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**PHASE 2 GEO-ENVIRONMENTAL
SITE ASSESSMENT REPORT**

**JOHNSON MATTHEY,
CLITHEROE WORKS,
PIMLICO INDUSTRIAL AREA,
WEST BRADFORD ROAD,
CLITHEROE, BB7 4QB**

Prepared for:

JOHNSON MATTHEY

By:

ENVIROSOLUTION LTD

The Quay Suite 5

No. 12 Princess Docks

Liverpool Waters

Liverpool

L3 1DL

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Prepared by	Tom Craig	Signature	
Prepared by	James McKinstry-West	Signature	J. Mc-West
Checked by	Gemma Lucas	Signature	

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Executive Summary

Contaminated Land

The recent intrusive investigation at the site has identified concentrations of potentially polluting substances in the groundwater and soil. However, after Tier 1 screening against GAC only Total EPH was observed at concentrations in excess of the screening levels in the groundwater. A review of the potential source-pathway-receptor linkages taking into account the site setting and the conservatism inherent in the screening criteria concludes that both the current and post redevelopment risks from contamination at the site is considered to be low. As such no remedial activities are deemed necessary at this time.

Geotechnical

The recent ground investigation at the site has identified compressible Made Ground and soft clay underlying the site. It is considered that these would exhibit poor load bearing properties within the upper 2.0m. These materials would not be suitable for the construction of shallow spread foundations due to the risk of unacceptable total and differential settlement occurring.

Foundation solutions have included square pad foundations at structural column positions set at a minimum depth of 2.0m bgl. These could be designated on the basis of a maximum allowable bearing pressure of 120 kN/m².

Alternatively, consideration could be given to supporting the main structure on either vibrostone columns or piles. Advice from specialist designers would be required along with detailed column load schedules to support a proprietary design. Bored cast in-situ piling is the recommended piling technique for this site. Driven or auger displacement pile advancement becomes difficult in ground with frequent boulder obstacles.

Floor slab design will depend on service requirements (racking loads/use of heavy duty fork lift trucks etc) and might be suspended or would also require some ground improvement.

Should there be any exceptional loads (i.e. heavy machinery) exceeding the above indicative bearing capacities, end bearing cast in-situ piles may be required. An additional exercise of rotary drilling should be undertaken to sufficiently penetrate through any weathered material to prove the continuity of competent rock.

The results from the chemical laboratory sulphate and pH analysis for the site indicate a Design Sulphate Class of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) class of AC-1.

Table of Contents

1	Introduction.....	6
1.1	Background.....	6
1.2	Objectives.....	6
1.3	Scope of Work.....	6
1.4	Previous Reports.....	6
2	Site Description.....	8
2.1	Site Location	8
2.2	Site Description.....	8
2.3	Development Proposals.....	8
3	Ground Investigation Methodology.....	9
3.1	Intrusive Field Works.....	9
3.2	Soil Sampling Methodology	9
3.3	Gas and Groundwater Monitoring	9
3.4	Laboratory Analysis.....	9
3.4.1	Chemical Analysis.....	9
3.4.2	QA/QC.....	10
3.4.3	Geotechnical Analysis	10
4	Ground Conditions.....	11
4.1	Made Ground.....	11
4.2	Superficial.....	11
4.3	Bedrock	11
4.4	Groundwater	12
5	Geotechnical Test Results and Appraisal.....	13
5.1	Geotechnical Model	13
5.2	Laboratory Test Results	14
5.2.1	Moisture Content.....	14
5.2.2	Particle Size Distribution	14
5.2.3	Plasticity Index	14
5.2.4	Ground Chemistry.....	15
6	Geotechnical Appraisal	16
6.1	Foundations	16
6.2	Excavations and Groundwater	17
6.3	Concrete Design	18
7	Generic Quantitative Risk Assessment.....	19
7.1	Introduction.....	19
7.2	Human Health Risk Assessment	19
7.2.1	Long Term Human Health Risks	19
7.2.2	Short Term Risks	19
7.3	Buildings and Buried Services	19
7.4	Controlled Waters	20
8	Ground Gas Risk Assessment.....	21
8.1	Introduction.....	21
8.2	Assessment Guidelines	21
8.3	Gas Monitoring Results	22
8.4	Semi-Quantitative Risk Assessment	22

9	Conclusions and Recommendations	23
9.1	Contaminated Land	23
9.2	Geotechnical	23

Appendices

Appendix A – Site Plans

Appendix B – Borehole Logs

Appendix C – Laboratory Data

Appendix D – Monitoring Data

Appendix E – Tier 1 Risk Assessments

1 Introduction

1.1 Background

EnviroSolution was commissioned to complete a Phase 2 geo-environmental site assessment at land located at the Johnson Matthey Clitheroe Works, Clitheroe. This work is required to support the planning application for a new industrial building at the site and to inform the foundation design.

1.2 Objectives

The objectives of the Phase 2 environmental site assessment were:

1. To obtain information on the ground conditions present beneath the site.
2. To provide an updated conceptual site model and complete a generic quantitative risk assessment in order to identify any environmental risks and liabilities associated with ground conditions at the site.
3. To provide a geotechnical appraisal of the site to inform foundation design.

1.3 Scope of Work

In order to achieve the objectives, the following scope of work was completed:

- An intrusive ground investigation (Phase 2) comprising a three-day cable percussive drilling exercise (5th to 7th June 2018) in order to obtain further information on the geology beneath the site and to retrieve soil samples for subsequent geotechnical and chemical laboratory analysis.
- Quantitative risk assessments utilising the ground investigation data in line with industry approved guidelines.

The scope of work was developed in accordance with the Environment Agency of England and Wales and Department for Environment Food and Rural Affairs (DEFRA) document '*Model Procedures for the Management of Land Contamination*' Contaminated Land Report (CLR) 11, dated 2004 and BS10175:2011+A1:2013 '*Investigation of Potentially Contaminated Sites – Code of Practice*'.

1.4 Previous Reports

The following investigation reports of the site and surrounding area have been completed:

- EnviroSolution Phase 1 Environmental Site Assessment Report, Johnson Matthey, June 2018.
- Strata Surveys Limited, Ground Investigation Report, Johnson Matthey Catalyst, Clitheroe, Report No. 13849, 23rd March 2007.

The information contained within these reports was used to inform the design of the Phase 2 intrusive ground investigation.

This report should be read in conjunction with the above reports, as the information presented provides the basis for the conceptual understanding of the site. Stratigraphic

information and quantitative geotechnical data has been used from the Strata Surveys Limited 2007 report where appropriate.

2 Site Description

2.1 Site Location

The approximate National Grid Reference for the site is 374523 443076 and the location is shown in **Figure 1 in Appendix A**.

2.2 Site Description

The site is irregular in shape and covers an area of approximately 1 hectare. The site slopes from north to south.

The site mostly disused with the eastern part used as a contractor's yard serving the industrial site. A number of containers used as offices and welfare facilities are present on the eastern side of the site and this area is also used for by contractors for parking. The ground covering is predominantly hardstanding comprises a mixture of concrete, tarmac and compacted gravel.

A large vegetated earth mound is present along the western site boundary acting as a screening bund.

Land use in the immediate surrounding area is predominantly industrial. Areas to the north and northeast have been quarried for limestone, land to the west is occupied by a boarding school and open fields.

The existing site layout is shown on **Figure 2 in Appendix A**.

2.3 Development Proposals

The proposed development comprises a large warehouse structure supported by columns. The actual proposed use is currently unknown, but it is understood that some heavy machinery will be installed within this building.

The development proposal is shown in **Figure 3 in Appendix A**.

3 Ground Investigation Methodology

3.1 Intrusive Field Works

The intrusive investigation works were undertaken by EnviroSolution Ltd between the 5th and 7th June 2018. The work comprised the following:

- The drilling of 6 no. cable percussion boreholes (designated BH1 – BH6) to depths of up to 8.20m below ground level (bgl).
- Geological logging of ground conditions at each location.
- In-situ geotechnical testing within boreholes.
- Collection of representative soil samples from all boreholes for subsequent chemical and geotechnical laboratory analysis.
- Installation of combined gas and groundwater monitoring standpipes in 3 no. boreholes (i.e. BH3, BH4 and BH5).

The exploratory hole locations are shown on **Figure 4**.

3.2 Soil Sampling Methodology

The exploratory holes were logged in accordance with the requirements of BS 5930: 2015 and BS EN 14688 Pts 1&2. Visual and olfactory evidence of contamination was noted if encountered. These observations were used to aid scheduling of samples for chemical laboratory analysis.

Soil samples were collected at distinct changes in lithology or on the basis of field observations. Undisturbed U100 samples were scheduled to be taken but difficult ground conditions prevented the samples from being retrieved.

Samples were collected with a clean trowel or by hand (using dedicated nitrile gloves for each sampling location). Samples were placed immediately into laboratory supplied sampling containers, specific to the type of analyses required. All sample containers were sealed and labelled with a unique location identity, depth and date of sampling.

3.3 Gas and Groundwater Monitoring

Three gas and groundwater monitoring visits were completed between the 15th and 27th June 2018. The following parameters were measured during each visit: methane, carbon dioxide, oxygen, hydrogen sulphide, flow, atmospheric pressure, ground water level and base level.

During the first visit a groundwater sample water collected from each borehole (i.e. BH3, BH4 and BH5). The boreholes were developed and purged prior to sampling to ensure that a representative sample was collected.

3.4 Laboratory Analysis

3.4.1 Chemical Analysis

All soil and groundwater samples were transported in cool boxes at the end of the day under a chain of custody regime to ALS Environmental and QTSE, who are both UKAS accredited laboratories. Analyses were conducted to MCerts standards where applicable.

Chemical analysis was scheduled on a total of nine soil samples (6 No. Made Ground and 3 No. natural soil) and three groundwater samples for a range of chemical parameters including: Toxic 9 metals, pH, asbestos ID, volatile and semi-volatile organic compounds (VOCs and SVOCs) and TPH criteria working group.

Chemical analysis was scheduled on 3 no. groundwater samples for the following chemical parameters: pH, heavy metals, TPH, VOCs and SVOCs.

3.4.2 QA/QC

Field methods and procedures complied with accepted industry standards (BS10175:2011). These standards include the use of specified sample pot types and agreed sampling decontamination procedures.

All samples were transported from the site to the analytical laboratory under a chain of custody regime within cool-boxes containing ice packs. All analytical results were subjected to a QA/QC validation check to ensure they met the Laboratory's target criteria.

3.4.3 Geotechnical Analysis

A programme of laboratory and in-situ testing was undertaken in accordance with BS:1377 (1990) 'Methods of Test for Soils for Civil Engineering Purposes'. The following tests being carried out:

BS Test No.	Description
Part 3.5, 4, 5	Natural moisture content, particle size distribution, plasticity testing.

The following laboratory testing outside the scope of BS1377 was also undertaken:

Standard or Methodology	Test Description
BRE Special Digest 1	Total Sulphate, Aqueous Extract Sulphate, Total Sulphur, pH

4 Ground Conditions

4.1 Made Ground

Made Ground was encountered in all exploratory boreholes at the surface (see **Appendix B**). The Made Ground generally consists of placed compact sandy stone and gravel fill used as a surface for vehicle access. A surface layer of Tarmacadam was noted in BH4 measuring 0.1m in thickness. Reworked clay fill was noted in BH5 at 0.6m bgl. The Made Ground deposits across the site were recorded to extend to between 0.3m and 1.8m bgl. The thicker Made Ground was recorded at Boreholes BH2 and BH5 within the centre of the site.

4.2 Superficial

Natural, superficial diamicton deposits of Quaternary age were encountered beneath the Made Ground in all exploratory holes. The deposits generally comprised soft to firm brown sandy gravelly clay with fine to medium gravels overlying stiff to very stiff gravelly clay with large boulders. Significant chiselling was required to progress holes in BH3 – BH6 due to boulder obstructions, SPT N-values frequently recorded >50 blows. Boreholes BH3 – BH6 were terminated due to difficult ground conditions. Casing became stuck in BH3 at 4.2m bgl.

The superficial material was recorded to extend to 8.2m bgl in BH1. Borehole termination points in BH3 – BH6 are interpreted as the base of the superficial deposits and the top of bedrock, however, these depths should be used with caution due to the presence of large boulders within the clay matrix.

Uncorrected SPT N-values for the diamicton range between 7 and >50 but a more appropriate range for the cohesive material would fall within the range of 7 and 34 omitting high results arising from boulder obstructions. This is indicative of a low medium strength clay with an undrained shear strength range of between 35kN/m^2 and 55kN/m^2 within the upper 2.0m. Beneath this is a medium strength clay, becoming very high strength clay with a characteristic undrained shear strength range of between 100kN/m^2 and 170kN/m^2 from a depth of 3.0m and beyond using the general approximation of:

Undrained shear strength = $N \times 5$ (after Stroud, 1974).

Similarly, the coefficient of compressibility (m_v) can be estimated as varying between $0.29\text{m}^2/\text{MN}$ and $0.18\text{m}^2/\text{MN}$ to depths of up to approximately 2.0m, reducing to between $0.06\text{m}^2/\text{MN}$ and $0.08\text{m}^2/\text{MN}$ from a depth of 3.0m.

4.3 Bedrock

Bedrock of the Clitheroe Limestone Formation was encountered in BH1 only, at a depth of 8.2m bgl. The bedrock comprised medium strong to strong black limestone recovered as angular gravel sized fragments.

Possible rockhead was noted in BH3 – BH6 at depths between 4.2m and 5.3m bgl, where SPT N-values exceed 50 blows and significant chiselling was required. These boreholes were eventually terminated at these depths. Interpretation of rockhead at these depths should be used with caution.

4.4 Groundwater

The standing groundwater level was not recorded during the investigative works. Groundwater inflow was noted in BH2 after 20 minutes.

The results of the groundwater monitoring are presented below:

Table 1: Groundwater Monitoring Data

Date	Depths bgl (m)	Monitoring Well		
		BH3	BH4	BH5
15/06/2018	Depth to Water	0.93	2.30	2.03
	Depth to Base of Borehole	4.07	4.65	4.02
21/06/2018	Depth to Water	0.86	1.43	2.47
	Depth to Base of Borehole	4.08	4.03	4.02
27/06/2018	Depth to Water	1.00	1.51	2.12
	Depth to Base of Borehole	4.07	4.65	3.99

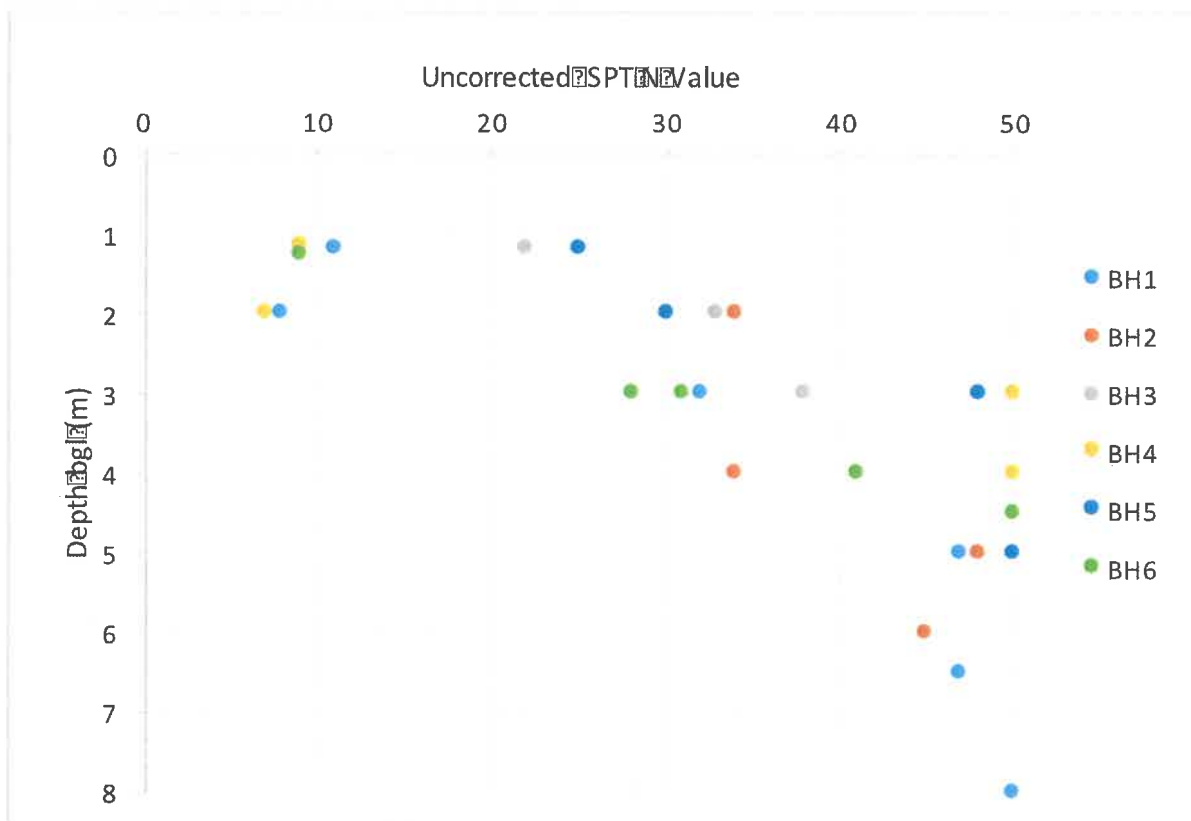
5 Geotechnical Test Results and Appraisal

5.1 Geotechnical Model

Table 2: Geotechnical Model

Stratum	Depth to Base (m bgl)	Parameters/ Comments
Made Ground	0.3m – 1.8m	Generally, 0.1m of tarmacadam hardstanding, overlying compact sandy stone GRAVEL fill. Reworked clay fill was noted in BH5 at 0.6m bgl.
Diamicton (Upper)	1.1m – 2.0m	Generally, a soft to firm brown sandy gravelly CLAY with fine to medium angular gravels. SPT N-values 7 – 11.
Diamicton (Lower)	4.2m – 8.2m	Generally, a stiff to very stiff medium to high strength gravelly CLAY with frequent large boulders. SPT N-values 22 – 50.
Limestone	Base Not Proven	Generally, a medium strong to strong black LIMESTONE, recovered as angular fragments. SPT N-values >50.

SPT – Depth Plot

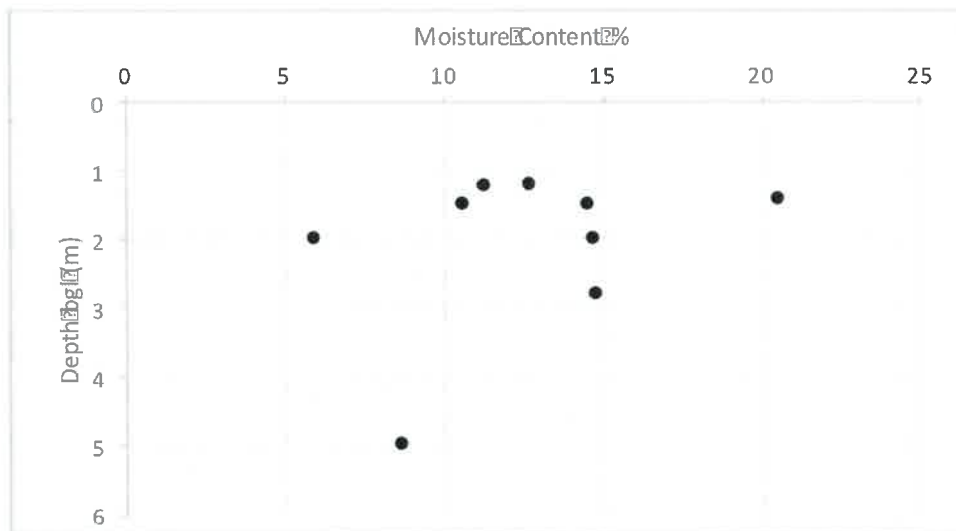


* Values quoted as 50 recorded at >50 blows

5.2 Laboratory Test Results

5.2.1 Moisture Content

The results of the moisture content test are summarised below and the data are included in **Appendix D**.



The results show a general decrease in moisture content with increasing depth, as would be expected.

5.2.2 Particle Size Distribution

The results of the particle size distribution tests are summarised below and the data are included in **Appendix C**.

The results concur that the diamicton can be described as a sandy gravelly CLAY with cobbles. Values for the coefficient of uniformity (C_u) could not be derived as the testing was unable to determine D_{10} but is likely above 10 when extrapolating the data. The diamicton can be considered well graded with variable gravel content.

5.2.3 Plasticity Index

The results of the Plasticity testing are summarised below and the data are included in **Appendix C**.

Table 3: Plasticity Results

Sample	Plastic Limit	Plasticity Index	Modified Plasticity Index	Volume Change Potential
BH2 at 2.8m	18	24	13.7	Low
BH4 at 1.5m	19	19	7.4	Low
BH5 at 3.5m	18	23	6.9	Low
BH6 at 1.4m	18	25	17.8	Low

* Modified Plasticity Index for % passing 425 μ m sieve in accordance with NHBC Standards Chapter 4.2

The above results are indicative of an intermediate plasticity low volume change potential clay.

5.2.4 Ground Chemistry

The results of the chemical testing carried out in accordance with BRE Special Digest 1:2005 Concrete in Aggressive Ground are summarised as follows: (See **Appendix C**).

Table 4: BRE Special Digest Data Summary

Material	Property	No. of Tests	Range of Results	Characteristic Values (BRE Special Digest 1)	Design Sulphate Class and ACEC Class
Made Ground	Sulphate (SO ₄) by 2:1 water soil extract (mg/l)	3	27 - 214	214	DS-1 AC-1
	pH	3	7.9 – 9.7	7.9	
	Total Sulphur %	3	<0.02 – 0.24	0.24	
	Chloride by 2:1 water soil extract (mg/l)	3	7.7 – 23.6	N/a	N/a
	Nitrate by 2:1 water soil extract (mg/l)	3	3.4 – 14.8	N/a	N/a
Diamicton (undifferentiated)	Sulphate (SO ₄) by 2:1 water soil extract (mg/l)	3	36 - 127	127	DS-1 AC-1
	pH	3	8.0 – 8.1	8.0	
	Total Sulphur %	3	0.03 – 0.47	0.47	
	Chloride by 2:1 water soil extract (mg/l)	3	7.1 – 8.9	N/a	N/a
	Nitrate by 2:1 water soil extract (mg/l)	3	< 1.5	N/a	N/a

6 Geotechnical Appraisal

6.1 Foundations

Made Ground was encountered in all exploratory boreholes at the surface and was recorded to extend to between 0.3m and 1.8m bgl and potentially deeper than this.

A soft to firm brown sandy gravelly clay underlies the Made Ground from depths between 1.10m and 2.0m. This upper unit of diamicton deposits is characterised by low SPT blow counts of between 7 and 11, indicating poor load bearing properties.

The Made Ground and upper unit of diamicton material would not be suitable for the construction of shallow spread foundations due to the risk of unacceptable total and differential settlement occurring. This is due to the variable nature of the material and weak intrinsic strength of the materials.

At depths greater than 2.0m bgl, the diamicton becomes stiff to very stiff with SPT blow counts of between 22 – 50, giving a characteristic undrained shear strength range of 100kN/m^2 and 200kN/m^2 . The lower diamicton is characterised by the presence of large boulders, frequently encountered as obstructions during drilling. For this reason, no undisturbed U100 samples could be retrieved.

Extensive geotechnical testing of the diamicton was completed by Strata Surveys Limited in 2007 (see Strata Surveys Limited, Ground Investigation Report, Johnson Matthey Catalyst, Clitheroe, Report No. 13849, 23rd March 2007). Multiple undrained unconsolidated triaxial 100mm multi-stage tests were completed, giving a shear strength range of 50 – 270kN/m^2 . The following table shows typical bearing capacities for pad foundations at several founding depths (see Strata Surveys Limited, Ground Investigation Report, Johnson Matthey Catalyst, Clitheroe, Report No. 13849, 23rd March 2007 for borehole locations):

Table 5: Soil Bearing Capacities (Strata Surveys Limited, 2007)

BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8	BH10
125 kN/m^2 at 2.5m	200 kN/m^2 at 2.2m	200 kN/m^2 at 3.0m	200 kN/m^2 at 3.0m	200 kN/m^2 at 3.0m	200 kN/m^2 3.0m	200 kN/m^2 at 2.5m	200 kN/m^2 at 2.0m	200 kN/m^2 at 2.0m

High levels of peat and soft clay were recorded at this site, which is to the south and east of the current site.

At the current site, there are several foundation options for the main supporting steel frame structure. The options are detailed below, designated Option 1 – 3.

Option 1 – Pad Foundations:

It is considered that columns could be supported on square pad foundations set within natural firm to stiff diamicton at a minimum depth of 2.0m. These pads could be designed on the basis of a maximum allowable bearing pressure of 120kN/m^2 . External dado walls would be

supported off ground beams spanning between column positions. Restrictions on using this method might include shallow groundwater, and poor options for floor slabs.

Further investigations might be considered at individual pad positions, using simple dynamic probing, to identify final pad dimensions in advance of main groundworks.

Option 2 – Ground Improvement:

Consideration could be given to using ground improvement techniques to strengthen the upper layers of low strength and variable compressibility soils. This could include an initial phase of vibrostone replacement to strengthen the ground beneath column positions and external wall, with a border grid of stone columns, followed by shallow lime stabilisation to support a ground bearing floor slab.

Further investigations may be required to confirm the suitability of the proposed lime or cement stabilisation methods.

Appropriate compliance testing procedures will need to be established to confirm design assumptions and installation methodology.

Option 3 – Piled Foundations:

A third option would be to use piled foundations. The piles should extent into the lower unit of diamicton with high SPT N-values. A variable thickness of Made Ground was noted in the boreholes. It is therefore recommended that initial designs should consider the use of a suspended floor slab incorporating a ring beam.

It is considered that bored cast in-situ piling would be the most suitable technique for this site. Driven or auger displacement pile advancement becomes difficult in ground with frequent boulder obstacles.

Appropriate test pile and works pile testing procedures will need to be established.

Specialist structural engineers will be required to prepare schedules for column loads and exceptional internal equipment loads. This information, together with these geotechnical design data, should then be sent to a specialist ground improvement and/or piling contractor to enable them to derive suitable proprietary designs.

Should there be any exceptional loads (i.e. heavy machinery) exceeding the above indicative bearing capacities, end bearing cast in-situ piles, socketed into the underlying limestone formations may be required. In this case it may be necessary to undertake an additional exercise of rotary drilling to sufficiently penetrate through any weathered material to prove the continuity of competent rock and to provide further design parameters.

6.2 Excavations and Groundwater

Three rounds of groundwater monitoring were completed over a three week period (see Section 6). Groundwater level was found to vary across the site between 0.86m bgl in BH3 and 2.47m bgl in BH5. Damp proofing of the ground floor slab should be considered.

Shallow service excavations are likely to remain stable in the short-term due to the predominately cohesive nature. Excavations in the granular Made Ground material may be prone to collapse, especially if excavated below the water table.

Further advice on excavation support is given in CIRIA Document 97: Trenching Practice.

Sump pumps should be adequate for dewatering shallow excavations if required.

Advice on groundwater control in construction is given in CIRIA Report C515: Groundwater Control Design and Practice.

6.3 Concrete Design

The results from the chemical laboratory sulphate and pH analysis for the site indicate a Design Sulphate Class of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) class of AC-1.

7 Generic Quantitative Risk Assessment

7.1 Introduction

The quantitative risk assessment has been undertaken in general accordance with guidance issued by the Environment Agency and comprises a Generic Quantitative Risk Assessment (GQRA) which screens site concentrations against Generic Assessment Criteria (GAC) based on the Preliminary Risk Assessment (PRA) and associated Preliminary Conceptual Site Model in Section 3. Where a concentration exceeds the GAC, the substance is confirmed as a Contaminant of Concern (CoC).

7.2 Human Health Risk Assessment

7.2.1 Long Term Human Health Risks

Taking into account the proposed land use at the site (industrial), GAC for commercial/industrial land use has been adopted for this assessment.

The source of the GAC utilised for this assessment comprise the CLEA Soil Guideline Values (SGVs) and LQM 'Suitable 4 Use Levels' and Category 4 Screening Levels'.

No substances were detected in samples taken from the Made Ground or natural ground soils beneath the site at concentrations in excess of the GAC (see **Appendix E**).

Asbestos was not identified in any of the Made Ground samples analysed from the site.

Long term risk to human health from soils in the site area are therefore considered to be low.

7.2.2 Short Term Risks

During the redevelopment of the site it will be necessary to implement measures to protect construction workers, and adjacent site users from the soil contaminants identified at the site. In addition, to ensure that they do not come into contact with contaminated soils and / or groundwater, construction workers and site visitors should wear appropriate personal protective equipment (PPE). Health and safety procedures would ensure that ingestion of contaminated soils and / or groundwater is avoided (e.g. by washing hands prior to eating, drinking and smoking).

7.3 Buildings and Buried Services

It is considered that the foundations for the proposed development could be at risk of attack from any aggressive chemicals contained within the ground. In line with the recommendations with BRE Special Digest 1 (2005) "Concrete in Aggressive Ground", the Design Sulphate Class for the site is likely DS-1 and AC-1 as previously detailed in Section 6.3.

Plastic pipe materials are potentially vulnerable to attack from elevated levels of hydrocarbons, which can potentially lead to contamination of potable water supplies, and water supply companies require the risk to their workers from other contaminants in the ground to be assessed. Therefore, if new water supply pipes are to be installed on site, it is

recommended that discussions are undertaken with the water supply company to confirm their requirements.

7.4 Controlled Waters

The GAC that have been adopted for this assessment are UK Drinking Water Standards for groundwater, this is due to the to the potential source-pathway-receptor linkage to the underlying Secondary aquifer at the site. The distance from the site to the River Ribble (i.e. >250m) is considered to limit the potential pollution linkage for freshwaters.

A number of substances were detected in the groundwater samples taken from the site. Only one substance concentration is observed in excess of the established GAC, this is Total Extractable Hydrocarbons (Total EPH; see **Appendix E**).

It should be noted that although exceedances of GAC have been identified, the assessment that has been undertaken is a Tier 1 assessment only and this is considered to be a highly conservative assessment given that the drinking water standards used may not be entirely applicable to the conditions in the aquifer. Furthermore, as diamicton is present beneath the site it would be expected that the movement of the groundwater detected beneath the site would be limited due to the impermeable nature of this strata. Additionally, upon redevelopment of the site area the presence of buildings and associated hardstanding will significantly reduce water infiltration in the area and as such further limit the potential for migration of any contaminants in the shallow soils beneath the site into the aquifer.

As the site is not located within a source protection zone it may be considered that abstractions for drinking water in the area is very unlikely. Therefore, the overall risk of impact to the Secondary Aquifer from the identified groundwater contaminants of concern is considered to be low and as such further detailed assessment is not considered necessary.

8 Ground Gas Risk Assessment

8.1 Introduction

Any material having an organic or biodegradable content e.g. organic clays, coal seams and domestic refuse, will have a potential for the generation of the gases methane, carbon dioxide and hydrogen sulphide (H₂S) and for the depletion of oxygen, with associated hazards of explosion or asphyxiation.

The principal hazardous gas associated with the degradation of organic materials is methane. As methane is biochemically reactive it is readily oxidised to carbon dioxide under aerobic conditions, the presence of carbon dioxide is therefore often associated with elevated methane.

An assessment of the ground gas sources and their potential for generation of gas is therefore necessary. A period of ground gas monitoring has been undertaken to assess if concentrations of gas exist on the site which may affect the development and require protection measures. A total of three monitoring rounds has been completed between the dates of 15/06/2018 and 27/06/2018.

8.2 Assessment Guidelines

The gas risk assessment presented below has been undertaken in general accordance with accordance with the British Standard BS8485:2015, *"Code of Practice for the Characterisation and Remediation from Ground Gas in Affected Developments"*. The guidance is written specifically for use by designers of gas protection measures relating to the development of a site. Reference has also been made to the CIRIA document C665:2007: *"Assessing Risks Posed by Hazardous Ground Gases to Buildings"*.

A semi-quantitative assessment method is proposed to include general classifications of risk obtained from a qualitative assessment undertaken for the site in question.

Gas concentrations and borehole flow rates are used to define a characteristic situation for a site based on the Gas Screening Value. The Gas Screening Value (in litres of gas per hour) for both methane and carbon dioxide is calculated as:

$$\text{Gas Screening Value (l/hr)} = \frac{\text{Gas Concentration (\%)} \times \text{Borehole Flow Rate (l/hr)}}{100}$$

These calculations are carried out on the worst case gas concentrations and flow rates encountered on the site.

The characteristic situation is then determined from Table 8.5 of the CIRIA C665 report. This Characteristic Situation is then used to define the general scope of gas protection measures required. Guidance is given on the number of protective measures required and the scope of the measures for each situation.

8.3 Gas Monitoring Results

Three rounds of gas monitoring have been completed. The monitoring results are presented in **Appendix D**.

8.4 Semi-Quantitative Risk Assessment

The gas screening value has been calculated for the site using the highest detected carbon dioxide concentration for the site of 3.3% in BH5 and highest gas flow reading of 0.2 l/hr. The gas screening value for the site has been calculated as 0.0066 l/hr. This classifies the site as Characteristic Situation 1 (very low risk) and this indicates that gas protection measures will not be required in the proposed development.

9 Conclusions and Recommendations

9.1 Contaminated Land

The recent intrusive investigation at the site has identified concentrations of potentially polluting substances in the groundwater and soil. However, after Tier 1 screening against GAC only Total EPH was observed at concentrations in groundwater in excess of the screening levels. A review of the potential source-pathway-receptor linkages taking into account the site setting and the conservatism inherent in the screening criteria concludes that both the current and post redevelopment risks from contamination at the site is considered to be low. As such no remedial activities are deemed necessary prior to redevelopment.

During the redevelopment of the site it will be necessary to implement measures to protect construction workers and adjacent site users and these should be commensurate to the concentration of contamination identified on the site. In addition, to ensure that they do not come into contact with contaminated soils and groundwater, it is recommended that construction workers and site visitors wear appropriate personal protective equipment (PPE) and that suitable Health and Safety procedures be adopted to ensure that ingestion of contaminated soils and groundwater is avoided (e.g. by washing hands prior to eating, drinking and smoking).

9.2 Geotechnical

The recent ground investigation at the site has identified compressible Made Ground and soft clay underlying the site. It is considered that these would exhibit poor load bearing properties within the upper 2.0m. These materials would not be suitable for the construction of shallow spread foundations due to the risk of unacceptable total and differential settlement occurring.

Foundation solutions have included square pad foundations at structural column positions set at a minimum depth of 2.0m bgl. These could be designated on the basis of a maximum allowable bearing pressure of 120 kN/m².

Alternatively, consideration could be given to supporting the main structure on either vibrostone columns or piles. Advice from specialist designers would be required along with detailed column load schedules to support a proprietary design.

Bored cast in-situ piling is the recommended piling technique for this site. Driven or auger displacement pile advancement becomes difficult in ground with frequent boulder obstacles.

Floor slab design will depend on service requirements (racking loads/use of heavy duty fork lift trucks etc) and might be suspended or would also require some ground improvement.

Should there be any exceptional loads (i.e. heavy machinery) exceeding the above indicative bearing capacities, end bearing cast in-situ piles may be required. An additional exercise of rotary drilling should be undertaken to sufficiently penetrate through any weathered material to prove the continuity of competent rock.

Other additional site investigations may be required depending on the selected foundation option.

Three rounds of groundwater monitoring were completed over a three week period (see Section 6). Groundwater level was found to vary across the site between 0.86m bgl in BH3 and 2.47m bgl in BH5. Damp proofing of the ground floor slab should be considered.

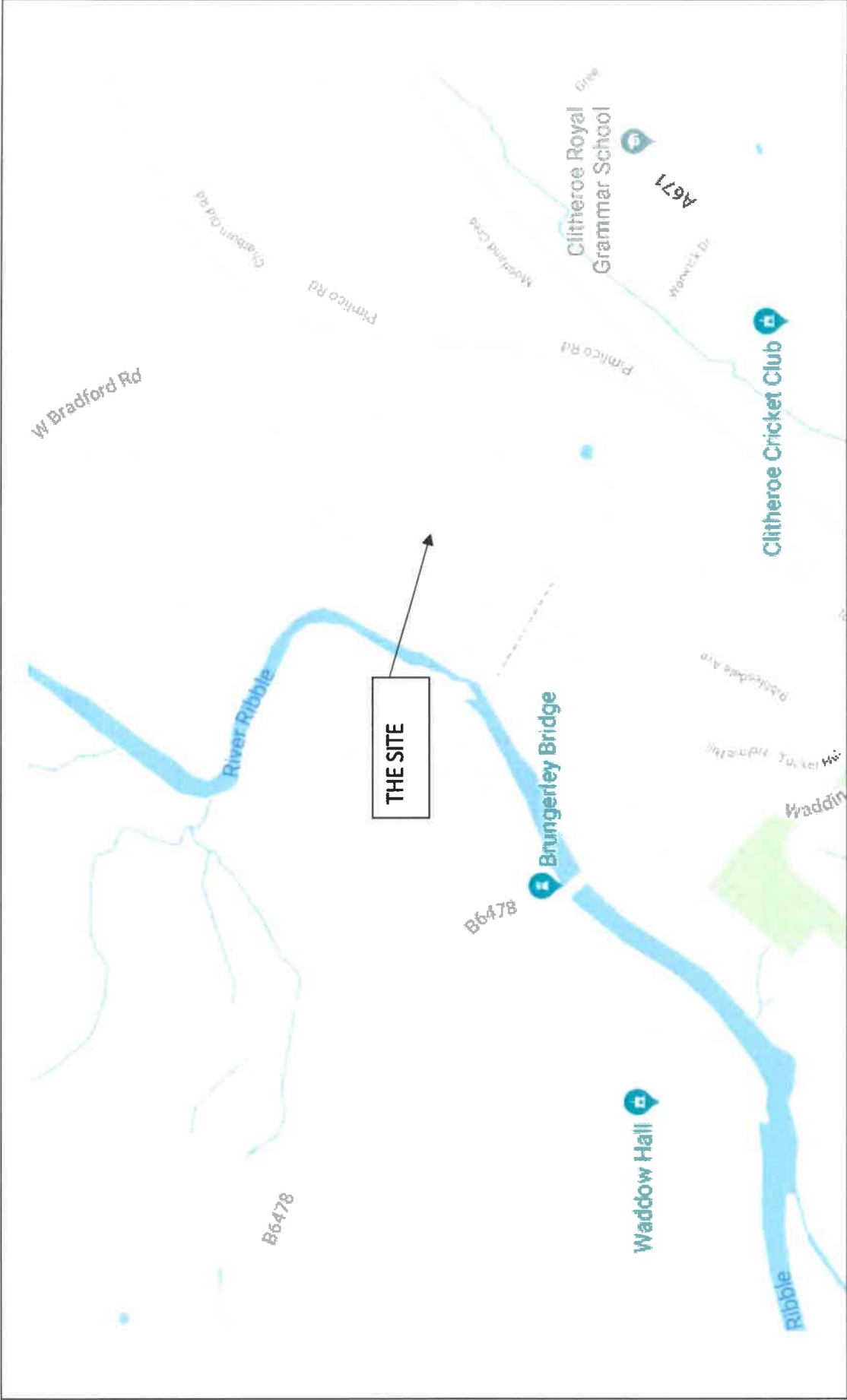
The results from the chemical laboratory sulphate and pH analysis for the site indicate a Design Sulphate Class of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) class of AC-1.

REFERENCES

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13. SP1010: Category 4 Screening Levels for Assessment of Land Affected by Contamination. DEFRA (2014).
14. British Standard BS8485, Code of Practice for the Characterisation and Remediation from Ground Gas in Affected Developments (2015).
15. CIRIA C665, Assessing Risks Posed by Hazardous Ground Gases to Buildings (2007).

APPENDICES

Appendix A – Site Location and Site Plan



enviro solution	Site Location Map
	Figure 1

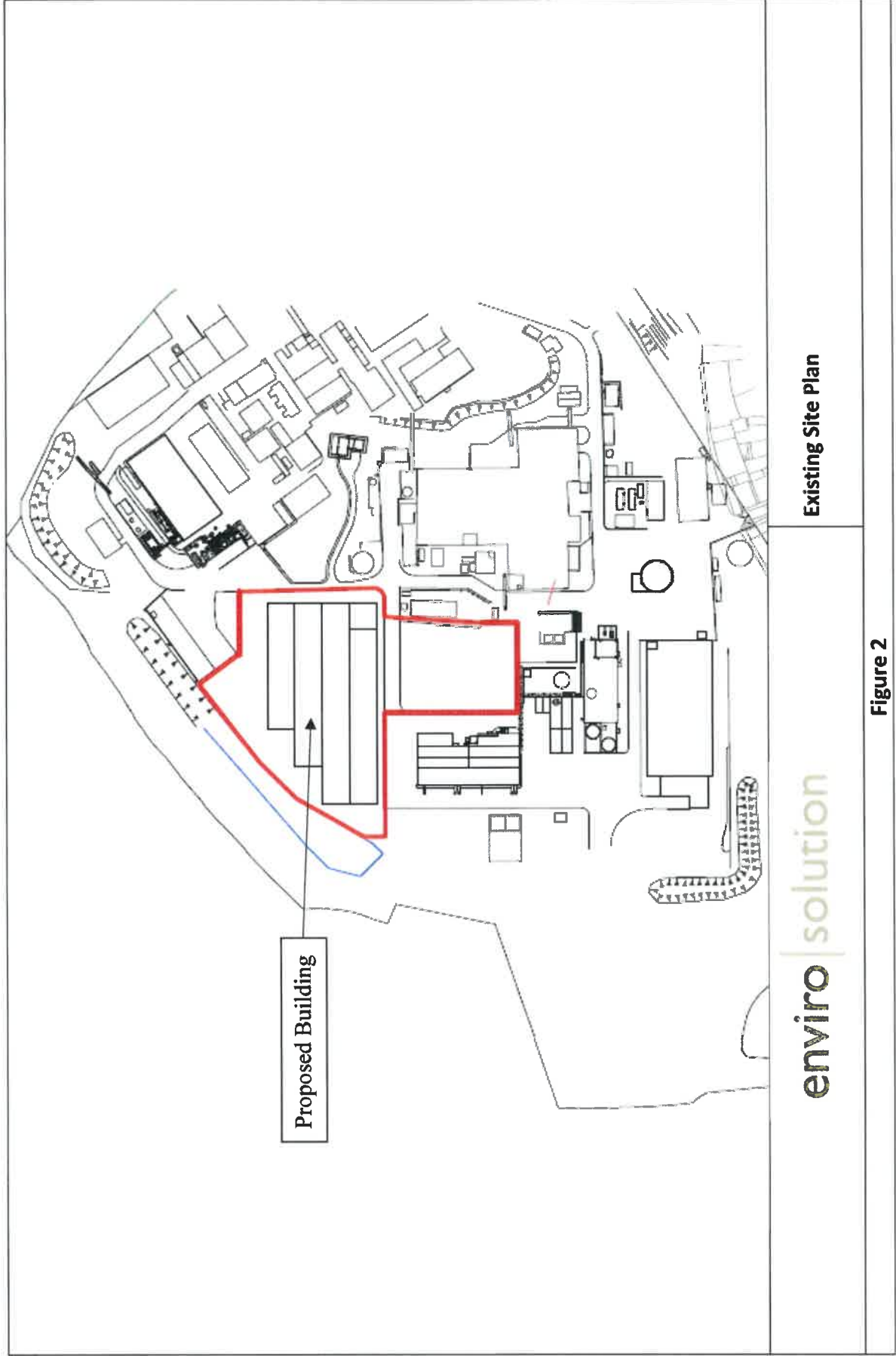
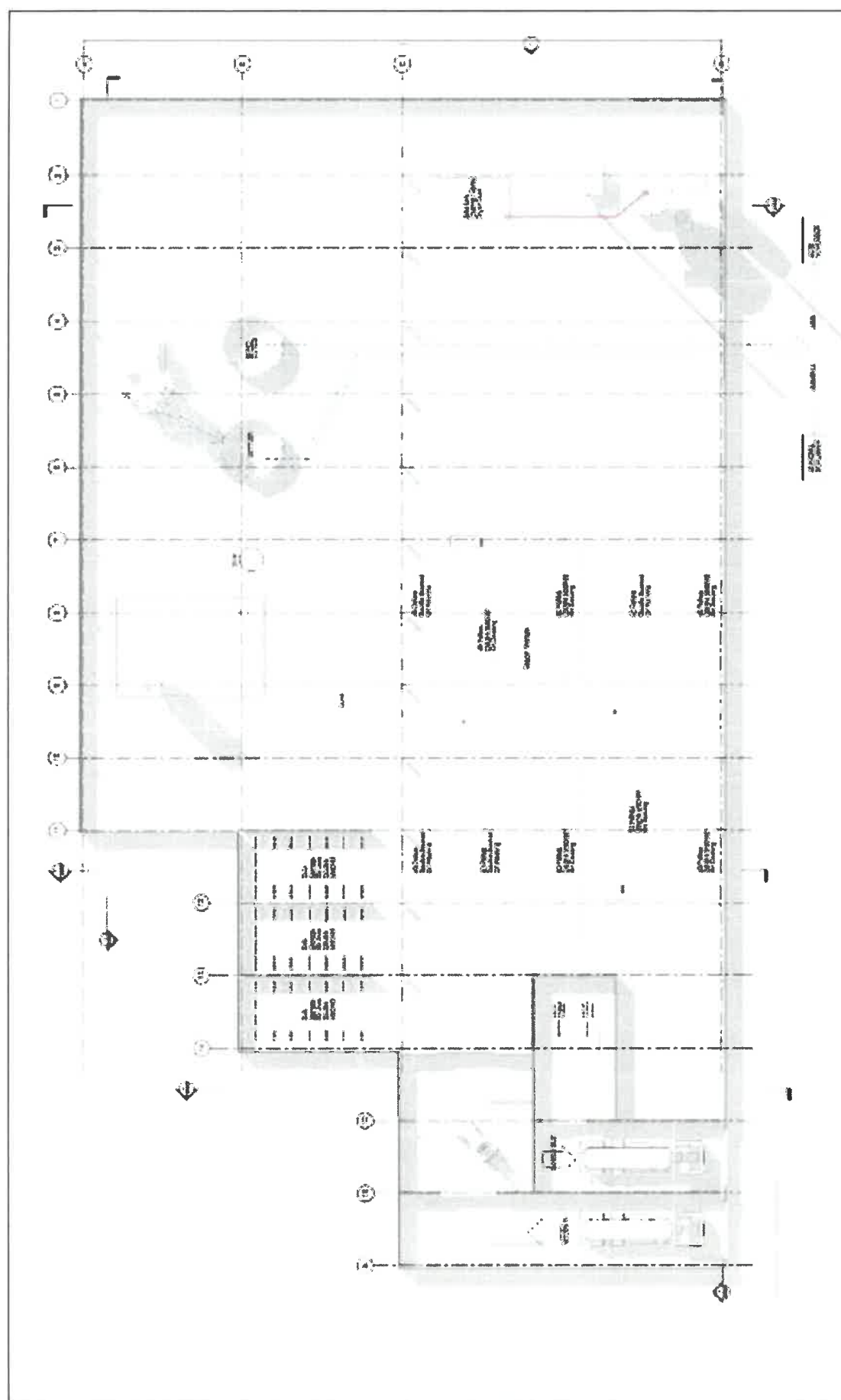


Figure 2



Proposed Site Plan

Figure 3



Appendix B – Borehole Logs

Job Title: Johnson Matthey				Client: Johnson Matthey				Borehole No: BH1						
Location: Clitheroe								Page 1 of 2						
Sample				Groundwater	Depth (m)	SPT	Drilling Dates: 05/06/2018				Drilling Method: Cable Percussion			
							Drilling Contractor: EnviroSolution Ltd				Borehole Diameter: 63mm			
							Logged by: Tom Craig				Screen Type & Diameter: n/a			
							Checked by: Gemma Lucas				Screen Slot Size: n/a			
Number	Type						Description				Comments		0	
					0		Made Ground: Compact stone and soil							
0.3m	J													
0.5m	J													
					1		Firm to stiff grey gravelly CLAY with fine to medium sub-angular gravels						1	
							Stiff Grey sandy gravelly CLAY with large boulders						2	
							Borehole continues onto next page						3	
													4	
													5	

Legend:

	Non - Slotted	Surrounded by 1m of bentonite seal, capped with flush cover and gas valve	
	Slotted	Surrounded by gravel and installed with end cap	

Disturbed Sample
 Undisturbed Sample
 * Headspace Analysis

† Down Borehole Analysis & Groundwater Table
 , Perched Water Table

Job Title: Johnson Matthey				Client: Johnson Matthey				Borehole No: BH1			
Location: Clitheroe								Page 2 of 2			
Sample			Groundwater	Depth (m)	SPT	Drilling Dates: 05/06/2018		Drilling Method: Cable Percussion			
						Drilling Contractor: EnviroSolution Ltd		Borehole Diameter: 63mm			
						Logged by: Tom Craig		Screen Type & Diameter: n/a			
						Checked by: Gemma Lucas		Screen Slot Size: n/a			
Number	Type					Description		Comments			
				0					0		
				6		Stiff Grey sandy gravelly CLAY with large boulders					
					47				1		
				7							
									2		
						Black limestone fragments frequent at base of the borehole		Limestone presence and high N-value interpreted as bedrock			
				8	50						
						End of borehole at 8.20m					
									3		
									4		
									5		
Legend:											
		Non - Slotted		Surrounded by 1m of bentonite seal, capped with flush cover and gas valve							
		Slotted		Surrounded by gravel and installed with end cap							
☒ Disturbed Sample ☐ Undisturbed Sample * Headspace Analysis		† Down Borehole Analysis & Groundwater Table , Perched Water Table									

Job Title: Johnson Matthey				Client: Johnson Matthey				Borehole No: BH2			
Location: Clitheroe								Page 1 of 1			
Sample			Groundwater	Depth (m)	SPT	Drilling Dates: 06/06/2018		Drilling Method: Cable Percussion			
						Drilling Contractor: EnviroSolution Ltd		Borehole Diameter: 63mm			
Number	Type					Logged by: Tom Craig		Screen Type & Diameter: n/a			
						Checked by: Gemma Lucas		Screen Slot Size: n/a			
				0		Description			Comments	0	
						Made Ground: Hardcore stone fill					
0.3m	↓										
0.7m	↓										
1.0m	↓			1		Made Ground: Brown gravelly CLAY fill				1	
1.2m	□				22						
1.7m	↓										
2.0m	□			2	34	Very stiff grey gravelly CLAY with large boulders				2	
2.8m	↓										
				3	36					3	
4.0m	□			4	34					4	
5.0m	□			5	48				Getting water inflow after 20 minutes	5	
6.0m	□				45						
						End of borehole at 6.0m					
Legend:											
		Non - Slotted		Surrounded by 1m of bentonite seal, capped with flush cover and gas valve							
		Slotted		Surrounded by gravel and installed with end cap							
↓ Disturbed Sample † Down Borehole Analysis □ Undisturbed Sample & Groundwater Table * Headspace Analysis , Perched Water Table											

Job Title: Johnson Matthey				Client: Johnson Matthey				Borehole No: BH3					
Location: Clitheroe								Page 1 of 1					
Sample			Groundwater	Depth (m)	SPT	Drilling Dates: 06/06/2018				Drilling Method: Cable Percussion			
						Drilling Contractor: EnviroSolution Ltd				Borehole Diameter: 63mm			
						Logged by: Tom Craig				Screen Type & Diameter: n/a			
						Checked by: Gemma Lucas				Screen Slot Size: n/a			
Number	Type					Description				Comments			
				0		Made Ground: Tarmac on stone fill						0	
0.3m	↓												
0.5m	↓												
					8	Soft brown sandy gravelly CLAY with fine to medium gravels							
				1								1	
					22								
1.5m	↓												
				2	33							2	
						Stiff brown gravelly CLAY with occasional boulders and large boulders							
				3	38					Casing became stuck beyond 4.20m and could not advance the hole		3	
										Possible rockhead			
				4	>50							4	
						End of borehole at 4.20m							
				5								5	
Legend:													
		Non - Slotted		Surrounded by 1m of bentonite seal, capped with flush cover and gas valve									
		Slotted		Surrounded by gravel and installed with end cap									
↓ Disturbed Sample † Down Borehole Analysis □ Undisturbed Sample & Groundwater Table * Headspace Analysis , Perched Water Table													

Job Title: Johnson Matthey				Client: Johnson Matthey				Borehole No: BH4			
Location: Clitheroe								Page 1 of 1			
Sample		Groundwater	Depth (m)	SPT	Drilling Dates: 07/06/2018			Drilling Method: Cable Percussion			
					Drilling Contractor: EnviroSolution Ltd			Borehole Diameter: 63mm			
					Logged by: Tom Craig			Screen Type & Diameter: n/a			
					Checked by: Gemma Lucas			Screen Slot Size: n/a			
Number	Type				Description			Comments			
			0		Description			Comments			
					Made Ground: Tarmac overlying compact stone and soil						
0.25m	↓										
0.4m	↓										
			1		Firm to stiff brown sandy gravelly CLAY with fine gravels						
			9								
1.5m	↓										
			2	7	Stiff grey / brown gravelly CLAY with large boulders			SPT refusal >50 blows with 10mm interpreted to be bedrock			
			3	>50							
			4	>50	End of borehole at 4.60m						
				>50							
			5								
Legend:											
		Non - Slotted		Surrounded by 1m of bentonite seal, capped with flush cover and gas valve							
		Slotted		Surrounded by gravel and installed with end cap							
↓ Disturbed Sample † Down Borehole Analysis □ Undisturbed Sample & Groundwater Table * Headspace Analysis , Perched Water Table											

Job Title: Johnson Matthey				Client: Johnson Matthey				Borehole No: BH5			
Location: Clitheroe								Page 1 of 1			
Sample			Groundwater	Depth (m)	SPT	Drilling Dates: 06/06/2018		Drilling Method: Cable Percussion			
						Drilling Contractor: EnviroSolution Ltd		Borehole Diameter: 63mm			
						Logged by: Tom Craig		Screen Type & Diameter: n/a			
						Checked by: Gemma Lucas		Screen Slot Size: n/a			
Number	Type					Description		Comments			
				0					0		
0.2m	↓					Made Ground: Compact hardcore stone fill					
0.5m	↓										
0.9m	↓					Made Ground: Brown reworked CLAY with stone fill					
1.2m	□			1	25				1		
1.7m	↓										
2.0m	□			2	30	Very stiff brown slightly sandy CLAY with gravels and large boulders			2		
				3	48			Chiselling required from 4.20m to 4.50m	3		
3.5m	↓										
				4	41				4		
				5	>50			Hole unable to progress beyond 5.3m	5		
						End of borehole at 5.30m					
Legend: Non - Slotted Surrounded by 1m of bentonite seal, capped with flush cover and gas valve Slotted Surrounded by gravel and installed with end cap ↓ Disturbed Sample † Down Borehole Analysis * Headspace Analysis □ Undisturbed Sample & Groundwater Table , Perched Water Table											

[illegible]

Appendix C – Laboratory Data



EnviroSolution Limited
18 North Drive
Liverpool
Merseyside
L15 8JG
Attention: Gemma Lucas

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

CERTIFICATE OF ANALYSIS

Date: 20 June 2018
Customer: H_ENVSOL_LIV
Sample Delivery Group (SDG): 180607-87
Your Reference: Johnson Matthey
Location: Johnson Matthey
Report No: 461019

This report has been revised and directly supersedes 460890 in its entirety.

We received 10 samples on Thursday June 07, 2018 and 7 of these samples were scheduled for analysis which was completed on Wednesday June 20, 2018. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Approved By:

Sonia McWhan
Operations Manager





Validated

CERTIFICATE OF ANALYSIS

SDG:	180607-87	Client Reference:	Johnson Matthey	Report Number:	461019
Location:	Johnson Matthey	Order Number:	ES12062018	Superseded Report:	460890

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
17698168	BH1		0.30	05/06/2018
17698169	BH1		0.50	05/06/2018
17698170	BH2		0.30	06/06/2018
17698171	BH2		0.70	06/06/2018
17698172	BH2		1.70	06/06/2018
17698177	BH3		0.30	06/06/2018
17698178	BH3		0.50	06/06/2018
17698173	BH5		0.20	06/06/2018
17698174	BH5		0.50	06/06/2018
17698176	BH5		1.70	06/06/2018

Maximum Sample/Coolbox Temperature (°C) :

16.8

ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 180607-87 Client Reference: Johnson Matthey Report Number: 461019
Location: Johnson Matthey Order Number: ES12062018 Superseded Report: 460890

Results Legend

X Test
N No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)

Customer Sample Reference

AGS Reference

Depth (m)

Container

Sample Type

Asbestos ID in Solid Samples

All

NDPs: 0
Tests: 4

X

X

X

X

EPH CWG (Aliphatic) GC (S)

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X

EPH CWG (Aromatic) GC (S)

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X

GRO by GC-FID (S)

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X

Metals in solid samples by OES

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X

pH

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X

Sample description

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X

Semi Volatile Organic Compounds

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X

TPH CWG GC (S)

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X

VOC MS (S)

All

NDPs: 0
Tests: 7

X

X

X

X

X

X

X



CERTIFICATE OF ANALYSIS

SDG: 180607-87
Location: Johnson Matthey**Client Reference:** Johnson Matthey
Order Number: ES12062018**Report Number:** 461019
Superseded Report: 460890

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
-----------	----------	------	-----------------	--------	-------------	--------	------------	-------------	-------

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
17698168	BH1	0.30	Light Brown	Loamy Sand	Stones	Vegetation
17698169	BH1	0.50	Light Brown	Silty Clay	Stones	Vegetation
17698170	BH2	0.30	Dark Brown	Loamy Sand	Stones	Vegetation
17698177	BH3	0.30	Dark Brown	Sand	Stones	Vegetation
17698178	BH3	0.50	Dark Brown	Clay Loam	Stones	None
17698173	BH5	0.20	Dark Brown	Loamy Sand	Stones	Vegetation
17698174	BH5	0.50	Dark Brown	Loamy Sand	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.



CERTIFICATE OF ANALYSIS

Validated

SDG: 180607-87
Location: Johnson Matthey

Client Reference: Johnson Matthey
Order Number: ES12062018

Report Number: 461019
Superseded Report: 460890

Semi Volatile Organic Compounds

Results Legend			Customer Sample Ref.	BH1	BH1	BH2	BH3	BH3	BH5
#	ISO17025 accredited.								
M	mCERTS accredited.								
aq	Aqueous / settled sample.								
dis.filt	Dissolved / filtered sample.								
tot.unfilt	Total / unfiltered sample.								
-	Subcontracted test.								
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery								
(F)	Trigger breach confirmed								
1-5&+%	Sample deviation (see appendix)								
Component	LOD/Units	Method							
Phenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pentachlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Nitroso-n-diisopropylamine	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Nitrobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Isophorone	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachloroethane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobutadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dioctyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dimethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Diethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Butyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzofuran	<100 µg/kg	TM157		<100	<100	<100	<100	<100	105
Carbazole	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Butylbenzyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157	197	<100	<100	<100	<100	<100	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Azobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Bromophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
3-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100

15:41:38 20/06/2018



Validated

CERTIFICATE OF ANALYSIS

SDG: 180607-87
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 461019
Superseded Report: 460890

Semi Volatile Organic Compounds

Results Legend			Customer Sample Ref.	BH1	BH1	BH2	BH3	BH3	BH5
#	ISO17028 accredited.		Depth (m)	0.30	0.50	0.30	0.30	0.50	0.20
M	mCERT8 accredited.		Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
aq	Aqueous / settled sample.		Date Sampled	05/06/2018	05/06/2018	06/06/2018	06/06/2018	06/06/2018	06/06/2018
diss.filt	Dissolved / filtered sample.		Sample Time						
tot.unfilt	Total / unfiltered sample.		Date Received	07/06/2018	07/06/2018	07/06/2018	07/06/2018	07/06/2018	07/06/2018
*	Subcontracted test.		SDG Ref	180607-87	180607-87	180607-87	180607-87	180607-87	180607-87
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery		Lab Sample No.(s)	17698168	17698169	17698170	17698177	17698178	17698173
(F)	Trigger breach confirmed		AGS Reference						
1-5.4.9.9	Sample deviation (see appendix)								
Component	LOD/Units	Method							
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	136
Acenaphthylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	105
Anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)anthracene	<100 µg/kg	TM157		104	<100	<100	<100	<100	<100
Benzo(b)fluoranthene	<100 µg/kg	TM157		135	<100	<100	<100	<100	<100
Benzo(k)fluoranthene	<100 µg/kg	TM157		124	<100	<100	<100	<100	<100
Benzo(a)pyrene	<100 µg/kg	TM157		155	<100	<100	<100	<100	<100
Benzo(g,h,i)perylene	<100 µg/kg	TM157		145	<100	<100	<100	<100	<100
Chrysene	<100 µg/kg	TM157		176	<100	117	<100	<100	115
Fluoranthene	<100 µg/kg	TM157		259	<100	150	<100	<100	461
Fluorene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	136
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		104	<100	<100	<100	<100	<100
Phenanthrene	<100 µg/kg	TM157		207	<100	192	124	<100	681
Pyrene	<100 µg/kg	TM157		259	<100	171	<100	<100	325
Naphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100



CERTIFICATE OF ANALYSIS

SDG: 180607-87
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 461019
Superseded Report: 460890

Semi Volatile Organic Compounds

Results Legend		Customer Sample Ref.	BH5				
#	ISO17025 accredited.						
M	mCERTS accredited.						
aq	Aqueous / settled sample.						
disa.filt	Dissolved / filtered sample.						
totLunfil	Total / unfiltered sample.						
^	Subcontracted test.						
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery	Depth (m)	0.50				
		Sample Type	Soil/Solid (S)				
		Data Sampled	05/05/2018				
		Sample Time					
		Data Received	07/05/2018				
		SDG Ref	180607-87				
(F)	Trigger breach confirmed	Lab Sample No.(s)	17698174				
1-5&+@	Sample deviation (see appendix)	AGS Reference					
Component	LOD/Units	Method					
Phenol	<100 µg/kg	TM157	<100				
Pentachlorophenol	<100 µg/kg	TM157	<100				
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157	<100				
Nitrobenzene	<100 µg/kg	TM157	<100				
Isophorone	<100 µg/kg	TM157	<100				
Hexachloroethane	<100 µg/kg	TM157	<100				
Hexachlorocyclopentadiene	<100 µg/kg	TM157	<100				
Hexachlorobutadiene	<100 µg/kg	TM157	<100				
Hexachlorobenzene	<100 µg/kg	TM157	<100				
n-Dioctyl phthalate	<100 µg/kg	TM157	<100				
Dimethyl phthalate	<100 µg/kg	TM157	<100				
Diethyl phthalate	<100 µg/kg	TM157	<100				
n-Dibutyl phthalate	<100 µg/kg	TM157	<100				
Dibenzofuran	<100 µg/kg	TM157	<100				
Carbazole	<100 µg/kg	TM157	<100				
Butylbenzyl phthalate	<100 µg/kg	TM157	<100				
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157	<100				
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157	<100				
bis(2-Chloroethyl)ether	<100 µg/kg	TM157	<100				
Azobenzene	<100 µg/kg	TM157	<100				
4-Nitrophenol	<100 µg/kg	TM157	<100				
4-Nitroaniline	<100 µg/kg	TM157	<100				
4-Methylphenol	<100 µg/kg	TM157	<100				
4-Chlorophenylphenylether	<100 µg/kg	TM157	<100				
4-Chloroaniline	<100 µg/kg	TM157	<100				
4-Chloro-3-methylphenol	<100 µg/kg	TM157	<100				
4-Bromophenylphenylether	<100 µg/kg	TM157	<100				
3-Nitroaniline	<100 µg/kg	TM157	<100				
2-Nitrophenol	<100 µg/kg	TM157	<100				
2-Nitroaniline	<100 µg/kg	TM157	<100				
2-Methylphenol	<100 µg/kg	TM157	<100				
1,2,4-Trichlorobenzene	<100 µg/kg	TM157	<100				
2-Chlorophenol	<100 µg/kg	TM157	<100				



CERTIFICATE OF ANALYSIS

SDG: 180607-87
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 461019
Superseded Report: 460890

Semi Volatile Organic Compounds

Results Legend		Customer Sample Ref.	BH5				
#	ISO17025 accredited.						
M	mCERTS accredited.						
aq	Aqueous / settled sample.						
dis.sflt	Dissolved / filtered sample.						
tot.unflt	Total / unfiltered sample.						
*	Subcontracted test.						
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery	Depth (m)	0.50				
(F)	Trigger breach confirmed	Sample Type	Sol/Solid (S)				
1-56.46	Sample deviation (see appendix)	Date Sampled	06/06/2018				
		Sample Time					
		Date Received	07/06/2018				
		SDG Ref	180607-87				
		Lab Sample No.(s)	17698174				
		AGS Reference					
Component	LOD/Units	Method					
2,6-Dinitrotoluene	<100 µg/kg	TM157	<100				
2,4-Dinitrotoluene	<100 µg/kg	TM157	<100				
2,4-Dimethylphenol	<100 µg/kg	TM157	<100				
2,4-Dichlorophenol	<100 µg/kg	TM157	<100				
2,4,6-Trichlorophenol	<100 µg/kg	TM157	<100				
2,4,5-Trichlorophenol	<100 µg/kg	TM157	<100				
1,4-Dichlorobenzene	<100 µg/kg	TM157	<100				
1,3-Dichlorobenzene	<100 µg/kg	TM157	<100				
1,2-Dichlorobenzene	<100 µg/kg	TM157	<100				
2-Chloronaphthalene	<100 µg/kg	TM157	<100				
2-Methylnaphthalene	<100 µg/kg	TM157	<100				
Acenaphthylene	<100 µg/kg	TM157	<100				
Acenaphthene	<100 µg/kg	TM157	<100				
Anthracene	<100 µg/kg	TM157	<100				
Benzo(a)anthracene	<100 µg/kg	TM157	<100				
Benzo(b)fluoranthene	<100 µg/kg	TM157	<100				
Benzo(k)fluoranthene	<100 µg/kg	TM157	<100				
Benzo(a)pyrene	<100 µg/kg	TM157	<100				
Benzo(g,h,i)perylene	<100 µg/kg	TM157	<100				
Chrysene	<100 µg/kg	TM157	<100				
Fluoranthene	<100 µg/kg	TM157	204				
Fluorene	<100 µg/kg	TM157	<100				
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157	<100				
Phenanthrene	<100 µg/kg	TM157	334				
Pyrene	<100 µg/kg	TM157	151				
Naphthalene	<100 µg/kg	TM157	<100				
Dibenzo(a,h)anthracene	<100 µg/kg	TM157	<100				
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157	<100				



CERTIFICATE OF ANALYSIS

Validated

SDG: 180607-87
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 461019
Superseded Report: 460890

VOC MS (S)

Results Legend			Customer Sample Ref.		BH1	BH1	BH2	BH3	BH3	BH5
#	ISO17025 accredited.		Depth (m) Sample Type Data Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.30	0.50	0.30	0.30	0.50	0.20
M	mCERTS accredited.				Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
aq	Aqueous / settled sample.				05/06/2018	05/06/2018	05/06/2018	05/06/2018	05/06/2018	05/06/2018
dis.filt	Dissolved / filtered sample.				07/06/2018	07/06/2018	07/06/2018	07/06/2018	07/06/2018	07/06/2018
tot.unfilt	Total / unfiltered sample.				180607-87	180607-87	180607-87	180607-87	180607-87	180607-87
*	Subcontracted test.				17698168	17698169	17698170	17698177	17698178	17698173
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery									
(F)	Trigger breach confirmed									
1-5&+%	Sample deviation (see appendix)									
Component	LOD/Units	Method								
Dibromofluoromethane**	%	TM116			106	102	106	106	101	106
Toluene-d8**	%	TM116			98.6	91.9	97.6	97.6	95.5	98.5
4-Bromofluorobenzene**	%	TM116			95.8	80.6	95.2	96.1	80.2	96.5
Dichlorodifluoromethane	<6 µg/kg	TM116			<1200	<6	<1200	<1200	<6	<1200
					M	M	M	M	M	M
Chloromethane	<7 µg/kg	TM116			<1400	<7	<1400	<1400	<7	<1400
					#	#	#	#	#	#
Vinyl Chloride	<6 µg/kg	TM116			<1200	<6	<1200	<1200	<6	<1200
					M	M	M	M	M	M
Bromomethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Chloroethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Trichlorofluoromethane	<6 µg/kg	TM116			<1200	<6	<1200	<1200	<6	<1200
					M	M	M	M	M	M
1,1-Dichloroethene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					#	#	#	#	#	#
Carbon Disulphide	<7 µg/kg	TM116			<1400	<7	<1400	<1400	<7	<1400
					M	M	M	M	M	M
Dichloromethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					#	#	#	#	#	#
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
trans-1,2-Dichloroethene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
1,1-Dichloroethane	<8 µg/kg	TM116			<1600	<8	<1600	<1600	<8	<1600
					M	M	M	M	M	M
cis-1,2-Dichloroethene	<6 µg/kg	TM116			<1200	<6	<1200	<1200	<6	<1200
					M	M	M	M	M	M
2,2-Dichloropropane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
Bromochloromethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Chloroform	<8 µg/kg	TM116			<1600	<8	<1600	<1600	<8	<1600
					M	M	M	M	M	M
1,1,1-Trichloroethane	<7 µg/kg	TM116			<1400	<7	<1400	<1400	<7	<1400
					M	M	M	M	M	M
1,1-Dichloropropene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Carbon tetrachloride	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
1,2-Dichloroethane	<5 µg/kg	TM116			<1000	<5	<1000	<1000	<5	<1000
					M	M	M	M	M	M
Benzene	<9 µg/kg	TM116			<1800	<9	<1800	<1800	<9	<1800
					M	M	M	M	M	M
Trichloroethene	<9 µg/kg	TM116			<1800	<9	<1800	<1800	<9	<1800
					#	#	#	#	#	#
1,2-Dichloropropane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Dibromomethane	<9 µg/kg	TM116			<1800	<9	<1800	<1800	<9	<1800
					M	M	M	M	M	M
Bromodichloromethane	<7 µg/kg	TM116			<1400	<7	<1400	<1400	<7	<1400
					M	M	M	M	M	M
cis-1,3-Dichloropropene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Toluene	<7 µg/kg	TM116			<1400	<7	<1400	<1400	<7	<1400
					M	M	M	M	M	M
trans-1,3-Dichloropropene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
1,1,2-Trichloroethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
1,3-Dichloropropane	<7 µg/kg	TM116			<1400	<7	<1400	<1400	<7	<1400
					M	M	M	M	M	M

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Validated

CERTIFICATE OF ANALYSIS

SDG: 180607-87
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 461019
Superseded Report: 460890

VOC MS (S)

Results Legend			Customer Sample Ref.		BH1	BH1	BH2	BH3	BH3	BH5
#	ISO17025 accredited.		Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		0.30	0.50	0.30	0.30	0.50	0.20
M	mCERTS accredited.				Sol/Solid (S)	Sol/Solid (S)	Sol/Solid (S)	Sol/Solid (S)	Sol/Solid (S)	Sol/Solid (S)
aq	Aqueous / settled sample.				05/06/2018	05/06/2018	06/06/2018	06/06/2018	06/06/2018	06/06/2018
dis.filt	Dissolved / filtered sample.				07/06/2018	07/06/2018	07/06/2018	07/06/2018	07/06/2018	07/06/2018
tot.unfilt	Total / unfiltered sample.				180607-87	180607-87	180607-87	180607-87	180607-87	180607-87
sub	Subcontracted test.				17698168	17698169	17698170	17698177	17698178	17698173
recovery	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery									
trigger	Trigger breach confirmed									
deviation	Sample deviation (see appendix)									
Component	LOD/Units	Method								
Tetrachloroethene	<5 µg/kg	TM116			<1000	<5	<1000	<1000	<5	<1000
					M	M	M	M	M	M
Dibromochloromethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
1,2-Dibromoethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Chlorobenzene	<5 µg/kg	TM116			<1000	<5	<1000	<1000	<5	<1000
					M	M	M	M	M	M
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Ethylbenzene	<4 µg/kg	TM116			<800	<4	<800	<800	<4	<800
					M	M	M	M	M	M
p/m-Xylene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					#	#	#	#	#	#
o-Xylene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Styrene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					#	#	#	#	#	#
Bromoform	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Isopropylbenzene	<5 µg/kg	TM116			<1000	<5	<1000	<1000	<5	<1000
					#	#	#	#	#	#
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					#	#	#	#	#	#
1,2,3-Trichloropropane	<16 µg/kg	TM116			<3200	<16	<3200	<3200	<16	<3200
					M	M	M	M	M	M
Bromobenzene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
Propylbenzene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
2-Chlorotoluene	<9 µg/kg	TM116			<1800	<9	<1800	<1800	<9	<1800
					M	M	M	M	M	M
1,3,5-Trimethylbenzene	<8 µg/kg	TM116			<1600	<8	<1600	<1600	<8	<1600
					M	M	M	M	M	M
4-Chlorotoluene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
tert-Butylbenzene	<14 µg/kg	TM116			<2800	<14	<2800	<2800	<14	<2800
					M	M	M	M	M	M
1,2,4-Trimethylbenzene	<9 µg/kg	TM116			<1800	<9	<1800	<1800	<9	<1800
					#	#	#	#	#	#
sec-Butylbenzene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
4-Isopropyltoluene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
1,3-Dichlorobenzene	<8 µg/kg	TM116			<1600	<8	<1600	<1600	<8	<1600
					M	M	M	M	M	M
1,4-Dichlorobenzene	<5 µg/kg	TM116			<1000	<5	<1000	<1000	<5	<1000
					M	M	M	M	M	M
n-Butylbenzene	<11 µg/kg	TM116			<2200	<11	<2200	<2200	<11	<2200
1,2-Dichlorobenzene	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					M	M	M	M	M	M
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116			<2800	<14	<2800	<2800	<14	<2800
					M	M	M	M	M	M
Tert-amyl methyl ether	<10 µg/kg	TM116			<2000	<10	<2000	<2000	<10	<2000
					#	#	#	#	#	#
1,2,4-Trichlorobenzene	<20 µg/kg	TM116			<4000	<20	<4000	<4000	<20	<4000
Hexachlorobutadiene	<20 µg/kg	TM116			<4000	<20	<4000	<4000	<20	<4000
Naphthalene	<13 µg/kg	TM116			<2600	<13	<2600	<2600	<13	<2600
					M	M	M	M	M	M
1,2,3-Trichlorobenzene	<20 µg/kg	TM116			<4000	<20	<4000	<4000	<20	<4000
					#	#	#	#	#	#



CERTIFICATE OF ANALYSIS

SDG: 180607-87
Location: Johnson Matthey

Client Reference: Johnson Matthey
Order Number: ES12062018

Report Number: 461019
Superseded Report: 460890

VOC MS (S)

Results Legend		Customer Sample Ref.	BHS				
#	ISO17025 accredited.						
M	mCERTS accredited.						
aq	Aqueous / settled sample.						
dis.filt	Dissolved / filtered sample.						
tot.unfilt	Total / unfiltered sample.						
*	Subcontracted test.						
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery						
(F)	Trigger breach confirmed						
1-5&+10	Sample deviation (see appendix)						
		Depth (m)	0.50				
		Sample Type	Sol/Solid (S)				
		Date Sampled	06/09/2018				
		Sample Time					
		Date Received	07/09/2018				
		SDG Ref	180607-87				
		Lab Sample No.(s)	17698174				
		AGS Reference					
Component	LOD/Units	Method					
Dibromofluoromethane**	%	TM116	104				
Toluene-d8**	%	TM116	96.6				
4-Bromofluorobenzene**	%	TM116	88				
Dichlorodifluoromethane	<6 µg/kg	TM116	<120				
			M				
Chloromethane	<7 µg/kg	TM116	<140				
			#				
Vinyl Chloride	<6 µg/kg	TM116	<120				
			M				
Bromomethane	<10 µg/kg	TM116	<200				
			M				
Chloroethane	<10 µg/kg	TM116	<200				
			M				
Trichlorofluoromethane	<6 µg/kg	TM116	<120				
			M				
1,1-Dichloroethene	<10 µg/kg	TM116	<200				
			#				
Carbon Disulphide	<7 µg/kg	TM116	<140				
			M				
Dichloromethane	<10 µg/kg	TM116	<200				
			#				
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116	<200				
			M				
trans-1,2-Dichloroethene	<10 µg/kg	TM116	<200				
			M				
1,1-Dichloroethane	<8 µg/kg	TM116	<160				
			M				
cis-1,2-Dichloroethene	<6 µg/kg	TM116	<120				
			M				
2,2-Dichloropropane	<10 µg/kg	TM116	<200				
Bromochloromethane	<10 µg/kg	TM116	<200				
			M				
Chloroform	<8 µg/kg	TM116	<160				
			M				
1,1,1-Trichloroethane	<7 µg/kg	TM116	<140				
			M				
1,1-Dichloropropene	<10 µg/kg	TM116	<200				
			M				
Carbontetrachloride	<10 µg/kg	TM116	<200				
			M				
1,2-Dichloroethane	<5 µg/kg	TM116	<100				
			M				
Benzene	<9 µg/kg	TM116	<180				
			M				
Trichloroethene	<9 µg/kg	TM116	<180				
			#				
1,2-Dichloropropane	<10 µg/kg	TM116	<200				
			M				
Dibromomethane	<9 µg/kg	TM116	<180				
			M				
Bromodichloromethane	<7 µg/kg	TM116	<140				
			M				
cis-1,3-Dichloropropene	<10 µg/kg	TM116	<200				
			M				
Toluene	<7 µg/kg	TM116	<140				
			M				
trans-1,3-Dichloropropene	<10 µg/kg	TM116	<200				
1,1,2-Trichloroethane	<10 µg/kg	TM116	<200				
			M				
1,3-Dichloropropane	<7 µg/kg	TM116	<140				
			M				



CERTIFICATE OF ANALYSIS

Validated

SDG: 180607-87
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 461019
Superseded Report: 460890

VOC MS (S)

Results Legend		Customer Sample Ref.	BHS				
#	ISO17025 accredited.						
M	mCERTS accredited.						
aq	Aqueous / settled sample.						
diss.filt	Dissolved / filtered sample.						
tot.unfilt	Total / unfiltered sample.						
^	Subcontracted test.						
^	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery						
(F)	Trigger breach confirmed						
1-65.4	Sample deviation (see appendix)						
Component	LOD/Units	Method					
Tetrachloroethene	<5 µg/kg	TM116	<100	M			
Dibromochloromethane	<10 µg/kg	TM116	<200	M			
1,2-Dibromoethane	<10 µg/kg	TM116	<200	M			
Chlorobenzene	<5 µg/kg	TM116	<100	M			
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116	<200	M			
Ethylbenzene	<4 µg/kg	TM116	<80	M			
p/m-Xylene	<10 µg/kg	TM116	<200	#			
o-Xylene	<10 µg/kg	TM116	<200	M			
Styrene	<10 µg/kg	TM116	<200	#			
Bromoform	<10 µg/kg	TM116	<200	M			
Isopropylbenzene	<5 µg/kg	TM116	<100	#			
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116	<200	#			
1,2,3-Trichloropropane	<16 µg/kg	TM116	<320	M			
Bromobenzene	<10 µg/kg	TM116	<200	M			
Propylbenzene	<10 µg/kg	TM116	<200	M			
2-Chlorotoluene	<9 µg/kg	TM116	<180	M			
1,3,5-Trimethylbenzene	<8 µg/kg	TM116	<160	M			
4-Chlorotoluene	<10 µg/kg	TM116	<200	M			
tert-Butylbenzene	<14 µg/kg	TM116	<280	M			
1,2,4-Trimethylbenzene	<9 µg/kg	TM116	<180	#			
sec-Butylbenzene	<10 µg/kg	TM116	<200				
4-Isopropyltoluene	<10 µg/kg	TM116	<200	M			
1,3-Dichlorobenzene	<8 µg/kg	TM116	<160	M			
1,4-Dichlorobenzene	<5 µg/kg	TM116	<100	M			
n-Butylbenzene	<11 µg/kg	TM116	<220				
1,2-Dichlorobenzene	<10 µg/kg	TM116	<200	M			
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116	<280	M			
Tert-amyl methyl ether	<10 µg/kg	TM116	<200	#			
1,2,4-Trichlorobenzene	<20 µg/kg	TM116	<400				
Hexachlorobutadiene	<20 µg/kg	TM116	<400				
Naphthalene	<13 µg/kg	TM116	<260	M			
1,2,3-Trichlorobenzene	<20 µg/kg	TM116	<400	#			



CERTIFICATE OF ANALYSIS

Validated

SDG: 180607-87 Client Reference: Johnson Matthey Report Number: 461019
Location: Johnson Matthey Order Number: ES12062018 Superseded Report: 460890

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	BH1 0.30 SOLID 05/06/2018 00:00:00 13/06/2018 11:29:15 180607-87 17698168 TM048	18/06/2018	Renata Bozhkov	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	BH2 0.30 SOLID 06/06/2018 00:00:00 13/06/2018 09:50:14 180607-87 17698170 TM048	14/06/2018	Barbara Urbanek-Walsh	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	BH3 0.30 SOLID 06/06/2018 00:00:00 13/06/2018 09:54:44 180607-87 17698177 TM048	14/06/2018	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	BH5 0.20 SOLID 06/06/2018 00:00:00 13/06/2018 09:52:35 180607-87 17698173 TM048	14/06/2018	Barbara Urbanek-Walsh	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected



CERTIFICATE OF ANALYSIS

SDG: 180607-87
Location: Johnson Matthey**Client Reference:** Johnson Matthey
Order Number: ES12062018**Report Number:** 461019
Superseded Report: 460890

Table of Results - Appendix

Method No	Reference	Description
PM001		Preparation of Samples for Metals Analysis
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM157	HP 6890 Gas Chromatograph (GC) system and HP 5973 Mass Selective Detector (MSD).	Determination of SVOC in Soils by GC-MS extracted by sonication in DCM/Acetone
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).



CERTIFICATE OF ANALYSIS

Validated

SDG: 180607-87
Location: Johnson Matthey

Client Reference: Johnson Matthey
Order Number: ES12062018

Report Number: 461019
Superseded Report: 460890

Test Completion Dates

Lab Sample No(s)
Customer Sample Ref.

AGS Ref.
Depth
Type

17698168	17698169	17698170	17698177	17698178	17698173	17698174
BH1	BH1	BH2	BH3	BH3	BH5	BH5
0.30	0.50	0.30	0.30	0.50	0.20	0.50
Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Asbestos ID in Solid Samples	18-Jun-2018		14-Jun-2018	14-Jun-2018		14-Jun-2018
EPH CWG (Aliphatic) GC (S)	15-Jun-2018	19-Jun-2018	15-Jun-2018	15-Jun-2018	15-Jun-2018	15-Jun-2018
EPH CWG (Aromatic) GC (S)	15-Jun-2018	19-Jun-2018	15-Jun-2018	15-Jun-2018	15-Jun-2018	15-Jun-2018
GRO by GC-FID (S)	15-Jun-2018	15-Jun-2018	18-Jun-2018	18-Jun-2018	15-Jun-2018	15-Jun-2018
Metals in solid samples by OES	15-Jun-2018	15-Jun-2018	18-Jun-2018	15-Jun-2018	15-Jun-2018	15-Jun-2018
pH	17-Jun-2018	18-Jun-2018	17-Jun-2018	17-Jun-2018	14-Jun-2018	17-Jun-2018
Sample description	13-Jun-2018	13-Jun-2018	13-Jun-2018	13-Jun-2018	13-Jun-2018	13-Jun-2018
Semi Volatile Organic Compounds	15-Jun-2018	15-Jun-2018	15-Jun-2018	15-Jun-2018	15-Jun-2018	15-Jun-2018
TPH CWG GC (S)	15-Jun-2018	19-Jun-2018	18-Jun-2018	18-Jun-2018	15-Jun-2018	15-Jun-2018
VOC MS (S)	20-Jun-2018	14-Jun-2018	20-Jun-2018	18-Jun-2018	14-Jun-2018	15-Jun-2018



CERTIFICATE OF ANALYSIS

SDG:	180607-87	Client Reference:	Johnson Matthey	Report Number:	461019
Location:	Johnson Matthey	Order Number:	ES12062018	Superseded Report:	460890

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



EnviroSolution Limited
18 North Drive
Liverpool
Merseyside
L15 8JG

Attention: Gemma Lucas

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)

Hawarden

Deeside

CH5 3US

Tel: (01244) 528700

Fax: (01244) 528701

email: hawardencustomerservices@alsglobal.com

Website: www.alsenvironmental.co.uk

CERTIFICATE OF ANALYSIS

Date: 18 June 2018
Customer: H_ENVSOL_LIV
Sample Delivery Group (SDG): 180608-66
Your Reference: Johnson Matthey
Location: Johnson Matthey
Report No: 460635

We received 4 samples on Friday June 08, 2018 and 4 of these samples were scheduled for analysis which was completed on Monday June 18, 2018. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Approved By:

Sonia McWhan

Operations Manager





Validated

CERTIFICATE OF ANALYSIS

SDG: 180608-66 Client Reference: Johnson Matthey Report Number: 460635
Location: Johnson Matthey Order Number: ES12062018 Superseded Report:

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
17704605	BH4		0.25	07/06/2018
17704606	BH4		0.40	07/06/2018
17704607	BH6		0.30	07/06/2018
17704608	BH6		1.20	07/06/2018

Maximum Sample/Coolbox Temperature (°C) :

19.4

ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 180608-66 Client Reference: Johnson Matthey Report Number: 460635
 Location: Johnson Matthey Order Number: ES12062018 Superseded Report:

Results Legend

X Test
N No Determination Possible

Sample Types -

S - Soil/Solid
 UNS - Unspecified Solid
 GW - Ground Water
 SW - Surface Water
 LE - Land Leachate
 PL - Prepared Leachate
 PR - Process Water
 SA - Saline Water
 TE - Trade Effluent
 TS - Treated Sewage
 US - Untreated Sewage
 RE - Recreational Water
 DW - Drinking Water Non-regulatory
 UNL - Unspecified Liquid
 SL - Sludge
 G - Gas
 OTH - Other

Lab Sample No(s)

Customer Sample Reference

AGS Reference

Depth (m)

Container

Sample Type

Asbestos ID in Solid Samples

All

NDPs: 0
Tests: 2

X

X

EPH CWG (Aliphatic) GC (S)

All

NDPs: 0
Tests: 2

X

X

EPH CWG (Aromatic) GC (S)

All

NDPs: 0
Tests: 2

X

X

GRO by GC-FID (S)

All

NDPs: 0
Tests: 2

X

X

Metals in solid samples by OES

All

NDPs: 0
Tests: 2

X

X

pH

All

NDPs: 0
Tests: 2

X

X

Sample description

All

NDPs: 0
Tests: 2

X

X

Semi Volatile Organic Compounds

All

NDPs: 0
Tests: 2

X

X

TPH CWG GC (S)

All

NDPs: 0
Tests: 2

X

X

VOC MS (S)

All

NDPs: 0
Tests: 2

X

X



CERTIFICATE OF ANALYSIS

Validated

SDG: 180608-66
Location: Johnson Matthey

Client Reference: Johnson Matthey
Order Number: ES12062018

Report Number: 460635
Superseded Report:

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
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Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
17704605	BH4	0.25	Black	Sand	Stones	Vegetation
17704607	BH6	0.30	Dark Brown	Loamy Sand	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.



CERTIFICATE OF ANALYSIS

Validated

SDG: 180608-66
Location: Johnson Matthey

Client Reference: Johnson Matthey
Order Number: ES12062018

Report Number: 460635
Superseded Report:

Semi Volatile Organic Compounds

Results Legend			Customer Sample Ref.	BH4	BH6			
#	ISO17025 accredited.							
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
+	Subcontracted test.							
+	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5.6.4.6	Sample deviation (see appendix)							
Component	LOD/Units	Method						
Phenol	<100 µg/kg	TM157	<100	<100				
Pentachlorophenol	<100 µg/kg	TM157	<100	<100				
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157	<100	<100				
Nitrobenzene	<100 µg/kg	TM157	<100	<100				
Isophorone	<100 µg/kg	TM157	<100	<100				
Hexachloroethane	<100 µg/kg	TM157	<100	<100				
Hexachlorocyclopentadiene	<100 µg/kg	TM157	<100	<100				
Hexachlorobutadiene	<100 µg/kg	TM157	<100	<100				
Hexachlorobenzene	<100 µg/kg	TM157	<100	<100				
n-Dioctyl phthalate	<100 µg/kg	TM157	<100	<100				
Dimethyl phthalate	<100 µg/kg	TM157	<100	<100				
Diethyl phthalate	<100 µg/kg	TM157	<100	<100				
n-Dibutyl phthalate	<100 µg/kg	TM157	<100	<100				
Dibenzofuran	<100 µg/kg	TM157	<100	<100				
Carbazole	<100 µg/kg	TM157	<100	<100				
Butylbenzyl phthalate	<100 µg/kg	TM157	<100	<100				
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157	<100	<100				
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157	<100	<100				
bis(2-Chloroethyl)ether	<100 µg/kg	TM157	<100	<100				
Azobenzene	<100 µg/kg	TM157	<100	<100				
4-Nitrophenol	<100 µg/kg	TM157	<100	<100				
4-Nitroaniline	<100 µg/kg	TM157	<100	<100				
4-Methylphenol	<100 µg/kg	TM157	<100	<100				
4-Chlorophenylphenylether	<100 µg/kg	TM157	<100	<100				
4-Chloroaniline	<100 µg/kg	TM157	<100	<100				
4-Chloro-3-methylphenol	<100 µg/kg	TM157	<100	<100				
4-Bromophenylphenylether	<100 µg/kg	TM157	<100	<100				
3-Nitroaniline	<100 µg/kg	TM157	<100	<100				
2-Nitrophenol	<100 µg/kg	TM157	<100	<100				
2-Nitroaniline	<100 µg/kg	TM157	<100	<100				
2-Methylphenol	<100 µg/kg	TM157	<100	<100				
1,2,4-Trichlorobenzene	<100 µg/kg	TM157	<100	<100				
2-Chlorophenol	<100 µg/kg	TM157	<100	<100				

16:07:57 18/06/2018



CERTIFICATE OF ANALYSIS

Validated

SDG: 180608-66
Location: Johnson Matthey

Client Reference: Johnson Matthey
Order Number: ES12062018

Report Number: 460635
Superseded Report:

Semi Volatile Organic Compounds

Results Legend		Customer Sample Ref.	BH4	BH6			
#	ISO17025 accredited.						
M	mCERTS accredited.						
aq	Aqueous / settled sample.						
diss.filt	Dissolved / filtered sample.						
tot.unfilt	Total / unfiltered sample.						
+	Subcontracted test.						
++	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery						
(F)	Trigger breach confirmed						
1-66+66	Sample deviation (see appendix)						
Component	LOD/Units	Method					
2,6-Dinitrotoluene	<100 µg/kg	TM157	<100	<100			
2,4-Dinitrotoluene	<100 µg/kg	TM157	<100	<100			
2,4-Dimethylphenol	<100 µg/kg	TM157	<100	<100			
2,4-Dichlorophenol	<100 µg/kg	TM157	<100	<100			
2,4,6-Trichlorophenol	<100 µg/kg	TM157	<100	<100			
2,4,5-Trichlorophenol	<100 µg/kg	TM157	<100	<100			
1,4-Dichlorobenzene	<100 µg/kg	TM157	<100	<100			
1,3-Dichlorobenzene	<100 µg/kg	TM157	<100	<100			
1,2-Dichlorobenzene	<100 µg/kg	TM157	<100	<100			
2-Chloronaphthalene	<100 µg/kg	TM157	<100	<100			
2-Methylnaphthalene	<100 µg/kg	TM157	104	<100			
Acenaphthylene	<100 µg/kg	TM157	<100	<100			
Acenaphthene	<100 µg/kg	TM157	<100	<100			
Anthracene	<100 µg/kg	TM157	<100	<100			
Benzo(a)anthracene	<100 µg/kg	TM157	<100	<100			
Benzo(b)fluoranthene	<100 µg/kg	TM157	<100	<100			
Benzo(k)fluoranthene	<100 µg/kg	TM157	<100	<100			
Benzo(a)pyrene	<100 µg/kg	TM157	<100	<100			
Benzo(g,h,i)perylene	<100 µg/kg	TM157	<100	<100			
Chrysene	<100 µg/kg	TM157	<100	<100			
Fluoranthene	<100 µg/kg	TM157	<100	<100			
Fluorene	<100 µg/kg	TM157	<100	<100			
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157	<100	<100			
Phenanthrene	<100 µg/kg	TM157	176	<100			
Pyrene	<100 µg/kg	TM157	<100	<100			
Naphthalene	<100 µg/kg	TM157	104	<100			
Dibenzo(a,h)anthracene	<100 µg/kg	TM157	<100	<100			
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157	<100	<100			



Validated

CERTIFICATE OF ANALYSIS

SDG: 180608-66
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 460635
Superseded Report:

VOC MS (S)

Results Legend		Customer Sample Ref.	BH4	BH6			
#	ISO17025 accredited.	Depth (m) Sample Type Data Sampled Sample Time Data Received SDG Ref Lab Sample No.(s) ALS Reference					
M	mCERTS accredited.						
aq	Aqueous / settled sample.		0.25	0.30			
disa.filt	Dissolved / filtered sample.		Soil/Solid (S)	Soil/Solid (S)			
tot.unfilt	Total / unfiltered sample.		07/06/2018	07/06/2018			
**	Subcontracted test.						
(F)	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery		08/06/2018	08/06/2018			
1-5.5+g@	Trigger breach confirmed		180608-66	180608-66			
	Sample deviation (see appendix)		17704605	17704607			
Component	LOD/Units	Method					
Dibromofluoromethane**	%	TM116	98.7	98.5			
Toluene-d8**	%	TM116	97	97.3			
4-Bromofluorobenzene**	%	TM116	99.8	102			
Dichlorodifluoromethane	<6 µg/kg	TM116	<1200	<1200			
Chloromethane	<7 µg/kg	TM116	<1400	<1400			
Vinyl Chloride	<6 µg/kg	TM116	<1200	<1200			
Bromomethane	<10 µg/kg	TM116	<2000	<2000			
Chloroethane	<10 µg/kg	TM116	<2000	<2000			
Trichlorofluoromethane	<6 µg/kg	TM116	<1200	<1200			
1,1-Dichloroethene	<10 µg/kg	TM116	<2000	<2000			
Carbon Disulphide	<7 µg/kg	TM116	<1400	<1400			
Dichloromethane	<10 µg/kg	TM116	<2000	<2000			
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116	<2000	<2000			
trans-1,2-Dichloroethene	<10 µg/kg	TM116	<2000	<2000			
1,1-Dichloroethane	<8 µg/kg	TM116	<1600	<1600			
cis-1,2-Dichloroethene	<6 µg/kg	TM116	<1200	<1200			
2,2-Dichloropropane	<10 µg/kg	TM116	<2000	<2000			
Bromochloromethane	<10 µg/kg	TM116	<2000	<2000			
Chloroform	<8 µg/kg	TM116	<1600	<1600			
1,1,1-Trichloroethane	<7 µg/kg	TM116	<1400	<1400			
1,1-Dichloropropene	<10 µg/kg	TM116	<2000	<2000			
Carbontetrachloride	<10 µg/kg	TM116	<2000	<2000			
1,2-Dichloroethane	<5 µg/kg	TM116	<1000	<1000			
Benzene	<9 µg/kg	TM116	<1800	<1800			
Trichloroethene	<9 µg/kg	TM116	<1800	<1800			
1,2-Dichloropropane	<10 µg/kg	TM116	<2000	<2000			
Dibromomethane	<9 µg/kg	TM116	<1800	<1800			
Bromodichloromethane	<7 µg/kg	TM116	<1400	<1400			
cis-1,3-Dichloropropene	<10 µg/kg	TM116	<2000	<2000			
Toluene	<7 µg/kg	TM116	<1400	<1400			
trans-1,3-Dichloropropene	<10 µg/kg	TM116	<2000	<2000			
1,1,2-Trichloroethane	<10 µg/kg	TM116	<2000	<2000			
1,3-Dichloropropane	<7 µg/kg	TM116	<1400	<1400			

16:07:57 18/06/2018



Validated

CERTIFICATE OF ANALYSIS

SDG: 180608-66
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 460635
Superseded Report:

VOC MS (S)

Results Legend		Customer Sample Ref.	BH4	BH6			
#	ISO17025 accredited.						
M	mCERTS accredited.						
aq	Aqueous / settled sample.						
diss.filt	Dissolved / filtered sample.						
tot.unfilt	Total / unfiltered sample.						
*	Subcontracted test.						
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery						
(F)	Trigger breach confirmed						
1-5.4.10	Sample deviation (see appendix)						
Component	LOD/Units	Method					
Tetrachloroethene	<5 µg/kg	TM116	<1000	<1000			
			M	M			
Dibromochloromethane	<10 µg/kg	TM116	<2000	<2000			
			M	M			
1,2-Dibromoethane	<10 µg/kg	TM116	<2000	<2000			
			M	M			
Chlorobenzene	<5 µg/kg	TM116	<1000	<1000			
			M	M			
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116	<2000	<2000			
			M	M			
Ethylbenzene	<4 µg/kg	TM116	<800	<800			
			M	M			
p/m-Xylene	<10 µg/kg	TM116	<2000	<2000			
			#	#			
o-Xylene	<10 µg/kg	TM116	<2000	<2000			
			M	M			
Styrene	<10 µg/kg	TM116	<2000	<2000			
			#	#			
Bromoform	<10 µg/kg	TM116	<2000	<2000			
			M	M			
Isopropylbenzene	<5 µg/kg	TM116	<1000	<1000			
			#	#			
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116	<2000	<2000			
			#	#			
1,2,3-Trichloropropane	<16 µg/kg	TM116	<3200	<3200			
			M	M			
Bromobenzene	<10 µg/kg	TM116	<2000	<2000			
			M	M			
Propylbenzene	<10 µg/kg	TM116	<2000	<2000			
			M	M			
2-Chlorotoluene	<9 µg/kg	TM116	<1800	<1800			
			M	M			
1,3,5-Trimethylbenzene	<8 µg/kg	TM116	<1600	<1600			
			M	M			
4-Chlorotoluene	<10 µg/kg	TM116	<2000	<2000			
			M	M			
tert-Butylbenzene	<14 µg/kg	TM116	<2800	<2800			
			M	M			
1,2,4-Trimethylbenzene	<9 µg/kg	TM116	<1800	<1800			
			#	#			
sec-Butylbenzene	<10 µg/kg	TM116	<2000	<2000			
4-Isopropyltoluene	<10 µg/kg	TM116	<2000	<2000			
			M	M			
1,3-Dichlorobenzene	<8 µg/kg	TM116	<1600	<1600			
			M	M			
1,4-Dichlorobenzene	<5 µg/kg	TM116	<1000	<1000			
			M	M			
n-Butylbenzene	<11 µg/kg	TM116	<2200	<2200			
1,2-Dichlorobenzene	<10 µg/kg	TM116	<2000	<2000			
			M	M			
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116	<2800	<2800			
			M	M			
Tert-amyl methyl ether	<10 µg/kg	TM116	<2000	<2000			
			#	#			
1,2,4-Trichlorobenzene	<20 µg/kg	TM116	<4000	<4000			
Hexachlorobutadiene	<20 µg/kg	TM116	<4000	<4000			
Naphthalene	<13 µg/kg	TM116	<2600	<2600			
			M	M			
1,2,3-Trichlorobenzene	<20 µg/kg	TM116	<4000	<4000			
			#	#			



CERTIFICATE OF ANALYSIS

SDG: 180608-66
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 460635
Superseded Report:

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	BH4 0.25 SOLID 07/06/2018 00:00:00 13/06/2018 19:09:46 180608-66 17704605 TM048	15/06/2018	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	BH6 0.30 SOLID 07/06/2018 00:00:00 13/06/2018 19:08:43 180608-66 17704607 TM048	15/06/2018	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected



CERTIFICATE OF ANALYSIS

Validated

SDG: 180608-66 **Client Reference:** Johnson Matthey **Report Number:** 460635
Location: Johnson Matthey **Order Number:** ES12062018 **Superseded Report:**

Table of Results - Appendix

Method No	Reference	Description
PM001		Preparation of Samples for Metals Analysis
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS
TM133	BS 1377: Part 3 1990; BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM157	HP 6890 Gas Chromatograph (GC) system and HP 5973 Mass Selective Detector (MSD).	Determination of SVOC in Soils by GC-MS extracted by sonication in DCM/Acetone
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).



Validated

CERTIFICATE OF ANALYSIS

SDG: 180608-66
Location: Johnson MattheyClient Reference: Johnson Matthey
Order Number: ES12062018Report Number: 460635
Superseded Report:

Test Completion Dates

Lab Sample No(s)	17704605	17704607
Customer Sample Ref.	BH4	BH5
AGS Ref.		
Depth	0.25	0.30
Type	Soil/Solid (S)	Soil/Solid (S)
Asbestos ID in Solid Samples	15-Jun-2018	15-Jun-2018
EPH CWG (Aliphatic) GC (S)	15-Jun-2018	15-Jun-2018
EPH CWG (Aromatic) GC (S)	15-Jun-2018	15-Jun-2018
GRO by GC-FID (S)	18-Jun-2018	15-Jun-2018
Metals in solid samples by OES	18-Jun-2018	18-Jun-2018
pH	17-Jun-2018	17-Jun-2018
Sample description	13-Jun-2018	13-Jun-2018
Semi Volatile Organic Compounds	18-Jun-2018	18-Jun-2018
TPH CWG GC (S)	18-Jun-2018	15-Jun-2018



CERTIFICATE OF ANALYSIS

SDG:
Location:

180608-66
Johnson Matthey

Client Reference:
Order Number:

Johnson Matthey
ES12062018

Report Number:
Superseded Report:

460635

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO 17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
◆	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



EnviroSolution Limited
18 North Drive
Liverpool
Merseyside
L15 8JG

Attention: James McKinstry-West

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

CERTIFICATE OF ANALYSIS

Date:	26 June 2018
Customer:	H_ENVSOL_LIV
Sample Delivery Group (SDG):	180616-54
Your Reference:	Johnson Matty
Location:	Clitheroe
Report No:	461687

We received 3 samples on Saturday June 16, 2018 and 3 of these samples were scheduled for analysis which was completed on Tuesday June 26, 2018. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Approved By:

Sonia McWhan
Operations Manager





CERTIFICATE OF ANALYSIS

Validated

SDG: 180616-54
Location: Clitheroe

Client Reference: Johnson Matty
Order Number:

Report Number: 461687
Superseded Report:

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
17755579	BH3		0.90 - 0.90	15/06/2018
17755578	BH4		2.60 - 2.60	15/06/2018
17755582	BH5		2.00 - 2.00	15/06/2018

Maximum Sample/Coolbox Temperature (°C) :

15.8

ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of

maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.



Validated

CERTIFICATE OF ANALYSIS

SDG: 180616-54
Location: ClitheroeClient Reference: Johnson Matty
Order Number:Report Number: 461687
Superseded Report:

SVOC MS (W) - Aqueous

Results Legend		Customer Sample Ref.	BH3	BH4	BH5		
#	ISO17226 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AQS Reference					
M	mCERTS accredited.						
aq	Aqueous / settled sample.						
dis.filt	Dissolved / filtered sample.						
tot.unfilt	Total / unfiltered sample.						
+	Subcontracted test.						
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery						
(F)	Trigger breach confirmed						
1-5&+%	Sample deviation (see appendix)						
Component	LOD/Units	Method					
1,2,4-Trichlorobenzene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
1,2-Dichlorobenzene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
1,3-Dichlorobenzene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
1,4-Dichlorobenzene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2,4,5-Trichlorophenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2,4,6-Trichlorophenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2,4-Dichlorophenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2,4-Dimethylphenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2,4-Dinitrotoluene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2,6-Dinitrotoluene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2-Chloronaphthalene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2-Chlorophenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2-Methylnaphthalene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2-Methylphenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2-Nitroaniline (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
2-Nitrophenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
3-Nitroaniline (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
4-Bromophenylphenylether (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
4-Chloro-3-methylphenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
4-Chloroaniline (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
4-Chlorophenylphenylether (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
4-Methylphenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
4-Nitroaniline (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
4-Nitrophenol (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
Azobenzene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
Acenaphthylene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
Acenaphthene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
Anthracene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
bis(2-Chloroethyl)ether (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
bis(2-Chloroethoxy)methane (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
bis(2-Ethylhexyl) phthalate (aq)	<2 µg/l	TM176	<2 #	<16 #	23.2 #		
Butylbenzyl phthalate (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		
Benzo(a)anthracene (aq)	<1 µg/l	TM176	<1 #	<8 #	<8 #		

09:05:57 26/06/2018



CERTIFICATE OF ANALYSIS

SDG: 180616-54
Location: ClitheroeClient Reference: Johnson Matty
Order Number:Report Number: 461687
Superseded Report:

SVOC MS (W) - Aqueous

Results Legend		Customer Sample Ref.	BH3	BH4	BH5			
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Data Received SDG Ref Lab Sample No.(s) AGS Reference	0.90 - 0.90	2.60 - 2.60	2.00 - 2.00			
M	mCERTS accredited.		Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
aq	Aqueous / settled sample.		15/06/2018	15/06/2018	15/06/2018			
dis.filt	Dissolved / filtered sample.		16/06/2018	16/06/2018	16/06/2018			
tot.unfilt	Total / unfiltered sample.		180616-54	180616-54	180616-54			
*	Subcontracted test.		17755579	17755578	17755582			
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-66.4%	Sample deviation (see appendix)							
Component	LOD/Units	Method						
Benzo(b)fluoranthene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Benzo(k)fluoranthene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Benzo(a)pyrene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Benzo(g,h,i)perylene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Carbazole (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Chrysene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Dibenzofuran (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
n-Dibutyl phthalate (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Diethyl phthalate (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Dibenzo(a,h)anthracene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Dimethyl phthalate (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
n-Dioctyl phthalate (aq)	<5 µg/l	TM176	<5	<40	<40	#	#	#
Fluoranthene (aq)	<1 µg/l	TM176	<1	<8	12	#	#	#
Fluorene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Hexachlorobenzene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Hexachlorobutadiene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Pentachlorophenol (aq)	<1 µg/l	TM176	<1	<8	<8			
Phenol (aq)	<1 µg/l	TM176	<1	<8	<8			
n-Nitroso-n-dipropylamine (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Hexachloroethane (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Nitrobenzene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Naphthalene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Isophorone (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Hexachlorocyclopentadiene (aq)	<1 µg/l	TM176	<1	<8	<8			
Phenanthrene (aq)	<1 µg/l	TM176	<1	<8	20.6	#	#	#
Indeno(1,2,3-cd)pyrene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#
Pyrene (aq)	<1 µg/l	TM176	<1	<8	<8	#	#	#



CERTIFICATE OF ANALYSIS

Validated

SDG: 180616-54
Location: Clitheroe

Client Reference: Johnson Matty
Order Number:

Report Number: 461687
Superseded Report:

VOC MS (W)

Results Legend			Customer Sample Ref.			BH3	BH4	BH5			
#	ISO17025 accredited.										
M	mCERTS accredited.										
aq	Aqueous / settled sample.										
diss.filt	Dissolved / filtered sample.										
totunfilt	Total / unfiltered sample.										
*	Subcontracted test.										
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery										
(F)	Trigger breach confirmed										
1-5&+@	Sample deviation (see appendix)										
Component	LOD/Units	Method	Depth (m)	Sample Type	Date Sampled	Sample Time	Date Received	SDG Ref	Lab Sample No.(s)	AGS Reference	
Dibromofluoromethane**	%	TM208	0.90 - 0.90	Ground Water (GW)	15/06/2018						
Toluene-d8**	%	TM208	2.60 - 2.60	Ground Water (GW)	15/06/2018						
4-Bromofluorobenzene**	%	TM208	2.00 - 2.00	Ground Water (GW)	15/06/2018						
Dichlorodifluoromethane	<1 µg/l	TM208									
Chloromethane	<1 µg/l	TM208									
Vinyl chloride	<1 µg/l	TM208									
Bromomethane	<1 µg/l	TM208									
Chloroethane	<1 µg/l	TM208									
Trichlorofluoromethane	<1 µg/l	TM208									
1,1-Dichloroethene	<1 µg/l	TM208									
Carbon disulphide	<1 µg/l	TM208									
Dichloromethane	<3 µg/l	TM208									
Methyl tertiary butyl ether (MTBE)	<1 µg/l	TM208									
trans-1,2-Dichloroethene	<1 µg/l	TM208									
1,1-Dichloroethane	<1 µg/l	TM208									
cis-1,2-Dichloroethene	<1 µg/l	TM208									
2,2-Dichloropropane	<1 µg/l	TM208									
Bromochloromethane	<1 µg/l	TM208									
Chloroform	<1 µg/l	TM208									
1,1,1-Trichloroethane	<1 µg/l	TM208									
1,1-Dichloropropene	<1 µg/l	TM208									
Carbon tetrachloride	<1 µg/l	TM208									
1,2-Dichloroethane	<1 µg/l	TM208									
Benzene	<1 µg/l	TM208									
Trichloroethene	<1 µg/l	TM208									
1,2-Dichloropropane	<1 µg/l	TM208									
Dibromomethane	<1 µg/l	TM208									
Bromodichloromethane	<1 µg/l	TM208									
cis-1,3-Dichloropropene	<1 µg/l	TM208									
Toluene	<1 µg/l	TM208									
trans-1,3-Dichloropropene	<1 µg/l	TM208									
1,1,2-Trichloroethane	<1 µg/l	TM208									
1,3-Dichloropropane	<1 µg/l	TM208									

09:05:57 26/06/2018



Validated

CERTIFICATE OF ANALYSIS

SDG: 180616-54
Location: ClitheroeClient Reference: Johnson Matty
Order Number:Report Number: 461687
Superseded Report:

VOC MS (W)

Results Legend		Customer Sample Ref.	BH3	BH4	BH5			
#	ISO17025 accredited.	Depth (m)	0.90 - 0.90	2.60 - 2.60	2.00 - 2.00			
M	mCERTS accredited.	Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
aq	Aqueous / settled sample.	Data Sampled	15/06/2018	15/06/2018	15/06/2018			
dis.filt	Dissolved / filtered sample.	Sample Time	16/06/2018	16/06/2018	16/06/2018			
tot.unfilt	Total / unfiltered sample.	Date Received	180616-54	180616-54	180616-54			
*	Subcontracted test.	Lab Sample No.(s)	17755579	17755578	17755582			
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery	AGS Reference						
(F)	Trigger breach confirmed							
1-5&+@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
Tetrachloroethene	<1 µg/l	TM208	<1	<1	<1	#	#	#
Dibromochloromethane	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,2-Dibromoethane	<1 µg/l	TM208	<1	<1	<1	#	#	#
Chlorobenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,1,1,2-Tetrachloroethane	<1 µg/l	TM208	<1	<1	<1	#	#	#
Ethylbenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
m,p-Xylene	<1 µg/l	TM208	<1	<1	<1	#	#	#
o-Xylene	<1 µg/l	TM208	<1	<1	<1	#	#	#
Styrene	<1 µg/l	TM208	<1	<1	<1	#	#	#
Bromoform	<1 µg/l	TM208	<1	<1	<1	#	#	#
Isopropylbenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,1,2,2-Tetrachloroethane	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,2,3-Trichloropropane	<1 µg/l	TM208	<1	<1	<1	#	#	#
Bromobenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
Propylbenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
2-Chlorotoluene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,3,5-Trimethylbenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
4-Chlorotoluene	<1 µg/l	TM208	<1	<1	<1	#	#	#
tert-Butylbenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,2,4-Trimethylbenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
sec-Butylbenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
4-iso-Propyltoluene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,3-Dichlorobenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,4-Dichlorobenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
n-Butylbenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,2-Dichlorobenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,2-Dibromo-3-chloropropane	<1 µg/l	TM208	<1	<1	<1			
1,2,4-Trichlorobenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#
Hexachlorobutadiene	<1 µg/l	TM208	<1	<1	<1	#	#	#
tert-Amyl methyl ether (TAME)	<1 µg/l	TM208	<1	<1	<1	#	#	#
Naphthalene	<1 µg/l	TM208	<1	<1	<1	#	#	#
1,2,3-Trichlorobenzene	<1 µg/l	TM208	<1	<1	<1	#	#	#



CERTIFICATE OF ANALYSIS

SDG: 180616-54
Location: Clitheroe**Client Reference:** Johnson Matty
Order Number:**Report Number:** 461687
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description
TM061	Method for the Determination of EPH, Massachusetts Dept. of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM172	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	EPH in Waters
TM176	EPA 8270D Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Determination of SVOCs in Water by GCMS
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM245	By GC-FID	Determination of GRO by Headspace in waters
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters, HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).



CERTIFICATE OF ANALYSIS

Validated

SDG: 180616-54
Location: Clitheroe

Client Reference: Johnson Matty
Order Number:

Report Number: 461687
Superseded Report:

Test Completion Dates

Lab Sample No(s)	17755579	17755578	17755582
Customer Sample Ref.	BH3	BH4	BH5
AGS Ref.			
Depth	0.90 - 0.90	2.60 - 2.60	2.00 - 2.00
Type	Ground Water	Ground Water	Ground Water
Dissolved Metals by ICP-MS	26-Jun-2018	22-Jun-2018	26-Jun-2018
EPH (DRO) (C10-C40) Aqueous (W)	18-Jun-2018	19-Jun-2018	18-Jun-2018
GRO by GC-FID (W)	22-Jun-2018	22-Jun-2018	22-Jun-2018
Mercury Dissolved	19-Jun-2018	18-Jun-2018	19-Jun-2018
pH Value	20-Jun-2018	20-Jun-2018	20-Jun-2018
SVOC MS (W) - Aqueous	22-Jun-2018	21-Jun-2018	21-Jun-2018
Total EPH (aq)	22-Jun-2018	22-Jun-2018	22-Jun-2018
Total Metals by ICP-MS	25-Jun-2018	25-Jun-2018	25-Jun-2018
VOC MS (W)	21-Jun-2018	21-Jun-2018	21-Jun-2018



CERTIFICATE OF ANALYSIS

SDG:**Location:**

180616-54

Clitheroe

Client Reference:**Order Number:**

Johnson Matty

Report Number:**Superseded Report:**

461687

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
◆	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



TEST REPORT

Report No:
Page 1 of 1

XTE 31217

TEST REPORT OF PARTICLE SIZE DISTRIBUTION & MOISTURE CONTENT OF SOILS

Method: Particle Size Distribution: BS 1377-2:1990.
Method: Moisture Content: BS 1377-2:1990

(Method 9.2, wet sieving)
(Method 3.2.3.3, oven drying)

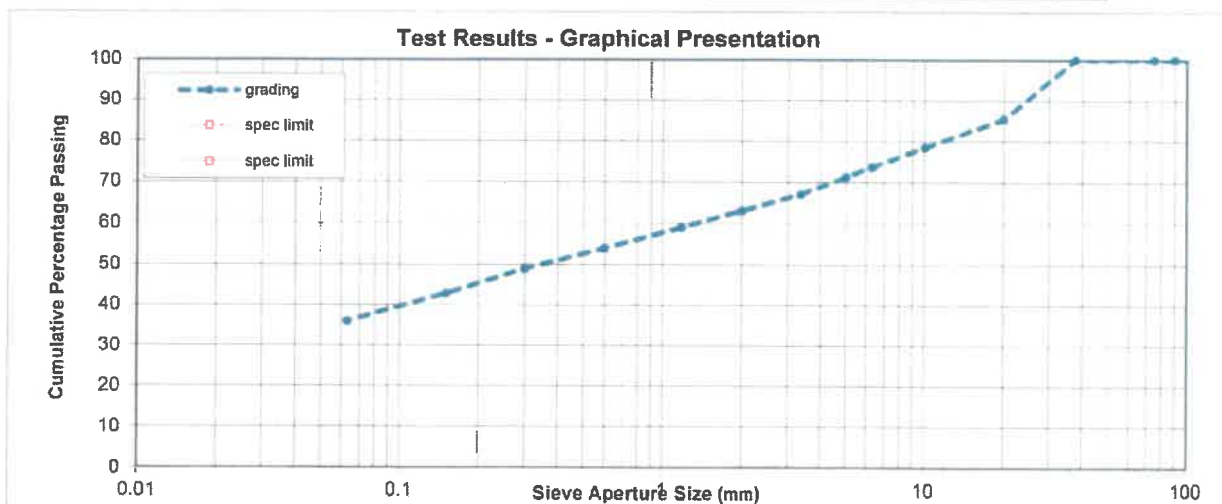
XTRATEC SAMPLE REF | XTE 31217
CUSTOMER/SITE SAMPLE REF | 339576

CLIENT | QTS Environmental Ltd
SITE | Clitheroe
TYPE OF MATERIAL | For Classification
SOIL DESCRIPTION | Brown silty clay with gravel
SPECIFICATION | For Classification
SUPPLIER/SOURCE | Site Won
SAMPLING LOCATION | BH1 @ 1.5m

SAMPLING METHOD | Unknown
SAMPLED BY | Client
TYPE OF SAMPLE | Bulk
DATE SAMPLED | Unknown
DATE RECEIVED | 12 June 2018
DATE TESTED | 15 June 2018
PREPARATION METHOD | BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS			
Sieve Size (mm)	Percent. Passing	Specified Limits (%)	
		lower	upper
125	100		
90	100		
75	100		
37.5	100		
20	85		
10	78		
6.3	74		
5	71		
3.35	67		
2	63		
1.18	59		
0.6	54		
0.3	49		
0.15	43		
0.063	36.1		

Moisture Content (%) 10.6



REMARKS: A certificate of sampling is not available

ISSUE TO: QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 21 June 2018

AUTHORISED BY: A Schofield Quality Manager

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



TEST REPORT

Report No:
Page 1 of 1

XTE 31218

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | XTE 31218
CUSTOMER/SITE SAMPLE REF | 339577

CLIENT	QTS Environmental Ltd
SITE	Clitheroe
TYPE OF MATERIAL	For Classification
SOIL DESCRIPTION	Brown sandy clay with gravel
SPECIFICATION	For Classification
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	BH2 @ 1.2m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	12 June 2018
DATE TESTED	15 June 2018
PREPARATION METHOD	BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS	
Moisture Content (%)	12.8

REMARKS:

ISSUE TO: QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 21 June 2018


AUTHORISED BY: A Schofield Quality
Manager

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



TEST REPORT

Report No:
Page 1 of 1

XTE 31219

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | XTE 31219
CUSTOMER/SITE SAMPLE REF | 339578

CLIENT	QTS Environmental Ltd
SITE	Clitheroe
TYPE OF MATERIAL	For Classification
SOIL DESCRIPTION	Brown sandy clay with gravel
SPECIFICATION	For Classification
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	BH2 @ 2m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	12 June 2018
DATE TESTED	15 June 2018
PREPARATION METHOD	BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS	
Moisture Content (%)	5.9

REMARKS:

ISSUE TO: QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 21 June 2018

AUTHORISED BY: A Schofield Quality
Manager

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



TEST REPORT

Report No:
Page 1 of 1

XTE 31220

TEST REPORT OF PLASTICITY INDEX

Method: BS 1377-2:1990 Method 4.4 Liquid Limit One Point
Method: BS 1377-2:1990 Method 5.3 Plastic Limit
Method: BS 1377-2:1990 Method 5.4 Plasticity Index

XTRATEC SAMPLE REF | XTE 31220
CUSTOMER/SITE SAMPLE REF | 339579

CLIENT | QTS Environmental Ltd
SITE | Clitheroe
SOIL DESCRIPTION | Brown clay with gravel
SUPPLIER/SOURCE | Insitu
SAMPLING LOCATION | BH2 @ 2.8m

SAMPLED BY | Client
TYPE OF SAMPLE | Bulk
DATE SAMPLED | Unknown
DATE RECEIVED | 12 June 2018
DATE TESTED | 15 June 2018
PREPARATION METHOD | Tested by Wet Sieving

TEST RESULTS	
Percentage Retained 425um (%)	43
Liquid Limit	42
Plastic Limit	18
Plasticity Index	24

REMARKS:

ISSUE TO: QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 21 June 2018


AUTHORISED BY A Schofield Quality
Manager

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



TEST REPORT

Report No:
Page 1 of 1

XTE 31220

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | XTE 31220
CUSTOMER/SITE SAMPLE REF | 339579

CLIENT	QTS Environmental Ltd
SITE	Clitheroe
TYPE OF MATERIAL	For Classification
SOIL DESCRIPTION	Brown clay with gravel
SPECIFICATION	For Classification
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	BH2 @ 2.8m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	12 June 2018
DATE TESTED	15 June 2018
PREPARATION METHOD	BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS	
Moisture Content (%)	14.8

REMARKS:

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Rose Lane, Lenham Heath
Maidstone
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DATE: 21 June 2018


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Manager

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
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TEST REPORT

Report No:
Page 1 of 1

XTE 31221

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | XTE 31221
CUSTOMER/SITE SAMPLE REF | 339580

CLIENT	QTS Environmental Ltd
SITE	Clitheroe
TYPE OF MATERIAL	For Classification
SOIL DESCRIPTION	Brown clay with gravel
SPECIFICATION	For Classification
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	BH2 @ 5m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	12 June 2018
DATE TESTED	15 June 2018
PREPARATION METHOD	BS 1377-1, 7.3.5.2 (Sub dividing)

TEST RESULTS	
Moisture Content (%)	8.7

REMARKS:

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DATE: 21 June 2018

AUTHORISED BY: A Schofield Quality
Manager

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Unit 4
Rose Lane Industrial Estate
Lenham Heath
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TEST REPORT

Report No:
Page 1 of 1

XTE 31222

TEST REPORT OF PARTICLE SIZE DISTRIBUTION & MOISTURE CONTENT OF SOILS

Method: Particle Size Distribution: BS 1377-2:1990.
Method: Moisture Content: BS 1377-2:1990

(Method 9.2, wet sieving)
(Method 3.2.3.3, oven drying)

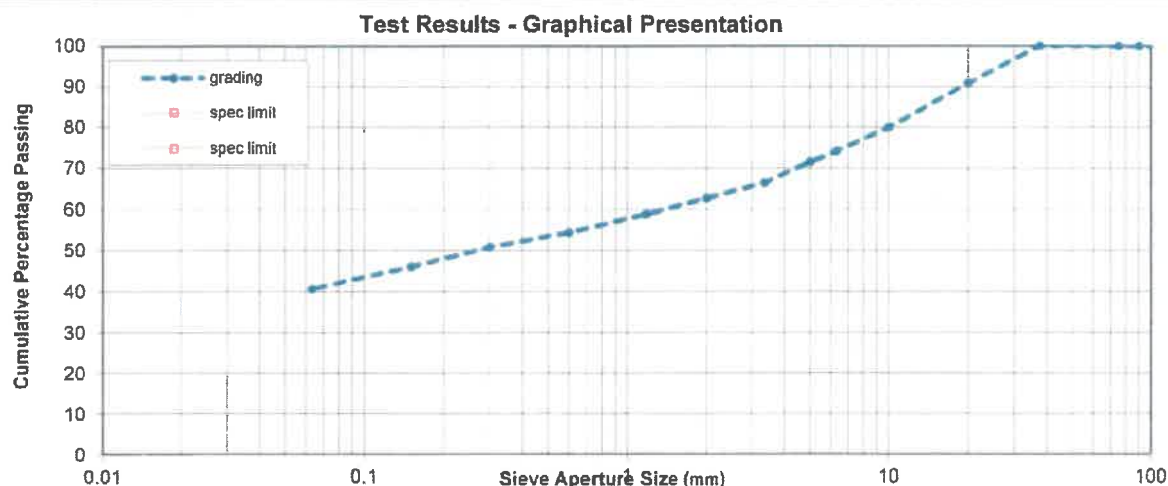
XTRATEC SAMPLE REF | XTE 31222
CUSTOMER/SITE SAMPLE REF | 339581

CLIENT | QTS Environmental Ltd
SITE | Clitheroe
TYPE OF MATERIAL | For Classification
SOIL DESCRIPTION | Brown silty clay with gravel
SPECIFICATION | For Classification
SUPPLIER/SOURCE | Site Won
SAMPLING LOCATION | BH3 @ 1.5m

SAMPLING METHOD | Unknown
SAMPLED BY | Client
TYPE OF SAMPLE | Bulk
DATE SAMPLED | Unknown
DATE RECEIVED | 12 June 2018
DATE TESTED | 15 June 2018
PREPARATION METHOD | BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS			
Sieve Size (mm)	Percent. Passing	Specified Limits (%)	
		lower	upper
125	100		
90	100		
75	100		
37.5	100		
20	91		
10	80		
6.3	74		
5	71		
3.35	66		
2	63		
1.18	59		
0.6	54		
0.3	51		
0.15	46		
0.063	40.6		

Moisture Content (%) | 9.6



REMARKS: A certificate of sampling is not available

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DATE: 21 June 2018

AUTHORISED BY: A Schofield Quality Manager

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Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
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TEST REPORT

Report No: **XTE 31223**
Page 1 of 1

TEST REPORT OF PLASTICITY INDEX

Method: BS 1377-2:1990 Method 4.4 Liquid Limit One Point
Method: BS 1377-2:1990 Method 5.3 Plastic Limit
Method: BS 1377-2:1990 Method 5.4 Plasticity Index

XTRATEC SAMPLE REF | XTE 31223
CUSTOMER/SITE SAMPLE REF | 339582

CLIENT | QTS Environmental Ltd
SITE | Clitheroe
SOIL DESCRIPTION | Brown sandy clay
SUPPLIER/SOURCE | Insitu
SAMPLING LOCATION | BH4 @ 1.5m

SAMPLED BY | Client
TYPE OF SAMPLE | Bulk
DATE SAMPLED | Unknown
DATE RECEIVED | 12 June 2018
DATE TESTED | 15 June 2018
PREPARATION METHOD | Tested by Wet Sieving

TEST RESULTS	
Percentage Retained 425um (%)	61
Liquid Limit	38
Plastic Limit	19
Plasticity Index	19

REMARKS:

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Maidstone
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Manager

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Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
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TEST REPORT

Report No:
Page 1 of 1

XTE 31223

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | XTE 31223
CUSTOMER/SITE SAMPLE REF | 339582

CLIENT	QTS Environmental Ltd
SITE	Clitheroe
TYPE OF MATERIAL	For Classification
SOIL DESCRIPTION	Brown sandy clay
SPECIFICATION	For Classification
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	BH4 @ 1.5m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	12 June 2018
DATE TESTED	15 June 2018
PREPARATION METHOD	BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS	
Moisture Content (%)	14.5

REMARKS:

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Manager

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TEST REPORT

Report No:
Page 1 of 1

XTE 31224

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | XTE 31224
CUSTOMER/SITE SAMPLE REF | 339583

CLIENT	QTS Environmental Ltd
SITE	Clitheroe
TYPE OF MATERIAL	For Classification
SOIL DESCRIPTION	Brown sandy clay
SPECIFICATION	For Classification
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	BH5 @ 1.2m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	12 June 2018
DATE TESTED	15 June 2018
PREPARATION METHOD	BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS	
Moisture Content (%)	11.3

REMARKS:

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Manager

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Rose Lane Industrial Estate
Lenham Heath
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TEST REPORT

Report No:
Page 1 of 1

XTE 31225

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | XTE 31225
CUSTOMER/SITE SAMPLE REF | 339584

CLIENT	QTS Environmental Ltd
SITE	Clitheroe
TYPE OF MATERIAL	For Classification
SOIL DESCRIPTION	Brown sandy clay
SPECIFICATION	For Classification
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	BH5 @ 2.0m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	12 June 2018
DATE TESTED	15 June 2018
PREPARATION METHOD	BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS	
Moisture Content (%)	14.7

REMARKS:

ISSUE TO: QTS Environmental Ltd
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DATE: 21 June 2018

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TEST REPORT

Report No:
Page 1 of 1

XTE 31226

TEST REPORT OF PLASTICITY INDEX

Method: BS 1377-2:1990 Method 4.4 Liquid Limit One Point
Method: BS 1377-2:1990 Method 5.3 Plastic Limit
Method: BS 1377-2:1990 Method 5.4 Plasticity Index

XTRATEC SAMPLE REF | XTE 31226
CUSTOMER/SITE SAMPLE REF | 339585

CLIENT | QTS Environmental Ltd
SITE | Clitheroe
SOIL DESCRIPTION | Brown sandy clay with gravel
SUPPLIER/SOURCE | Insitu
SAMPLING LOCATION | BH5 @ 3.5m

SAMPLED BY | Client
TYPE OF SAMPLE | Bulk
DATE SAMPLED | Unknown
DATE RECEIVED | 12 June 2018
DATE TESTED | 15 June 2018
PREPARATION METHOD | Tested by Wet Sieving

TEST RESULTS	
Percentage Retained 425um (%)	70
Liquid Limit	41
Plastic Limit	18
Plasticity Index	23

REMARKS:

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Manager

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Rose Lane Industrial Estate
Lenham Heath
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TEST REPORT

Report No:
Page 1 of 1

XTE 31227

TEST REPORT OF PLASTICITY INDEX

Method: BS 1377-2:1990 Method 4.4 Liquid Limit One Point
Method: BS 1377-2:1990 Method 5.3 Plastic Limit
Method: BS 1377-2:1990 Method 5.4 Plasticity Index

XTRATEC SAMPLE REF | XTE 31227
CUSTOMER/SITE SAMPLE REF | 339586

CLIENT | QTS Environmental Ltd
SITE | Clitheroe
SOIL DESCRIPTION | Brown sandy clay with gravel
SUPPLIER/SOURCE | Insitu
SAMPLING LOCATION | BH6 @ 1.4m

SAMPLED BY | Client
TYPE OF SAMPLE | Bulk
DATE SAMPLED | Unknown
DATE RECEIVED | 12 June 2018
DATE TESTED | 15 June 2018
PREPARATION METHOD | Tested by Wet Sieving

TEST RESULTS	
Percentage Retained 425um (%)	29
Liquid Limit	43
Plastic Limit	18
Plasticity Index	25

REMARKS:

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Manager

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TEST REPORT

Report No:
Page 1 of 1

XTE 31227

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | XTE 31227
CUSTOMER/SITE SAMPLE REF | 339586

CLIENT	QTS Environmental Ltd
SITE	Clitheroe
TYPE OF MATERIAL	For Classification
SOIL DESCRIPTION	Brown sandy clay with gravel
SPECIFICATION	For Classification
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	BH6 @ 1.4m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	12 June 2018
DATE TESTED	15 June 2018
PREPARATION METHOD	BS 1377-1. 7.3.5.2 (Sub dividing)

TEST RESULTS	
Moisture Content (%)	20.5

REMARKS:

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Maidstone
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DATE: 21 June 2018


AUTHORISED BY: A Schofield Quality
Manager



Tom Craig
Envirosolution Ltd
Suite 5
The Quay
No. 12 Princes Dock
Liverpool Waters
Liverpool
L3 1DL

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

DETS Report No: 18-76597

Site Reference: Clitheroe

Project / Job Ref: Johnson Matthey

Order No: ES110618

Sample Receipt Date: 12/06/2018

Sample Scheduled Date: 12/06/2018

Report Issue Number: 1

Reporting Date: 18/06/2018

Authorised by:

Russell Jarvis
Associate Director of Client Services

Authorised by:

Dave Ashworth
Deputy Quality Manager



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 18-76597	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Enviroolution Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Clitheroe	TP / BH No	BH2	BH2	BH2	BH4	BH5
Project / Job Ref: Johnson Matthey	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: ES110618	Depth (m)	1.00	3.00	6.00	1.50	0.90
Reporting Date: 18/06/2018	QTSE Sample No	339570	339571	339572	339573	339574

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.9	8.0	8.0	8.1	8.0
Total Sulphate as SO ₄	mg/kg	< 200	NONE	271	1106	649	231	278
Total Sulphate as SO ₄	%	< 0.02	NONE	0.03	0.11	0.06	0.02	0.03
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	58	127	85	36	27
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.06	0.13	0.08	0.04	0.03
Total Sulphur	%	< 0.02	NONE	0.02	0.47	0.41	0.03	< 0.02
Ammonium as NH ₄	mg/kg	< 0.5	NONE	3.5	4.9	4	6.8	3.3
Ammonium as NH ₄	mg/l	< 0.05	NONE	0.35	0.49	0.40	0.68	0.33
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	21	14	18	17	15
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	10.7	7.1	8.9	8.7	7.7
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	7	< 3	< 3	< 3	30
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	3.4	< 1.5	< 1.5	< 1.5	14.8
W/S Magnesium	mg/l	< 0.1	NONE	1.9	5.4	5.1	1.7	1.6

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Subcontracted analysis (S)



DETS Ltd
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Rose Lane
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Maidstone
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Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 18-76597	Date Sampled	None Supplied				
EnviroSolution Ltd	Time Sampled	None Supplied				
Site Reference: Clitheroe	TP / BH No	BH6				
Project / Job Ref: Johnson Matthey	Additional Refs	None Supplied				
Order No: ES110618	Depth (m)	0.10				
Reporting Date: 18/06/2018	QTSE Sample No	339575				

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	MCERTS	9.7			
Total Sulphate as SO ₄	mg/kg	< 200	NONE	1730			
Total Sulphate as SO ₄	%	< 0.02	NONE	0.17			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	214			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.21			
Total Sulphur	%	< 0.02	NONE	0.24			
Ammonium as NH ₄	mg/kg	< 0.5	NONE	2.6			
Ammonium as NH ₄	mg/l	< 0.05	NONE	0.26			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	47			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	23.6			
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	13			
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	6.4			
W/S Magnesium	mg/l	< 0.1	NONE	0.8			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
 Subcontracted analysis (S)



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Tel : 01622 850410



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 18-76597	
Enviroresolution Ltd	
Site Reference: Clitheroe	
Project / Job Ref: Johnson Matthey	
Order No: ES110618	
Reporting Date: 18/06/2018	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 339570	BH2	None Supplied	1.00	16.4	Brown sandy clay
^ 339571	BH2	None Supplied	3.00	4.8	Black sandy clay
^ 339572	BH2	None Supplied	6.00	15.6	Brown clay with stones
^ 339573	BH4	None Supplied	1.50	14.9	Brown sandy clay
^ 339574	BH5	None Supplied	0.90	18	Black sandy clay
^ 339575	BH6	None Supplied	0.10	2.4	Brown sandy clay with stones and concrete

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{L/S}

Unsuitable Sample ^{U/S}

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 18-76597

EnviroSolution Ltd

Site Reference: Clitheroe

Project / Job Ref: Johnson Matthey

Order No: ES110618

Reporting Date: 18/06/2018

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40, C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (all: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35, C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (all: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44, C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Appendix D – Monitoring Data

Appendix D - Gas Monitoring Data

		15/06/2018			21/06/2018			27/06/2018		
		BH3	BH4	BH5	BH3	BH4	BH5	BH3	BH4	BH5
Methane	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO2	%	0.0	0.9	2.2	0.0	0.9	1.7	0.0	2.5	3.3
Oxygen	%	20.4	17.0	17.6	20.8	16.1	17.9	20.9	11.7	15.1
H2S	ppm	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
CO	ppm	4.0	0.0	1.0	5.0	0.0	0.0	5.0	0.0	6.0
Flow	l/hr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Atm. Pres	mbar	1006	1007	1006	1017.0	1017.0	1017.0	1019.0	1019.0	1018.0

Appendix E – Tier 1 Risk Assessments

Tier 1 Human Health Risk Assessment - Soils

Determinand	Units	GAC	BH1 0.30m MG	BH1 0.50m Clay	BH2 0.30m MG	BH3 0.30m MG	BH3 0.50m Clay	BH4 0.25m MG	BH5 0.20m MG	BH5 0.50m Clay	BH6 0.30m MG
Inorganics	pH Units		8.5	8.3	8.14	8.42	7.97	7.84	8.47	8.07	10.6
Metals - (Solids)											
Arsenic	mg/kg	640	4.57	12.3	5	3.17	15.1	2.96	5.29	7.9	4.7
Cadmium	mg/kg	190	0.247	0.527	0.325	0.287	2.44	0.278	0.203	0.274	0.338
Chromium	mg/kg	8600	9.23	19.1	7.48	7.49	14.6	6.86	7.18	9.84	10.3
Copper	mg/kg	68000	17.6	25.6	12.1	10.5	30.9	10.9	13.8	20.3	22.6
Lead	mg/kg	0	11.8	22.8	20.6	10	38.8	13.3	9.45	14.3	14.4
Nickel	mg/kg	980	23.5	44.4	14.5	17.7	80	19.9	21.7	29.4	26.2
Zinc	mg/kg	730000	68.6	76.5	61	51.5	31.5	68.1	56.7	85.4	100
TPH Criteria Working Group (TPH CWG)											
Aliphatics >C5-C6	µg/kg	3200000	<10	<10	<10	<10	<10	<10	<10	<10	27.8
Aliphatics >C6-C8	µg/kg	7800000	<10	<10	<10	<10	<10	<10	<10	<10	27.8
Aliphatics >C8-C10	µg/kg	2000000	<10	<10	<10	<10	<10	<10	<10	<10	55.5
Aliphatics >C10-C12	µg/kg	9700000	<10	<10	<10	<10	<10	<10	<10	<10	23.3
Aliphatics >C12-C16	µg/kg	59000000	<10	<10	<10	<10	<10	<10	<10	<10	14.4
Aliphatics >C16-C21	µg/kg	1600000000	<100	<100	<100	1400	<100	<100	1130	<100	248
Aliphatics >C21-C35	µg/kg	1600000000	3130	<100	1450	1510	<100	911	1290	<100	4450
Aliphatics >C35-C44	µg/kg	15000	15000	<100	21100	5620	<100	14900	5160	2010	91100
Total Aliphatics >C12-C44	µg/kg	-	27400	<100	42100	8530	<100	27300	7570	2010	139000
Aromatics >EC5-EC7	µg/kg	26000000	27400	<100	42100	8530	<100	27300	7570	2010	139000
Aromatics >EC7-EC8	µg/kg	56000000	<10	<10	<10	13.5	<10	<10	11.5	<10	79.9
Aromatics >EC8-EC10	µg/kg	3500000	<10	<10	<10	10.4	<10	<10	10.5	<10	65.5
Aromatics >EC12-EC16	µg/kg	36000000	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >EC16-EC21	µg/kg	28000000	1030	<100	1160	<100	<100	815	1300	962	1020
Aromatics >EC21-EC35	µg/kg	3720	3720	<100	3500	2700	<100	3000	2690	1780	5190
Aromatics >EC35-EC44	µg/kg	28000000	23800	<100	34300	1030	<100	18100	<100	838	59900
Aromatics >EC40-EC44	µg/kg	28000000	23800	<100	34300	1030	<100	18100	<100	838	59900
Total Aromatics >EC12-EC44	µg/kg	-	10400	<100	15100	<100	<100	8110	<100	<100	25300
Total Aliphatics & Aromatics >C5-C44	µg/kg	-	55900	4410	72700	9680	<100	38600	6270	7210	150000
Semi-Volatile Organic Compounds (SVOCs)											
Dibenzofuran	µg/kg	-	<100	<100	<100	<100	<100	<100	105	<100	<100
bis(2-Ethylhexyl) phthalate	µg/kg	85000000	197	<100	<100	<100	<100	<100	<100	<100	<100
2-Methylnaphthalene	µg/kg	-	<100	<100	<100	<100	<100	104	136	<100	<100
Acenaphthene	µg/kg	8400000	<100	<100	<100	<100	<100	<100	105	<100	<100
Benzo(a)anthracene	µg/kg	170000	104	<100	<100	<100	<100	<100	<100	<100	<100
Benzo(b)fluoranthene	µg/kg	44000	135	<100	<100	<100	<100	<100	<100	<100	<100
Benzo(k)fluoranthene	µg/kg	1200000	124	<100	<100	<100	<100	<100	<100	<100	<100
Benzo(a)pyrene	µg/kg	35000	155	<100	<100	<100	<100	<100	<100	<100	<100
Benzo(g,h,i)perylene	µg/kg	3900000	145	<100	<100	<100	<100	<100	<100	<100	<100
Chrysene	µg/kg	350000	176	<100	117	<100	<100	<100	<100	<100	<100
Fluoranthene	µg/kg	23000000	259	<100	150	<100	<100	<100	115	<100	<100
Fluorene	µg/kg	63000000	<100	<100	<100	<100	<100	<100	461	204	<100
Indeno(1,2,3-cd)pyrene	µg/kg	500000	104	<100	<100	<100	<100	<100	136	<100	<100
Phenanthrene	µg/kg	22000000	207	<100	<100	<100	<100	<100	<100	<100	<100
Pyrene	µg/kg	54000000	259	<100	171	<100	<100	<100	681	334	<100

Tier 1 Human Health Risk Assessment - Controlled Waters

Determinand	Units	GAC	BH3	BH4	BH5
Inorganics					
pH	pH Units		7.65	7.69	7.71
Filtered (Dissolved) Metals					
Arsenic (diss.filt)	µg/l	10	<0.5	0.598	<0.5
Nickel (diss.filt)	µg/l	20	<0.4	3.64	1.85
Selenium (diss.filt)	µg/l	10	1.63	4.99	<1
Zinc (diss.filt)	µg/l	5000	1.71	2.76	1.58
Unfiltered (Total) Metals					
Hardness, Total as CaCO3 unfiltered	mg/l	-	4530	2470	5270
EPH (Extractable Petroleum Hydrocarbons)					
EPH Range >C10 - C40 (aq)	µg/l	-	166	971	2450
TPH Criteria Working Group (TPH CWG)					
Total EPH (C6-C40) (aq)	µg/l	10	166	971	2450
Semi-Volatile Organic Compounds (SVOCs)					
bis(2-Ethylhexyl) phthalate (aq)	µg/l	-	<2	<16	23.2
Fluoranthene (aq)	µg/l	-	<1	<8	12
Phenanthrene (aq)	µg/l	-	<1	<8	20.6

Notes

Only those substances that have been detected at concentrations above to LoD have been included in the table above.

GAC = UK Drinking Water Standards

GAC Exceedance

