# SUMMARY OF SOIL CLASSIFICATION TESTS

**(B.S. 1377 : PART 2 : 1990)**

| Hole Number | Sample Number | Sample Type | Depth m | Moisture Content % Clause 3.2 | Bulk Density $Mg/m^3$ Clause 7.2 | Dry Density $Mg/m^3$ Clause 7.2 | Particle Density $Mg/m^3$ Clause 8.2 | Liquid Limit % Clause 4.3/4.4 | Plastic Limit % Clause 5.3 | Plasticity Index % Clause 5.4 | % Passing .425mm | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WS4 | | D | 0.60 | 27 | | | | 45 | 23 | 22 | 94 | Intermediate plasticity CI. |
| WS5 | | D | 0.80 | 12 | | | | 28 | 16 | 12 | 82 | Low plasticity CL. |
| WS6 | | D | 1.40 | 15 | | | | 29 | 19 | 10 | 95 | Low plasticity CL. |
| TP15 | | D | 2.00 | 21 | | | | 40 | 22 | 18 | 94 | Intermediate plasticity CI. |
| TP25 | | D | 1.20 | 18 | | | | 37 | 20 | 17 | 93 | Intermediate plasticity CI. |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**SYMBOLS : NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

PSL
Professional Soils Laboratory

| Compiled by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| | 07/10/14 | | 07/10/14 | | 07/10/14 |

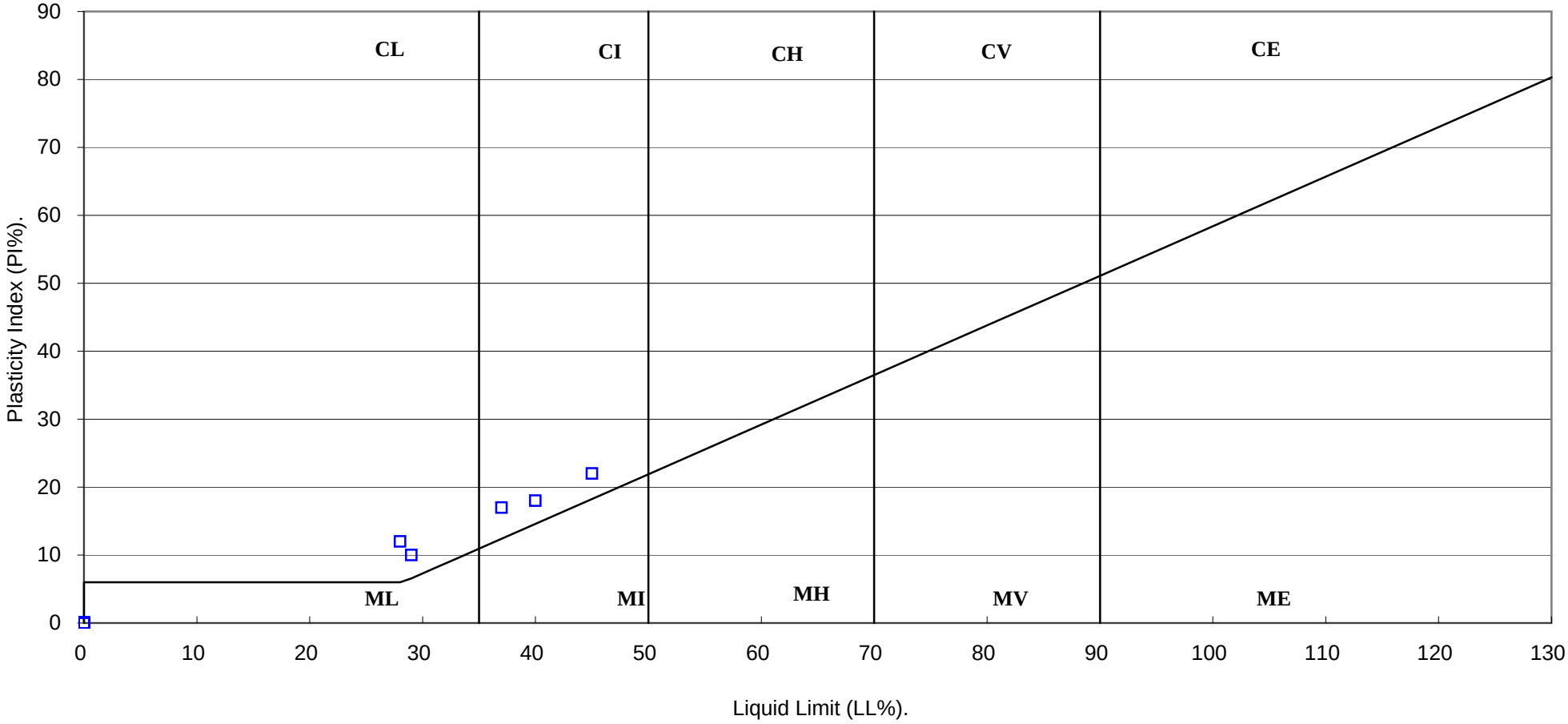
**CARRS LANE, CUDWORTH.**

**Contract No:** **PSL14/4935**

**Client Ref:** **C6138**

# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

**(B.S.5930 : 1999)**




| PSL Professional Soils Laboratory | Compiled by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|---|
| | | 07/10/14 | | 07/10/14 | | 07/10/14 |
| | CARRS LANE, CUDWORTH. | | | | Contract No: | PSL14/4935 |
| | | | | | Client Ref: | |

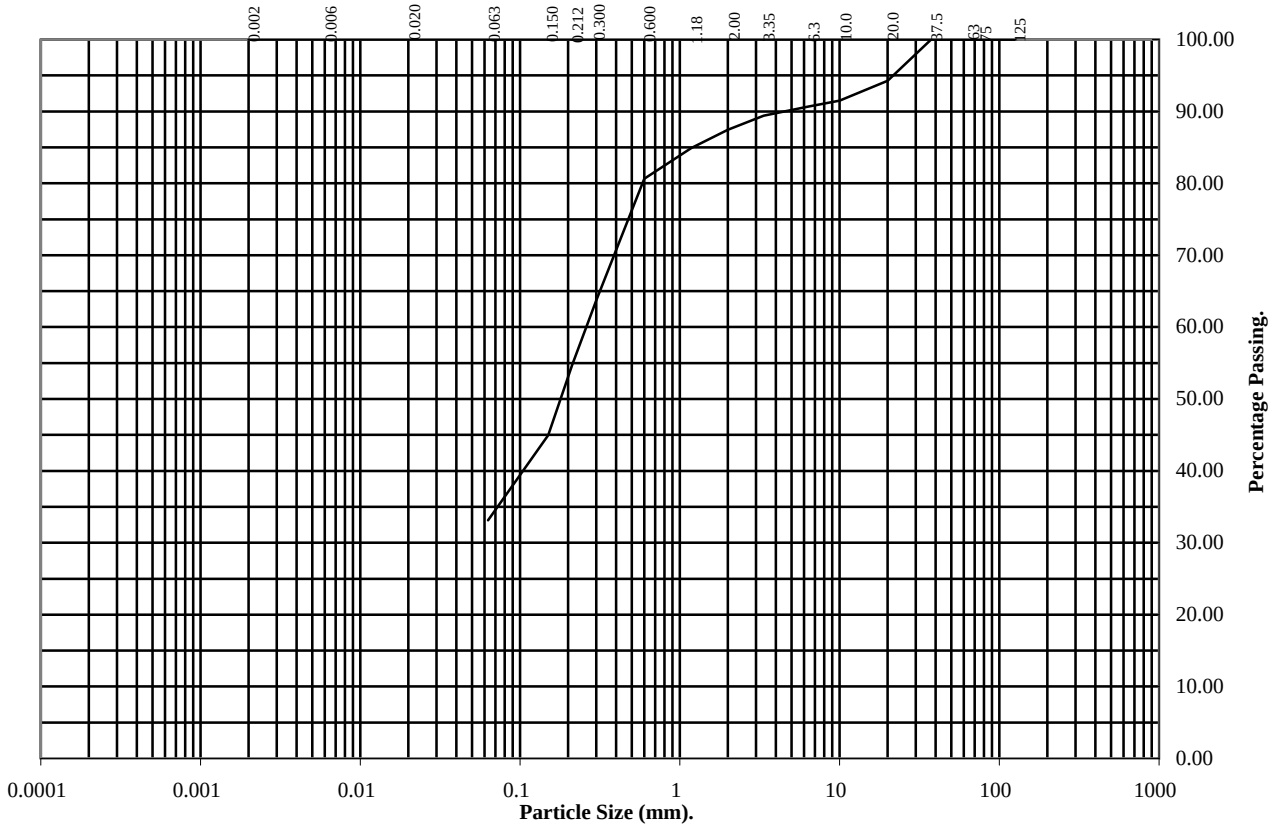
# Particle Size Distribution Test

**BS1377 : Part 2 : 1990**

Wet Sieve, Clause 9.2

**Hole Number:** **TP17** **Depth (m):** **0.60-0.70**

**Sample Number:** **Sample Type:** **B**




| BS Test Sieve | Percentage Passing |
|---|---|
| 125 | 100 |
| 75 | 100 |
| 63 | 100 |
| 37.5 | 100 |
| 20 | 94 |
| 10 | 91 |
| 6.3 | 91 |
| 3.35 | 89 |
| 2 | 87 |
| 1.18 | 85 |
| 0.6 | 81 |
| 0.3 | 64 |
| 0.212 | 55 |
| 0.15 | 45 |
| 0.063 | 33 |

| Soil Fraction | Total Percentage |
|---|---|
| Cobbles | 0 |
| Gravel | 13 |
| Sand | 54 |
| Silt / Clay | 33 |

**Remarks:**
See summary of soil descriptions.

| Checked By | Date | Approved By | Date |
|---|---|---|---|
| | 07/10/14 | | 07/10/14 |

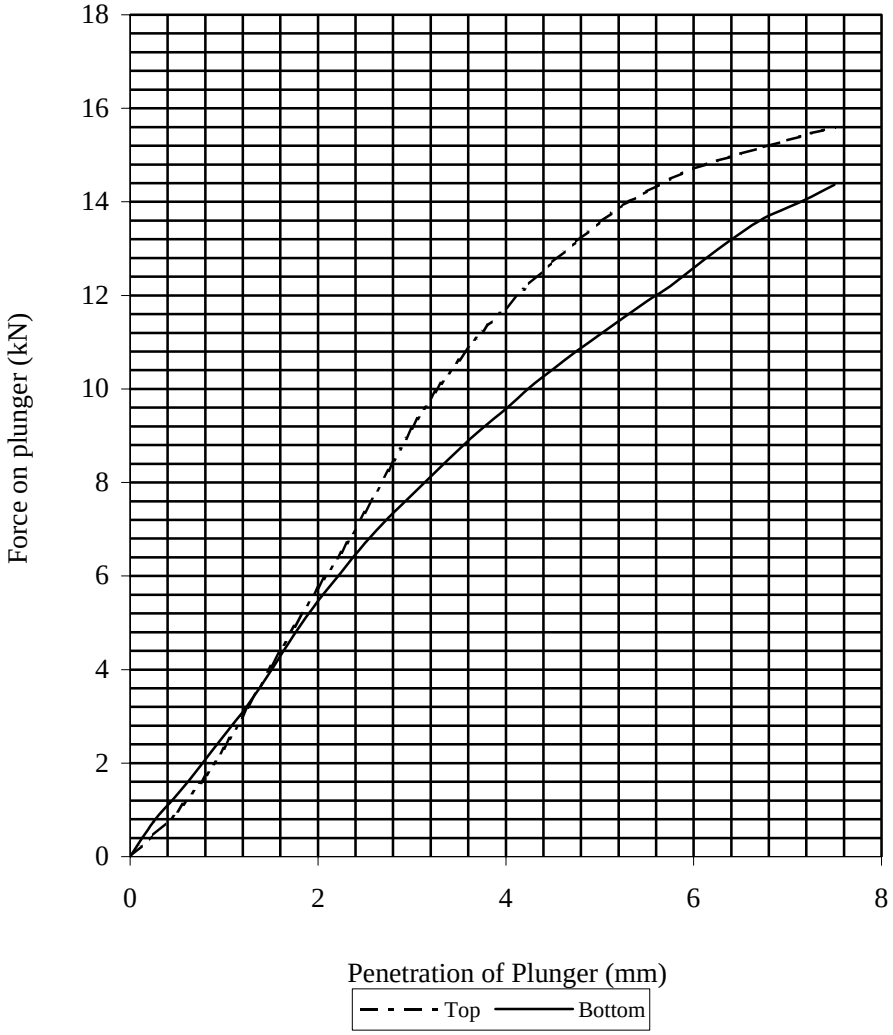
| | | |
|---|---|---|
| PSL Professional Soils Laboratory | **CARRS LANE, CUDWORTH.** | **Contract No.: PSL14/4935** |

# California Bearing Ratio Test.

**BS 1377 : Part 4 : 1990**

**Hole Number:** **TP27** **Depth (m):** **0.60-0.80**

**Sample Number:** **Sample Type:** **B**




| Initial Sample Conditions | | Test Conditions | | Method of compaction | 2.5Kg Rammer | | |
|---|---|---|---|---|---|---|---|
| Moisture Content: | 12 | Surcharge Kg: | 4.20 | Final Moisture Content % | | C.B.R. Value % | |
| Bulk Density Mg/m3: | 2.16 | Soaking Time hrs | 0 | Sample Top | 12 | Sample Top | 67.8 |
| Dry Density Mg/m3: | 1.94 | Swelling mm: | 0 | Sample Bottom | 12 | Sample Bottom | 55.8 |
| Percentage retained on 20mm BS test sieve: | 16 | Remarks: | See Summary of Soil Description. | | | | |

| Checked by | Date | Approved By | Date |
|---|---|---|---|
| M.Smith | 07/10/14 | M.Smith | 07/10/14 |

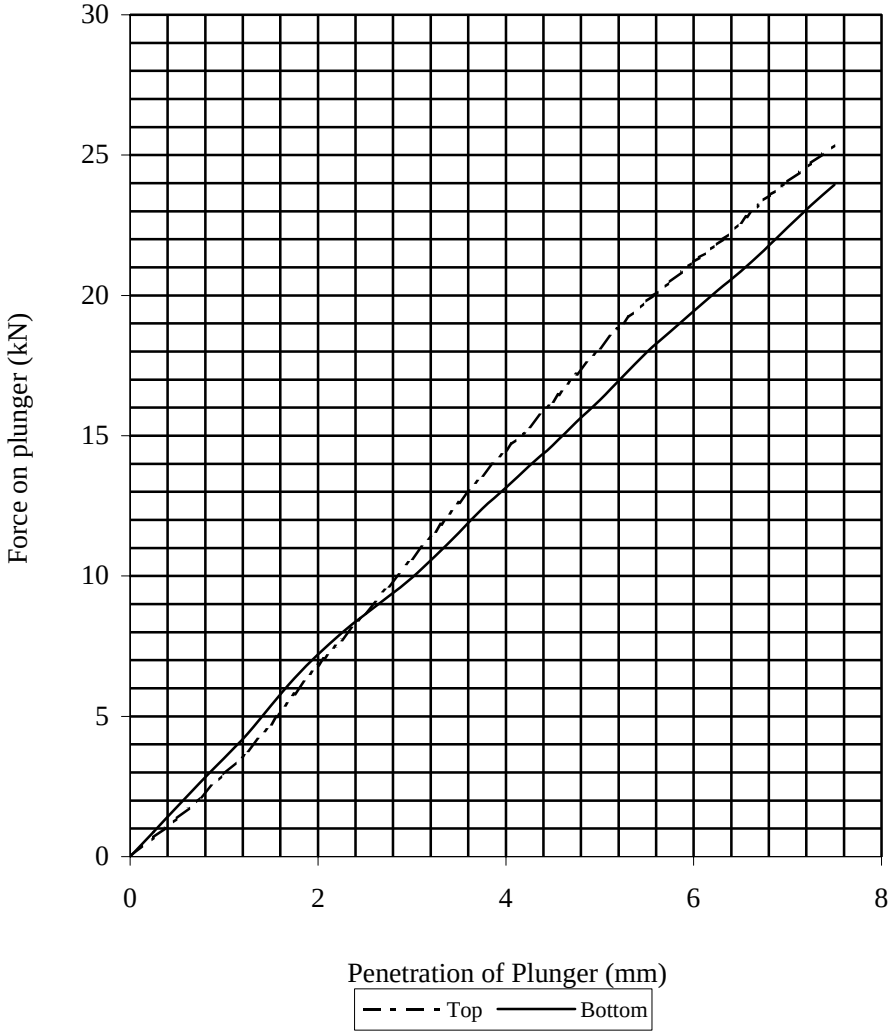
| PSL Professional Soils Laboratory | CARRS LANE, CUDWORTH. | Contract No. PSL14/4935 |
|---|---|---|

# California Bearing Ratio Test.

**BS 1377 : Part 4 : 1990**

**Hole Number:** **TP35** **Depth (m):** **0.40-0.60**

**Sample Number:** **Sample Type:** **B**




| Initial Sample Conditions | | Test Conditions | | Method of compaction | 2.5Kg Rammer | | |
|---|---|---|---|---|---|---|---|
| Moisture Content: | 11 | Surcharge Kg: | 4.20 | Final Moisture Content % | | C.B.R. Value % | |
| Bulk Density Mg/m3: | 2.07 | Soaking Time hrs | 0 | Sample Top | 11 | Sample Top | 90.6 |
| Dry Density Mg/m3: | 1.86 | Swelling mm: | 0 | Sample Bottom | 11 | Sample Bottom | 81.3 |
| Percentage retained on 20mm BS test sieve: | 57 | Remarks: | See Summary of Soil Description. | | | | |

| Checked by | Date | Approved By | Date |
|---|---|---|---|
| M.Burns | 07/10/14 | M.Burns | 07/10/14 |

| PSL Professional Soils Laboratory | CARRS LANE, CUDWORTH. | Contract No. PSL14/4935 |
|---|---|---|

Derwentside Environmental Testing Services

# Certificate of Analysis

## Certificate Number 14-17161

08-Oct-14

*Client* Sirius Geotechnical & Environmental
4245 Park Approach
Thorpe Park
Leeds
LS15 8GB

| | |
|---|---|
| *Our Reference* | 14-17161 |
| *Client Reference* | C6138 |
| *Contract Title* | Carrs Lane, Cudworth |
| *Description* | 6 Soil samples. |
| *Date Received* | 02-Oct-14 |
| *Date Started* | 02-Oct-14 |
| *Date Completed* | 08-Oct-14 |
| *Test Procedures* | Identified by prefix DETSn (details on request). |

*Notes* Opinions and interpretations are outside the scope of UKAS 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

Rob Brown
Business Manager

MCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2139

# Summary of Chemical Analysis
# Matrix Descriptions

*Our Ref* 14-17161
*Client Ref* C6138
*Contract Title* Carrs Lane, Cudworth

| Sample ID | Depth | Lab No | Completed | Matrix Description |
|---|---|---|---|---|
| TP4 | 0.9 | 707894 | 08/10/2014 | Brown clayey SAND |
| WS9 | 0.8 | 707895 | 08/10/2014 | Brown gravelly clayey SAND |
| WS4 | 1.8 | 707896 | 08/10/2014 | Brown sandy CLAY |
| WS7 | 1.9 | 707897 | 08/10/2014 | Light brown gravelly SAND |
| TP23 | 1 | 707898 | 08/10/2014 | Brown grey sandy CLAY |
| TP23 | 2 | 707899 | 08/10/2014 | Brown grey gravelly sandy CLAY |

# Summary of Chemical Analysis
# Soil Samples

*Our Ref* 14-17161
*Client Ref* C6138
*Contract Title* Carrs Lane, Cudworth

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Lab No** | 707894 | 707895 | 707896 | 707897 | 707898 | 707899 |
| | | | **Sample ID** | TP4 | WS9 | WS4 | WS7 | TP23 | TP23 |
| | | | **Depth** | 0.90 | 0.80 | 1.80 | 1.90 | 1.00 | 2.00 |
| | | | **Other ID** | | | | | | |
| | | | **Sample Type** | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL |
| | | | **Sampling Date** | 17/09/14 | 23/09/14 | 23/09/14 | 23/09/14 | 16/09/14 | 16/09/14 |
| | | | **Sampling Time** | n/s | n/s | n/s | n/s | n/s | n/s |
| **Test** | **Method** | **LOD** | **Units** | | | | | | |
| **Inorganics** | | | | | | | | | |
| pH | DETSC 2008# | | | 7.6 | 7.6 | 6.6 | 7.4 | 5.2 | 5.7 |
| Sulphate Aqueous Extract as SO4 | DETSC 2076# | 10 | mg/l | 18 | 13 | 32 | < 10 | 29 | 25 |

Key: # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

# Information in Support of the Analytical Results

*Our Ref* 14-17161
*Client Ref* C6138
*Contract* Carrs Lane, Cudworth

## Containers Received & Deviating Samples

| Lab No | Sample ID | Date Sampled | Containers Received | Holding time exceeded for tests | Inappropriate container for tests |
|---|---|---|---|---|---|
| 707894 | TP4 0.90 SOIL | 17/09/14 | PT 1L | pH (7 days) | |
| 707895 | WS9 0.80 SOIL | 23/09/14 | PT 1L | pH (7 days) | |
| 707896 | WS4 1.80 SOIL | 23/09/14 | PT 1L | pH (7 days) | |
| 707897 | WS7 1.90 SOIL | 23/09/14 | PT 1L | pH (7 days) | |
| 707898 | TP23 1.00 SOIL | 16/09/14 | PT 1L | pH (7 days) | |
| 707899 | TP23 2.00 SOIL | 16/09/14 | PT 1L | pH (7 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 and/or inappropriate containers 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

# Appendix A - Details of Analysis

| Method | Parameter | Units | Limit of Detection | Sample Preparation | Sub-Contracted | UKAS | MCERTS |
|---|---|---|---|---|---|---|---|
| DETSC 2002 | Organic matter | % | 0.1 | Air Dried | No | Yes | Yes |
| DETSC 2003 | Loss on ignition | % | 0.01 | Air Dried | No | Yes | Yes |
| DETSC 2008 | pH | pH Units | 1 | Air Dried | No | Yes | Yes |
| DETSC 2024 | Sulphide | mg/kg | 10 | Air Dried | No | Yes | Yes |
| DETSC 2076 | Sulphate Aqueous Extract as SO4 | mg/l | 10 | Air Dried | No | Yes | Yes |
| DETSC 2084 | Total Carbon | % | 0.5 | Air Dried | No | Yes | Yes |
| DETSC 2084 | Total Organic Carbon | % | 0.5 | Air Dried | No | Yes | Yes |
| DETSC 2119 | Ammoniacal Nitrogen as N | mg/kg | 0.5 | Air Dried | No | Yes | Yes |
| DETSC 2130 | Cyanide free | mg/kg | 0.1 | Air Dried | No | Yes | Yes |
| DETSC 2130 | Cyanide total | mg/kg | 0.1 | Air Dried | No | Yes | Yes |
| DETSC 2130 | Phenol - Monohydric | mg/kg | 0.3 | Air Dried | No | Yes | Yes |
| DETSC 2130 | Thiocyanate | mg/kg | 0.6 | Air Dried | No | Yes | Yes |
| DETSC 2321 | Total Sulphate as SO4 | % | 0.01 | Air Dried | No | Yes | Yes |
| DETSC 2325 | Mercury | mg/kg | 0.05 | Air Dried | No | Yes | Yes |
| DETSC 3049 | Sulphur (free) | mg/kg | 0.75 | Air Dried | No | Yes | Yes |
| DETSC2123 | Boron (water soluble) | mg/kg | 0.2 | Air Dried | No | Yes | Yes |
| DETSC2301 | Arsenic | mg/kg | 0.2 | Air Dried | No | Yes | Yes |
| DETSC2301 | Barium | mg/kg | 1.5 | Air Dried | No | Yes | Yes |
| DETSC2301 | Beryllium | mg/kg | 0.2 | Air Dried | No | Yes | Yes |
| DETSC2301 | Cadmium Available | mg/kg | 0.1 | Air Dried | No | Yes | Yes |
| DETSC2301 | Cadmium | mg/kg | 0.1 | Air Dried | No | Yes | Yes |
| DETSC2301 | Cobalt | mg/kg | 0.7 | Air Dried | No | Yes | Yes |
| DETSC2301 | Chromium | mg/kg | 0.15 | Air Dried | No | Yes | Yes |
| DETSC2301 | Copper | mg/kg | 0.2 | Air Dried | No | Yes | Yes |
| DETSC2301 | Manganese | mg/kg | 20 | Air Dried | No | Yes | Yes |
| DETSC2301 | Molybdenum | mg/kg | 0.4 | Air Dried | No | Yes | Yes |
| DETSC2301 | Nickel | mg/kg | 1 | Air Dried | No | Yes | Yes |
| DETSC2301 | Lead | mg/kg | 0.3 | Air Dried | No | Yes | Yes |
| DETSC2301 | Selenium | mg/kg | 0.5 | Air Dried | No | Yes | Yes |
| DETSC2301 | Zinc | mg/kg | 1 | Air Dried | No | Yes | Yes |
| DETSC 3072 | Ali/Aro C10-C35 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C10-C12 | mg/kg | 1.5 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C10-C12 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C10-C35 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C12-C16 | mg/kg | 1.2 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C12-C16 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C16-C21 | mg/kg | 1.5 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C16-C21 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C21-C35 | mg/kg | 3.4 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C21-C35 | mg/kg | 3.4 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C10-C12 | mg/kg | 0.9 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C10-C12 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C10-C35 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C12-C16 | mg/kg | 0.5 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C12-C16 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C16-C21 | mg/kg | 0.6 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C16-C21 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C21-C35 | mg/kg | 1.4 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C21-C35 | mg/kg | 1.4 | As Received | No | Yes | Yes |
| DETS 062 | Benzene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | Ethylbenzene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | Toluene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | Xylene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | m+p Xylene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | o Xylene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3311 | C10-C24 Diesel Range Organics (DRO) | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3311 | C24-C40 Lube Oil Range Organics (LORO) | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3311 | EPH (C10-C40) | mg/kg | 10 | As Received | No | Yes | Yes |

# Appendix A - Details of Analysis

| Method | Parameter | Units | Limit of Detection | Sample Preparation | Sub-Contracted | UKAS | MCERTS |
|---|---|---|---|---|---|---|---|
| DETSC 3303 | Acenaphthene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Acenaphthylene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(a)pyrene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(a)anthracene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(b)fluoranthene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(k)fluoranthene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(g,h,i)perylene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Dibenzo(a,h)anthracene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Fluoranthene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Indeno(1,2,3-c,d)pyrene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Naphthalene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Phenanthrene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Pyrene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 28 + PCB 31 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 52 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 101 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 118 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 153 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 138 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 180 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB Total | mg/kg | 0.01 | As Received | No | Yes | Yes |

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Derwentside Environmental Testing Services

# Certificate of Analysis

## Certificate Number 14-16985-1

13-Oct-14

*Client* Sirius Geotechnical & Environmental
4245 Park Approach
Thorpe Park
Leeds
LS15 8GB

| | |
|---|---|
| *Our Reference* | 14-16985-1 |
| *Client Reference* | C6138 |
| *Contract Title* | Cudworth |
| *Description* | 7 Soil samples, 3 Leachate samples. |
| *Date Received* | 30-Sep-14 |
| *Date Started* | 30-Sep-14 |
| *Date Completed* | 06-Oct-14 |
| *Test Procedures* | Identified by prefix DETSn (details on request), Asbestos Analysis DETSC 1101. |

*Notes* **This report supersedes 14-16985, Extra Testing**

Opinions and interpretations are outside the scope of UKAS 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*



Rob Brown
Business Manager

MCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2139

# Summary of Chemical Analysis
# Matrix Descriptions

*Our Ref* 14-16985-1
*Client Ref* C6138
*Contract Title* Cudworth

| Sample ID | Other ID | Depth | Lab No | Completed | Matrix Description |
|---|---|---|---|---|---|
| WS2 | ES | 0.4 | 707082 | 06/10/2014 | Brown gravelly clayey SAND |
| WS5 | ES | 0.1 | 707083 | 06/10/2014 | Dark brown gravelly clayey SAND with numerous rootlets |
| WS10 | ES | 0.1 | 707084 | 06/10/2014 | Dark brown gravelly sandy CLAY with odd rootlets |
| TP2 | | 0.1 | 707085 | 06/10/2014 | Dark brown gravelly clayey SAND |
| TP14 | | 0.3 | 707086 | 06/10/2014 | Brown gravelly clayey SAND with odd rootlets |
| TP17 | | 0.1 | 707087 | 06/10/2014 | Dark brown gravelly clayey SAND |
| TP25 | | 0.3 | 707088 | 06/10/2014 | Brown gravelly clayey SAND with numerous rootlets |

# Summary of Chemical Analysis
# Soil Samples

*Our Ref* 14-16985-1
*Client Ref* C6138
*Contract Title* Cudworth

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Lab No** | 707082 | 707083 | 707084 | 707085 | 707086 | 707087 | 707088 |
| | | | **Sample ID** | WS2 | WS5 | WS10 | TP2 | TP14 | TP17 | TP25 |
| | | | **Depth** | 0.40 | 0.10 | 0.10 | 0.10 | 0.30 | 0.10 | 0.30 |
| | | | **Other ID** | ES | ES | ES | | | | |
| | | | **Sample Type** | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL |
| | | | **Sampling Date** | 23/09/14 | 23/09/14 | 23/09/14 | 19/09/14 | 18/09/14 | 18/09/14 | 18/09/14 |
| | | | **Sampling Time** | n/s | n/s | n/s | n/s | n/s | n/s | n/s |
| **Test** | **Method** | **LOD** | **Units** | | | | | | | |
| **Metals** | | | | | | | | | | |
| Arsenic | DETSC 2301# | 0.2 | mg/kg | 8.4 | 24 | 28 | 17 | 14 | 19 | |
| Cadmium | DETSC 2301# | 0.1 | mg/kg | 0.3 | 0.9 | 0.8 | 0.6 | 0.6 | 0.6 | |
| Chromium | DETSC 2301# | 0.15 | mg/kg | 17 | 32 | 24 | 20 | 25 | 21 | |
| Copper | DETSC 2301# | 0.2 | mg/kg | 21 | 42 | 55 | 32 | 30 | 42 | |
| Lead | DETSC 2301# | 0.3 | mg/kg | 22 | 76 | 70 | 50 | 54 | 54 | |
| Mercury | DETSC 2325# | 0.05 | mg/kg | < 0.05 | 0.13 | 0.21 | 0.09 | 0.08 | 0.29 | |
| Nickel | DETSC 2301# | 1 | mg/kg | 16 | 24 | 25 | 18 | 21 | 19 | |
| Selenium | DETSC 2301# | 0.5 | mg/kg | < 0.5 | < 0.5 | < 0.5 | < 0.5 | 0.7 | < 0.5 | |
| Zinc | DETSC 2301# | 1 | mg/kg | 44 | 100 | 110 | 69 | 110 | 89 | |
| **Inorganics** | | | | | | | | | | |
| pH | DETSC 2008# | | | 7.2 | 6.5 | 6.8 | 6.5 | 6.5 | 6.7 | |
| Calorific Value | DETSC 5008 | 1 | MJ/kg | < 1.0 | | 1.3 | | | | < 1.0 |
| Total Organic Carbon | DETSC 2002 | 0.1 | % | 0.7 | 3.6 | 2.7 | 1.5 | 1.4 | 2.2 | |
| Sulphate Aqueous Extract as SO4 | DETSC 2076# | 10 | mg/l | 25 | 19 | 13 | < 10 | 16 | 10 | |
| Total Sulphate as SO4 | DETSC 2321# | 0.01 | % | 0.03 | 0.13 | 0.06 | 0.06 | 0.05 | 0.06 | |
| **Petroleum Hydrocarbons** | | | | | | | | | | |
| Aliphatic C5-C6 | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 | | | | | |
| Aliphatic C6-C8 | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 | | | | | |
| Aliphatic C8-C10 | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 | | | | | |
| Aliphatic C10-C12 | DETSC 3072# | 1.5 | mg/kg | < 1.5 | < 1.5 | | | | | |
| Aliphatic C12-C16 | DETSC 3072# | 1.2 | mg/kg | < 1.2 | < 1.2 | | | | | |
| Aliphatic C16-C21 | DETSC 3072# | 1.5 | mg/kg | < 1.5 | < 1.5 | | | | | |
| Aliphatic C21-C35 | DETSC 3072# | 3.4 | mg/kg | < 3.4 | < 3.4 | | | | | |
| Aliphatic C5-C35 | DETSC 3072* | 10 | mg/kg | < 10 | < 10 | | | | | |
| Aromatic C5-C7 | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 | | | | | |
| Aromatic C7-C8 | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 | | | | | |
| Aromatic C8-C10 | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 | | | | | |
| Aromatic C10-C12 | DETSC 3072# | 0.9 | mg/kg | < 0.9 | < 0.9 | | | | | |
| Aromatic C12-C16 | DETSC 3072# | 0.5 | mg/kg | < 0.5 | < 0.5 | | | | | |
| Aromatic C16-C21 | DETSC 3072# | 0.6 | mg/kg | < 0.6 | < 0.6 | | | | | |
| Aromatic C21-C35 | DETSC 3072# | 1.4 | mg/kg | < 1.4 | < 1.4 | | | | | |
| Aromatic C5-C35 | DETSC 3072* | 10 | mg/kg | < 10 | < 10 | | | | | |
| TPH Ali/Aro | DETSC 3072* | 10 | mg/kg | < 10 | < 10 | | | | | |

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

# Summary of Chemical Analysis
# Soil Samples

*Our Ref* 14-16985-1
*Client Ref* C6138
*Contract Title* Cudworth

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Lab No** | 707082 | 707083 | 707084 | 707085 | 707086 | 707087 | 707088 |
| | | | **Sample ID** | WS2 | WS5 | WS10 | TP2 | TP14 | TP17 | TP25 |
| | | | **Depth** | 0.40 | 0.10 | 0.10 | 0.10 | 0.30 | 0.10 | 0.30 |
| | | | **Other ID** | ES | ES | ES | | | | |
| | | | **Sample Type** | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL |
| | | | **Sampling Date** | 23/09/14 | 23/09/14 | 23/09/14 | 19/09/14 | 18/09/14 | 18/09/14 | 18/09/14 |
| | | | **Sampling Time** | n/s | n/s | n/s | n/s | n/s | n/s | n/s |
| **Test** | **Method** | **LOD** | **Units** | | | | | | | |
| **PAHs** | | | | | | | | | | |
| Naphthalene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | 0.3 | 0.2 | < 0.1 | < 0.1 | < 0.1 | |
| Acenaphthylene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | |
| Acenaphthene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | |
| Fluorene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | 0.2 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | |
| Phenanthrene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | 0.3 | 0.6 | < 0.1 | < 0.1 | < 0.1 | |
| Anthracene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | 0.2 | 0.3 | < 0.1 | < 0.1 | < 0.1 | |
| Fluoranthene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | 0.4 | 1.6 | 0.3 | < 0.1 | < 0.1 | |
| Pyrene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | 0.4 | 1.5 | 0.3 | < 0.1 | < 0.1 | |
| Benzo(a)anthracene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | 0.9 | < 0.1 | < 0.1 | < 0.1 | |
| Chrysene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | 1.0 | < 0.1 | < 0.1 | < 0.1 | |
| Benzo(b)fluoranthene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | 0.9 | < 0.1 | < 0.1 | < 0.1 | |
| Benzo(k)fluoranthene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | 0.5 | < 0.1 | < 0.1 | < 0.1 | |
| Benzo(a)pyrene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | 0.9 | < 0.1 | < 0.1 | < 0.1 | |
| Benzo(g,h,i)perylene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | |
| Dibenzo(a,h)anthracene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | |
| Indeno(1,2,3-c,d)pyrene | DETSC 3301 | 0.1 | mg/kg | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | |
| PAH | DETSC 3301 | 1.6 | mg/kg | < 1.6 | 1.8 | 8.5 | < 1.6 | < 1.6 | < 1.6 | |
| **Phenols** | | | | | | | | | | |
| Phenol - Monohydric | DETSC 2130# | 0.3 | mg/kg | < 0.3 | 0.8 | 0.5 | 0.5 | 0.4 | 0.7 | |
| **OCPs** | | | | | | | | | | |
| alpha-BHC | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| gamma-BHC (Lindane) | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| beta-BHC | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| delta-BHC | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Heptachlor | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Aldrin | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Heptachlor epoxide | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| gamma-Chlordane | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Endosulphan I & Alpha-chlorodane | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| 4,4-DDE | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Dieldrin | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Endrin | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Endosulphan II & 4,4-DDD | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Endrin aldehyde | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| 4,4-DDT | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Endosulphan sulphate | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Methoxychlor | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Endrin ketone | DETSC 3441* | 0.1 | mg/kg | | | | < 0.1 | | | |

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

# Summary of Chemical Analysis
# Soil Samples

*Our Ref* 14-16985-1
*Client Ref* C6138
*Contract Title* Cudworth

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Lab No** | 707082 | 707083 | 707084 | 707085 | 707086 | 707087 | 707088 |
| **Sample ID** | WS2 | WS5 | WS10 | TP2 | TP14 | TP17 | TP25 |
| **Depth** | 0.40 | 0.10 | 0.10 | 0.10 | 0.30 | 0.10 | 0.30 |
| **Other ID** | ES | ES | ES | | | | |
| **Sample Type** | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL |
| **Sampling Date** | 23/09/14 | 23/09/14 | 23/09/14 | 19/09/14 | 18/09/14 | 18/09/14 | 18/09/14 |
| **Sampling Time** | n/s | n/s | n/s | n/s | n/s | n/s | n/s |

| **Test** | **Method** | **LOD** | **Units** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **OPPs** | | | | | | | | | | |
| Dichlorvos | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Mevinphos | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Demeton-O | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Ethoprop | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Naled | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Phorate | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Demeton-S | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Diazinon | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Disulfoton | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Methylparathion | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Ronnel | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Fenthion | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Chlopyrifos | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Trichlorinate | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Merphos | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Stirofos | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Tokuthion | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Fensulfothion | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Bolstar | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Azinphos methyl | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |
| Coumaphos | DETSC 3443* | 0.1 | mg/kg | | | | < 0.1 | | | |

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

# Summary of Chemical Analysis
# Leachate Samples

*Our Ref* 14-16985-1
*Client Ref* C6138
*Contract Title* Cudworth

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | **Lab No** | 710585 | 710586 | 710587 |
| | | | **Sample ID** | WS2 | WS5 | WS10 |
| | | | **Depth** | 0.40 | 0.10 | 0.10 |
| | | | **Other ID** | | | |
| | | | **Sample Type** | LEACHATE | LEACHATE | LEACHATE |
| | | | **Sampling Date** | 23/09/14 | 23/09/14 | 23/09/14 |
| | | | **Sampling Time** | n/s | n/s | n/s |
| **Test** | **Method** | **LOD** | **Units** | | | |
| **Preparation** | | | | | | |
| BS EN 12457 10:1 | DETS 036* | | | Y | Y | Y |
| **Metals** | | | | | | |
| Arsenic, Dissolved | DETSC 2306 | 0.16 | ug/l | 1.4 | 1.1 | 2.2 |
| Cadmium, Dissolved | DETSC 2306 | 0.03 | ug/l | < 0.03 | < 0.03 | < 0.03 |
| Chromium, Dissolved | DETSC 2306 | 0.25 | ug/l | < 0.25 | < 0.25 | < 0.25 |
| Copper, Dissolved | DETSC 2306 | 0.4 | ug/l | 3.7 | 3.0 | 2.5 |
| Lead, Dissolved | DETSC 2306 | 0.09 | ug/l | 0.56 | 1.1 | 0.45 |
| Mercury, Dissolved | DETSC 2306 | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Nickel, Dissolved | DETSC 2306 | 0.5 | ug/l | 0.6 | < 0.5 | < 0.5 |
| Selenium, Dissolved | DETSC 2306 | 0.25 | ug/l | < 0.25 | < 0.25 | < 0.25 |
| Zinc, Dissolved | DETSC 2306 | 1.25 | ug/l | 2.80 | 3.78 | 1.93 |
| **Inorganics** | | | | | | |
| pH | DETSC 2008 | | | 8.2 | 8.2 | 8.0 |
| **PAHs** | | | | | | |
| Naphthalene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthylene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Fluorene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Phenanthrene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Anthracene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Fluoranthene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | 0.02 |
| Pyrene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | 0.01 |
| Benzo(a)anthracene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Chrysene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Benzo(b)fluoranthene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | 0.02 |
| Benzo(k)fluoranthene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | 0.01 |
| Benzo(a)pyrene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | 0.01 |
| Benzo(g,h,i)perylene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Dibenzo(a,h)anthracene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| Indeno(1,2,3-c,d)pyrene | DETS 074* | 0.01 | ug/l | < 0.01 | < 0.01 | < 0.01 |
| PAH | DETS 074* | 0.2 | ug/l | < 0.20 | < 0.20 | < 0.20 |
| **Phenols** | | | | | | |
| Phenol | * | 0.5 | ug/l | < 0.50 | < 0.50 | < 0.50 |

Key: * -not accredited. n/s -not supplied.

# Summary of Asbestos Analysis
# Soil Samples

*Our Ref* 14-16985-1
*Client Ref* C6138
*Contract Title* Cudworth

| Lab No | Sample ID | Material Type | Result | Comment* | Analyst |
|---|---|---|---|---|---|
| 707082 | WS2 ES 0.40 | SOIL | NAD | none | Colin Patrick |
| 707084 | WS10 ES 0.10 | SOIL | NAD | none | Colin Patrick |
| 707086 | TP14 0.30 | SOIL | NAD | none | Colin Patrick |

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

# Information in Support of the Analytical Results

*Our Ref* 14-16985-1
*Client Ref* C6138
*Contract* Cudworth

## Containers Received & Deviating Samples

| Lab No | Sample ID | Date Sampled | Containers Received | Holding time exceeded for tests | Inappropriate container for tests |
|---|---|---|---|---|---|
| 707082 | WS2 0.40 SOIL | 23/09/14 | GJ 1L, GJ 60ml | pH (7 days) | |
| 707083 | WS5 0.10 SOIL | 23/09/14 | GJ 1L, GJ 60ml | pH (7 days) | |
| 707084 | WS10 0.10 SOIL | 23/09/14 | GJ 1L, GJ 60ml | pH (7 days) | |
| 707085 | TP2 0.10 SOIL | 19/09/14 | GJ 1L, GJ 60ml | pH (7 days) | |
| 707086 | TP14 0.30 SOIL | 18/09/14 | GJ 1L, GJ 60ml | pH (7 days) | |
| 707087 | TP17 0.10 SOIL | 18/09/14 | GJ 1L, GJ 60ml | pH (7 days) | |
| 707088 | TP25 0.30 SOIL | 18/09/14 | GJ 1L, GJ 60ml | | |
| 710585 | WS2 0.40 LEACHATE | 23/09/14 | GJ 1L (1L) | | |
| 710586 | WS5 0.10 LEACHATE | 23/09/14 | GJ 1L (1L) | | |
| 710587 | WS10 0.10 LEACHATE | 23/09/14 | GJ 1L (1L) | | |

Key: G-Glass J-Jar

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 and/or inappropriate containers 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

# Appendix A - Details of Analysis

| Method | Parameter | Units | Limit of Detection | Sample Preparation | Sub-Contracted | UKAS | MCERTS |
|---|---|---|---|---|---|---|---|
| DETSC 2002 | Organic matter | % | 0.1 | Air Dried | No | Yes | Yes |
| DETSC 2003 | Loss on ignition | % | 0.01 | Air Dried | No | Yes | Yes |
| DETSC 2008 | pH | pH Units | 1 | Air Dried | No | Yes | Yes |
| DETSC 2024 | Sulphide | mg/kg | 10 | Air Dried | No | Yes | Yes |
| DETSC 2076 | Sulphate Aqueous Extract as SO4 | mg/l | 10 | Air Dried | No | Yes | Yes |
| DETSC 2084 | Total Carbon | % | 0.5 | Air Dried | No | Yes | Yes |
| DETSC 2084 | Total Organic Carbon | % | 0.5 | Air Dried | No | Yes | Yes |
| DETSC 2119 | Ammoniacal Nitrogen as N | mg/kg | 0.5 | Air Dried | No | Yes | Yes |
| DETSC 2130 | Cyanide free | mg/kg | 0.1 | Air Dried | No | Yes | Yes |
| DETSC 2130 | Cyanide total | mg/kg | 0.1 | Air Dried | No | Yes | Yes |
| DETSC 2130 | Phenol - Monohydric | mg/kg | 0.3 | Air Dried | No | Yes | Yes |
| DETSC 2130 | Thiocyanate | mg/kg | 0.6 | Air Dried | No | Yes | Yes |
| DETSC 2321 | Total Sulphate as SO4 | % | 0.01 | Air Dried | No | Yes | Yes |
| DETSC 2325 | Mercury | mg/kg | 0.05 | Air Dried | No | Yes | Yes |
| DETSC 3049 | Sulphur (free) | mg/kg | 0.75 | Air Dried | No | Yes | Yes |
| DETSC2123 | Boron (water soluble) | mg/kg | 0.2 | Air Dried | No | Yes | Yes |
| DETSC2301 | Arsenic | mg/kg | 0.2 | Air Dried | No | Yes | Yes |
| DETSC2301 | Barium | mg/kg | 1.5 | Air Dried | No | Yes | Yes |
| DETSC2301 | Beryllium | mg/kg | 0.2 | Air Dried | No | Yes | Yes |
| DETSC2301 | Cadmium Available | mg/kg | 0.1 | Air Dried | No | Yes | Yes |
| DETSC2301 | Cadmium | mg/kg | 0.1 | Air Dried | No | Yes | Yes |
| DETSC2301 | Cobalt | mg/kg | 0.7 | Air Dried | No | Yes | Yes |
| DETSC2301 | Chromium | mg/kg | 0.15 | Air Dried | No | Yes | Yes |
| DETSC2301 | Copper | mg/kg | 0.2 | Air Dried | No | Yes | Yes |
| DETSC2301 | Manganese | mg/kg | 20 | Air Dried | No | Yes | Yes |
| DETSC2301 | Molybdenum | mg/kg | 0.4 | Air Dried | No | Yes | Yes |
| DETSC2301 | Nickel | mg/kg | 1 | Air Dried | No | Yes | Yes |
| DETSC2301 | Lead | mg/kg | 0.3 | Air Dried | No | Yes | Yes |
| DETSC2301 | Selenium | mg/kg | 0.5 | Air Dried | No | Yes | Yes |
| DETSC2301 | Zinc | mg/kg | 1 | Air Dried | No | Yes | Yes |
| DETSC 3072 | Ali/Aro C10-C35 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C10-C12 | mg/kg | 1.5 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C10-C12 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C10-C35 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C12-C16 | mg/kg | 1.2 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C12-C16 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C16-C21 | mg/kg | 1.5 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C16-C21 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C21-C35 | mg/kg | 3.4 | As Received | No | Yes | Yes |
| DETSC 3072 | Aliphatic C21-C35 | mg/kg | 3.4 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C10-C12 | mg/kg | 0.9 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C10-C12 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C10-C35 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C12-C16 | mg/kg | 0.5 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C12-C16 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C16-C21 | mg/kg | 0.6 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C16-C21 | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C21-C35 | mg/kg | 1.4 | As Received | No | Yes | Yes |
| DETSC 3072 | Aromatic C21-C35 | mg/kg | 1.4 | As Received | No | Yes | Yes |
| DETS 062 | Benzene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | Ethylbenzene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | Toluene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | Xylene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | m+p Xylene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETS 062 | o Xylene | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3311 | C10-C24 Diesel Range Organics (DRO) | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3311 | C24-C40 Lube Oil Range Organics (LORO) | mg/kg | 10 | As Received | No | Yes | Yes |
| DETSC 3311 | EPH (C10-C40) | mg/kg | 10 | As Received | No | Yes | Yes |

# Appendix A - Details of Analysis

| Method | Parameter | Units | Limit of Detection | Sample Preparation | Sub-Contracted | UKAS | MCERTS |
|---|---|---|---|---|---|---|---|
| DETSC 3303 | Acenaphthene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Acenaphthylene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(a)pyrene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(a)anthracene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(b)fluoranthene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(k)fluoranthene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Benzo(g,h,i)perylene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Dibenzo(a,h)anthracene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Fluoranthene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Indeno(1,2,3-c,d)pyrene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Naphthalene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Phenanthrene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3303 | Pyrene | mg/kg | 0.03 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 28 + PCB 31 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 52 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 101 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 118 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 153 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 138 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB 180 | mg/kg | 0.01 | As Received | No | Yes | Yes |
| DETSC 3401 | PCB Total | mg/kg | 0.01 | As Received | No | Yes | Yes |

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

# APPENDIX D

# SOAKAWAY RESULTS

| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Barratt & David Wilson Homes | | |
| Site: | Carrs Lane, Cudworth | | |
| Job No: | C6138 | Test No: | SA1 - 1 |

## CALCULATION OF SOIL INFILTRATION RATE

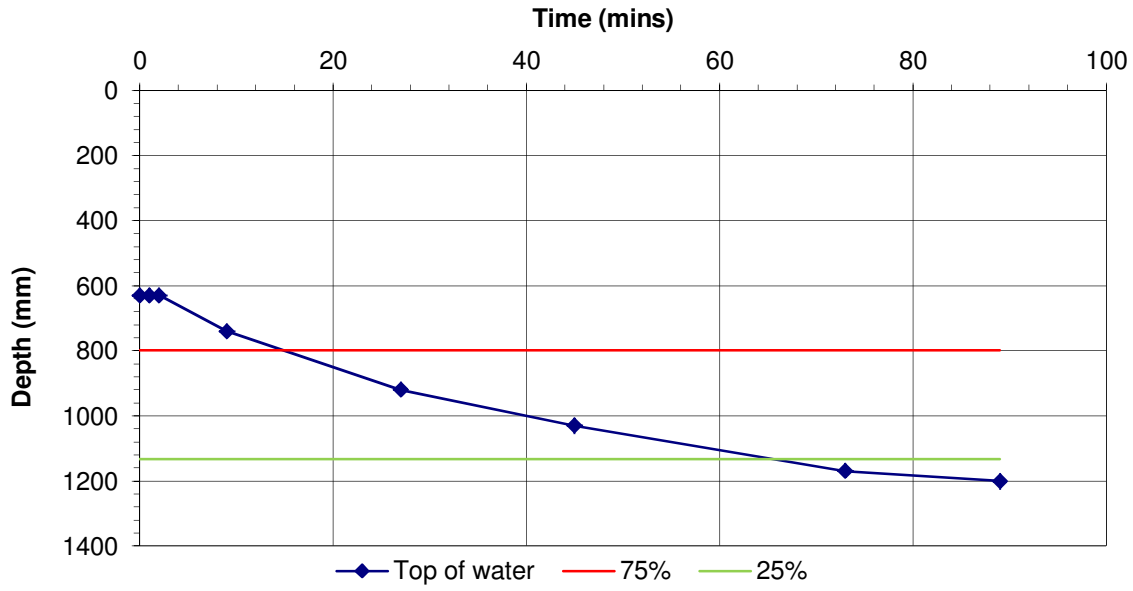
| Time (min) | Depth (mm) |
|---|---|
| 0 | 630 |
| 1 | 630 |
| 2 | 630 |
| 9 | 740 |
| 27 | 920 |
| 45 | 1030 |
| 73 | 1170 |
| 89 | 1200 |

| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 3.00 |
| | Width (m) = | 0.80 |
| | Depth (m) = | 1.30 |

| | |
|---|---|
| Depth at start of test (mm)= | 630mm |
| Depth of trial pit (mm)= | 1300mm |
| 75% effective depth (mm)= | 798mm |
| 50% effective depth = | 965mm |
| 25% effective depth = | 1133mm |
| Base area of pit ($m^2$) = | 2.400 |
| Effective area of loss 50% ($m^2$) = | 4.946 |
| Volume outflow 75 - 25% ($m^3$) = | 0.804 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 15 |
| tp 25 (min) = | 66 |

| Soil infiltration rate, f, (m/s) = | 5.31E-05 | Normal test |
|---|---|---|
| Input by: | GB | Date: 3.10.2014 |
| Checked by: | JL | Date: 7.10.2014 |



| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Barratt & David Wilson Homes | | |
| Site: | Carrs Lane, Cudworth | | |
| Job No: | C6138 | Test No: | SA1 - 2 |

## CALCULATION OF SOIL INFILTRATION RATE

| Time (min) | Depth (mm) |
|---|---|
| 0 | 700 |
| 1 | 700 |
| 4 | 720 |
| 15 | 780 |
| 26 | 860 |
| 32 | 890 |
| 37 | 920 |
| 42 | 950 |
| 47 | 1000 |
| 54 | 1075 |

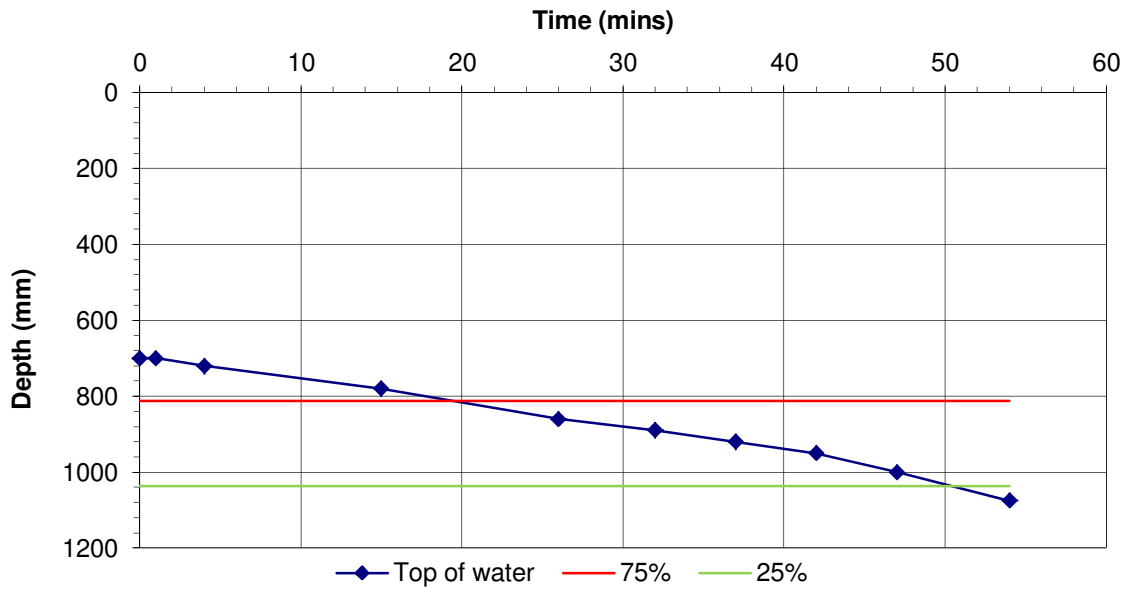
| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 3.00 |
| | Width (m) = | 0.80 |
| | Depth (m) = | 1.15 |

| | |
|---|---|
| Depth at start of test (mm)= | 700mm |
| Depth of trial pit (mm)= | 1150mm |
| 75% effective depth (mm)= | 813mm |
| 50% effective depth = | 925mm |
| 25% effective depth = | 1038mm |
| Base area of pit ($m^2$) = | 2.400 |
| Effective area of loss 50% ($m^2$) = | 4.110 |
| Volume outflow 75 - 25% ($m^3$) = | 0.540 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 20 |
| tp 25 (min) = | 50.5 |

| Soil infiltration rate, f, (m/s) = | 7.18E-05 | Normal test |
|---|---|---|

| Input by: | GB | Date: | 3.10.2014 |
|---|---|---|---|
| Checked by: | JL | Date: | 7.10.2014 |



| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Barratt & David Wilson Homes | | |
| Site: | Carrs Lane, Cudworth | | |
| Job No: | C6138 | Test No: | SA2 - 1 |

## CALCULATION OF SOIL INFILTRATION RATE

| Time (min) | Depth (mm) |
|---|---|
| 0 | 700 |
| 1 | 750 |
| 2 | 780 |
| 3 | 800 |
| 4 | 820 |
| 5 | 840 |
| 10 | 950 |
| 20 | 1100 |
| 25 | 1120 |
| 36 | 1190 |
| 43 | 1250 |
| 47 | 1260 |

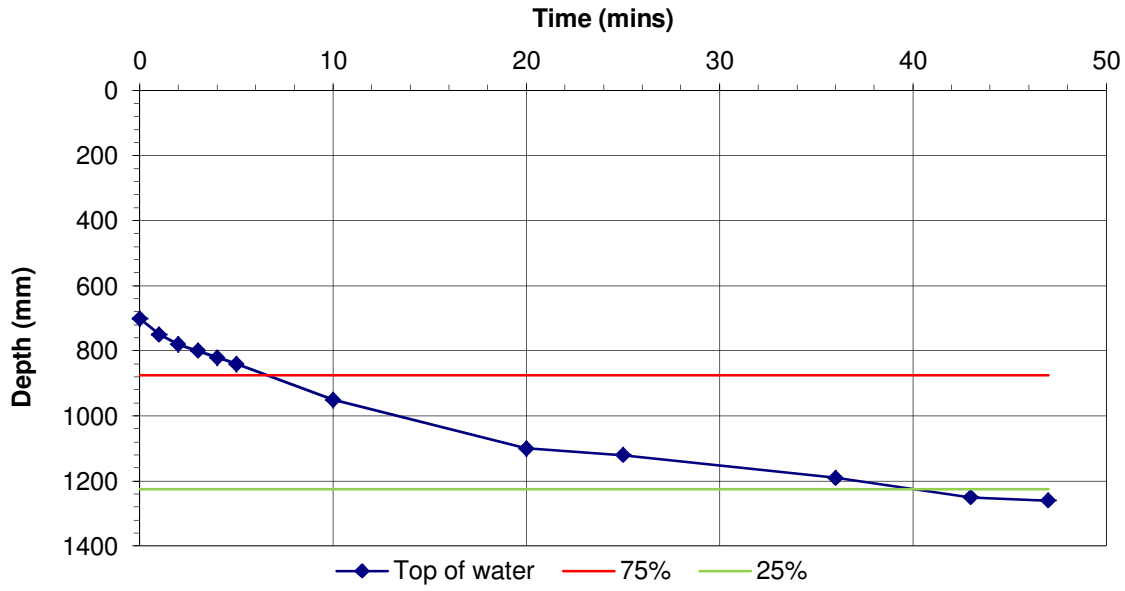
| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 3.10 |
| | Width (m) = | 0.70 |
| | Depth (m) = | 1.40 |

| | |
|---|---|
| Depth at start of test (mm)= | 700mm |
| Depth of trial pit (mm)= | 1400mm |
| 75% effective depth (mm)= | 875mm |
| 50% effective depth = | 1050mm |
| 25% effective depth = | 1225mm |
| Base area of pit ($m^2$) = | 2.170 |
| Effective area of loss 50% ($m^2$) = | 4.830 |
| Volume outflow 75 - 25% ($m^3$) = | 0.760 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 6.5 |
| tp 25 (min) = | 40 |

| Soil infiltration rate, f, (m/s) = | 7.82E-05 | Normal test |
|---|---|---|

| Input by: | GB | Date: | 3.10.2014 |
|---|---|---|---|
| Checked by: | JL | Date: | 7.10.2014 |



# SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007

| | | | |
|---|---|---|---|
| Client: | Barratt & David Wilson Homes | | |
| Site: | Carrs Lane, Cudworth | | |
| Job No: | C6138 | Test No: | SA2 - 2 |

## CALCULATION OF SOIL INFILTRATION RATE

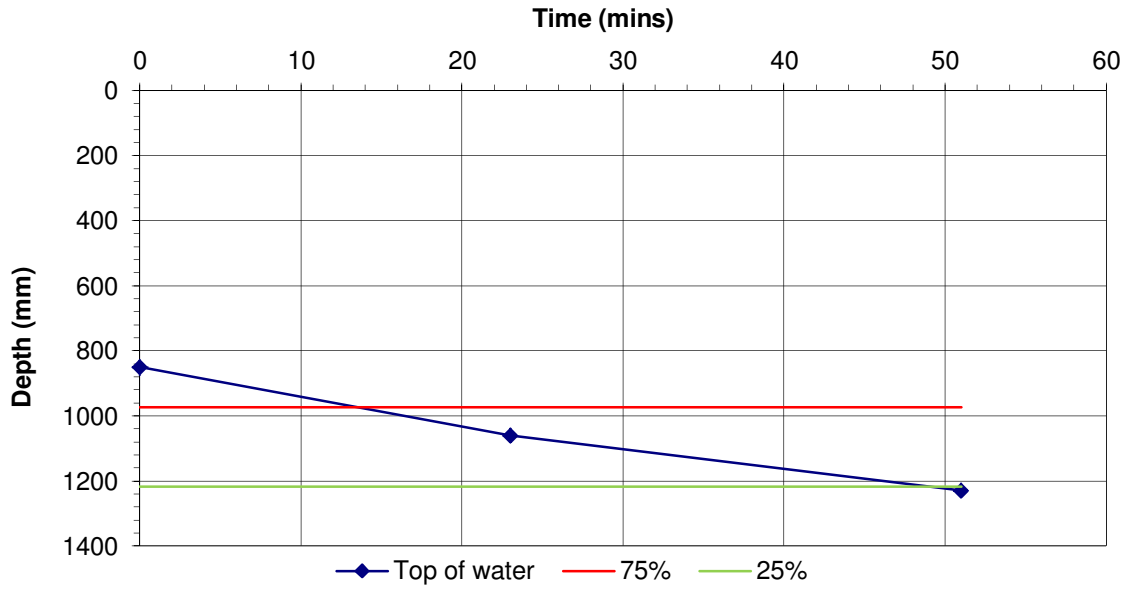
| Time (min) | Depth (mm) |
|---|---|
| 0 | 850 |
| 23 | 1060 |
| 51 | 1230 |

| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 3.10 |
| | Width (m) = | 0.70 |
| | Depth (m) = | 1.34 |

| | |
|---|---|
| Depth at start of test (mm)= | 850mm |
| Depth of trial pit (mm)= | 1340mm |
| 75% effective depth (mm)= | 973mm |
| 50% effective depth = | 1095mm |
| 25% effective depth = | 1218mm |
| Base area of pit ($m^2$) = | 2.170 |
| Effective area of loss 50% ($m^2$) = | 4.032 |
| Volume outflow 75 - 25% ($m^3$) = | 0.532 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 13.5 |
| tp 25 (min) = | 49 |

| | | | |
|---|---|---|---|
| Soil infiltration rate, f, (m/s) = | | 6.19E-05 | Normal test |
| Input by: | GB | Date: | 3.10.2014 |
| Checked by: | JL | Date: | 7.10.2014 |



**SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007**

| | | | |
|---|---|---|---|
| **Client:** | **Barratt & David Wilson Homes** | | |
| **Site:** | **Carrs Lane, Cudworth** | | |
| **Job No:** | **C6138** | **Test No:** | **SA3 - 1** |

## CALCULATION OF SOIL INFILTRATION RATE

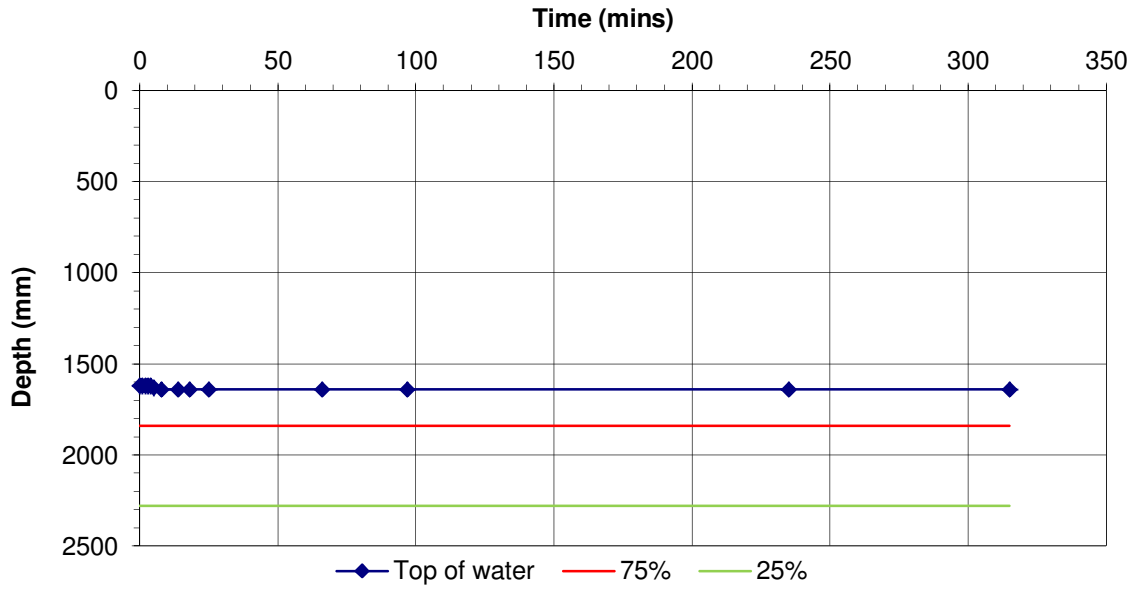
| Time (min) | Depth (mm) |
|---|---|
| 0 | 1620 |
| 1 | 1620 |
| 2 | 1620 |
| 3 | 1620 |
| 4 | 1620 |
| 5 | 1630 |
| 8 | 1640 |
| 14 | 1640 |
| 18 | 1640 |
| 25 | 1640 |
| 66 | 1640 |
| 97 | 1640 |
| 235 | 1640 |
| 315 | 1640 |

| **Size of Soakaway** | | |
|---|---|---|
| | Length (m) = | 2.70 |
| | Width (m) = | 0.60 |
| | Depth (m) = | 2.50 |

| | |
|---|---|
| **Depth at start of test (mm)=** | 1620mm |
| **Depth of trial pit (mm)=** | 2500mm |
| **75% effective depth (mm)=** | 1840mm |
| **50% effective depth =** | 2060mm |
| **25% effective depth =** | 2280mm |
| **Base area of pit ($m^2$) =** | 1.620 |
| **Effective area of loss 50% ($m^2$) =** | 4.524 |
| **Volume outflow 75 - 25% ($m^3$) =** | 0.713 |

| **From the graph:** | |
|---|---|
| **tp 75 (min) =** | Not achieved |
| **tp 25 (min) =** | Not achieved |

| | | | |
|---|---|---|---|
| **Soil infiltration rate, f, (m/s) =** | | **Not calculated** | **Normal test** |
| **Input by:** | **GB** | **Date:** | **3.10.2014** |
| **Checked by:** | **JL** | **Date:** | **7.10.2014** |



| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Barratt & David Wilson Homes | | |
| Site: | Carrs Lane, Cudworth | | |
| Job No: | C6138 | Test No: | SA4 - 1 |

## CALCULATION OF SOIL INFILTRATION RATE

| Time (min) | Depth (mm) |
|---|---|
| 0 | 1200 |
| 1 | 1250 |
| 2 | 1270 |
| 3 | 1270 |
| 4 | 1270 |
| 5 | 1280 |
| 8 | 1300 |
| 12 | 1310 |
| 15 | 1310 |
| 17 | 1320 |
| 43 | 1370 |
| 86 | 1480 |
| 144 | 1570 |
| 175 | 1600 |

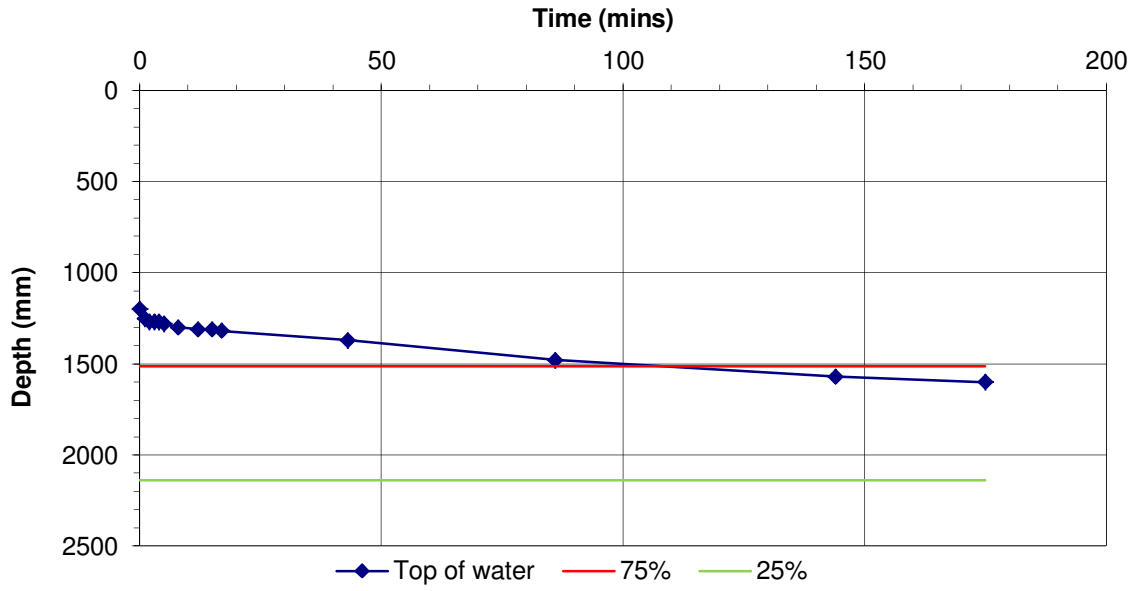
| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 3.40 |
| | Width (m) = | 0.80 |
| | Depth (m) = | 2.45 |

| | |
|---|---|
| Depth at start of test (mm)= | 1200mm |
| Depth of trial pit (mm)= | 2450mm |
| 75% effective depth (mm)= | 1513mm |
| 50% effective depth = | 1825mm |
| 25% effective depth = | 2138mm |
| Base area of pit ($m^2$) = | 2.720 |
| Effective area of loss 50% ($m^2$) = | 7.970 |
| Volume outflow 75 - 25% ($m^3$) = | 1.700 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 100 |
| tp 25 (min) = | Not achieved |

| Soil infiltration rate, f, (m/s) = | Not calculated | Normal test |
|---|---|---|

| Input by: | GB | Date: | 3.10.2014 |
|---|---|---|---|
| Checked by: | JL | Date: | 6.10.2014 |



| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Barratt & David Wilson Homes | | |
| Site: | Carrs Lane, Cudworth | | |
| Job No: | C6138 | Test No: | SA5 - 1 |

## CALCULATION OF SOIL INFILTRATION RATE

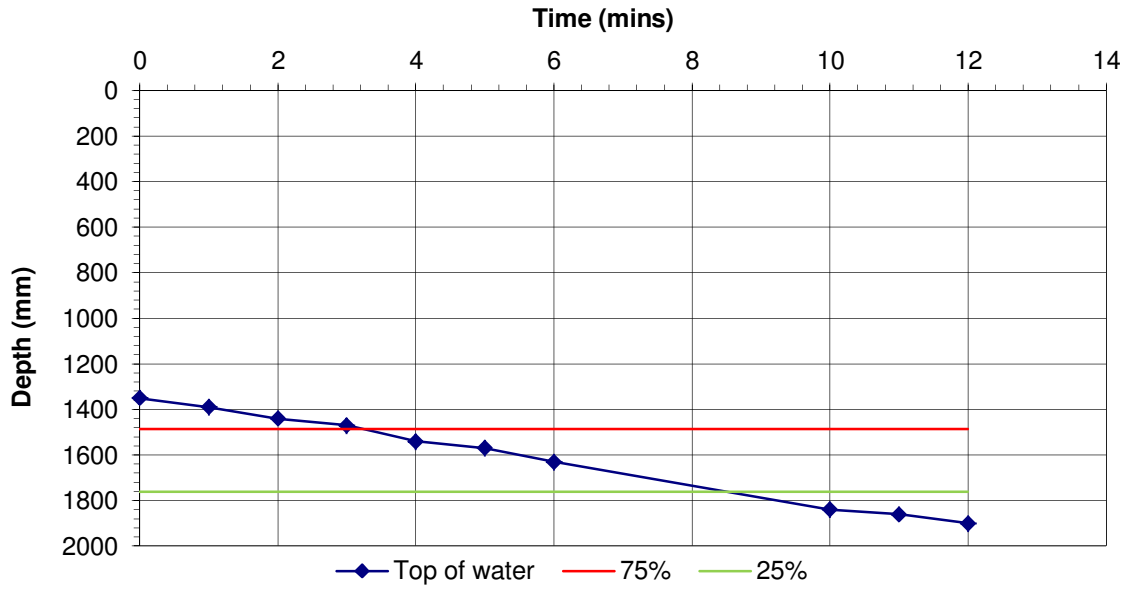
| Time (min) | Depth (mm) |
|---|---|
| 0 | 1350 |
| 1 | 1390 |
| 2 | 1440 |
| 3 | 1470 |
| 4 | 1540 |
| 5 | 1570 |
| 6 | 1630 |
| 10 | 1840 |
| 11 | 1860 |
| 12 | 1900 |

| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 3.20 |
| | Width (m) = | 0.70 |
| | Depth (m) = | 1.90 |

| | |
|---|---|
| Depth at start of test (mm)= | 1350mm |
| Depth of trial pit (mm)= | 1900mm |
| 75% effective depth (mm)= | 1488mm |
| 50% effective depth = | 1625mm |
| 25% effective depth = | 1763mm |
| Base area of pit ($m^2$) = | 2.240 |
| Effective area of loss 50% ($m^2$) = | 4.385 |
| Volume outflow 75 - 25% ($m^3$) = | 0.616 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 3.2 |
| tp 25 (min) = | 8.45 |

| Soil infiltration rate, f, (m/s) = | 4.46E-04 | Normal test |
|---|---|---|
| | | |
| Input by: GB | Date: | 3.10.2014 |
| Checked by: JL | Date: | 6.10.2014 |



| | | | | |
|---|---|---|---|---|
| | **SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007** | | | |
| | **Client:** | **Barratt & David Wilson Homes** | | |
| | **Site:** | **Carrs Lane, Cudworth** | | |
| | **Job No:** | **C6138** | **Test No:** | **SA5 - 2** |

## CALCULATION OF SOIL INFILTRATION RATE

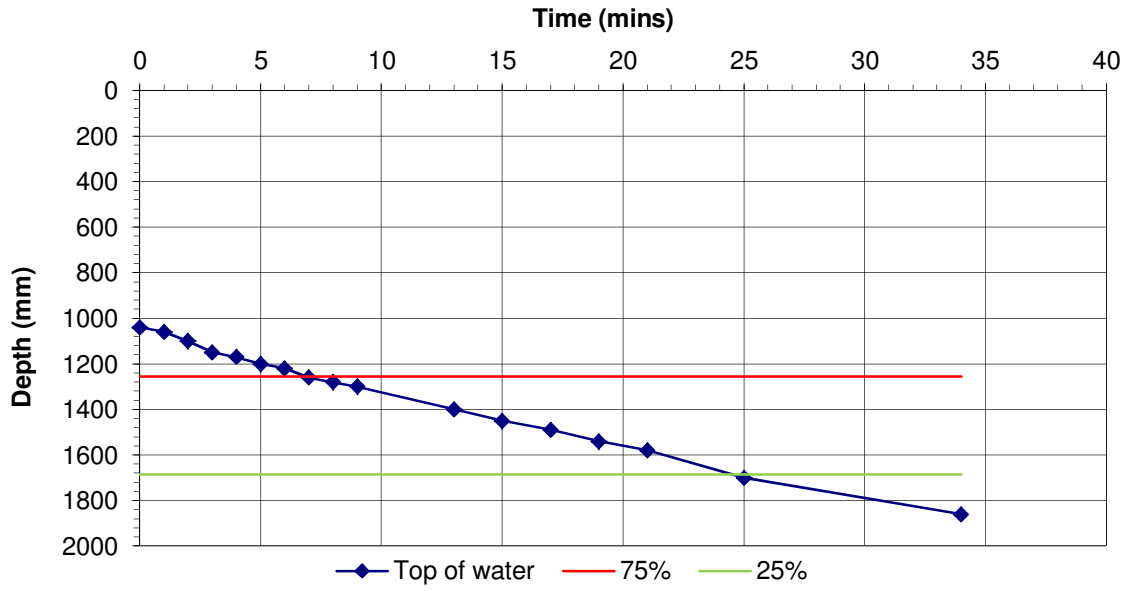
| Time (min) | Depth (mm) |
|---|---|
| 0 | 1040 |
| 1 | 1060 |
| 2 | 1100 |
| 3 | 1150 |
| 4 | 1170 |
| 5 | 1200 |
| 6 | 1220 |
| 7 | 1260 |
| 8 | 1280 |
| 9 | 1300 |
| 13 | 1400 |
| 15 | 1450 |
| 17 | 1490 |
| 19 | 1540 |
| 21 | 1580 |
| 25 | 1700 |
| 34 | 1860 |

| | | |
|---|---|---|
| **Size of Soakaway** | Length (m) = | 3.20 |
| | Width (m) = | 0.70 |
| | Depth (m) = | 1.90 |

| | |
|---|---|
| **Depth at start of test (mm)=** | 1040mm |
| **Depth of trial pit (mm)=** | 1900mm |
| **75% effective depth (mm)=** | 1255mm |
| **50% effective depth =** | 1470mm |
| **25% effective depth =** | 1685mm |
| **Base area of pit ($m^2$) =** | 2.240 |
| **Effective area of loss 50% ($m^2$) =** | 5.594 |
| **Volume outflow 75 - 25% ($m^3$) =** | 0.963 |

| **From the graph:** | |
|---|---|
| **tp 75 (min) =** | 6.9 |
| **tp 25 (min) =** | 24 |

| | | | |
|---|---|---|---|
| **Soil infiltration rate, f, (m/s) =** | | **1.68E-04** | **Normal test** |
| **Input by:** | **GB** | **Date:** | **3.10.2014** |
| **Checked by:** | **JL** | **Date:** | **6.10.2014** |



**SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007**

| | | | |
|---|---|---|---|
| **Client:** | **Barratt & David Wilson Homes** | | |
| **Site:** | **Carrs Lane, Cudworth** | | |
| **Job No:** | **C6138** | **Test No:** | **SA5 - 3** |

## CALCULATION OF SOIL INFILTRATION RATE

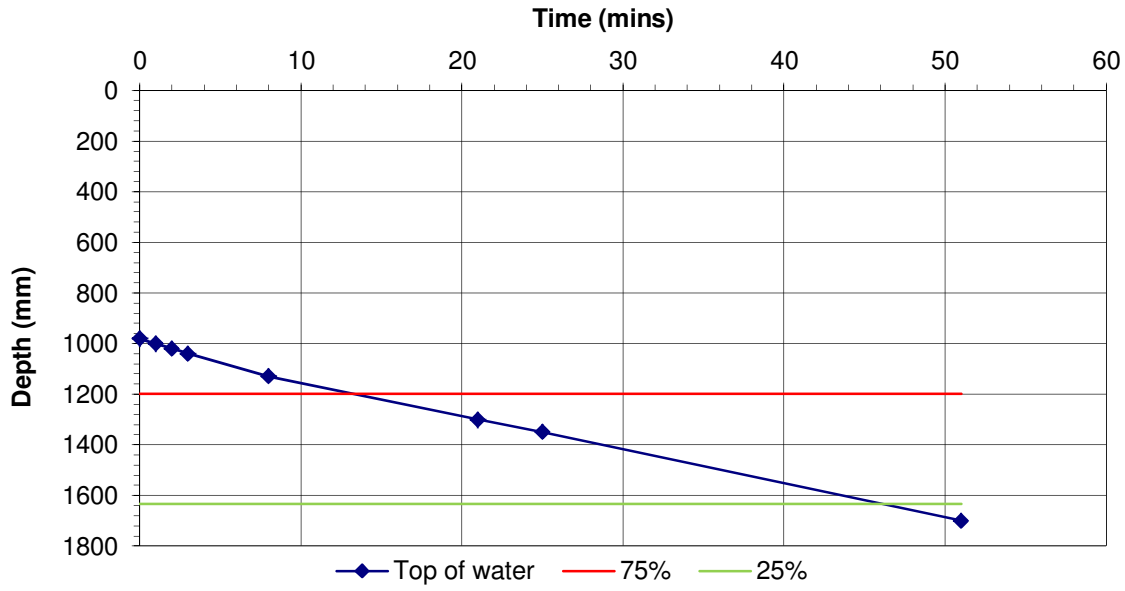
| Time (min) | Depth (mm) |
|---|---|
| 0 | 980 |
| 1 | 1000 |
| 2 | 1020 |
| 3 | 1040 |
| 8 | 1130 |
| 21 | 1300 |
| 25 | 1350 |
| 51 | 1700 |

| | | |
|---|---|---|
| **Size of Soakaway** | Length (m) = | 3.20 |
| | Width (m) = | 0.70 |
| | Depth (m) = | 1.85 |

| | |
|---|---|
| **Depth at start of test (mm)=** | 980mm |
| **Depth of trial pit (mm)=** | 1850mm |
| **75% effective depth (mm)=** | 1198mm |
| **50% effective depth =** | 1415mm |
| **25% effective depth =** | 1633mm |
| **Base area of pit ($m^2$) =** | 2.240 |
| **Effective area of loss 50% ($m^2$) =** | 5.633 |
| **Volume outflow 75 - 25% ($m^3$) =** | 0.974 |

| **From the graph:** | |
|---|---|
| **tp 75 (min) =** | 13 |
| **tp 25 (min) =** | 45.5 |

| | | | |
|---|---|---|---|
| **Soil infiltration rate, f, (m/s) =** | | **8.87E-05** | **Normal test** |
| **Input by:** | **GB** | **Date:** | **3.10.2014** |
| **Checked by:** | **JL** | **Date:** | **6.10.2014** |



# APPENDIX E

# GROUND GAS AND GROUNDWATER MONITORING RESULTS

# Ground Gas and Groundwater Monitoring Record Sheet

**JOB DETAILS:**

**Client:** Barratt & David Wilson Homes **Job No:** C6138
**Site:** Cudworth **Visit No:** 1 **of** 1
**Date:** 03/10/2014 **Operator:** Alex Edward **Project Manager:** Jenny Levitt

| | GAS CONCENTRATIONS | | | | | | | | | | | | VOLATILES | | FLOW DATA | | | | Worst-credible GSVs | | WELL AND WATER DATA | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monitoring Point | Methane (%v/v) | | %LEL | | Carbon dioxide (%v/v) | | Carbon monoxide (ppmv) | | Hydrogen sulphide (ppmv) | | Oxygen (%v/v) | | PID Peak (ppm) | Product thickness (mm) | Flow rate (l/hr) | | Differential borehole Pressure (Pa) | Time for flow to equalise (secs) | Methane (l/hr) | CO2 (l/hr) | Water level (mbgl) | Depth of well (m) | Reduced level (mAOD) | Water level (mAOD) | Response Zone | |
| | Peak | Steady | Peak | Steady | Peak | Steady | Peak | Steady | Peak | Steady | Min. | Steady | | | Peak | Steady | | | | | | | | | | |
| WS1 | ND | ND | ND | ND | 0.1 | 0.1 | 2 | 1 | 2 | 1 | 21.2 | 21.2 | ND | ND | ND | ND | ND | ND | NA | 0.0001 | ND | 2.10 | 54.13 | NA | NAT - G & Bed | |
| WS2 | ND | ND | ND | ND | 0.9 | 0.9 | 4 | 1 | 2 | 1 | 20.3 | 20.3 | ND | ND | 0.5 | 0.5 | 1 | 5 | NA | 0.0045 | ND | 3.00 | 42.39 | NA | NAT - G & Bed | Cover smashed, well tap missing. Replaced well tap and left for 2 hours before monitoring. |
| WS3 | ND | ND | ND | ND | 1.7 | 1.6 | 3 | 1 | 2 | 1 | 19.9 | 19.9 | ND | ND | ND | ND | ND | ND | NA | 0.0016 | 2.92 | 4.50 | 37.53 | 34.61 | NAT - G, C, Coal & Bed | Cover smashed, well tap missing. Replaced well tap and left for 2 hours before monitoring. C. 1.5m of water in well. Purged approx 1 litre Very slow recharge, came back to do gas monitoring and had only recharged c.200mm No odour, no sheen, brown in colour. |
| WS4 | ND | ND | ND | ND | 1.3 | 1.3 | 3 | 1 | 2 | 1 | 20.0 | 20.0 | ND | ND | ND | ND | ND | ND | NA | 0.0013 | 1.30 | 2.05 | 55.56 | 54.26 | NAT - C & Bed | |
| WS5 | ND | ND | ND | ND | 1.5 | 1.4 | 3 | 1 | 1 | 0 | 21.5 | 21.5 | ND | ND | ND | ND | ND | ND | NA | 0.0014 | ND | 2.05 | 38.70 | NA | NAT - C & Bed | Cover removed , well tap missing. Replaced well tap and left for 2 hours before monitoring. |
| WS6 | ND | ND | ND | ND | 1.8 | 1.8 | 2 | 1 | 2 | 1 | 19.7 | 19.7 | ND | ND | ND | ND | ND | ND | NA | 0.0018 | ND | 2.05 | 35.50 | NA | NAT - C | |
| WS7 | ND | ND | ND | ND | 2.2 | 2.1 | 4 | 1 | 2 | 1 | 19.8 | 19.8 | ND | ND | 0.5 | 0.5 | 1 | 5 | NA | 0.0105 | ND | 2.05 | 41.99 | NA | NAT - G & Bed | Cover removed and well tap missing. Replaced well tap and left for 2 hours before monitoring. |
| **Max** | ND | ND | ND | ND | 2.2 | 2.1 | 4 | 1 | 2 | 1 | 21.5 | 21.5 | ND | ND | 0.5 | 0.5 | 1.0 | 5 | NA | 0.0105 | 2.92 | 4.50 | 55.56 | 54.26 | | |
| **Min** | ND | ND | ND | ND | 0.1 | 0.1 | 2 | 1 | 1 | 0 | 19.7 | 19.7 | ND | ND | ND | ND | ND | 5 | NA | 0.0001 | 1.30 | 2.05 | 35.50 | 34.61 | | |

| Worst-possible GSVs | |
|---|---|
| NA | 0.0105 |

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular
Bed - Bedrock

**NB:** Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

**METEOROLOGICAL AND SITE INFORMATION:**

(Select correct box with X or enter data, as applicable)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State of ground: | X | Dry | | Moist | | Wet | | Snow | | Frozen | | |
| Wind: | | Calm | X | Light | | Moderate | | Strong | | | | |
| Cloud cover: | | None | X | Slight | | Cloudy | | Overcast | | | | |
| Precipitation: | X | None | | Slight | | Moderate | | Heavy | | | | |
| Time monitoring performed: | | | 09:30 | Start | | | 15:30 | End | | | | |
| Barometric pressure (mbar): | | | 1012 | Start | | | 1010 | End | | | | |
| Pressure trend (Daily): | | | X | Falling | | Steady | | Rising | | | | |
| Source: | BBC | | | | | | | | | | | |
| Air Temperature (Deg. C): | | | 18 | Before | | | 25 | After | | | | |

**INSTRUMENTATION TECHNICAL SPECIFICATIONS:**

**Ground gas meter:** GFM400
Gas Range: **$CH_4$** 0 - 100% **$CO_2$** 0 - 100% **$O_2$** 0 - 25%
Gas Flow range: +100/-50 l/hour
Differential Pressure: (+/-) 1000 Pa
**Date of last calibration:** 12/03/2014
**Date of next calibration:** 12/03/2015

**Ambient air check:** **$CH_4$** 0.0 **$CO_2$** 0.0 **$O_2$** 21.1

**PID:** Phocheck3000
Calibrated range: 0-100ppm
Calibration gas: isobutylene
Response time: 0.1
Accuracy: plus/ minus 5% displayer reading
**Date of last calibration:** 25/11/2013
**Date of next calibration:** 26/11/2014

# APPENDIX F

# SIRIUS GENERIC ASSESSMENT CRITERIA

# SIRIUS GENERIC ASSESSMENT CRITERIA

## Context

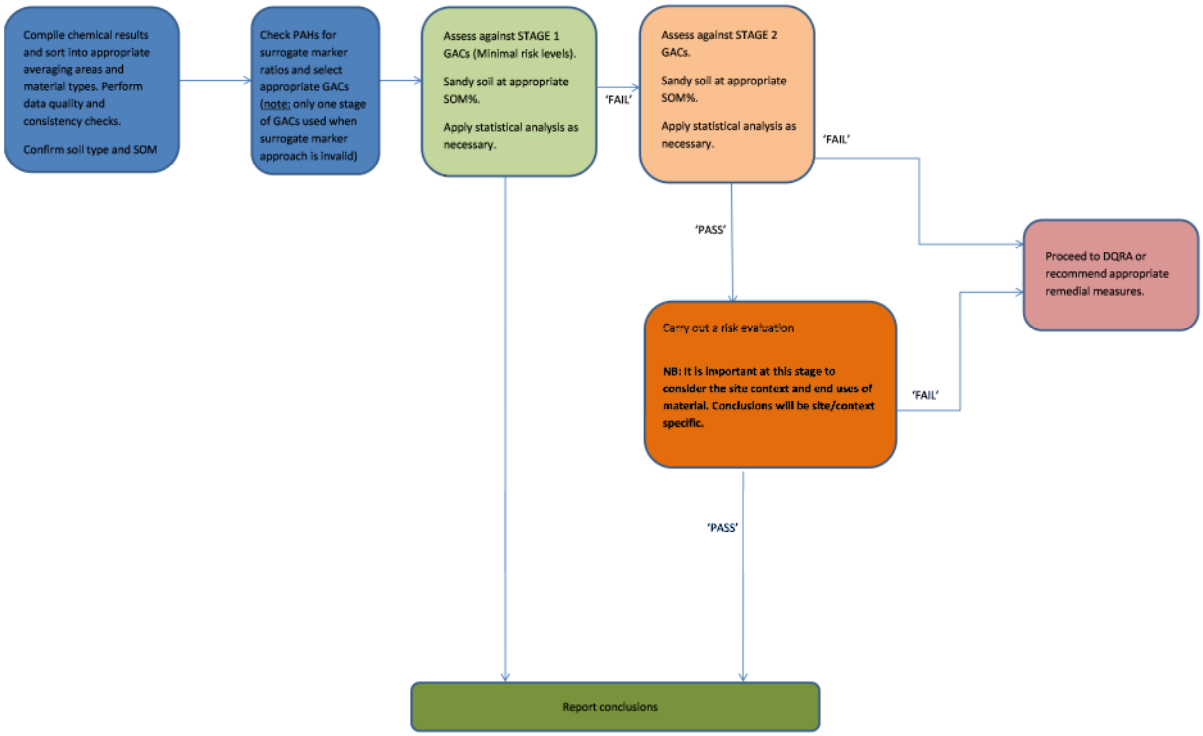
The framework for conducting site investigations, risk assessments and undertaking any necessary remedial works in the UK is provided by Environment Agency report CLR11 "Model Procedures for the Management of Contaminated Land". This presents a phased approach to risk assessment, involving: identification and qualitative assessment of potential pollutant linkages (source-pathway-receptor relationships) by means of a Conceptual Site Model; Generic Quantitative Risk Assessment (GQRA) of potentially significant pollutant links by comparing contaminant concentrations with appropriate Generic Assessment Criteria (GAC) values; and, if required, a Detailed Quantitative Risk Assessment (DQRA) based on site-specific conditions.

## Assessment of Risk to Human Health

Introduction

A staged approach to GQRA has been adopted by Sirius for the evaluation of soil concentration data, as shown schematically in Figure 1.

**Figure 1. GQRA Process.**



The first stage of GQRA comprises assessment of the data against GAC values derived using toxicological parameter values based on "minimum risk". Any contaminants exceeding their GACs at this stage are further assessed against Stage 2 GACs, which have been derived using Low Level of Toxicological Concern (LLTC) criteria, where these are available.

With appropriate justification, a contaminant concentration that does not exceed the relevant Stage 2 GAC value may be considered to indicate that the land is "suitable for use". The appropriate use of LLTC-based criteria within the planning regime is considered reasonable by government agencies, as most recently highlighted in the letter (dated 3rd September 2014) to all local authorities from Lord de Mauley, Parliamentary Under Secretary at DEFRA.

A narrative "risk evaluation" must therefore accompany any Stage 2 assessment to justify the conclusions drawn. Where appropriate, this may provide a basis for eliminating from further consideration those contaminants whose concentrations do not exceed the applicable Stage 2 GAC value.

For the specific case of lead, the Category 4 Screening Level criteria given in CL:AIRE (2014)[1] have been adopted directly as GACs, as these are considered to be based on expert interpretation of current toxicological evidence.

In some areas, background concentrations of lead, other metals and metalloids, and/or individual PAHs may exceed their respective GACs and it may be appropriate to consider relative site and background concentration data as part of a more detailed assessment of the data.

Derivation of GACs

Except where otherwise stated, GACs have been derived by Sirius using CLEA version 1.06.

The GAC values have been derived for a sandy soil type, which will be conservative for the majority of soils (including made ground) encountered on historically contaminated sites. For organic contaminants, criteria have been set for various Soil Organic Matter (SOM) contents.

The parameter values for the land-use cases are consistent with those given in Environment Agency (2009)[2] but have been updated (where relevant) for respiration rate, exposure frequency for dermal contact outdoors, soil adherence factors for children, and plant uptake concentration factors in line with CL:AIRE (2014) and Nathanail *et al*. (2015)[3]. Where available in published expert reviews of the literature, compound-specific plant concentration factors have been used in preference to the generic plant uptake models built into the CLEA model. No correction has been made in deriving the GACs for the "Top Two" crop types in the Residential with Homegrown Produce land use; the criteria will therefore be conservative in this regard.

Unless specifically stated, chemical and toxicological parameter values were obtained from:

[1] CL:AIRE (2014) "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination", Report SP1010, rev. 2.

[2] Environment Agency (2009) "Updated Technical Background to the CLEA Model", Report SC050021/SR3.

[3] Nathanail, C.P. *et al*. (2015) "The LQM/CIEH S4ULs for Human Health Risk Assessment". Publication No. S4UL3031, Land Quality Press, Nottingham.

- Environment Agency Science Report SC050021 series;
- Nathanail *et al.* (2015);
- CL:AIRE-AGS-EIC (2010)[4].

GACs for Genotoxic PAHs

Our approach to the assessment of genotoxic PAHs retains the use of benzo(a)pyrene as a surrogate marker. This approach for genotoxic PAHs is recommended by the HPA (2010)[5], which we consider to be the authoritative current guidance produced by a UK expert body and note that it was retained in the DEFRA Category 4 Screening Levels project (CL:AIRE, 2014).

The surrogate marker approach allows the assessment of the combined carcinogenic risk associated with all genotoxic PAHs[6] present as a mixture within soil, even though detailed toxicological information for many of the individual compounds may be lacking. The approach is based on determining the risk posed by the genotoxic PAH mixture using the concentration of benzo(a)pyrene present as an indicator.

To use the GAC for benzo(a)pyrene as a surrogate marker, a number of requirements must be met (HPA, 2010):

- Benzo(a)pyrene must be present in all soil samples containing genotoxic PAHs for which this method of assessment is being used;
- A similar profile of the genotoxic PAHs relative to benzo(a)pyrene should be present in all of the samples being assessed;
- The PAH profile of PAHs in the soil samples should be similar to that present in the pivotal toxicity study on which toxicological criterion for benzo(a)pyrene was based (Culp et al., 1998[7]). Table 1 provides the basis for defining the acceptable range.

Data indicate that contaminated soils in the UK generally meet these criteria[8] but the assessor must review their dataset before adopting this approach. If the above criteria are not met, then the surrogate marker approach must not be adopted and individual GAC or SSAC values are to be applied.

[4] CL:AIRE-AGS-EIC (2010) "Soil Generic Assessment Criteria for Human Health Risk Assessment". CL:AIRE, London.
[5] HPA (2010) "Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)", version 5.
[6] The genotoxic PAHs included in the USEPA PAH 16 analysis reported by analytical labs are: benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo(a)pyrene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene.
[7] Culp, S. *et al.* (1998) Carcinogenesis, 19, 117-124.
[8] Bull, S. & Collins, C. (2013) Environ. Geochem. Health, 31, 101-109.

**Table 1. Profile of Genotoxic PAHs Relative to Benzo(a)pyrene that are Considered Acceptable for Application of Benzo(a)pyrene as a Surrogate Marker.**

| PAH | Acceptable Ratio of PAH Concentration to Benzo(a)pyrene for Application of Surrogate Marker Assessment | |
|---|---|---|
| | Lower Limit | Upper Limit |
| Benz[a]anthracene | 0.12 | 12.43 |
| Benzo[b]fluoranthene | 0.11 | 10.85 |
| Benzo[k]fluoranthene | 0.04 | 3.72 |
| Benzo[g,h,i]perylene | 0.08 | 8.22 |
| Chrysene | 0.12 | 11.61 |
| Dibenz[a,h]anthracene | 0.01 | 1.38 |
| Indeno[1,2,3-c,d]pyrene | 0.07 | 7.27 |

For further information see: HPA (2010).

Soil Criteria Set for Purposes Other Than Human Health Protection

The Sirius GACs for sulphate, total organic carbon (TOC) and calorific value are set on basis of risks other than human health and their exceedance does not indicate a potential risk to future site users:

- The GAC for sulphate content is based on potential detrimental effects on buried concrete[9] and must be assessed with reference to the soil pH;
- The GAC for TOC content is provided for indicative assessment of disposal options if off-site landfill of soil were to be considered. This GAC is set at the 'Inert' waste threshold and should be considered as for information purposes only;
- The GAC for calorific value is set to assist in an initial assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.

Assessment criteria more stringent than those for human health may be set for specific purposes, for example, elimination of nuisance odours or ensuring that potentially mobile free-phase organic products are not present.

## Controlled Waters

The Environment Agency's "Remedial Targets Methodology" (2006) provides a framework for assessing the potential for pollution of controlled waters and for deriving remedial target concentrations in soil and groundwater.

There are no generic groundwater or surface water quality standards that are applicable to all sites. However, Environmental Quality Standards (EQS) and Drinking Water Standards (DWS) are considered appropriate assessment criteria for many cases and these are used by Sirius where appropriate to the potential pollutant linkages under consideration.

[9] BRE (2005) "Concrete in Aggressive Ground", Special Digest No. 1; 3rd Edition.

## Soil Leachability

The Environment Agency's Remedial Targets Methodology recommends the use of the BS EN 12475 leachate methods; this is the standard test specified by Sirius.

The results of the leachate analysis are compared to the relevant GAC values for controlled waters.

# The Sirius Group
# Stage 1 Generic Assessment Criteria for Soils

**Revision:** 17th February 2015

| Parameter | Residential (mg/kg, unless otherwise stated) | | | | | | Commercial / Industrial (mg/kg, unless otherwise stated) | | | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| | With Homegrown Produce | | | Without Homegrown Produce | | | | | | |
| | 1% SOM | 2.5% SOM | 5% SOM | 1% SOM | 2.5% SOM | 5% SOM | 1% SOM | 2.5% SOM | 5% SOM | |
| **Metals/Metalloids** | | | | | | | | | | |
| Arsenic (inorganic) | 37 | | | 40 | | | 630 | | | [1] |
| Cadmium | 11 | | | 85 | | | 190 | | | [2] |
| Chromium (III) | 910 | | | 4000 | | | 8600 | | | |
| Chromium (VI) | 6.0 | | | 6.1 | | | 33 | | | [3] |
| Copper | 200 | | | 7100 | | | 68000 | | | [4] |
| Lead | 200 | | | 310 | | | 2300 | | | [5] |
| Mercury (inorganic) | 40 | | | 56 | | | 1100 | | | [6] |
| Nickel | 180 | | | 180 | | | 980 | | | [7] |
| Selenium | 250 | | | 430 | | | 12000 | | | |
| Vanadium | 410 | | | 1200 | | | 9000 | | | |
| Zinc | 450 | | | 40000 | | | 750000 | | | [4] |
| **Other Inorganics** | | | | | | | | | | |
| pH | <5 or >9 | | | <5 or >9 | | | <5 or >9 | | | |
| Total Sulphate | 2400 | | | 2400 | | | 2400 | | | [8] |
| Water-Soluble Sulphate | 0.5 g/l | | | 0.5 g/l | | | 0.5 g/l | | | [8] |
| Free Cyanide | 34 | | | 34 | | | 1400 | | | [9] |
| **Organics** | | | | | | | | | | |
| **PAHs** | | | | | | | | | | |
| Acenaphthene | 200 | 490 | 920 | 2000 | 3600 | 4900 | 75000 | 92000 | 100000 | |
| Acenaphthylene | 170 | 400 | 760 | 2000 | 3600 | 4900 | 76000 | 93000 | 100000 | |
| Anthracene | 2300 | 5300 | 9400 | 30000 | 34000 | 36000 | 520000 | 540000 | 540000 | [10] |
| Benzo(a)anthracene | Assessed using benzo(a)pyrene as a surrogate marker | | | | | | | | | [10] |
| Benzo(a)pyrene | 2.1 | 2.1 | 2.2 | 2.3 | 2.3 | 2.3 | 27 | 27 | 27 | [11] |
| Benzo(b)fluoranthene | Assessed using benzo(a)pyrene as a surrogate marker | | | | | | | | | [10] |
| Benzo(k)fluoranthene | Assessed using benzo(a)pyrene as a surrogate marker | | | | | | | | | [10] |
| Benzo(g,h,i)perylene | Assessed using benzo(a)pyrene as a surrogate marker | | | | | | | | | [10] |
| Chrysene | Assessed using benzo(a)pyrene as a surrogate marker | | | | | | | | | [10] |
| Dibenzo(a,h)anthracene | Assessed using benzo(a)pyrene as a surrogate marker | | | | | | | | | [10] |
| Fluoranthene | 280 | 560 | 820 | 1500 | 1600 | 1600 | 23000 | 23000 | 23000 | |
| Fluorene | 170 | 390 | 730 | 2200 | 3400 | 4000 | 60000 | 67000 | 70000 | |
| Indeno(1,2,3-c,d)pyrene | Assessed using benzo(a)pyrene as a surrogate marker | | | | | | | | | [10] |
| Naphthalene | 1.0 | 2.3 | 4.6 | 1.0 | 2.4 | 4.7 | 110 | 260 | 510 | |
| Phenanthrene | 95 | 220 | 380 | 1300 | 1400 | 1500 | 22000 | 22000 | 23000 | |
| Pyrene | 620 | 1200 | 1900 | 3700 | 3800 | 3800 | 54000 | 54000 | 54000 | |
| **BTEX and related** | | | | | | | | | | |
| Benzene | 0.063 | 0.13 | 0.24 | 0.16 | 0.30 | 0.38 | 15 | 28 | 49 | |
| Toluene | 100 | 240 | 460 | 370 | 830 | 1100 | 33000 | 68000 | 110000 | |
| Ethylbenzene | 26 | 62 | 120 | 34 | 81 | 110 | 3200 | 7400 | 14000 | |
| Xylenes (total) | 28 | 67 | 130 | 33 | 78 | 110 | 3200 | 7700 | 15000 | [12] |
| 1,2,4-trimethylbenzene | 0.22 | 0.53 | 1.1 | 0.24 | 0.58 | 1.2 | 39 | 93 | 170 | |
| Iso-propylbenzene | 6.6 | 16 | 32 | 6.8 | 17 | 33 | 1300 | 3100 | 6100 | |
| Propylbenzene | 21 | 51 | 100 | 23 | 57 | 110 | 3800 | 9100 | 17000 | |
| Styrene | 6.9 | 16 | 32 | 21 | 49 | 93 | 3100 | 6100 | 9500 | |
| **TPH** | | | | | | | | | | |
| Aliphatic EC 5-6 | 24 | 41 | 68 | 24 | 41 | 48 | 2400 | 4100 | 6900 | |
| Aliphatic EC >6-8 | 53 | 110 | 210 | 53 | 110 | 150 | 5300 | 11000 | 21000 | |
| Aliphatic EC >8-10 | 13 | 31 | 61 | 13 | 31 | 43 | 1300 | 3100 | 6000 | |
| Aliphatic EC >10-12 | 62 | 150 | 300 | 62 | 150 | 220 | 6100 | 15000 | 28000 | |
| Aliphatic EC >12-16 | 510 | 1200 | 2300 | 510 | 1200 | 1700 | 43000 | 72000 | 85000 | |
| Aliphatic EC >16-35 | 41000 | 70000 | 90000 | 42000 | 70000 | 80000 | >1E6 | >1E6 | >1E6 | [13] |
| Aromatic EC >5-7 | 53 | 110 | 200 | 150 | 300 | 380 | 15000 | 28000 | 48000 | |
| Aromatic EC >7-8 | 100 | 240 | 460 | 370 | 820 | 1100 | 33000 | 68000 | 110000 | |
| Aromatic EC >8-10 | 20 | 48 | 94 | 22 | 54 | 75 | 2200 | 5200 | 9800 | |
| Aromatic EC >10-12 | 63 | 150 | 290 | 120 | 290 | 400 | 11000 | 22000 | 30000 | |
| Aromatic EC >12-16 | 140 | 320 | 570 | 1100 | 1900 | 2100 | 35000 | 37000 | 37000 | |
| Aromatic EC >16-21 | 260 | 540 | 840 | 1800 | 1900 | 1900 | 28000 | 28000 | 28000 | |
| Aromatic EC >21-35 | 1100 | 1500 | 1700 | 1900 | 1900 | 1900 | 28000 | 28000 | 28000 | |

# The Sirius Group
# Stage 1 Generic Assessment Criteria for Soils

| Parameter | Residential (mg/kg, unless otherwise stated) | | | | | | Commercial / Industrial (mg/kg, unless otherwise stated) | | | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| | With Homegrown Produce | | | Without Homegrown Produce | | | | | | |
| | 1% SOM | 2.5% SOM | 5% SOM | 1% SOM | 2.5% SOM | 5% SOM | 1% SOM | 2.5% SOM | 5% SOM | |
| **Chlorinated Organics** | | | | | | | | | | |
| Chlorobenzene | 0.19 | 0.44 | 0.86 | 0.19 | 0.45 | 0.87 | 31 | 71 | 140 | |
| Dichloromethane (DCM) | 0.47 | 0.78 | 1.2 | 1.2 | 1.7 | 2.4 | 250 | 340 | 470 | |
| 1,1-dichloroethane (DCA) | 1.4 | 2.4 | 4.0 | 1.4 | 2.4 | 4.1 | 260 | 420 | 690 | |
| 1,2-dichloroethane (DCA) | 0.0031 | 0.0048 | 0.0076 | 0.0035 | 0.0053 | 0.0084 | 0.34 | 0.51 | 0.81 | |
| 1,1-dichloroethene (DCE) | 0.15 | 0.26 | 0.45 | 0.15 | 0.26 | 0.46 | 24 | 43 | 74 | |
| *cis*-1,2-dichloroethene (DCE) | 0.066 | 0.12 | 0.20 | 0.069 | 0.12 | 0.21 | 14 | 23 | 38 | |
| *trans*-1,2-dichloroethene (DCE) | 0.11 | 0.21 | 0.38 | 0.12 | 0.22 | 0.39 | 21 | 37 | 65 | |
| Pentachlorophenol | 0.21 | 0.52 | 1.0 | 27 | 30 | 31 | 400 | 400 | 400 | |
| 1,1,1,2-tetrachloroethane | 0.56 | 1.3 | 2.6 | 0.63 | 1.5 | 2.9 | 59 | 140 | 270 | |
| 1,1,2,2-tetrachloroethane | 0.98 | 2.1 | 4.0 | 1.6 | 3.4 | 6.3 | 150 | 310 | 570 | |
| Tetrachloroethene (PCE) | 0.074 | 0.17 | 0.32 | 0.07 | 0.17 | 0.33 | 10 | 23 | 45 | |
| Tetrachloromethane (CT) | 0.011 | 0.024 | 0.046 | 0.011 | 0.024 | 0.046 | 1.6 | 3.6 | 6.9 | |
| 1,1,1-trichloroethane (TCA) | 3.7 | 7.8 | 15 | 3.8 | 7.9 | 15 | 370 | 770 | 1400 | |
| 1,1,2-trichloroethane (TCA) | 0.39 | 0.85 | 1.6 | 0.51 | 1.1 | 2.0 | 89 | 180 | 320 | |
| Trichloroethene (TCE) | 0.0070 | 0.015 | 0.028 | 0.0071 | 0.015 | 0.68 | 1.5 | 2.8 | 44 | |
| Trichloromethane (CF) | 0.43 | 0.80 | 1.4 | 0.48 | 0.89 | 53 | 98 | 170 | 300 | |
| Vinyl Chloride | 0.00034 | 0.00045 | 0.00062 | 0.00037 | 0.00048 | 0.00066 | 0.038 | 0.049 | 0.068 | |
| **Miscellaneous Organics** | | | | | | | | | | |
| Carbon disulphide | 0.066 | 0.13 | 0.25 | 0.066 | 0.13 | 0.25 | 6.7 | 14 | 25 | |
| Di-(2-ethylhexyl)-phthalate | 290 | 660 | 1100 | 3900 | 4000 | 4100 | 85000 | 85000 | 8600 | |
| MTBE | 31 | 55 | 94 | 39 | 68 | 120 | 7400 | 12000 | 19000 | |
| Phenol | 110 | 190 | 330 | 420 | 440 | 440 | 440 | | | [14] |
| Methylphenols (cresols), total | 78 | 170 | 330 | 5600 | 8200 | 9900 | 160000 | 170000 | 18000 | [15] |
| 2,4-dimethylphenol (m-xylenol) | 18 | 43 | 82 | 200 | 430 | 720 | 15000 | 23000 | 28000 | |
| **Other Parameters** | | | | | | | | | | |
| TOC | 3% w/w | | | 3% w/w | | | 3% w/w | | | [16] |
| Calorific Value | 2 MJ/kg | | | 2 MJ/kg | | | 2 MJ/kg | | | [17] |
| Asbestos | Fibres present | | | Fibres present | | | Fibres present | | | |

All concentration-based criteria are rounded to 2 significant figures.

The criteria assume a sandy soil type, which will be conservative for the great majority of soils (including made ground) encountered on historically contaminated sites.

Except where otherwise stated, criteria have been derived by Sirius using CLEA version 1.06. Parameters for the land use cases are consistent with those given in Environment Agency (2009) "Updated Technical Background to the CLEA Model", report SC050021/SR3 but updated (where relevant) for respiration rate, exposure frequency for dermal contact outdoors, soil adherence factors for children, and plant uptake concentration factors given in CL:AIRE (2014) and Nathanail et al., (2015). No correction has been made for the "Top Two" crop types in the Residential with Homegrown Produce land use and the criteria will therefore be conservative in this regard.

Health Criteria Values (HCVs) and (except where specifically noted) chemical property data were obtained from:
- Environment Agency Science Report SC050021 Series;
- Nathanail et al. (2015);
- CL:AIRE-AGS-EIC (2010).

**Footnotes**

**[1]** Based on oral GAC as this is the lower GAC and reflects a cancer risk many orders of magnitude greater than for inhalation.

**[2]** Determined for lifetime exposure. Plant uptake concentration factors applied were as given in CL:AIRE (2014). The GAC values are based on data for soils having a pH value in the range 6-8; caution should be applied in applying them at pH values outside this range, especially at pH values <5.

**[3]** Both oral and inhalation HCVs are based on local toxicological effects and therefore the lowest (oral) GAC value is adopted.

**[4]** For the Residential with Homegrown Produce land use, the GAC values for Cu and Zn are based on potential phytotoxic effects and have been set at the maximum allowable concentrations for sewage sludge-amended soils presented in the "Sludge (Use in Agriculture) Regulations" (SI 1263/1989); these criteria may also be applied in any land use where plants are to be grown. The equivalent GAC values for human health protection in the Residential with Homegrown Produce land use are around an order of magnitude greater.

**[5]** The Category 4 Screening Levels for lead defined in CL:AIRE (2013) have been adopted directly to provide an acceptable basis for initial assessment of data. Where background concentrations of lead exceed the GAC value, then site-specific evaluation will be required.

**[6]** The SGV for mercury is based on inorganic mercury which represents the most common form encountered within the environment. This is considered appropriate for most sites as: "…the SGV for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methylmercury compounds are likely to be very low" (Environment Agency report SC050021/Mercury SGV). Analysis and specific assessment for elemental or methylated forms of mercury will need to be considered if historical land use or site-specific factors indicate that these forms of mercury are likely to be present.

**[7]** Toxicological effects by inhalation are localised, therefore the lower of the GAC values for oral and inhalation HCVs have been adopted.

| Parameter | Residential (mg/kg, unless otherwise stated) | | | | | | Commercial / Industrial (mg/kg, unless otherwise stated) | | | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| | With Homegrown Produce | | | Without Homegrown Produce | | | | | | |
| | 1% SOM | 2.5% SOM | 5% SOM | 1% SOM | 2.5% SOM | 5% SOM | 1% SOM | 2.5% SOM | 5% SOM | |

**[8]** BRE (2005). Sulphate is not considered to pose a potential risk to human health under normal circumstances – this GAC applies to construction cases only and is set at the upper limit for DS-1 Design Sulphate Class concrete.

**[9]** GAC calculated for acute risk. Further information can be provided upon request.

**[10]** The genotoxic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene) are routinely assessed using benzo(a)pyrene as a surrogate (HPA (2010) "Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)", version 5). Separate information on this approach is provided.

**[11]** Calculated using a 'minimum risk' oral index dose derived from the application of a 10,000x safety factor to the BMD10 presented in CL:AIRE (2014) for benzo(a)pyrene as a surrogate marker and the inhalation index dose specified in CL:ARE (2014) and Nathanail *et al*. (2015). As a conservative measure, the GAC is based on combined exposure pathways to account for systemic carcinogenic effects. Further information on the derivation can be provided upon request.

**[12]** For screening purposes, a single GAC has been set for total xylene. This is the lowest of the values calculated for the three individual xylene isomers.

**[13]** "No GAC" indicates that no value has been specified for this land use as the TDSI cannot be exceeded at achievable soil concentrations.

**[14]** 440mg/kg is the minimum concentration that is protective for direct skin contact with phenol (See Environment Agency SR050021/Phenol SGV) and is adopted where GACs for chronic exposure are higher.

**[15]** For screening purposes, a single GAC has been set for total methylphenol. This is the lowest of the values calculated for the three individual methylphenol isomers.

**[16]** The Hazardous Waste (England and Wales) Regulations 2005. TOC content in itself does not represent a potential risk to human health. This GAC is provided for indicative assessment of disposal options, in the case that off-site landfill of soil is undertaken. This GAC is specified at the 'Inert' waste threshold and should be considered as for information purposes only.

**[17]** ICRCL (1986) Guidance Note 61/84, 2nd Edition, Notes on the Fire Hazards of Contaminated Land. Calorific value is not an indication of direct human health risk but may be useful in assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.