle Size Grading    | 5            |
| 4.5kg Compaction         | 5            |
| Loss on Ignition         | 5            |

A full set of the geotechnical laboratory test certificates is presented within Appendix III.

### 4.3 Environmental Laboratory Testing

Environmental testing was carried out on selected soil samples obtained from the ground investigation. The purpose of the testing was to gain a baseline view of any raised levels of contaminants that may exist on site. The suites of tests undertaken for human health assessment are listed in Table 3. Five soil samples were tested for this suite of potential contaminants.

A full set of environmental laboratory test certificates is provided in Appendix IV.

Table 3a: Geo-Environmental Tests on Soil Samples.

| Heavy Metals   |                       |                    |                   |
|----------------|-----------------------|--------------------|-------------------|
| • Arsenic      | • Barium              | • Beryllium        | • Boron (soluble) |
| • Cadmium      | • Chromium (III & VI) | • Copper           | • Lead            |
| • Mercury      | • Nickel              | • Selenium         | • Vanadium        |
| • Zinc         |                       |                    |                   |
| Inorganics     |                       |                    |                   |
| • pH           | • Total Sulphate      | • Soluble Sulphate | • Sulphide        |
| • Sulphur      | • Organic Matter      | • Total Cyanide    | • Complex Cyanide |
| • Free Cyanide | • Asbestos            |                    |                   |

Table 3b: Geo-Environmental Tests on Soil Samples (Continued)

|                                                 |                           |                          |                        |
|-------------------------------------------------|---------------------------|--------------------------|------------------------|
| <b>Poly Aromatic Hydrocarbons</b>               |                           |                          |                        |
| • Naphthalene                                   | • Acenaphthylene          | • Acenaphthene           | • Fluorene             |
| • Phenanthrene                                  | • Anthracene              | • Fluoranthene           | • Pyrene               |
| • Benzo(a)anthracene                            | • Chrysene                | • Benzo(b)fluoranthene   | • Benzo(k)fluoranthene |
| • Benzo(a)pyrene                                | • Indeno(1,2,3-cd) pyrene | • Dibenzo(a,h)anthracene | • Benzo(ghi)perylene   |
| <b>Total Petroleum Hydrocarbons</b>             |                           |                          |                        |
| <i>TPH-CWG Aliphatic Split:</i>                 | • EC5 – EC6               | • EC6 – EC8              | • EC8 – EC10           |
| • EC10 – EC12                                   | • EC12 – EC16             | • EC16 – EC21            | • EC21 – EC35          |
| <i>TPH-CWG Aromatic Split:</i>                  | • EC5 – EC7               | • EC7 – EC8              | • EC8 – EC10           |
| • EC10 – EC12                                   | • EC12 – EC16             | • EC16 – EC21            | • EC21 – EC35          |
| <b>Aromatic, Monoaromatics &amp; Oxygenates</b> |                           |                          |                        |
| • Phenols                                       | • Benzene                 | • Toluene                | • Ethylbenzene         |
| • p & m - xylene                                | • o - xylene              | • MTBE                   |                        |

All environmental testing was undertaken by a specialist testing house Partner (*Chemtest*) who hold the required MCERTS accreditation and ISO17025 Standards, which are stipulated on the individual test certificates.

## 5. GROUND CONDITIONS

### 5.1 Summary of Strata Encountered

A detailed description of the strata encountered during the investigation is given in the Engineering Geologist's logs presented in Appendix II. Table 4 summarises the strata encountered in the investigation holes.

Table 4: Summary of strata encountered

| Trial Pit | Depth (m.bgl) |     | Description                                                                                                                                                                                                                                               |
|-----------|---------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | From          | To  |                                                                                                                                                                                                                                                           |
| TP A      | GL            | 1.0 | Loose to compact grey slightly clayey/silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and rare coal fragments, with some cobbles of sandstone   |
| TP B      | GL            | 1.0 | Loose to compact grey slightly clayey/silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and rare coal fragments, with some cobbles of sandstone   |
| TP C      | GL            | 1.0 | Loose to compact grey clayey, silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and rare coal fragments, with some cobbles of sandstone/ironstone |
| TP D      | GL            | 1.0 | Loose to compact grey clayey, silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and coal fragments, with some cobbles of sandstone                |
| TP E      | GL            | 1.0 | Loose to compact grey clayey, silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and rare coal fragments, with some cobbles of sandstone           |

The succession of strata in each trial pit generally revealed a similar composition of shallow Made Ground over the site.

### 5.2 Groundwater Conditions

No groundwater was encountered in any of the trial holes during the investigation. No groundwater monitoring installations were instructed as part of this commission.

*Please Note: Groundwater levels are subject to diurnal, seasonal and climatic conditions or may vary due to other causes.*

### 5.3 Visual & Olfactory Evidence of Contamination

There was no visual and / or olfactory evidence of any soil contamination during the investigation works.

There was no evidence of any contaminated groundwater during the investigation works.

## 6.0 GEOTECHNICAL DISCUSSION

### 6.1 General

The aim of this geotechnical assessment was to determine the suitability of the in-situ material for re-use as engineered fill on site. Any potential contamination issues revealed within the ground are discussed in Section 7.

Precise detail of any proposed levels or depth of any cut or fill are not known at present. The advice given herein may require revision once further details are known.

### 6.2 Engineering Properties of Strata

The engineering descriptions of the strata are presented on the Trial Pit logs in Appendix II.

The geotechnical classification testing results are summarised below.

Table 5: Summary of Geotechnical Test Results

| Trial Pit | Depth (m) | Classification/Performance Tests |                      |                           |        |      |           | Compaction Tests |                          |
|-----------|-----------|----------------------------------|----------------------|---------------------------|--------|------|-----------|------------------|--------------------------|
|           |           | w %                              | Loss on Ignition (%) | Particle Size Grading (%) |        |      |           | OMC (%)          | MDD (Mg/m <sup>3</sup> ) |
|           |           |                                  |                      | Cobbles                   | Gravel | Sand | Silt/Clay |                  |                          |
| WS01      | 0.5       | 6.7 / 8.2                        | 3.7                  | 0                         | 60     | 33   | 7         | 14               | 1.97                     |
| WS01      | 0.5       | 5.2 / 7.6                        | 3.5                  | 0                         | 54     | 31   | 15        | 13               | 1.91                     |
| WS03      | 0.5       | 5.0 / 4.8                        | 5.0                  | 0                         | 41     | 33   | 26        | 10               | 2.01                     |
| WS03      | 0.5       | 7.0 / 4.3                        | 16                   | 0                         | 58     | 24   | 18        | 11               | 2.01                     |
| WS04      | 0.5       | 7.5 / 9.5                        | 4.7                  | 0                         | 47     | 31   | 22        | 13               | 1.94                     |

Note: OMC: Optimum Moisture Content  
MDD: Maximum Dry Density

### 6.3 Re-Use of Site Won Soils

The laboratory test certificates for the classification and compaction tests are presented in Appendix III.

From the particle size gradings of the soils, these broadly fall into Class 1A *Well Graded Granular Material* according to the Highways Agency Specification for Highway Works Series 600 (SHW).

The SHW defines the placement method for Class 1A in Table 6/4 as Method 2. The principle of the SHW is that by adopting the method specified in Table 6/4, then at least 95% of maximum compaction would be achieved if placed within an acceptable moisture content range. A method compaction specification rules out the need for extensive validation testing during filling operations.

The laboratory testing results for the five site-won samples have recorded the following compaction parameters:

Table 6: Compaction Test Results

| Test/Parameter                              | Range of Results |
|---------------------------------------------|------------------|
| Maximum Dry Density (MDD) Mg/m <sup>3</sup> | 1.91 – 2.01      |
| Optimum Moisture Content (OMC) %            | 10 – 14          |
| Natural Moisture Content (NMC) %            | 4.3 – 9.5        |
| MC Range for 95% Compaction                 | OMC ± 5%         |

The suitability of the performance of the material as-dug will be moisture content dependent.

The natural moisture content of these soils ranged between 4% and 10%.

The compaction testing recorded maximum dry densities (MDD) of between 1.91 Mg/m<sup>3</sup> and 2.01Mg/m<sup>3</sup> at corresponding Optimum Moisture Contents (OMC) of between 10% and 14%.

In most re-engineering of soils, a figure of 95% of maximum dry density is considered to be the desired performance for an engineered fill when used as a structural fill. By plotting the 95% level of MDD over the range of moisture contents of the compaction test curve, a range of moisture contents can be derived to achieve 95% compaction.

The acceptable range of moisture content to achieve 95% compaction was OMC  $\pm$  5%. The average OMC was 12%. The average natural moisture content (NMC) of the soils was 7%. This places the average NMC at OMC-5%, i.e., within the acceptable range to achieve optimum compaction.

Table 6/4 of SHW lists the requirements for placement of fill once classified at suitable material. The extract from Table 6/4 shows the required thickness of compacted layers and number of passes of various size rollers. For example, as below; for a 2,500kg smoothed wheel roller, Method 2 requires 10 passes on layers 125mm in thickness.

Table 7: SHW Series 600 Table 6/4 Extract

| Type of Compaction Plant                                                  | Ref No. | Category                                                 | Method 1 |    | Method 2 |    |
|---------------------------------------------------------------------------|---------|----------------------------------------------------------|----------|----|----------|----|
|                                                                           |         |                                                          | D        | N# | D        | N# |
| Smoothed wheeled roller (or vibratory roller operating without vibration) | 1       | Mass per metre width of roll: over 2100 kg up to 2700 kg | 125      | 8  | 125      | 10 |
|                                                                           | 2       | over 2700 kg up to 5400 kg                               | 125      | 6  | 125      | 8  |
|                                                                           | 3       | over 5400 kg                                             | 150      | 4  | 150      | 8  |

## 6.4 Concrete Classification

The Aggressive Chemical Environment for Concrete (ACEC) classification for the site has been assessed according to the guidelines within BRE Special Digest (2005) using the chemical test results from the contamination testing. For classification purposes, based on the BRE guidance, groundwater must be classed as 'mobile' unless proven to be 'static' over a 24hr period.

The pH values of the soil samples taken from across the site ranged between 7.6 and 8.3 whilst the levels of water-soluble sulphate (SO<sub>4</sub>) content of the tested soil samples were all less than 0.043g/litre.

Based on the site being effectively 'brownfield' soils, due to the made ground; with an assumed mobile groundwater the Design Sulphate class for the site is assessed as DS-1 with an ACEC classification as AC-1.

## 7.0 GEO-ENVIRONMENTAL APPRAISAL

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### 7.1 General

Selected samples from the investigation have been tested for potential contamination by way of a baseline assessment of the risks to the site end users using a Tier 2 Generic Quantitative Risk Assessment methodology.

The risks to human health are considered herein. The assessment does not extend to wider environmental issues of controlled waters.

### 7.2 Human Health Risk Assessment Criteria

For the purposes of Quantum Geotechnic Ltd assessments, the most recent and applicable SGVs, GACs, SU4Ls and C4SLs are used based on the proposed site end use and development and overall suitability. These are all referenced within the text. SU4Ls take precedence in QGL assessments. Where these are not available or suitable, C4SLs are adopted.

By adopting the CLEA approach to human health risk assessment as defined in new regulatory guidance 'Land Contamination Risk Management' (LCRM); [www.gov.uk/government/publications/land-contamination-risk-management-lcrm](http://www.gov.uk/government/publications/land-contamination-risk-management-lcrm) (superseding CLR11), a human health risk assessment has been undertaken for the proposed development adopting the most appropriate end use model of a *Commercial End Use*.

The assessment criteria used in this assessment is that presented by LQM / CIEH in their publication *The LQM / CIEH S4ULs for Human Health Risk Assessment* (2015). The S4ULs (Suitable for Use Levels) used have been derived in accordance with UK legislation as well as Environment Agency policy. These have been used in conjunction with a modified version of the Environmental Agency CLEA software and available guidance provided to the contaminated land practitioner community for the purpose of deriving Generic Assessment Criteria (GAC).

The LQM / CIEH S4ULs are intended for use in assessing potential risks posed to human health by contaminants in soil and as transparently derived and cautious 'trigger values' above which further assessment or remedial action may be necessary. By using the LQM / CIEH S4ULs, Quantum acknowledges Copyright Land Quality Management Ltd reproduced with permission, Publication Number S4UL3409. All Rights Reserved.

### 7.3 Soil Sample Test Results Comparisons

#### 7.3.1 Asbestos

No Asbestos was identified in the five samples tested.

#### 7.3.2 Heavy Metal and Inorganic Compounds

The results of levels of potential contaminants have been compared to GACs as described above for a '*Residential End Use with Plant Uptake*' situation, as being considered the most appropriate threshold for human health relating to the ultimate use of soils on this site.

The concentrations of heavy metal / inorganic compounds are listed in the Table 8. The test results certificates are included in Appendix IV.

Table 8: Summary of Heavy Metals and General Inorganic Soil Test Results.

| Determinant                                   | Concentration Range (mg/kg – unless specified) | LQM/CIEH (2015) GAC (mg/kg) Residential + Plants <sup>(1)</sup> | Exceedances |
|-----------------------------------------------|------------------------------------------------|-----------------------------------------------------------------|-------------|
| pH (as pH units)                              | 7.6 – 8.3                                      | < 5                                                             | 0           |
| Cyanide – Total                               | < 0.5                                          | 34                                                              | 0           |
| Free Cyanide                                  | < 0.5                                          | 34                                                              | 0           |
| Water Soluble Sulphate (SO <sub>4</sub> ) g/l | <0.01 – 0.04 g/l                               | 0.5 g/l                                                         | 0           |
| Organic Matter                                | 5.9 – 69                                       | n/a                                                             | n/a         |
| Arsenic                                       | 6.1 – 16                                       | 37                                                              | 0           |
| Beryllium                                     | < 1.0 – 1.3                                    | 1.7                                                             | 0           |
| Boron (water soluble)                         | < 0.4 – 0.42                                   | 290                                                             | 0           |
| Cadmium                                       | 0.15 – 0.20                                    | 11                                                              | 0           |
| Chromium                                      | 9.2 – 16                                       | 910                                                             | 0           |
| Copper                                        | 36 – 51                                        | 2400                                                            | 0           |
| Lead                                          | 22 – 43                                        | 200                                                             | 0           |
| Mercury                                       | < 0.1                                          | 40                                                              | 0           |
| Nickel                                        | 27 – 43                                        | 130                                                             | 0           |
| Selenium                                      | 0.27 – 0.62                                    | 250                                                             | 0           |
| Vanadium                                      | 7 – 22                                         | 410                                                             | 0           |
| Zinc                                          | 76 - 110                                       | 3700                                                            | 0           |

Notes:

(1) GAC from LQM/CIEH S4ULs 2015.

### 7.3.3 Total Phenols

Total Phenols (monohydric) all recorded values of < 0.1mg/kg in the soil samples.

### 7.3.4 Speciated Polycyclic Aromatic Hydrocarbons

The results of levels of potential contaminants as have been compared to GACs as described, for a *Residential* end use as being considered the most appropriate threshold for human health relating to handling of soils and for a Soil Organic Matter (SOM) content of 6% (minimum recorded value in tests: 5.9%). The test certificates are included in Appendix IV. The concentrations of speciated Polycyclic Aromatic Hydrocarbon are summarised and compared in the Table 9 over page.

Three determinands were above the threshold value for the proposed end use.

Table 9: Summary of Speciated Polycyclic Aromatic Hydrocarbon Soil Test Results.

| Determinant             | Concentration Range<br>(mg/kg – unless<br>specified) | LQM/CIEH (2015) GAC<br>Residential + Plants (mg/kg) |             |
|-------------------------|------------------------------------------------------|-----------------------------------------------------|-------------|
|                         |                                                      | 6% SOM                                              | Exceedances |
| Naphthalene             | < 0.1 – 3.3                                          | 13                                                  | 0           |
| Acenaphthylene          | < 0.1 – 0.73                                         | 920                                                 | 0           |
| Acenaphthene            | < 0.1 – 0.53                                         | 1100                                                | 0           |
| Fluorene                | < 0.1 – 0.9                                          | 860                                                 | 0           |
| Phenanthrene            | 0.9 – 4.8                                            | 440                                                 | 0           |
| Anthracene              | 0.34 – 1.7                                           | 11000                                               | 0           |
| Fluoranthene            | 1.2 – 5.7                                            | 890                                                 | 0           |
| Pyrene                  | 1.1 – 5.0                                            | 2000                                                | 0           |
| Benzo(a)anthracene      | 1.1 – 4.8                                            | 13                                                  | 0           |
| Chrysene                | 1.2 – 5.1                                            | 27                                                  | 0           |
| Benzo(b)fluoranthene    | 1.1 – 5.2                                            | 3.7                                                 | 2           |
| Benzo(k)fluoranthene    | 0.47 – 2.2                                           | 100                                                 | 0           |
| Benzo(a)pyrene          | 0.72 – 3.4                                           | 3.0                                                 | 1           |
| Indeno(1,2,3-cd) pyrene | 0.48 – 1.8                                           | 41                                                  | 0           |
| Dibenz(a,h)anthracene   | 0.24 – 0.95                                          | 0.3                                                 | 3           |
| Benzo(ghi)perylene      | 0.36 – 1.5                                           | 350                                                 | 0           |

Notes:

(1). GAC from LQM/CIEH S4ULs 2015.

### 7.3.5 Monoaromatic Compounds and Oxygenates

Benzene, Toluene, Ethylbenzene, Xylene compounds and MTBE were all tested within the soil samples. All recorded values of <0.1µg/kg; all below the generic assessment criteria.

### 7.3.6 Total Petroleum Hydrocarbons

The results of levels of potential contaminants have been compared to GAC as described, for a *Commercial* end use as being considered the most appropriate threshold for human health relating to handling of soils and for a Soil Organic Matter (SOM) content of 6%. The test certificates are included in Appendix IV. The concentrations of speciated Petroleum Hydrocarbon are summarised and compared in the Table 10 over page.

These all fell below the relevant threshold.

Table 10: Summary of Petroleum Hydrocarbon Soil Test Results.

| Analytical Parameter     | Site Results Range (mg/kg) | LQM/CIEH (2015) GAC <sup>(1)</sup><br>Residential (mg/kg) |             |
|--------------------------|----------------------------|-----------------------------------------------------------|-------------|
|                          |                            | 6% SOM                                                    | Exceedances |
| TPH – Aliphatic EC5-6    | < 1.0                      | 160                                                       | 0           |
| TPH – Aliphatic >EC6-8   | < 1.0                      | 530                                                       | 0           |
| TPH – Aliphatic >EC8-10  | < 1.0                      | 150                                                       | 0           |
| TPH – Aliphatic >EC10-12 | < 1.0                      | 760                                                       | 0           |
| TPH – Aliphatic >EC12-16 | < 1.0                      | 4,300                                                     | 0           |
| TPH – Aliphatic >EC16-21 | < 1.0                      |                                                           | 0           |
| TPH – Aliphatic >EC21-35 | < 1.0 – 4.9                | 110,000 <sup>(2)</sup>                                    | 0           |
| TPH – Aliphatic >EC35-44 | < 1.0                      | 110,000                                                   | 0           |
| TPH – Aromatic >EC5-7    | < 1.0                      | 300                                                       | 0           |
| TPH – Aromatic >EC7-8    | < 1.0                      | 660                                                       | 0           |
| TPH – Aromatic >EC8-10   | < 1.0                      | 190                                                       | 0           |
| TPH – Aromatic >EC10-12  | < 1.0                      | 380                                                       | 0           |
| TPH – Aromatic >EC12-16  | < 1.0                      | 660                                                       | 0           |
| TPH – Aromatic >EC16-21  | < 1.0                      | 930                                                       | 0           |
| TPH – Aromatic >EC21-35  | < 1.0 – 65                 | 1,700                                                     | 0           |
| TPH – Aromatic >EC35-44  | < 1.0                      | 1,700                                                     | 0           |

Notes:

(1). GAC from LQM/CIEH S4ULs 2015.

(2). GAC for C16 – C35 quoted.

## 7.4 Contaminated Land Risk Assessment

The scope of works included testing of select soil samples in order to assess potential risks to human health from an accepted suite of potential contaminants of concern. The following section summarises those findings.

### 7.4.1 Human Health Assessment & Recommendations

The majority of potential contaminants analysed from within the soils recorded concentrations values well below the prescribed generic assessment criteria for a *Residential end use with plant uptake*. The exception to this was three polycyclic aromatic hydrocarbon determinants which recorded values in up to two samples marginally in excess of the generic assessment criteria.

Based on this, a potential contamination source does exist for a pollutant linkage that may constitute a risk to future site users.

The consequence of this, without undertaking any more detailed risk assessment and further testing, is that all areas of gardens and landscaping should be capped with a 600mm layer of suitable inert capping and topsoil. No special measures are required in areas of hard-standing.

As general good practice, we would recommend that suitable welfare and hygiene facilities are available on site during all construction work.

## 8 REFERENCES

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### British Geological Survey (BGS)

- British Geological Survey Sheet SO 00 NW, 1:10,560 scale.
- BGS Geology of Britain Viewer ([www.bgs.ac.uk](http://www.bgs.ac.uk)).

### Specialist Publications

- BS 5930:2015+A1:2020 '*Code of Practice for Site Investigations*'
- BS 1377:1990 '*Methods of test for soils for civil engineering purposes*'.
- BS EN ISO 14688-1:2018 *Geotechnical investigation and testing. Identification and classification of soil. Identification and description.*
- BS EN ISO 14688-2:2018 *Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.*
- Highways Agency. MCDHW Volume 1 Specification for Highway Works, Series 600
- Health and Safety Executive Guidance Note EH40/90
- BRE (2005) Special Digest 1:2005, 3<sup>rd</sup> Edition, *Concrete in aggressive ground*.
- BS 6031: 2009 *Code of Practice for Earthworks*.
- Land Contamination Risk Management (LCRM) [www.gov.uk/government/publications/land-contamination-risk-management-lcrm](http://www.gov.uk/government/publications/land-contamination-risk-management-lcrm)
- LQM / CIEH Suitable for Use Levels (S4UL) for Human Health Risk Assessment, 2015

## APPENDIX I – SITE PLAN

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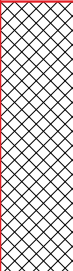
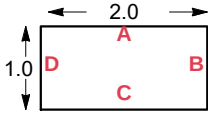
Plas Newydd, Llanedi, Pontarddulais, SA4 0FQ  
Tel: 01554 744880 E: [enquiries@quantumgeotech.co.uk](mailto:enquiries@quantumgeotech.co.uk)

## Upper Colliers Row, Merthyr Tydfil Trial Pit Location Plan

|         |          |       |          |
|---------|----------|-------|----------|
| Job No: | Q0558    | Date: | July '21 |
| Ref:    | Figure 1 | By:   | JS       |

## APPENDIX II – TRIAL PIT LOGS

---

| <b>Contract : Upper Colliers Row, Merthyr Tydfil</b><br><b>Client : Maxiom Developments</b>                                                                                                     |             |          |                                                                                        |                                                  |                   |                                                                                                                                                                                                                                                                                                           | <b>Trial Pit No.</b><br><b>TP A</b>                                                 |                                                                                       |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|----------------------------------------------------------------------------------------|--------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------|
| Dates : 17/6/21 - 17/6/21<br>Location : Plot 8/9                                                                                                                                                |             |          |                                                                                        | Job Number : Q0558<br>Engineer : Quantum Geotech |                   | Ground Level :<br>Coordinates:                                                                                                                                                                                                                                                                            |                                                                                     |                                                                                       |       |
| m B.G.L.                                                                                                                                                                                        | Samples     |          | Tests                                                                                  |                                                  | Strata            |                                                                                                                                                                                                                                                                                                           |                                                                                     |                                                                                       | WATER |
|                                                                                                                                                                                                 | Depth       | Type No. | Depth                                                                                  | Test Results                                     | Depth (Thickness) | Description                                                                                                                                                                                                                                                                                               | Legend                                                                              | Depth (Thickness)                                                                     |       |
| 1                                                                                                                                                                                               | 0.50 - 1.00 | B1       |                                                                                        |                                                  | 1.00              | MADE GROUND: Loose to compact grey slightly clayey/silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and rare coal fragments, with some cobbles of sandstone<br><br>TP Terminated at target depth |  | (1.00)                                                                                |       |
|                                                                                                                                                                                                 | 0.50 - 1.00 | ES1      |                                                                                        |                                                  |                   |                                                                                                                                                                                                                                                                                                           |                                                                                     |                                                                                       |       |
|                                                                                                                                                                                                 | 0.50 - 1.00 | B2       |                                                                                        |                                                  |                   |                                                                                                                                                                                                                                                                                                           |                                                                                     |                                                                                       |       |
|                                                                                                                                                                                                 | 0.50 - 1.00 | B3       |                                                                                        |                                                  |                   |                                                                                                                                                                                                                                                                                                           |                                                                                     |                                                                                       |       |
| <b>PLAN</b><br>                                                                                              |             |          | Groundwater: None Encountered<br><br>Stability: Relatively Stable<br><br>Shoring: None |                                                  |                   | Remarks:                                                                                                                                                                                                                                                                                                  |                                                                                     |                                                                                       |       |
| Equipment Used: 13T Tracked Excavator                                                                                                                                                           |             |          |                                                                                        |                                                  |                   |                                                                                                                                                                                                                                                                                                           |                                                                                     |                                                                                       |       |
|  Plas Newydd, Pontarddulais, Swansea<br>SA4 0FQ<br>Tel: 01554 744880<br>email: enquiries@quantumgeotech.co.uk |             |          |                                                                                        | Operator: J Stark                                |                   | Logged By: 1 Of 2                                                                                                                                                                                                                                                                                         |                                                                                     | m Per Page: 5                                                                         |       |
| All measurements in metres unless otherwise stated                                                                                                                                              |             |          |                                                                                        |                                                  |                   |                                                                                                                                                                                                                                                                                                           |                                                                                     |  |       |

**Contract : Upper Colliers Row, Merthyr Tydfil**

**Client : Maxiom Developments**

**Trial Pit No.**

**TP A**

Dates : 17/6/21 - 17/6/21

Job Number : Q0558

Ground Level :

Location : Plot 8/9

Engineer : Quantum Geotech

Coordinates:



Plas Newydd, Pontarddulais, Swansea  
SA4 0FQ  
Tel: 01554 744880  
email: enquiries@quantumgeotech.co.uk

Operator:

Logged By:

J Stark

Sheet No.

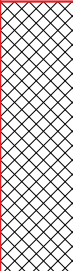
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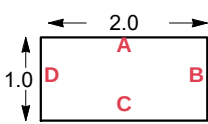
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otherwise stated



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| <b>Contract : Upper Colliers Row, Merthyr Tydfil</b><br><b>Client : Maxiom Developments</b> |  |  |  |                                                  |  |                                | <b>Trial Pit No.</b><br><b>TP B</b> |  |
| Dates : 17/6/21 - 17/6/21<br>Location : Plot 6/7                                            |  |  |  | Job Number : Q0558<br>Engineer : Quantum Geotech |  | Ground Level :<br>Coordinates: |                                     |  |

| m B.G.L. | Samples     |          | Tests |              | Strata            |                                                                                                                                                                                                                                                                                                           |                                                                                     |                   | WATER |
|----------|-------------|----------|-------|--------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------|-------|
|          | Depth       | Type No. | Depth | Test Results | Depth (Thickness) | Description                                                                                                                                                                                                                                                                                               | Legend                                                                              | Depth (Thickness) |       |
| 1        | 0.50 - 1.00 | B1       |       |              | 1.00              | MADE GROUND: Loose to compact grey slightly clayey/silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and rare coal fragments, with some cobbles of sandstone<br><br>TP Terminated at target depth |  | (1.00)            |       |
|          | 0.50 - 1.00 | ES1      |       |              | 1.00              |                                                                                                                                                                                                                                                                                                           |                                                                                     | 1.00              |       |
|          | 0.50 - 1.00 | B2       |       |              |                   |                                                                                                                                                                                                                                                                                                           |                                                                                     |                   |       |
|          | 0.50 - 1.00 | B3       |       |              |                   |                                                                                                                                                                                                                                                                                                           |                                                                                     |                   |       |

|                                                                                                    |  |                                                                                        |  |          |  |
|----------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------|--|----------|--|
| <b>PLAN</b><br> |  | Groundwater: None Encountered<br><br>Stability: Relatively Stable<br><br>Shoring: None |  | Remarks: |  |
|----------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------|--|----------|--|

Equipment Used: 13T Tracked Excavator

|                                                                                    |                                                                                                              |                      |                       |                     |                 |                                                    |                                                                                       |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------|-----------------------|---------------------|-----------------|----------------------------------------------------|---------------------------------------------------------------------------------------|
|  | Plas Newydd, Pontarddulais, Swansea<br>SA4 0FQ<br>Tel: 01554 744880<br>email: enquiries@quantumgeotech.co.uk | Operator:<br>J Stark | Logged By:<br>J Stark | Sheet No.<br>1 Of 2 | m Per Page<br>5 | All measurements in metres unless otherwise stated |  |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------|-----------------------|---------------------|-----------------|----------------------------------------------------|---------------------------------------------------------------------------------------|

**Contract : Upper Colliers Row, Merthyr Tydfil**

**Client : Maxiom Developments**

**Trial Pit No.  
TP B**

Dates : 17/6/21 - 17/6/21

Job Number : Q0558

Ground Level :

Location : Plot 6/7

Engineer : Quantum Geotech

Coordinates:



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Tel: 01554 744880  
email: enquiries@quantumgeotech.co.uk

Operator:

Logged By:

J Stark

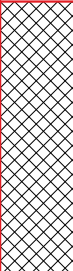
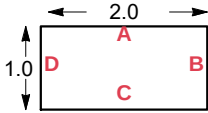
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metres unless  
otherwise stated



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| <b>Contract : Upper Colliers Row, Merthyr Tydfil</b><br><b>Client : Maxiom Developments</b>                                                                                                     |                                      |                       |                                                                                        |              |                   |                                                                                                                                                                                                                                                                        | <b>Trial Pit No.</b><br><b>TP C</b>                                                 |                   |                                                                                                                                             |
| Dates : 17/6/21 - 17/6/21<br>Location : Plot 1/2/3                                                                                                                                              |                                      |                       | Job Number : Q0558<br>Engineer : Quantum Geotech                                       |              |                   | Ground Level :<br>Coordinates:                                                                                                                                                                                                                                         |                                                                                     |                   |                                                                                                                                             |
| m B.G.L.                                                                                                                                                                                        | <b>Samples</b>                       |                       | <b>Tests</b>                                                                           |              | <b>Strata</b>     |                                                                                                                                                                                                                                                                        |                                                                                     |                   | <b>WATER</b>                                                                                                                                |
|                                                                                                                                                                                                 | Depth                                | Type No.              | Depth                                                                                  | Test Results | Depth (Thickness) | Description                                                                                                                                                                                                                                                            | Legend                                                                              | Depth (Thickness) |                                                                                                                                             |
| 1                                                                                                                                                                                               | 0.50 - 1.00<br>0.50 -<br>0.50 - 1.00 | B1<br>ES1<br>B2<br>B3 |                                                                                        |              | 1.00              | MADE GROUND: Loose to compact grey clayey, silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and rare coal fragments, with some cobbles of sandstone/ironstone |  | (1.00)            |                                                                                                                                             |
|                                                                                                                                                                                                 |                                      |                       |                                                                                        |              | 1.00              | TP Terminated at target depth                                                                                                                                                                                                                                          |                                                                                     | 1.00              |                                                                                                                                             |
| <b>PLAN</b><br>                                                                                              |                                      |                       | Groundwater: None Encountered<br><br>Stability: Relatively Stable<br><br>Shoring: None |              |                   | Remarks:                                                                                                                                                                                                                                                               |                                                                                     |                   |                                                                                                                                             |
| Equipment Used: 13T Tracked Excavator                                                                                                                                                           |                                      |                       |                                                                                        |              |                   |                                                                                                                                                                                                                                                                        |                                                                                     |                   |                                                                                                                                             |
|  Plas Newydd, Pontarddulais, Swansea<br>SA4 0FQ<br>Tel: 01554 744880<br>email: enquiries@quantumgeotech.co.uk |                                      |                       | Operator: J Stark                                                                      |              | Logged By: 1 Of 2 |                                                                                                                                                                                                                                                                        | m Per Page: 5                                                                       |                   | All measurements in metres unless otherwise stated<br> |

**Contract : Upper Colliers Row, Merthyr Tydfil**

**Client : Maxiom Developments**

**Trial Pit No.  
TP C**

Dates : 17/6/21 - 17/6/21

Job Number : Q0558

Ground Level :

Location : Plot 1/2/3

Engineer : Quantum Geotech

Coordinates:



Plas Newydd, Pontarddulais, Swansea  
SA4 0FQ  
Tel: 01554 744880  
email: enquiries@quantumgeotech.co.uk

Operator:

Logged By:

J Stark

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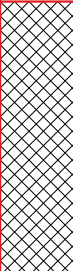
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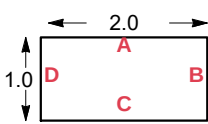
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| <b>Contract : Upper Colliers Row, Merthyr Tydfil</b><br><b>Client : Maxiom Developments</b> |  |  |  |                                                                |  |                                              | <b>Trial Pit No.</b><br><b>TP D</b> |  |
| <b>Dates :</b> 17/6/21 - 17/6/21<br><b>Location :</b> Plot 3/5                              |  |  |  | <b>Job Number :</b> Q0558<br><b>Engineer :</b> Quantum Geotech |  | <b>Ground Level :</b><br><b>Coordinates:</b> |                                     |  |

| m B.G.L. | Samples     |          | Tests |              | Strata            |                                                                                                                                                                                                                                                                                              |                                                                                     |                   | WATER |
|----------|-------------|----------|-------|--------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------|-------|
|          | Depth       | Type No. | Depth | Test Results | Depth (Thickness) | Description                                                                                                                                                                                                                                                                                  | Legend                                                                              | Depth (Thickness) |       |
| 1        | 0.50 - 1.00 | B1       |       |              | 1.00              | MADE GROUND: Loose to compact grey clayey, silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and coal fragments, with some cobbles of sandstone<br><br>TP Terminated at target depth |  | (1.00)            |       |
|          | 0.50 -      | ES1      |       |              |                   |                                                                                                                                                                                                                                                                                              |                                                                                     |                   |       |
|          | 0.50 - 1.00 | B2       |       |              |                   |                                                                                                                                                                                                                                                                                              |                                                                                     |                   |       |
|          |             | B3       |       |              |                   |                                                                                                                                                                                                                                                                                              |                                                                                     |                   |       |

|                                                                                                    |  |                                                                                                             |                 |
|----------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------|-----------------|
| <b>PLAN</b><br> |  | <b>Groundwater:</b> None Encountered<br><br><b>Stability:</b> Relatively Stable<br><br><b>Shoring:</b> None | <b>Remarks:</b> |
|----------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------|-----------------|

**Equipment Used:** 13T Tracked Excavator

|                                                                                    |                                                                                                              |                             |                              |                            |                        |                                                    |                                                                                       |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------|----------------------------|------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------|
|  | Plas Newydd, Pontarddulais, Swansea<br>SA4 0FQ<br>Tel: 01554 744880<br>email: enquiries@quantumgeotech.co.uk | <b>Operator:</b><br>J Stark | <b>Logged By:</b><br>J Stark | <b>Sheet No.</b><br>1 Of 2 | <b>m Per Page</b><br>5 | All measurements in metres unless otherwise stated |  |
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**Contract : Upper Colliers Row, Merthyr Tydfil**

**Client : Maxiom Developments**

**Trial Pit No.  
TP D**

Dates : 17/6/21 - 17/6/21

Job Number : Q0558

Ground Level :

Location : Plot 3/5

Engineer : Quantum Geotech

Coordinates:



Plas Newydd, Pontarddulais, Swansea  
SA4 0FQ  
Tel: 01554 744880  
email: enquiries@quantumgeotech.co.uk

Operator:

Logged By:

J Stark

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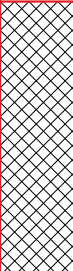
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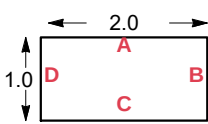
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otherwise stated



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| <b>Contract : Upper Colliers Row, Merthyr Tydfil</b><br><b>Client : Maxiom Developments</b> |  |  |  |                                                  |  |                                | <b>Trial Pit No.</b><br><b>TP E</b> |  |
| Dates : 17/6/21 - 17/6/21<br>Location : Plot 4/5/10                                         |  |  |  | Job Number : Q0558<br>Engineer : Quantum Geotech |  | Ground Level :<br>Coordinates: |                                     |  |

| m B.G.L. | Samples     |          | Tests |              | Strata            |                                                                                                                                                                                                                                                                                                   |                                                                                     |                   | WATER |
|----------|-------------|----------|-------|--------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------|-------|
|          | Depth       | Type No. | Depth | Test Results | Depth (Thickness) | Description                                                                                                                                                                                                                                                                                       | Legend                                                                              | Depth (Thickness) |       |
| 1        | 0.50 - 1.00 | B1       |       |              | 1.00              | MADE GROUND: Loose to compact grey clayey, silty fine to coarse sandy GRAVEL (fine to coarse angular and subangular), comprising predominantly sandstone, siltstone & mudstone with some ash/clinker and rare coal fragments, with some cobbles of sandstone<br><br>TP Terminated at target depth |  | (1.00)            |       |
|          | 0.50 -      | ES1      |       |              |                   |                                                                                                                                                                                                                                                                                                   |                                                                                     |                   |       |
|          | 0.50 - 1.00 | B2       |       |              |                   |                                                                                                                                                                                                                                                                                                   |                                                                                     |                   |       |
|          |             | B3       |       |              |                   |                                                                                                                                                                                                                                                                                                   |                                                                                     |                   |       |

|                                                                                                    |  |                                                                                        |          |
|----------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------|----------|
| <b>PLAN</b><br> |  | Groundwater: None Encountered<br><br>Stability: Relatively Stable<br><br>Shoring: None | Remarks: |
|----------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------|----------|

Equipment Used: 13T Tracked Excavator

|                                                                                    |                                                                                                              |                      |                       |                     |                 |                                                    |                                                                                       |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------|-----------------------|---------------------|-----------------|----------------------------------------------------|---------------------------------------------------------------------------------------|
|  | Plas Newydd, Pontarddulais, Swansea<br>SA4 0FQ<br>Tel: 01554 744880<br>email: enquiries@quantumgeotech.co.uk | Operator:<br>J Stark | Logged By:<br>J Stark | Sheet No.<br>1 Of 2 | m Per Page<br>5 | All measurements in metres unless otherwise stated |  |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------|-----------------------|---------------------|-----------------|----------------------------------------------------|---------------------------------------------------------------------------------------|

**Contract : Upper Colliers Row, Merthyr Tydfil**

**Client : Maxiom Developments**

**Trial Pit No.  
TP E**

Dates : 17/6/21 - 17/6/21

Job Number : Q0558

Ground Level :

Location : Plot 4/5/10

Engineer : Quantum Geotech

Coordinates:



Plas Newydd, Pontarddulais, Swansea  
SA4 0FQ  
Tel: 01554 744880  
email: enquiries@quantumgeotech.co.uk

Operator:

Logged By:

J Stark

Sheet No.

2 Of 2

m Per  
Page

All measurements in  
metres unless  
otherwise stated



## APPENDIX III – GEOTECHNICAL LABORATORY TEST RESULTS

---



## Contract Number: 54538

Client Ref: **Q0558**

Report Date: **03-07-2021**

Client PO:

Client **Quantum Geotechnic Ltd**  
**Plas Newydd**  
**Llanedi**  
**Pontarddulais**  
**Swansea**  
**SA4 0FQ**

Contract Title: **Colliers Row, Merthyr Tydfil**  
For the attention of: **John Stark**

Date Received: **17-06-2021**

Date Completed: **03-07-2021**

| Test Description                                                                                                                          | Qty |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Moisture Content of Soil</b><br>BS1377 : Part 2 : Clause 3.2 : 1990 - * UKAS                                                           | 5   |
| <b>PSD Wet &amp; Dry Sieve method</b><br>BS 1377:1990 - Part 2 : 9.2 - * UKAS                                                             | 5   |
| <b>PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected)</b><br>BS 1377:1990 - Part 2 : 9.4 - * UKAS | 4   |
| <b>LOI</b><br>Sub-contracted Test                                                                                                         | 5   |
| <b>Dry Den/MC (4.5kg Rammer Method 1 Litre Mould/CBR Mould)</b><br>BS 1377:1990 - Part 4 : 3.5 - * UKAS                                   | 5   |
| <b>Samples Received</b><br>- @ Non Accredited Test                                                                                        | 10  |
| <b>Disposal of samples for job</b>                                                                                                        | 1   |

Notes: Observations and Interpretations are outside the UKAS Accreditation  
\* - denotes test included in laboratory scope of accreditation  
# - denotes test carried out by approved contractor  
@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

#### Approved Signatories:

Emma Sharp (Office Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)  
Shaun Jones (Laboratory manager) - Wayne Honey (Administrative Assistant / Health and Safety)



**PARTICLE SIZE DISTRIBUTION**  
**BS 1377 Part 2:1990**  
**Wet Sieve, Clause 9.2**

Contract Number 54538

Borehole/Pit No. TPA

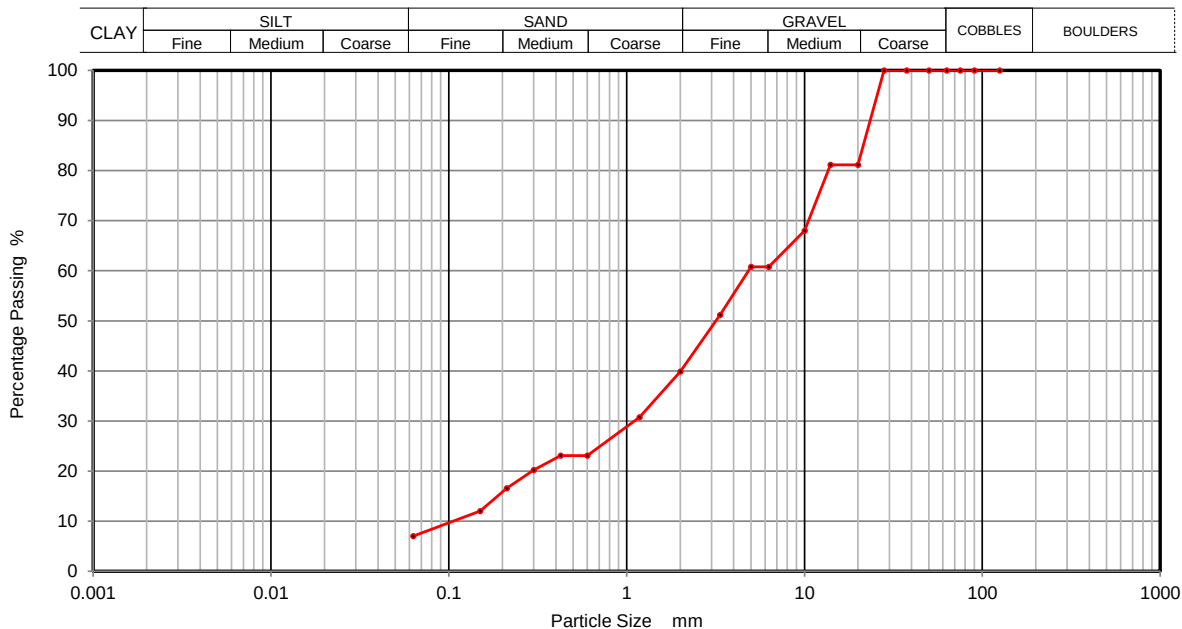
Site Name Colliers Row, Merthyr Tydfil Sample No. 1 + 2

Soil Description Grey slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL

Depth Top 0.50

Depth Base

Date Tested 02/07/2021 Sample Type B



| Sieving          |           | Sedimentation    |           |
|------------------|-----------|------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm | % Passing |
| 125              | 100       |                  |           |
| 90               | 100       |                  |           |
| 75               | 100       |                  |           |
| 63               | 100       |                  |           |
| 50               | 100       |                  |           |
| 37.5             | 100       |                  |           |
| 28               | 100       |                  |           |
| 20               | 81        |                  |           |
| 14               | 81        |                  |           |
| 10               | 68        |                  |           |
| 6.3              | 61        |                  |           |
| 5                | 61        |                  |           |
| 3.35             | 51        |                  |           |
| 2                | 40        |                  |           |
| 1.18             | 31        |                  |           |
| 0.6              | 23        |                  |           |
| 0.425            | 23        |                  |           |
| 0.3              | 20        |                  |           |
| 0.212            | 17        |                  |           |
| 0.15             | 12        |                  |           |
| 0.063            | 7         |                  |           |

|                                                     |     |
|-----------------------------------------------------|-----|
| MC in accordance with BS1377 Part 2 1990 Clause 3.2 |     |
| Moisture Content %                                  | 6.7 |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Cobbles            | 0          |
| Gravel             | 60         |
| Sand               | 33         |
| Silt and Clay      | 7          |
|                    |            |
|                    |            |

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| David    | Approved | 03/07/2021 | Paul Evans   |  |



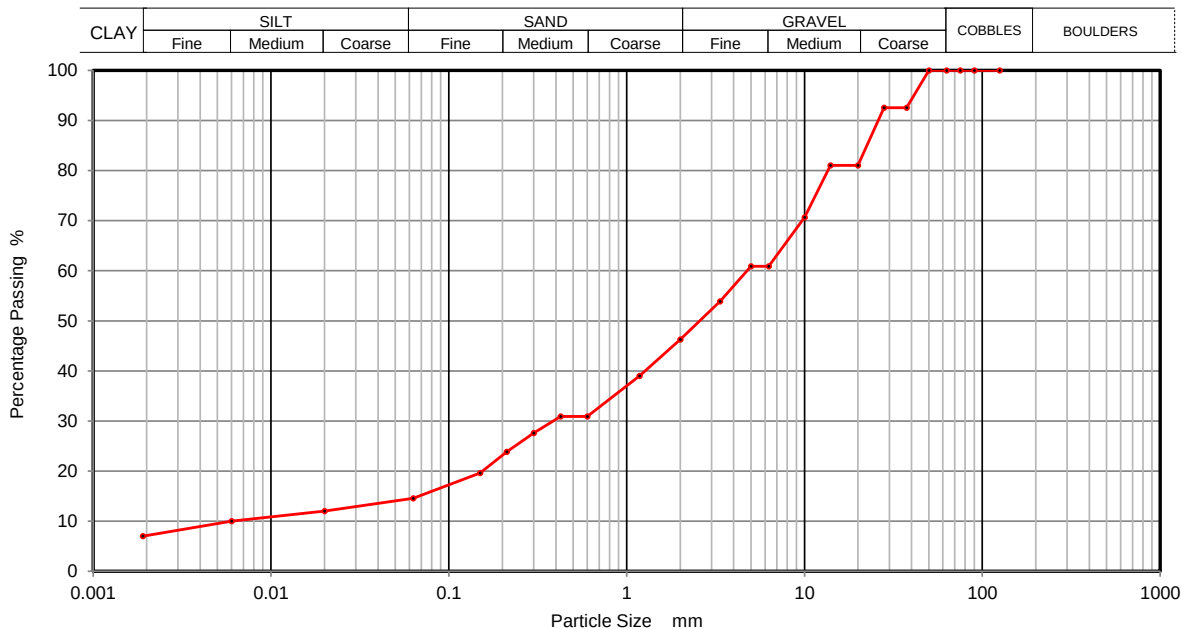
2788



**PARTICLE SIZE DISTRIBUTION**  
**BS 1377 Part 2:1990**  
**Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**

|                  |       |
|------------------|-------|
| Contract Number  | 54538 |
| Borehole/Pit No. | TPB   |
| Sample No.       | 1 + 2 |
| Depth Top        | 0.50  |
| Depth Base       |       |
| Sample Type      | B     |

|                  |                                                                                |
|------------------|--------------------------------------------------------------------------------|
| Site Name        | Colliers Row, Merthyr Tydfil                                                   |
| Soil Description | Grey slightly clayey slightly silty fine to coarse sandy fine to coarse GRAVEL |
| Date Tested      | 02/07/2021                                                                     |



| Sieving          |           | Sedimentation    |           |
|------------------|-----------|------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm | % Passing |
| 125              | 100       | 0.0200           | 12        |
| 90               | 100       | 0.0060           | 10        |
| 75               | 100       | 0.0020           | 7         |
| 63               | 100       |                  |           |
| 50               | 100       |                  |           |
| 37.5             | 93        |                  |           |
| 28               | 93        |                  |           |
| 20               | 81        |                  |           |
| 14               | 81        |                  |           |
| 10               | 71        |                  |           |
| 6.3              | 61        |                  |           |
| 5                | 61        |                  |           |
| 3.35             | 54        |                  |           |
| 2                | 46        |                  |           |
| 1.18             | 39        |                  |           |
| 0.6              | 31        |                  |           |
| 0.425            | 31        |                  |           |
| 0.3              | 28        |                  |           |
| 0.212            | 24        |                  |           |
| 0.15             | 20        |                  |           |
| 0.063            | 15        |                  |           |

|                                                     |     |
|-----------------------------------------------------|-----|
| MC in accordance with BS1377 Part 2 1990 Clause 3.2 |     |
| Moisture Content %                                  | 5.2 |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Cobbles            | 0          |
| Gravel             | 54         |
| Sand               | 31         |
| Silt               | 8          |
| Clay               | 7          |

Remarks  
 Preparation and testing in accordance with BS1377 unless noted below

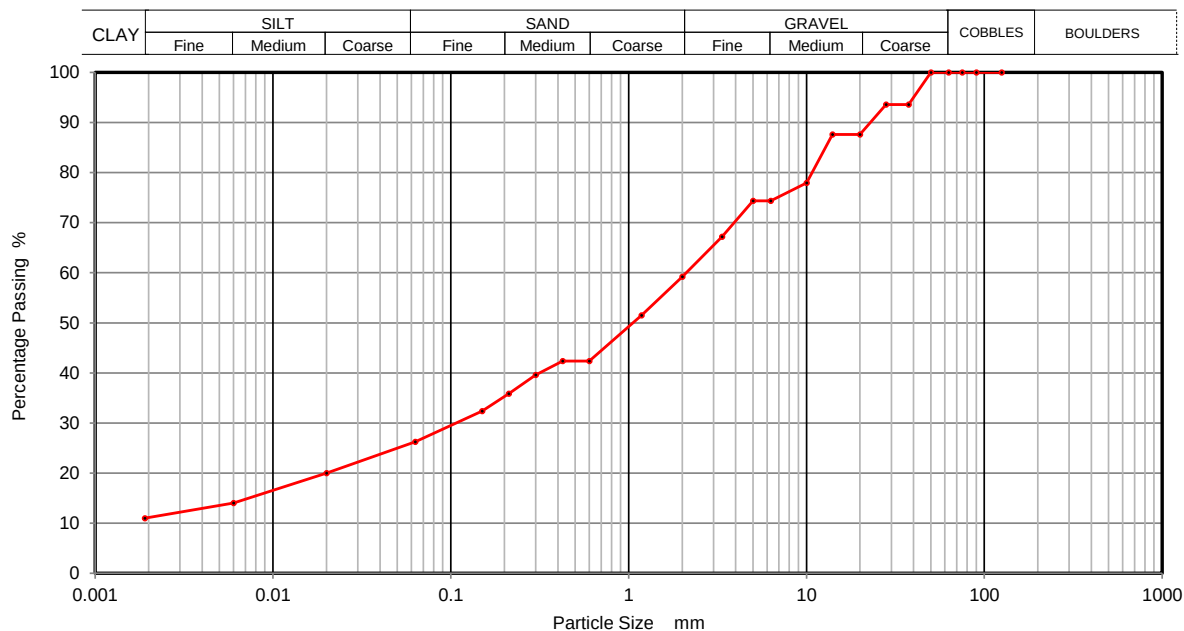
|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| David    | Approved | 03/07/2021 | Paul Evans   |  |





**PARTICLE SIZE DISTRIBUTION**  
**BS 1377 Part 2:1990**  
**Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**

|                  |                                                              |
|------------------|--------------------------------------------------------------|
| Contract Number  | 54538                                                        |
|                  | Borehole/Pit No. TPC                                         |
| Site Name        | Colliers Row, Merthyr Tydfil                                 |
| Soil Description | Grey clayey silty fine to coarse sandy fine to coarse GRAVEL |
|                  | Depth Top 0.50                                               |
|                  | Depth Base                                                   |
| Date Tested      | 02/07/2021                                                   |
| Sample Type      | B                                                            |



| Sieving          |           | Sedimentation    |           |
|------------------|-----------|------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm | % Passing |
| 125              | 100       | 0.0200           | 20        |
| 90               | 100       | 0.0060           | 14        |
| 75               | 100       | 0.0020           | 11        |
| 63               | 100       |                  |           |
| 50               | 100       |                  |           |
| 37.5             | 94        |                  |           |
| 28               | 94        |                  |           |
| 20               | 88        |                  |           |
| 14               | 88        |                  |           |
| 10               | 78        |                  |           |
| 6.3              | 74        |                  |           |
| 5                | 74        |                  |           |
| 3.35             | 67        |                  |           |
| 2                | 59        |                  |           |
| 1.18             | 51        |                  |           |
| 0.6              | 42        |                  |           |
| 0.425            | 42        |                  |           |
| 0.3              | 40        |                  |           |
| 0.212            | 36        |                  |           |
| 0.15             | 32        |                  |           |
| 0.063            | 26        |                  |           |

|                                                     |     |
|-----------------------------------------------------|-----|
| MC in accordance with BS1377 Part 2 1990 Clause 3.2 |     |
| Moisture Content %                                  | 5.0 |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Cobbles            | 0          |
| Gravel             | 41         |
| Sand               | 33         |
| Silt               | 15         |
| Clay               | 11         |

Remarks  
 Preparation and testing in accordance with BS1377 unless noted below

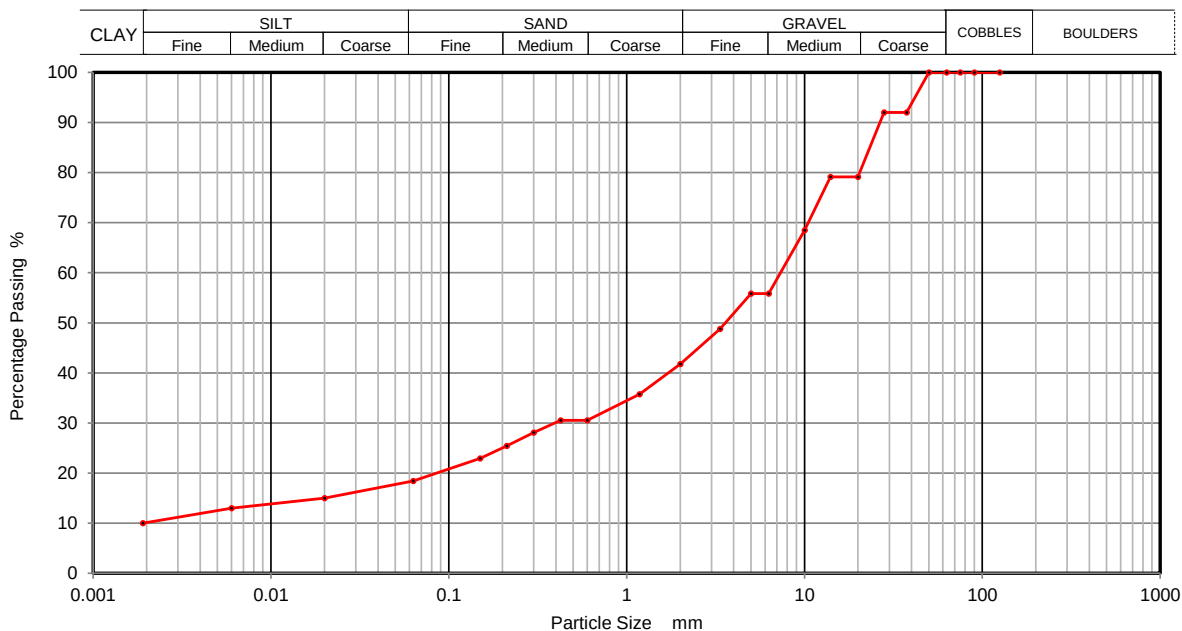
|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| David    | Approved | 03/07/2021 | Paul Evans   |  |





**PARTICLE SIZE DISTRIBUTION**  
**BS 1377 Part 2:1990**  
**Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**

|                  |                                                                       |                  |       |
|------------------|-----------------------------------------------------------------------|------------------|-------|
|                  |                                                                       | Contract Number  | 54538 |
|                  |                                                                       | Borehole/Pit No. | TPD   |
| Site Name        | Colliers Row, Merthyr Tydfil                                          | Sample No.       | 1 + 2 |
| Soil Description | Grey slightly silty clayey fine to coarse sandy fine to coarse GRAVEL | Depth Top        | 0.50  |
|                  |                                                                       | Depth Base       |       |
| Date Tested      | 02/07/2021                                                            | Sample Type      | B     |



| Sieving          |           | Sedimentation    |           |
|------------------|-----------|------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm | % Passing |
| 125              | 100       | 0.0200           | 15        |
| 90               | 100       | 0.0060           | 13        |
| 75               | 100       | 0.0020           | 10        |
| 63               | 100       |                  |           |
| 50               | 100       |                  |           |
| 37.5             | 92        |                  |           |
| 28               | 92        |                  |           |
| 20               | 79        |                  |           |
| 14               | 79        |                  |           |
| 10               | 69        |                  |           |
| 6.3              | 56        |                  |           |
| 5                | 56        |                  |           |
| 3.35             | 49        |                  |           |
| 2                | 42        |                  |           |
| 1.18             | 36        |                  |           |
| 0.6              | 31        |                  |           |
| 0.425            | 31        |                  |           |
| 0.3              | 28        |                  |           |
| 0.212            | 25        |                  |           |
| 0.15             | 23        |                  |           |
| 0.063            | 18        |                  |           |

|                                                     |     |
|-----------------------------------------------------|-----|
| MC in accordance with BS1377 Part 2 1990 Clause 3.2 |     |
| Moisture Content %                                  | 7.0 |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Cobbles            | 0          |
| Gravel             | 58         |
| Sand               | 24         |
| Silt               | 8          |
| Clay               | 10         |

Remarks  
 Preparation and testing in accordance with BS1377 unless noted below

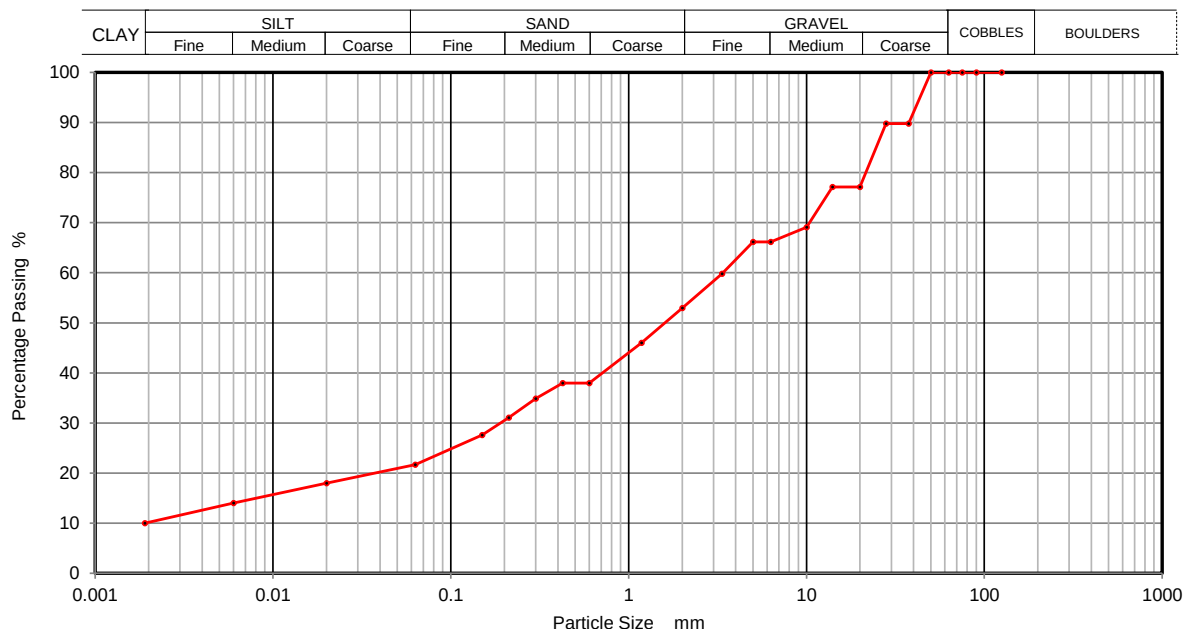
|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| David    | Approved | 03/07/2021 | Paul Evans   |  |





**PARTICLE SIZE DISTRIBUTION**  
**BS 1377 Part 2:1990**  
**Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**

|                  |                                                              |                  |       |
|------------------|--------------------------------------------------------------|------------------|-------|
|                  |                                                              | Contract Number  | 54538 |
|                  |                                                              | Borehole/Pit No. | TPE   |
| Site Name        | Colliers Row, Merthyr Tydfil                                 | Sample No.       | 1 + 2 |
| Soil Description | Grey clayey silty fine to coarse sandy fine to coarse GRAVEL | Depth Top        | 0.50  |
|                  |                                                              | Depth Base       |       |
| Date Tested      | 02/07/2021                                                   | Sample Type      | B     |



| Sieving          |           | Sedimentation    |           |
|------------------|-----------|------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm | % Passing |
| 125              | 100       | 0.0200           | 18        |
| 90               | 100       | 0.0060           | 14        |
| 75               | 100       | 0.0020           | 10        |
| 63               | 100       |                  |           |
| 50               | 100       |                  |           |
| 37.5             | 90        |                  |           |
| 28               | 90        |                  |           |
| 20               | 77        |                  |           |
| 14               | 77        |                  |           |
| 10               | 69        |                  |           |
| 6.3              | 66        |                  |           |
| 5                | 66        |                  |           |
| 3.35             | 60        |                  |           |
| 2                | 53        |                  |           |
| 1.18             | 46        |                  |           |
| 0.6              | 38        |                  |           |
| 0.425            | 38        |                  |           |
| 0.3              | 35        |                  |           |
| 0.212            | 31        |                  |           |
| 0.15             | 28        |                  |           |
| 0.063            | 22        |                  |           |

|                                                     |     |
|-----------------------------------------------------|-----|
| MC in accordance with BS1377 Part 2 1990 Clause 3.2 |     |
| Moisture Content %                                  | 7.5 |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Cobbles            | 0          |
| Gravel             | 47         |
| Sand               | 31         |
| Silt               | 12         |
| Clay               | 10         |

Remarks  
 Preparation and testing in accordance with BS1377 unless noted below

|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| David    | Approved | 03/07/2021 | Paul Evans   |  |



Project Location Colliers Row, Merthyr Tydfil

Sample No 1 + 2

Date Tested 22/06/2021

Depth Top 0.50

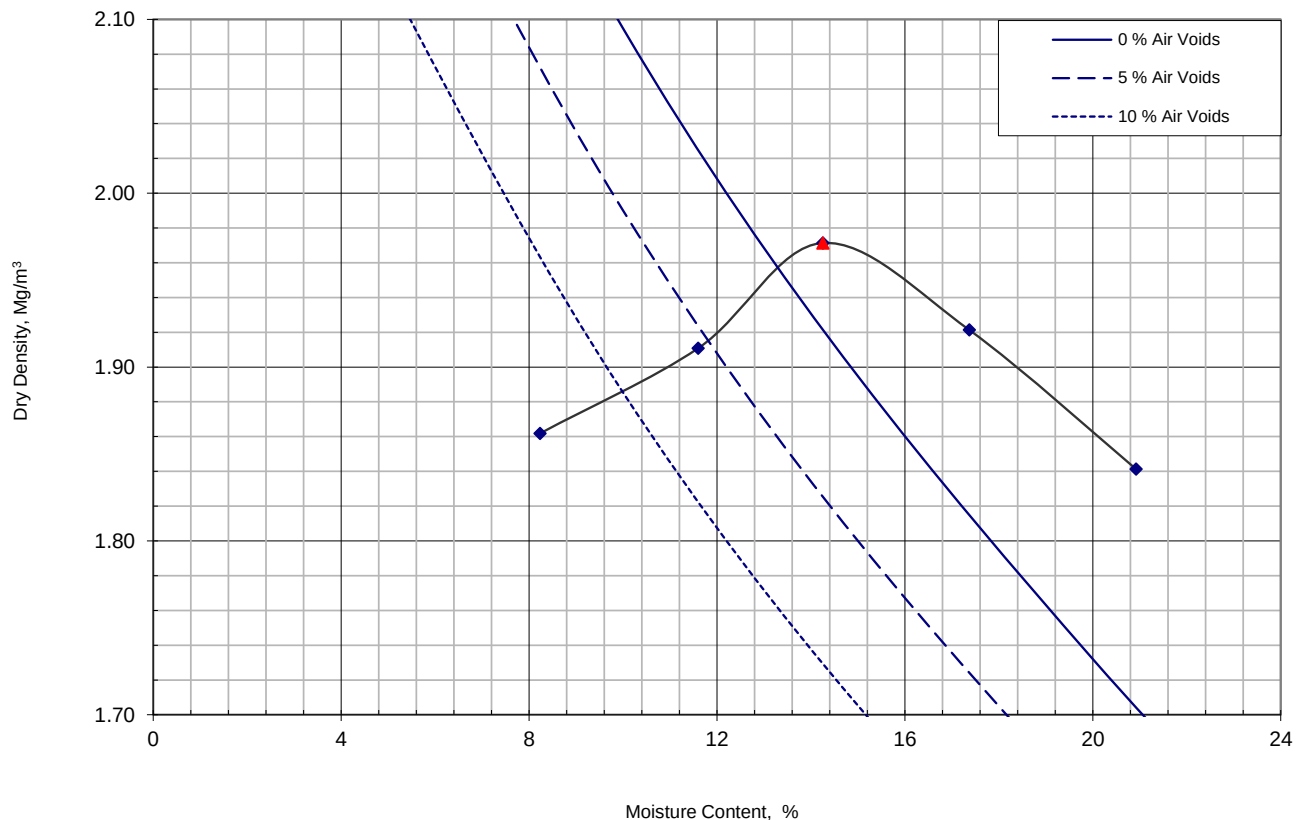
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type B

Sample Description



| Compaction Point | 1    | 2    | 3    | 4    | 5    |  |  |  |  |  |  |  |
|------------------|------|------|------|------|------|--|--|--|--|--|--|--|
| Moisture Content | 8.2  | 12   | 14   | 17   | 21   |  |  |  |  |  |  |  |
| Bulk Density     | 2.01 | 2.13 | 2.25 | 2.26 | 2.23 |  |  |  |  |  |  |  |
| Dry Density      | 1.86 | 1.91 | 1.97 | 1.92 | 1.84 |  |  |  |  |  |  |  |

|                          |              |       |
|--------------------------|--------------|-------|
| Initial Moisture Content | 8.2          | %     |
| Maximum Dry Density      | 1.97         | Mg/m3 |
| Optimum Moisture Content | 14.0         | %     |
| Particle Density         | 2.65 Assumed | Mg/m3 |
| Material Retained 37.5mm | 0            | %     |
| Material Retained 20mm   | 19           | %     |

|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| Conal    | Approved | 03/07/2021 | Paul Evans   |  |

## Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 54538

Borehole / Pit No TPB

Project Location Colliers Row, Merthyr Tydfil

Sample No 1 + 2

Date Tested 22/06/2021

Depth Top 0.50

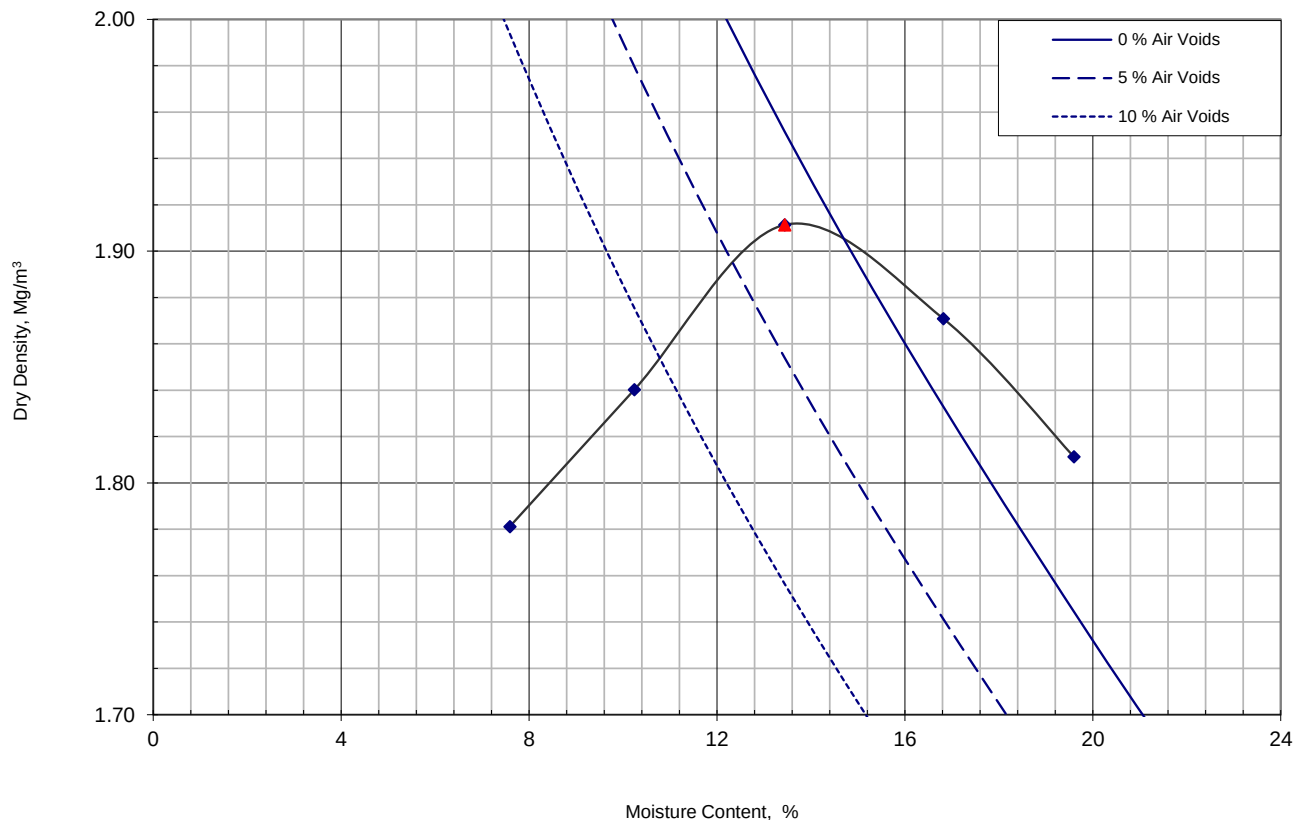
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type B

Sample Description



| Compaction Point | 1    | 2    | 3    | 4    | 5    |  |  |  |  |  |  |  |
|------------------|------|------|------|------|------|--|--|--|--|--|--|--|
| Moisture Content | 7.6  | 10   | 13   | 17   | 20   |  |  |  |  |  |  |  |
| Bulk Density     | 1.92 | 2.03 | 2.17 | 2.19 | 2.17 |  |  |  |  |  |  |  |
| Dry Density      | 1.78 | 1.84 | 1.91 | 1.87 | 1.81 |  |  |  |  |  |  |  |

|                          |              |       |
|--------------------------|--------------|-------|
| Initial Moisture Content | 10           | %     |
| Maximum Dry Density      | 1.91         | Mg/m3 |
| Optimum Moisture Content | 13.0         | %     |
| Particle Density         | 2.65 Assumed | Mg/m3 |
| Material Retained 37.5mm | 7            | %     |
| Material Retained 20mm   | 12           | %     |

|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| Conal    | Approved | 03/07/2021 | Paul Evans   |  |

Project Location Colliers Row, Merthyr Tydfil

Sample No 1 + 2

Date Tested 22/06/2021

Depth Top 0.50

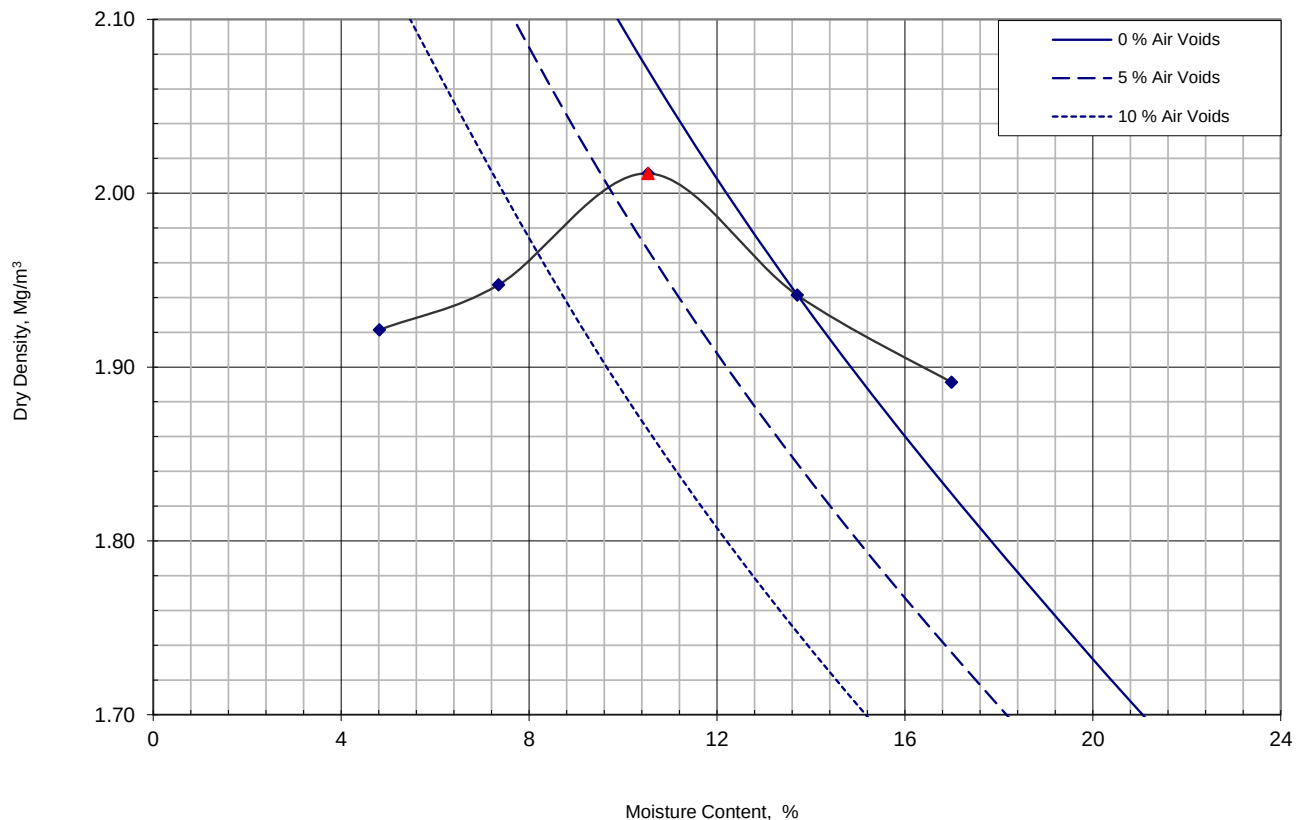
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type B

Sample Description



| Compaction Point | 1    | 2    | 3    | 4    | 5    |  |  |  |  |  |  |  |
|------------------|------|------|------|------|------|--|--|--|--|--|--|--|
| Moisture Content | 4.8  | 7.4  | 11   | 14   | 17   |  |  |  |  |  |  |  |
| Bulk Density     | 2.01 | 2.09 | 2.22 | 2.21 | 2.21 |  |  |  |  |  |  |  |
| Dry Density      | 1.92 | 1.95 | 2.01 | 1.94 | 1.89 |  |  |  |  |  |  |  |

|                          |              |                   |
|--------------------------|--------------|-------------------|
| Initial Moisture Content | 7.4          | %                 |
| Maximum Dry Density      | 2.01         | Mg/m <sup>3</sup> |
| Optimum Moisture Content | 11.0         | %                 |
| Particle Density         | 2.65 Assumed | Mg/m <sup>3</sup> |
| Material Retained 37.5mm | 6            | %                 |
| Material Retained 20mm   | 6            | %                 |

|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| Conal    | Approved | 03/07/2021 | Paul Evans   |  |

## Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 54538

Borehole / Pit No TPD

Project Location Colliers Row, Merthyr Tydfil

Sample No 1 + 2

Date Tested 22/06/2021

Depth Top 0.50

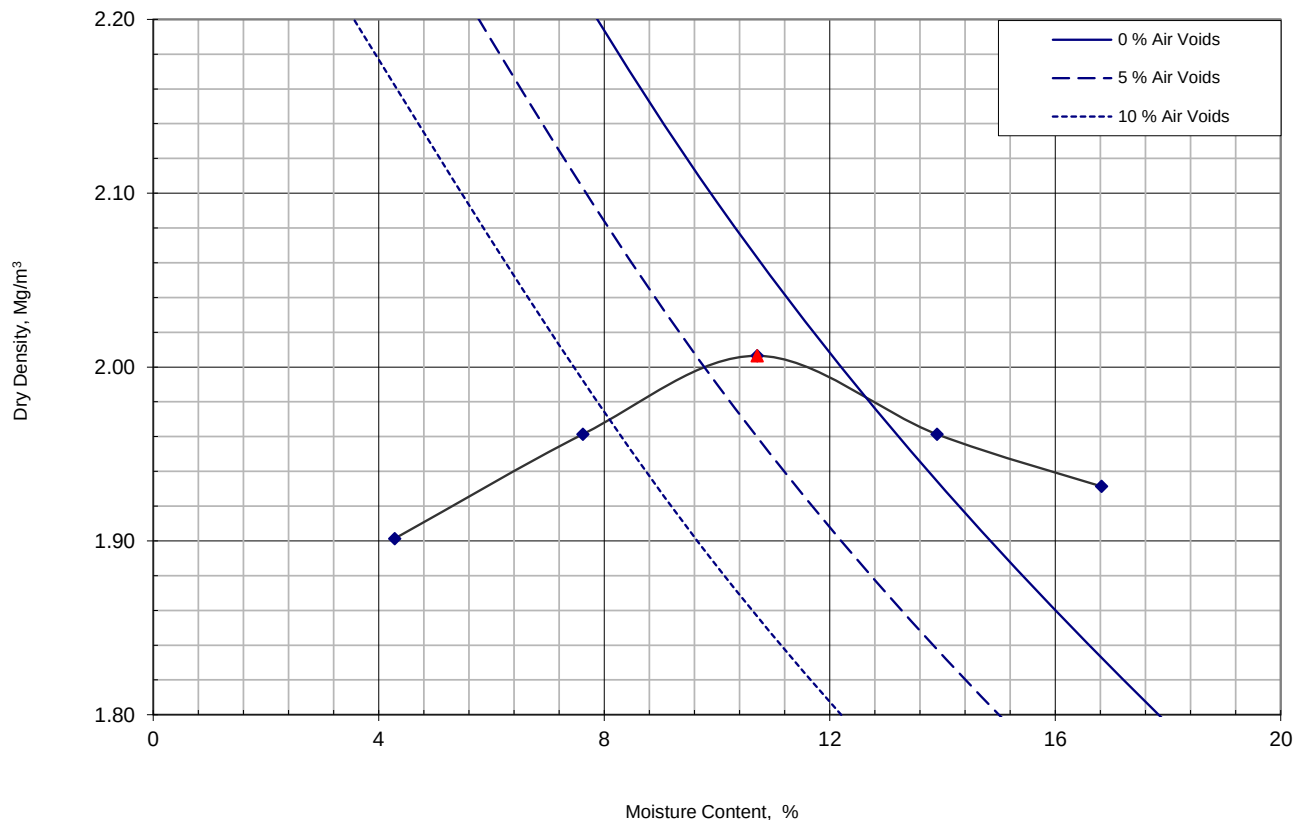
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type B

Sample Description



| Compaction Point | 1    | 2    | 3    | 4    | 5    |  |  |  |  |  |  |  |
|------------------|------|------|------|------|------|--|--|--|--|--|--|--|
| Moisture Content | 4.3  | 7.6  | 11   | 14   | 17   |  |  |  |  |  |  |  |
| Bulk Density     | 1.98 | 2.11 | 2.22 | 2.23 | 2.26 |  |  |  |  |  |  |  |
| Dry Density      | 1.90 | 1.96 | 2.01 | 1.96 | 1.93 |  |  |  |  |  |  |  |

|                          |              |       |
|--------------------------|--------------|-------|
| Initial Moisture Content | 11           | %     |
| Maximum Dry Density      | 2.01         | Mg/m3 |
| Optimum Moisture Content | 11.0         | %     |
| Particle Density         | 2.65 Assumed | Mg/m3 |
| Material Retained 37.5mm | 8            | %     |
| Material Retained 20mm   | 13           | %     |

|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| Conal    | Approved | 03/07/2021 | Paul Evans   |  |

## Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number 54538

Borehole / Pit No TPE

Project Location Colliers Row, Merthyr Tydfil

Sample No 1 + 2

Date Tested 22/06/2021

Depth Top 0.50

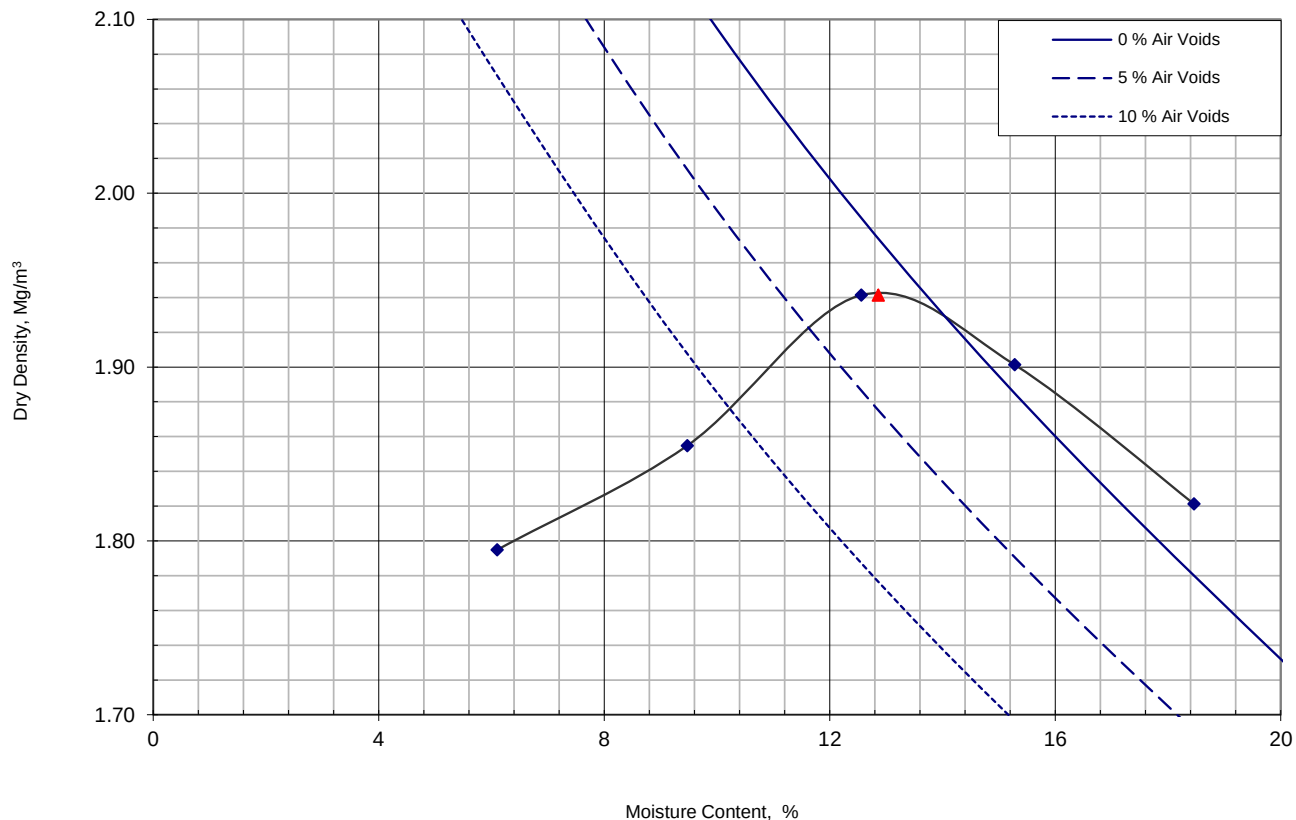
Compaction Method 4.5 Kg Rammer

Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.5

Sample Type B

Sample Description



| Compaction Point | 1    | 2    | 3    | 4    | 5    |  |  |  |  |  |  |  |
|------------------|------|------|------|------|------|--|--|--|--|--|--|--|
| Moisture Content | 6.1  | 9.5  | 13   | 15   | 18   |  |  |  |  |  |  |  |
| Bulk Density     | 1.90 | 2.03 | 2.19 | 2.19 | 2.16 |  |  |  |  |  |  |  |
| Dry Density      | 1.79 | 1.85 | 1.94 | 1.90 | 1.82 |  |  |  |  |  |  |  |

|                          |              |       |
|--------------------------|--------------|-------|
| Initial Moisture Content | 9.5          | %     |
| Maximum Dry Density      | 1.94         | Mg/m3 |
| Optimum Moisture Content | 13.0         | %     |
| Particle Density         | 2.65 Assumed | Mg/m3 |
| Material Retained 37.5mm | 10           | %     |
| Material Retained 20mm   | 13           | %     |

|          |          |            |              |  |
|----------|----------|------------|--------------|--|
| Operator | Checked  | 02/07/2021 | Richard John |  |
| Conal    | Approved | 03/07/2021 | Paul Evans   |  |



## Certificate of Analysis

**Certificate Number** 21-13009

**Issued:** 25-Jun-21

**Client** GEO Site and Testing Services Ltd  
Unit 4  
Heol Aur  
Dafen Ind Est  
Dafen  
Carmarthenshire  
SA14 8QN

**Our Reference** 21-13009

**Client Reference** Q0558

**Order No** (not supplied)

**Contract Title** Colliers Row, Merthyr Tydfil

**Description** 5 Soil samples.

**Date Received** 21-Jun-21

**Date Started** 21-Jun-21

**Date Completed** 25-Jun-21

**Test Procedures** Identified by prefix DETSn (details on request).

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

**Approved By**

A handwritten signature in blue ink, appearing to read "A. Fenwick".

Adam Fenwick  
Contracts Manager



## Summary of Chemical Analysis

### Soil Samples

Our Ref 21-13009

Client Ref Q0558

Contract Title Colliers Row, Merthyr Tydfil

| Lab No        | 1864840 | 1864841 | 1864842 | 1864843 | 1864844 |
|---------------|---------|---------|---------|---------|---------|
| Sample ID     | TPA     | TPB     | TPC     | TPD     | TPE     |
| Depth         | 0.50    | 0.50    | 0.50    | 0.50    | 0.50    |
| Other ID      |         |         |         |         |         |
| Sample Type   | B       | B       | B       | B       | B       |
| Sampling Date | n/s     | n/s     | n/s     | n/s     | n/s     |
| Sampling Time | n/s     | n/s     | n/s     | n/s     | n/s     |

| Test                      | Method      | LOD  | Units |     |     |     |    |     |
|---------------------------|-------------|------|-------|-----|-----|-----|----|-----|
| <b>Inorganics</b>         |             |      |       |     |     |     |    |     |
| Loss on Ignition at 440oC | DETSC 2003# | 0.01 | %     | 3.7 | 3.5 | 5.0 | 16 | 4.7 |

## Information in Support of the Analytical Results

Our Ref 21-13009  
 Client Ref Q0558  
 Contract Colliers Row, Merthyr Tydfil

### Containers Received & Deviating Samples

| Lab No  | Sample ID     | Date Sampled | Containers Received | Holding time exceeded for tests                       | Inappropriate container for tests |
|---------|---------------|--------------|---------------------|-------------------------------------------------------|-----------------------------------|
| 1864840 | TPA 0.50 SOIL |              | PT 1L               | Sample date not supplied, Loss on Ignition (730 days) |                                   |
| 1864841 | TPB 0.50 SOIL |              | PT 1L               | Sample date not supplied, Loss on Ignition (730 days) |                                   |
| 1864842 | TPC 0.50 SOIL |              | PT 1L               | Sample date not supplied, Loss on Ignition (730 days) |                                   |
| 1864843 | TPD 0.50 SOIL |              | PT 1L               | Sample date not supplied, Loss on Ignition (730 days) |                                   |
| 1864844 | TPE 0.50 SOIL |              | PT 1L               | Sample date not supplied, Loss on Ignition (730 days) |                                   |

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

## APPENDIX IV – ENVIRONMENTAL LABORATORY TEST RESULTS

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2183

# Final Report

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**Report No.:** 21-20951-1  
**Initial Date of Issue:** 28-Jun-2021  
**Client** Quantum Geotechnic Ltd  
**Client Address:** Plas Newydd  
Llanedi  
Pontarddulais  
Swansea  
SA4 0FQ  
**Contact(s):** johnstark@quantumgeotech.co.uk  
**Project** Q0558 Colliers Row, Merthyr Tydfil  
**Quotation No.:**  
**Order No.:**  
**No. of Samples:** 5  
**Turnaround (Wkdays):** 5  
**Date Approved:** 28-Jun-2021

**Date Received:** 21-Jun-2021

**Date Instructed:** 21-Jun-2021

**Results Due:** 25-Jun-2021

**Approved By:**



**Details:** Glynn Harvey, Technical Manager

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## Results - Soil

**Project: Q0558 Colliers Row, Merthyr Tydfil**

|                                       |                             |            |              |            |                      |                      |                      |                      |                      |
|---------------------------------------|-----------------------------|------------|--------------|------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| <b>Client: Quantum Geotechnic Ltd</b> | <b>Chemtest Job No.:</b>    |            |              |            | 21-20951             | 21-20951             | 21-20951             | 21-20951             | 21-20951             |
| <b>Quotation No.:</b>                 | <b>Chemtest Sample ID.:</b> |            |              |            | 1224623              | 1224624              | 1224625              | 1224626              | 1224627              |
| <b>Order No.:</b>                     | <b>Client Sample Ref.:</b>  |            |              |            | TP A / ES1           | TP B / ES1           | TP C / ES1           | TP D / ES1           | TP E / ES1           |
|                                       | <b>Client Sample ID.:</b>   |            |              |            | ES1                  | ES1                  | ES1                  | ES1                  | ES1                  |
|                                       | <b>Sample Location:</b>     |            |              |            | TP A                 | TP B                 | TP C                 | TP D                 | TP E                 |
|                                       | <b>Sample Type:</b>         |            |              |            | SOIL                 | SOIL                 | SOIL                 | SOIL                 | SOIL                 |
|                                       | <b>Top Depth (m):</b>       |            |              |            | 0.5                  | 0.5                  | 0.5                  | 0.5                  | 0.5                  |
|                                       | <b>Date Sampled:</b>        |            |              |            | 17-Jun-2021          | 17-Jun-2021          | 17-Jun-2021          | 17-Jun-2021          | 17-Jun-2021          |
|                                       | <b>Time Sampled:</b>        |            |              |            | 0:00                 | 0:00                 | 0:00                 | 0:00                 | 0:00                 |
|                                       | <b>Asbestos Lab:</b>        |            |              |            | DURHAM               | DURHAM               | DURHAM               | DURHAM               | DURHAM               |
| <b>Determinand</b>                    | <b>Accred.</b>              | <b>SOP</b> | <b>Units</b> | <b>LOD</b> |                      |                      |                      |                      |                      |
| ACM Type                              | U                           | 2192       |              | N/A        | -                    | -                    | -                    | -                    | -                    |
| Asbestos Identification               | U                           | 2192       |              | N/A        | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected |
| Moisture                              | N                           | 2030       | %            | 0.020      | 8.0                  | 10                   | 6.3                  | 6.8                  | 8.2                  |
| pH                                    | U                           | 2010       |              | 4.0        | 8.3                  | 7.6                  | 8.0                  | 8.2                  | 8.3                  |
| Boron (Hot Water Soluble)             | U                           | 2120       | mg/kg        | 0.40       | 0.42                 | < 0.40               | < 0.40               | < 0.40               | 0.52                 |
| Sulphate (2:1 Water Soluble) as SO4   | U                           | 2120       | g/l          | 0.010      | 0.043                | < 0.010              | < 0.010              | < 0.010              | < 0.010              |
| Sulphur (Elemental)                   | U                           | 2180       | mg/kg        | 1.0        | 3.5                  | 4.8                  | 1.8                  | 7.4                  | 15                   |
| Cyanide (Complex)                     | U                           | 2300       | mg/kg        | 0.50       | < 0.50               | < 0.50               | < 0.50               | < 0.50               | < 0.50               |
| Cyanide (Free)                        | U                           | 2300       | mg/kg        | 0.50       | < 0.50               | < 0.50               | < 0.50               | < 0.50               | < 0.50               |
| Cyanide (Total)                       | U                           | 2300       | mg/kg        | 0.50       | < 0.50               | < 0.50               | < 0.50               | < 0.50               | < 0.50               |
| Sulphide (Easily Liberatable)         | N                           | 2325       | mg/kg        | 0.50       | 1.6                  | 1.5                  | 1.6                  | 1.6                  | 1.5                  |
| Sulphate (Total)                      | U                           | 2430       | %            | 0.010      | 0.090                | 0.081                | 0.075                | 0.11                 | 0.25                 |
| Arsenic                               | U                           | 2450       | mg/kg        | 1.0        | 7.9                  | 6.1                  | 7.1                  | 9.4                  | 16                   |
| Barium                                | U                           | 2450       | mg/kg        | 10         | 71                   | 53                   | 71                   | 79                   | 170                  |
| Beryllium                             | U                           | 2450       | mg/kg        | 1.0        | < 1.0                | < 1.0                | < 1.0                | < 1.0                | 1.3                  |
| Cadmium                               | U                           | 2450       | mg/kg        | 0.10       | 0.20                 | 0.15                 | 0.18                 | 0.17                 | 0.17                 |
| Chromium                              | U                           | 2450       | mg/kg        | 1.0        | 14                   | 11                   | 9.2                  | 11                   | 16                   |
| Copper                                | U                           | 2450       | mg/kg        | 0.50       | 51                   | 39                   | 36                   | 42                   | 43                   |
| Mercury                               | U                           | 2450       | mg/kg        | 0.10       | < 0.10               | < 0.10               | < 0.10               | < 0.10               | < 0.10               |
| Nickel                                | U                           | 2450       | mg/kg        | 0.50       | 43                   | 33                   | 27                   | 32                   | 31                   |
| Lead                                  | U                           | 2450       | mg/kg        | 0.50       | 43                   | 22                   | 25                   | 35                   | 40                   |
| Selenium                              | U                           | 2450       | mg/kg        | 0.20       | 0.27                 | 0.38                 | 0.33                 | 0.62                 | 0.55                 |
| Vanadium                              | U                           | 2450       | mg/kg        | 5.0        | 8.9                  | 7.0                  | 8.4                  | 11                   | 22                   |
| Zinc                                  | U                           | 2450       | mg/kg        | 0.50       | 110                  | 79                   | 86                   | 79                   | 76                   |
| Chromium (Trivalent)                  | N                           | 2490       | mg/kg        | 1.0        | 14                   | 11                   | 9.2                  | 11                   | 16                   |
| Chromium (Hexavalent)                 | N                           | 2490       | mg/kg        | 0.50       | < 0.50               | < 0.50               | < 0.50               | < 0.50               | < 0.50               |
| Organic Matter                        | U                           | 2625       | %            | 0.40       | 5.9                  | 28                   | 14                   | 69                   | 34                   |
| Aliphatic TPH >C5-C6                  | N                           | 2680       | mg/kg        | 1.0        | < 1.0                | < 1.0                | < 1.0                | < 1.0                | < 1.0                |
| Aliphatic TPH >C6-C8                  | N                           | 2680       | mg/kg        | 1.0        | < 1.0                | < 1.0                | < 1.0                | < 1.0                | < 1.0                |
| Aliphatic TPH >C8-C10                 | U                           | 2680       | mg/kg        | 1.0        | < 1.0                | < 1.0                | < 1.0                | < 1.0                | < 1.0                |
| Aliphatic TPH >C10-C12                | U                           | 2680       | mg/kg        | 1.0        | < 1.0                | < 1.0                | < 1.0                | < 1.0                | < 1.0                |
| Aliphatic TPH >C12-C16                | U                           | 2680       | mg/kg        | 1.0        | < 1.0                | < 1.0                | < 1.0                | < 1.0                | < 1.0                |
| Aliphatic TPH >C16-C21                | U                           | 2680       | mg/kg        | 1.0        | < 1.0                | < 1.0                | < 1.0                | < 1.0                | < 1.0                |
| Aliphatic TPH >C21-C35                | U                           | 2680       | mg/kg        | 1.0        | < 1.0                | 4.9                  | < 1.0                | < 1.0                | < 1.0                |
| Aliphatic TPH >C35-C44                | N                           | 2680       | mg/kg        | 1.0        | < 1.0                | < 1.0                | < 1.0                | < 1.0                | < 1.0                |

## Results - Soil

**Project: Q0558 Colliers Row, Merthyr Tydfil**

|                                |                      |      |       |      |             |             |             |             |             |
|--------------------------------|----------------------|------|-------|------|-------------|-------------|-------------|-------------|-------------|
| Client: Quantum Geotechnic Ltd | Chemtest Job No.:    |      |       |      | 21-20951    | 21-20951    | 21-20951    | 21-20951    | 21-20951    |
| Quotation No.:                 | Chemtest Sample ID.: |      |       |      | 1224623     | 1224624     | 1224625     | 1224626     | 1224627     |
| Order No.:                     | Client Sample Ref.:  |      |       |      | TP A / ES1  | TP B / ES1  | TP C / ES1  | TP D / ES1  | TP E / ES1  |
|                                | Client Sample ID.:   |      |       |      | ES1         | ES1         | ES1         | ES1         | ES1         |
|                                | Sample Location:     |      |       |      | TP A        | TP B        | TP C        | TP D        | TP E        |
|                                | Sample Type:         |      |       |      | SOIL        | SOIL        | SOIL        | SOIL        | SOIL        |
|                                | Top Depth (m):       |      |       |      | 0.5         | 0.5         | 0.5         | 0.5         | 0.5         |
|                                | Date Sampled:        |      |       |      | 17-Jun-2021 | 17-Jun-2021 | 17-Jun-2021 | 17-Jun-2021 | 17-Jun-2021 |
|                                | Time Sampled:        |      |       |      | 0:00        | 0:00        | 0:00        | 0:00        | 0:00        |
|                                | Asbestos Lab:        |      |       |      | DURHAM      | DURHAM      | DURHAM      | DURHAM      | DURHAM      |
| Determinand                    | Accred.              | SOP  | Units | LOD  |             |             |             |             |             |
| Total Aliphatic Hydrocarbons   | N                    | 2680 | mg/kg | 5.0  | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       |
| Aromatic TPH >C5-C7            | N                    | 2680 | mg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Aromatic TPH >C7-C8            | N                    | 2680 | mg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Aromatic TPH >C8-C10           | U                    | 2680 | mg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Aromatic TPH >C10-C12          | U                    | 2680 | mg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Aromatic TPH >C12-C16          | U                    | 2680 | mg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Aromatic TPH >C16-C21          | U                    | 2680 | mg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Aromatic TPH >C21-C35          | U                    | 2680 | mg/kg | 1.0  | < 1.0       | 38          | < 1.0       | 65          | < 1.0       |
| Aromatic TPH >C35-C44          | N                    | 2680 | mg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Total Aromatic Hydrocarbons    | N                    | 2680 | mg/kg | 5.0  | < 5.0       | 38          | < 5.0       | 65          | < 5.0       |
| Total Petroleum Hydrocarbons   | N                    | 2680 | mg/kg | 10.0 | < 10        | 43          | < 10        | 65          | < 10        |
| Naphthalene                    | U                    | 2700 | mg/kg | 0.10 | < 0.10      | 2.9         | < 0.10      | 3.3         | 1.7         |
| Acenaphthylene                 | U                    | 2700 | mg/kg | 0.10 | < 0.10      | 0.66        | < 0.10      | 0.73        | 0.39        |
| Acenaphthene                   | U                    | 2700 | mg/kg | 0.10 | < 0.10      | 0.31        | < 0.10      | 0.53        | 0.29        |
| Fluorene                       | U                    | 2700 | mg/kg | 0.10 | < 0.10      | 0.67        | < 0.10      | 0.90        | < 0.10      |
| Phenanthrene                   | U                    | 2700 | mg/kg | 0.10 | 0.65        | 4.8         | 0.90        | 4.7         | 2.8         |
| Anthracene                     | U                    | 2700 | mg/kg | 0.10 | 0.39        | 1.7         | 0.34        | 1.5         | 0.96        |
| Fluoranthene                   | U                    | 2700 | mg/kg | 0.10 | 2.0         | 5.3         | 1.2         | 5.7         | 3.8         |
| Pyrene                         | U                    | 2700 | mg/kg | 0.10 | 1.8         | 4.5         | 1.1         | 5.0         | 3.4         |
| Benzo[a]anthracene             | U                    | 2700 | mg/kg | 0.10 | 1.6         | 3.7         | 1.1         | 4.8         | 2.9         |
| Chrysene                       | U                    | 2700 | mg/kg | 0.10 | 2.2         | 3.9         | 1.2         | 5.1         | 3.2         |
| Benzo[b]fluoranthene           | U                    | 2700 | mg/kg | 0.10 | 2.0         | 4.1         | 1.1         | 5.2         | 3.0         |
| Benzo[k]fluoranthene           | U                    | 2700 | mg/kg | 0.10 | 0.92        | 2.1         | 0.47        | 2.2         | 1.3         |
| Benzo[a]pyrene                 | U                    | 2700 | mg/kg | 0.10 | 1.2         | 2.4         | 0.72        | 3.4         | 2.0         |
| Indeno(1,2,3-c,d)Pyrene        | U                    | 2700 | mg/kg | 0.10 | 0.81        | 1.5         | 0.48        | 1.8         | 1.2         |
| Dibenz(a,h)Anthracene          | U                    | 2700 | mg/kg | 0.10 | 0.30        | 0.70        | 0.24        | 0.95        | 0.67        |
| Benzo[g,h,i]perylene           | U                    | 2700 | mg/kg | 0.10 | 0.69        | 1.4         | 0.36        | 1.5         | 1.0         |
| Total Of 16 PAH's              | U                    | 2700 | mg/kg | 2.0  | 15          | 41          | 9.2         | 47          | 29          |
| Benzene                        | U                    | 2760 | µg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Toluene                        | U                    | 2760 | µg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Ethylbenzene                   | U                    | 2760 | µg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| m & p-Xylene                   | U                    | 2760 | µg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| o-Xylene                       | U                    | 2760 | µg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Methyl Tert-Butyl Ether        | U                    | 2760 | µg/kg | 1.0  | < 1.0       | < 1.0       | < 1.0       | < 1.0       | < 1.0       |
| Total Phenols                  | U                    | 2920 | mg/kg | 0.10 | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |

## 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                                                                                                                                                           |
| 2180 | Sulphur (Elemental) in Soils by HPLC                                | Sulphur                                                                                                                                                                                                                                                      | Dichloromethane extraction / HPLC with UV detection                                                                                                                                    |
| 2192 | Asbestos                                                            | Asbestos                                                                                                                                                                                                                                                     | Polarised light microscopy / Gravimetry                                                                                                                                                |
| 2300 | Cyanides & Thiocyanate in Soils                                     | Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate                                                                                                                                                                              | Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.                                                                                    |
| 2325 | Sulphide in Soils                                                   | Sulphide                                                                                                                                                                                                                                                     | Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N-dimethyl-p-phenylenediamine.                                                           |
| 2430 | Total Sulphate in soils                                             | Total Sulphate                                                                                                                                                                                                                                               | Acid digestion followed by determination of sulphate in extract by ICP-OES.                                                                                                            |
| 2450 | Acid Soluble Metals in Soils                                        | Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc                                                                                                     | Acid digestion followed by determination of metals in extract by ICP-MS.                                                                                                               |
| 2490 | Hexavalent Chromium in Soils                                        | Chromium [VI]                                                                                                                                                                                                                                                | Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide. |
| 2625 | Total Organic Carbon in Soils                                       | Total organic Carbon (TOC)                                                                                                                                                                                                                                   | Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.                                                                                             |
| 2680 | TPH A/A Split                                                       | Aliphatics: >C5-C6, >C6-C8,>C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35, >C35- C44Aromatics: >C5-C7, >C7-C8, >C8- C10, >C10-C12, >C12-C16, >C16- C21, >C21- C35, >C35- C44                                                                                | Dichloromethane extraction / GCxGC FID detection                                                                                                                                       |
| 2700 | Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID | Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene | Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)                                                   |
| 2760 | Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS       | Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule                                                                                                                         | Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.                             |
| 2920 | Phenols in Soils by HPLC                                            | Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.                                                                                                            | 60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.                                                                               |

## **Report Information**

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### **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

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### **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)

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### **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](mailto:customerservices@chemtest.com)