GROUNDSMITHS
GEOTECHNICAL ENGINEERS

Site Investigation Report

HIGHSTONE LANE, WORSBROUGH, BARNSLEY

Project Ref: GUK-0925-01

GROUNDSMITHS
GEOTECHNICAL ENGINEERS

PROJECT:

Residential Development

REPORT REFERENCE:

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SITE REFERENCE:

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Worsbrough
Barnsley

CLIENT:

Mr M. Hague

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1 INTRODUCTION

1.1 Appointment

Groundsmiths (UK) Ltd ('Groundsmiths') were appointed by Mr M. Hague (the 'Client') % Demolition & Geotechnical Limited to provide general geo-environmental services in relation to the assessment of shallow depth ground conditions within the area of proposed development at land off Highstone Lane, Worsbrough, Barnsley (herein referred to as the 'Site').

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1.2 Report Context & Status

It is understood that the Client intends to build a single detached dwelling with associated access and soft landscaping. This Report presents the findings of a limited phase of intrusive ground investigation carried out to assess the general nature of the underlying ground conditions within and around the vicinity to where the dwelling is to be built.

Intrusive fieldwork was undertaken in general accordance with the requirements of BS 5930:2015+A1:2020 [1], BS 10175:2011+A2:2017 [2], BS EN 1997-1:2004+A1:2013 [3], BS EN 1997-2:2007 [4]. Laboratory testing was completed in accordance with all relevant guidance as indicated.

Interpretation and recommendations given in this Report should not be assumed valid for adjacent areas of land, or for alternate land use. Should the proposed Site usage change, the recommendations and conclusions presented in this Report will need to be re-assessed in accordance with all current guidance.

1.3 Limitations of Study

This Report has been compiled subject to the limitations detailed in Section 7 and any other limitations stated specifically in the text.

The individual strata depths and reduced levels recorded on the investigation logs are those from existing ground elevations. Topographical elevations, where given, are approximate as it is noted that level reduction has occurred across part of the Site and Groundsmiths are not in possession of current survey data.

2 INTRUSIVE SITE INVESTIGATION

2.1 Objectives

The overall objectives of the investigation were to:

- Assess the general ground conditions within the area of proposed development, including the thickness of any made ground deposits, the presence of any cohesive soils, the depth to groundwater (if present), and the depth to refusal (i.e. SPT N = 50) on competent underlying bedrock;
- Investigate the potential for any obstructions and/or excavation difficulties that may be encountered in construction;
- Determine the geotechnical parameters of the underlying natural strata via *in situ* testing and laboratory based analysis, and
- Identify the nature and concentration of any contamination within individual soil matrices as encountered, including sulphate analysis to assist with buried concrete design, and that associated with UKWIR for potable water supply pipes.

2.2 Scope of Investigation

The scope of works completed is summarised in Table 2.1, below. The locations of the exploratory holes completed are shown on the appended investigation positions plan, 0925-01-004.

Table 2.1 - Summary of Site-specific Ground Investigation Works

Element of Work	Date Completed	Investigation Positions	No. of Tests	Maximum Depth (m bgl)
Percussive boring with *in situ* testing and sample recovery	28th November 2025	BH1 – BH6	6	3.2

Strata descriptions of the soils encountered are in general compliance with BS EN ISO 14688-1:2002+A1:2013 [5], BS EN ISO 14688-2:2004+A1:2014 [6], and BS EN ISO 14689:2003 [7].

2.3 Testing

Environmental

Environmental sampling was undertaken for the purposes of collecting representative samples of the on-Site soils for laboratory analysis. The intention of the testing was to establish the

nature, concentration, and spatial distribution of any general contamination present within the individual soil matrices encountered.

Soil samples were recovered from within the following approximate depth range: Ground Level-0.5m bgl, 0.5-1.0m bgl, and then at 1.0m centres thereafter, or as ground conditions required/allowed. All environmental soil samples were collected in a combination of 500ml plastic tubs with sealable lids, 250ml glass amber jars and 60ml glass VOC jars. Care was taken to minimise cross contamination between sampling events.

Where analysis was scheduled, testing of all samples was undertaken at the premises of Construction Testing Solutions Ltd. The analytical strategy adopted for the investigation was designed to provide an overall assessment of contaminant concentrations within the identified soil matrices, taking account of the potential contaminants of concern indicated in the preliminary CSM. The testing of the following principal analytes was therefore undertaken:

- 6 No. CLEA standard suite for metals/metalloids (including As, Ba, Bo, Cd, Cr, Cu, Hg, Pb, Ni, Se, Zn) and Thiocyanate;
- 6 No. pH, Soil Organic Matter and Total Organic Carbon;
- 6 No. Total and Water Soluble Sulphate, Sulphide, Total Sulphur, and Total Potential Sulphate;
- 6 No. Speciated Polycyclic Aromatic Hydrocarbon;
- 3 No. Speciated Total Petroleum Hydrocarbon, Monoaromatics and Oxygenates;
- 3 No. VOC;
- 3 No. SVOC;
- 6 No. Electrical Conductivity & Redox Potential;
- 6 No. Asbestos identification, and
- 6 No. Monohydric Phenol (Total).

Geotechnical

With respect to the general material composition of the natural on-Site soils encountered, the following laboratory geotechnical tests were carried out:

- 8 No. Natural Water (Moisture) Content, and
- 8 No. Soil Classification (Atterberg Single Point) with percentage passing.

All laboratory testing was carried out in accordance with current British Standard guidance and/or other in-house procedure by Professional Soils Laboratory Limited ('PSL') [8-10].

In-situ standard penetration testing ('SPT') [11] was undertaken at 1.0m centres in all percussive boreholes to establish a general understanding of the ground strength with depth (to refusal) across the Site; refusal for SPT was taken to be where the penetration count N was equal to 50.

2.4 Proven Ground Conditions

NOTE: The account given herein is based on the ground conditions observed during the investigation only. It is important to note that there could be the potential for there to be lateral and/or vertical variation in the reported ground conditions between each of the investigation positions completed given the nature of the indicated Coal Measures deposits to be encountered at this Site. This should be allowed for at the detailed design-phase stage.

A generalised summary of the lithologies encountered is given in Table 2.2, below. For a full description of the ground conditions recorded at each investigation position, reference should be made to the individual borehole records provided in Appendix A.

Table 2.2 - Summary of General Soils Profile

Lithology	Typical Descriptions (not limited to)
Made Ground (Reconstituted Ground)	- None recorded.
Pennine Middel Coal Measures (Undifferentiated mudstone, siltstone, and sandstone with coal seams)	- Locally soft, stiff becoming very stiff yellow-brown-grey mottled thinly laminated CLAY with mudstone lithorelicts. Medium becoming high undrained shear strength. Intermediate plasticity; - Extremely weak light brown-grey clayey thinly laminated weathered MUDSTONE with lithorelicts. High undrained shear strength. Intermediate to low plasticity; - Shaley COAL (poor quality).

Made Ground

No made ground deposits were recorded within the area of investigation.

Coal Measures (including the Abdy Coal)

The underlying natural soils represent a typical weathered profile routinely observed in Coal Measures mudstone, siltstone, and sandstone deposits across the district.

Information obtained from the British Geological Survey ('BGS') indicates that the Abdy Coal ('Abdy') passes through the Site trending broadly north-west south-east. Notwithstanding some localised variation with spatial extent and depth, the underlying shallow-depth and undisturbed natural strata on the southern side of its crop (i.e boreholes BH1 and BH3) were noted to comprise stiff becoming very stiff thinly laminated clay with mudstone lithorelicts to a depth of c.1.0-1.3m bgl before the Abdy (shaley and of poor quality) was encountered.

In BH1 the coal was thin at 0.3m, whilst in BH3 refusal was recorded in it (so its thickness could not be confirmed).

On the northern side of the Abdy's crop (i.e. boreholes BH2, BH4, BH5 and BH6) the surficial soils typically comprised an upper horizon of stiff becoming very stiff thinly laminated clay before transitioning to become extremely weak becoming very weak laminated mudstone from a depth of about 2.0m bgl.

The Abdy Coal (again shaley and of poor quality) was proven beneath this in boreholes BH2, BH4, and BH6 (confirmed as being 1.0m thick in BH6) to 3.0m bgl, before mudstone was again recorded below. Borehole BH5 refused at shallow depth at the clay/mudstone interface at 1.0m bgl.

Groundwater

It may be reported that no groundwater was recorded in any of the boreholes. Seasonal variation due to fluctuations in groundwater levels should always be anticipated, although groundwater influx to shallow depth given the observed character of the underlying soils and the Site's geographic position is considered unlikely to occur.

3 GEOTECHNICAL TESTING & MATERIAL PROPERTIES

Test data obtained from the ground investigation works completed has been assessed in order to allow for the classification of the on-Site cohesive soils and to identify the presence of any typical ranges, trends, and/or anomalies as may exist. The following data is provided:

- Liquid and plastic limit (Atterberg) tests.
- Moisture content tests.
- Results of in situ standard penetration tests.

Classification Testing

Shrinkable soils such as clays are subject to changes in volume as their water (moisture) content increases or decreases, this being affected by seasonal change and/or other factors such as the water demand of trees. The resulting shrinkage or swelling of soil can cause subsidence or heave damage to foundations, the structures they support, and underground services.

Geotechnical laboratory index testing in conjunction with water content determination was carried out on representative samples of the Coal Measures deposits so that a basic assessment of the cohesive fraction could be established[1]. All tests to determine the water content, liquid limit, plastic limit, and the plasticity index of the soil samples recovered were performed by PSL. The results of the testing for the dataset are summarised in Table 3.1, below and overleaf, whilst a copy of the individual laboratory certification (Ref. PSL25/9462) is presented in Appendix B.

Table 3.1 - Summary of Natural Moisture Content and Atterberg Limits Results

Determinand	No. of Samples	Depth Range (m bgl)	Range (%) (*mean value*)	Comment
Water Content (W)	8	0.9 - 2.0	9.7 – 22.0* (*16.45*)	Typical range of values for weathered slightly gravelly Coal Measures cohesive deposits
Liquid Limit (wL)			30.0 – 62.0 (*51.2*)	
Plastic Limit (Wp)			19.0 – 27.0 (*23.7*)	
Plasticity Index (Ip)			11.0 – 36.0** (*27.5*)	

[1] The fine soil component represented by clay and silt and containing clay minerals (both alone and/or in mixture with coarser material) are typically classified according to their plasticity characteristics. This is determined by Atterberg Limits tests which are carried out on fine soils and any fine and medium sand particles to measure the liquid limit and plastic limit; this being in accordance with those methods prescribed in BS1377-2: 2022. The degree of plasticity of fine soils is classified using the following terms: non-plastic; low; intermediate, and high (after BS EN ISO 14688-2: 2017).

Determinand	No. of Samples	Depth Range (m bgl)	Range (%)	Comment
Passing 425µm test sieve	8	0.9 - 2.0	79 - 98	All samples contained lithorelicts

* Moisture content of the samples at the time they were received by the laboratory.
** Plasticity index as determined by the laboratory, not the modified plasticity index[2]

Consistency & Liquidity Indices

Field observations indicate that the clay and mudstone deposits exhibit variable albeit typically high undrained shear strengths. Correlation of the laboratory results in accordance with BS EN ISO 14688-2 to determine the Consistency Index (I_C) of the cohesive fraction for these has been undertaken, where:

$$I_c = (w_L - w) / I_p$$

I_C = Consistency Index; w_L = Liquid Limit; w = Water Content; I_p = Plasticity Index

A summary of the data is given in Table 3.2, below. It is cautioned that variation between sampling positions could likely occur given the nature of the soils and their state of weathering. The given classifications should, therefore, be assumed to be 'an approximation of strength' only.

Table 3.2 - Summary of Consistency Index Values for Clays and Silts

Sample	Depth (m bgl)	Water Content (%)	Liquid Limit (%)	Plasticity Index (%)	Consistency Index (I_C)*	General Field Observed Consistency
BH5-DS1	1.0	22	60	33	1.15	Very stiff
BH6-DS1	0.9	15	38	17	1.35	Very stiff
BH1-DS1	1.8	9.7	42	21	1.54	Extremely weak^
BH2-DS1	0.9	16.9	58	32	1.28	
BH2-DS2	1.8	18	61	36	1.19	
BH4-DS1	0.9	11.1	30	11	1.72	
BH4-DS2	1.5	17.7	59	34	1.21	
BH6-DS2	2.0	21.2	62	36	1.13	

FOR GUIDANCE ONLY:
* I_c: <0.25 = Very soft; 0.25 - 0.5 = Soft; 0.5 - 0.75 = Firm; 0.75 - 1.0 = Stiff; >1.0 = Very Stiff (BS EN ISO 14688-2:2017).
^ Laboratory index testing implies that the strata has weathered to clay. Comparison of data is not valid for rock. Field observations for the weathered mudstone samples are consistent with descriptions given in Table 25 of BS 5930:2015+A1:2020 and are therefore regarded, in terms of UCS, as being extremely weak to very weak (0.6-5.0MPa).

[2] In accordance with current guidance (e.g. NHBC Standards [12]) shrinkable soils may be classified as containing more than 35% fine particles and having a modified plasticity index of 10%, or greater. Soils which fall below 10% may be regarded as being non-plastic.

For comparison, soil classification was assessed in accordance with the Liquidity Index. This index is a measure of soil consistency and strength at a given water content, this being the numerical difference between the natural water content and the plastic limit (expressed as a percentage ratio of the plasticity index), where:

$$I_L = (w - w_p) / I_p$$

I_L = Liquidity Index; **w** = Water Content; w_p = Plastic Limit; I_p = Plasticity Index

A summary of the data is given in Table 3.3, below. As with the consistency data, the given classifications should be assumed to be 'an approximation of strength' only.

Table 3.3 - Summary of Liquidity Index Values of Clays & Silts

Sample	Depth (m bgl)	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (I_L)*
BH5-DS1	1.0	22	60	27	33	-0.15
BH6-DS1	0.9	15	38	21	17	-0.35
BH1-DS1	1.8	9.7	42	21	21	-0.54
BH2-DS1	0.9	16.9	58	26	32	-0.28
BH2-DS2	1.8	18	61	25	36	-0.19
BH4-DS1	0.9	11.1	30	19	11	-0.72
BH4-DS2	1.5	17.7	59	25	34	-0.21
BH6-DS2	2.0	21.2	62	26	36	-0.13

FOR GUIDANCE ONLY:

* Suggested parameters for Liquidity Index (I_L) comparison are given in Waltham, A.C. (2009) *Foundations of Engineering Geology: Third Edition* as: >0.5 = Soft; 0.2 - 0.5 = Firm; -0.1 - 0.2 = Stiff; -0.4 - -0.1 = Very Stiff; < -0.4 = Hard.

Volume Change Potential

The plasticity index results have been assessed in accordance with NHBC guidance. The Standards issued by the NHBC allow for an assessment of the index data so that a modified plasticity index (*I*'p) may be calculated; this is expressed as the plasticity index multiplied by the percentage of particles less than 425µm. The resultant Volume Change Potential (VCP) is expressed using the following terms: High, Intermediate, or Low.

For pure clay soils and other soils with 100% of particles less than 425µm the modified result will be the same, however, for mixed materials where gravelly clay soils are derived from weathered underlying bedrock material, such as mudstone or sandstone, the use of the modified plasticity index can often result in a more economic foundation design.

A summary of the VCP for the samples tested is given in Table 3.4, overleaf.

Table 3.4 - Summary of Volume Change Potential

Sample	Depth (m bgl)	Plasticity Index (%)	% Passing 425µm	I'_p*	Volume Change Potential
BH5-DS1	1.0	33	88	29.04	Intermediate
BH6-DS1	0.9	17	97	16.49	Low
BH1-DS1	1.8	21	96	20.16	Intermediate
BH2-DS1	0.9	32	94	30.08	Intermediate
BH2-DS2	1.8	36	95	34.20	Intermediate
BH4-DS1	0.9	11	79	8.69	Non-plastic
BH4-DS2	1.5	34	93	31.62	Intermediate
BH6-DS2	2.0	36	98	35.28	Intermediate

FOR GUIDANCE ONLY:
* <10% = Non-plastic. 10-19% = Low. 20-39% = Intermediate. 40% & greater = High (after NHBC: 2024).

The result of the VCP assessment indicate that the underlying cohesive soils have a generally intermediate plasticity, but for there to be some non-plastic and low plasticity materials present also. The highest reported VCP should be adopted in construction where foundations lie within influencing distance of existing, removed, or proposed trees and planting.

In Situ Standard Penetration Testing

Standard Penetration Testing ('SPT') was carried out in each of the percussive boreholes to obtain and understanding of the general strength profile of the underlying soils with increasing depth. All (uncorrected) penetration data is presented on the individual borehole records in Appendix A, whilst a graphical representation of the data, presented as 'step diagrams', is also provided.

The SPT test has become one of the most frequently used *in situ* ground investigation tools to determine density and aid in the assessment of the strength profile of granular containing deposits, weak rocks, and fine (cohesive) soils. There has been much debate (e.g. Stroud [13], Stroud & Butler [14], Charles [15], and Tomlinson [16]) over the use of such data however, with research dating back to the mid 1970's where Stroud investigated and established that there was a simple relationship between the SPT N value collected in the field, undrained shear strength (c_u), and the plasticity index (Ip) of cohesive overconsolidated soils, amongst other parameters. The outcome of that assessment is indicated in Figure 1, overleaf.

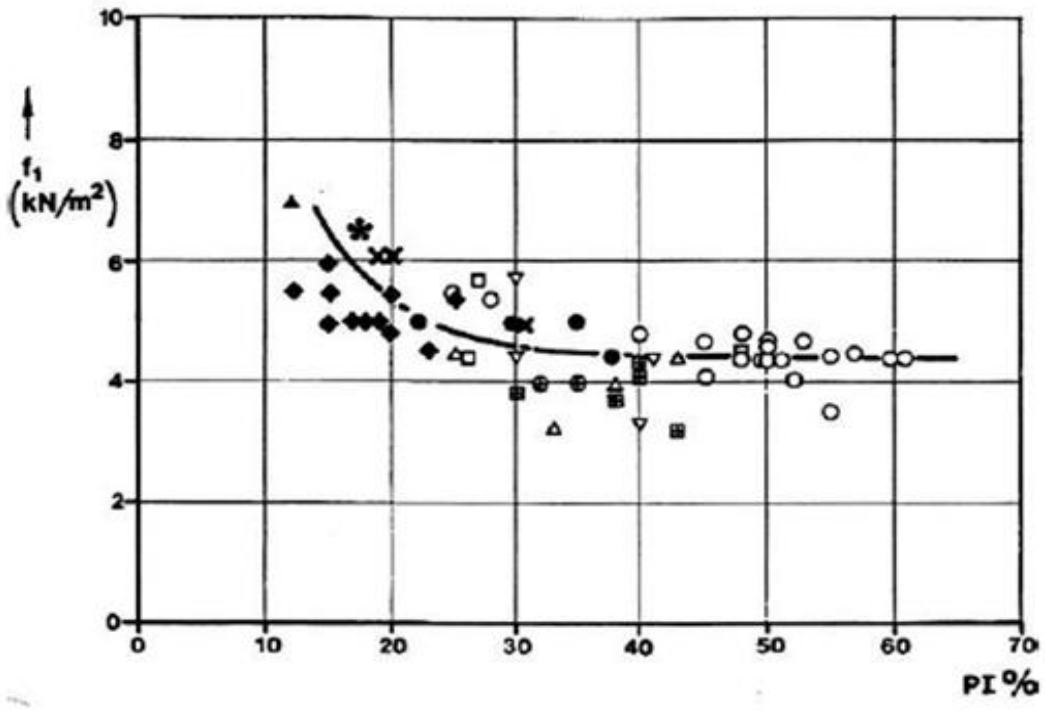


Figure 1 – Relationship between mass shear strength, plasticity and SPT (after Stroud, 1975)

In reviewing the various research articles and publications that sought to further knowledge of this matter, it is evident that it became the norm to adopt a 'rule of thumb' approach, based on the Stroud data, when seeking to estimate undrained shear strength values for cohesive soils from SPT N data. Although various empirical relationships have since been postulated, the general approach has been to multiply N by an independent factor, or f_1 value as it was characterised, so that undrained shear strength may be determined as $c_u = f_1 \times N$. The f_1 value to be adopted is widely reported to be 5.0 (as kN/m^2).

In providing brief commentary on the SPT data collected for this Site, N values measured during the investigation at each of the incremental test depths that were achieved ranged between: 16 and 50 at 1.0m bgl (average = 28.7), 30 and 50 at 2.0m bgl (average = 45.0) and 50 at 3.0m bgl (average = 50). Further advancement of the boreholes when refusal at SPT N = 50 was achieved was not possible due to the penetration resistance encountered (in either clay, mudstone, or the Abdy Coal).

Given the thickness of the deposits in which SPT measurement could be made, the data is somewhat limited. However, the SPT N counts in all instances are high, with refusal at N = 50 being recorded at relatively shallow depths in each instance. An indication of the estimated undrained shear strength (c_u) of the underlying soils, based on the measured N values and in using the above cited Stroud correlation and an f_1 value of 5, is given in Table 3.5, overleaf.

Table 3.5 - Summary of Estimated Undrained Shear Strength

Investigation Position	Depth (m bgl)	SPT 'N' ^*	Estimated Undrained Strength (c_u) from SPT^^ (kPa)
BH1	1.0	16	80.0
BH1	2.0	50	250
BH2	1.0	20	100
BH2	2.0	50	250
BH3	1.0	50	250
BH4	1.0	16	80.0
BH4	2.0	50	250
BH5	1.0	50	250
BH6	1.0	20	100
BH6	2.0	30	150
BH6	3.0	50	250

FOR GUIDANCE ONLY:
^* Uncorrected numerical in situ SPT 'N' value recorded in the field;
^^ Estimated shear strength is based on the Stroud Correlation, conservatively assuming $c_u = f_1$ x uncorrected SPT (N) where f_1 is 5.0.

Overall, it is considered however that some caution should be applied when using SPT data given the variation in the character of the soils encountered and the variability/uncertainty in the bearing capacities they offer.

Data should therefore be assessed within the context of all other Site-based observations, laboratory plasticity data, predicted settlement characteristics, and in relation to the development proposals (e.g. line loads that need to be achieved).

4 ENVIRONMENTAL TESTING

4.1 Preamble

A selection of representative disturbed samples of the underlying natural strata were selected for laboratory chemical analysis. These samples were analysed for the suite of contaminants outlined in Section 2.3 above. A summary of the pertinent test results is given in the following tables, whilst a copy of the individual certification (Ref. L25/13372/GRS – 25-94747) is presented in full in Appendix C.

There are no apparent contaminated land conditions which need to be satisfied from a planning perspective, so general assessment of the appended data in relation to the Site's use and its end users has not been undertaken. The following sections provide, however, an assessment of the data with respect to general construction requirements, namely the nature of new buried concrete products and potable water supply pipes to be adopted.

4.2 Contamination & Performance of Cementitious Products

Natural strata samples were analysed for general inorganics including water soluble sulphate so that an assessment of risk could be made in relation to those guidelines prescribed in BRE Special Digest 1 [17]. A copy of the laboratory test certification is presented in Appendix C, whilst a summary of the dataset is given in Table 4.1, below.

Table 4.1 - Summary of Sulphate & Sulphide Concentrations

Analytical Parameter	Units	Allowable Concentration	Concentration Range
pH	pH units	<5	5.2 - 7.3
Total Sulphate (as SO_4)	mg/kg	2,400	<100 - 400
Water Soluble Sulphate (as SO_4)	g/l (mg/l)	0.5 (500)	0.017 (17) – 0.051 (51)
Total Potential Sulphate (TPS)	%	0.24^	0.04 - 0.09
Sulphide	mg/kg	-	<15
Total Sulphur	%	-	0.01 - 0.03

(dl) – laboratory detection limit.
^ This refers to the upper DS-1 TPS value and is applicable only to locations where concrete will be exposed to sulphate ions, which may result from the oxidation of sulphides such as pyrite following ground disturbance (e.g. within colliery spoil materials, opencast back fill etc). There is no evidence to suggest that such conditions prevail at the subject Site.

A qualitative assessment of the data was carried out in accordance with Sections C4 and C5 of BRE SD1, to assess whether the soil conditions at the Site would be aggressive to any new buried concrete products. In accordance with Table C2 of BRE SD1 and assuming a worst case water soluble sulphate concentration (based on a 2:1 water/soil extract) of 51.0mg/l, a Design Sulphate Classification of DS1 and an ACEC of AC-1s is indicated. This is based on classification

for a brownfield location having a static groundwater regime at pH >2.5 and a TPS of <0.24%. Risk from Oxidisable Sulphide would not be expected on the basis of the observed geology and the measured sulphate concentrations.

4.3 UKWIR

UK Water Industry Research ('UKWIR') [18] published guidance in relation to the selection of appropriate water supply pipes to be laid at brownfield sites. This guidance supersedes the Water Regulations Advisory Scheme ('WRAS') Information and Guidance Note 9-04-03 "Laying Pipes in Contaminated Land", which has been withdrawn.

In general accordance with the testing requirements of the UKWIR guidance, analysis of numerous representative samples of the underlying natural strata were recovered from depths between 0.5m bgl and 2.0m bgl[3]. Notwithstanding the general suite chemical testing as completed, testing for UKWIR comprised those determinands summarised in Table 4.2, below and overleaf [NOTE: *Given that not all contaminants assessed under UKWIR were assumed to be present, not all determinands have values that may be assigned to them*].

Table 4.2 - Summary of UKWIR Contaminant Data

Determinand	PE Threshold (mg/kg)	Laboratory Limit of Detection	Concentration Range (mg/kg)
Total VOC	0.5	0.005	<dl - 0.01
Total BTEX and MTBE	0.1	0.005	<dl
Total SVOC (excluding PAH)	2.0	Variable	<dl
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2.0	Variable	<dl
EC10-EC16 Aliphatic and Aromatic Hydrocarbons	10.0	1 (EC10-12) 2 (EC12-16)	< dl - 1.4 <dl - 2.2
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	8 (EC16-35 Aliphatic) 10 (EC16-35 Aromatic)	3.4 - 7.5 <2.0 - 3.7
Phenol (from SVOC)	2.0	0.2	<dl
Cresols and Chlorinated Phenol (from SVOC)**	2.0	0.1-0.3	<dl

Table Contd./

[3] UKWIR guidance states that water pipes are normally laid between 0.75m and 1.35m from finished ground level to crown of pipe. Samples taken for testing shall represent a) the soil in which the pipes are to be laid, and b) those to at least 500mm below the underside of the proposed pipes. Where proposed pipe depths are unknown at the time of investigation, soil samples representative of the ground conditions between surface level and 1.5m below finished ground level shall be taken as a minimum.

Determinand	PE Threshold (mg/kg)	Laboratory Limit of Detection	Concentration Range (mg/kg)
Ethers	0.5	Variable	-
Nitrobenzene	0.5	0.3	<dl
Ketones	0.5	-	-
Aldehydes	0.5	-	-
Corrosiveness^^ (Electrical conductivity, redox potential (Eh) and pH)	Conductivity (µS/cm)	10	32 - 74
	Redox (mV)	-800	184 - 256
	pH (pH units)	No LoD	5.2 - 7.3

<dl – Laboratory limit of detection.

**Sum of 2-Chlorophenol, 2-Methylphenol, 4-Methylphenol, 2-Nitrophenol, 2,4-Dimethylphenol, 2,4-Dichlorophenol, 4-Chloro-3-Methylphenol, 2,4,6-Trichlorophenol and 2,4,5-Trichlorophenol.

^^For wrapped steel (ground is corrosive if pH is <7 and conductivity is >400µS/cm); for wrapped ductile iron (ground is corrosive if pH is <5, redox is not neutral and conductivity is >400µS/cm); for copper (ground is corrosive if pH is <5 or >8 and redox is positive).

5 RECOMMENDATIONS

5.1 Construction – Risk Evaluation

Sulphate Attack

A Design Sulphate Classification of DS1 is indicated on the basis of the laboratory data, with the Aggressive Chemical Environment Class being AC-1s.

There was no evidence of gypsum crystals, red-brown ferric oxide, or yellow-brown hydrated ferric oxide on any of the soils encountered. The potential for new in-ground concrete products to be exposed to sulphate ions within the underlying natural strata would not therefore be expected. Consultation should be made with the Designing Engineer, however, with respect to the final concrete mix to be adopted.

Potable Water Supplies

Water providers are required to maintain the safety of staff, contractors, and customers. On this basis, water providers work with a range of trigger values when laying mains pipes or services in contaminated or potentially contaminated ground, in the same way that assessment is made by contaminated land practitioners.

Testing to full UKWIR was not considered necessary on the basis of the expectant source-pathway-receptor linkages, although a broad spectrum of testing in addition to redox/electrical conductivity, and pH determination has been completed to assess the contaminative status of the Site. On the basis of the available data and the brownfield nature of the Site, it is considered that standard PE pipework should be suitable, and measures compliant with BS8588:2017 [19] (e.g. Protecta-Line) would not be required.

It is recommended that the results of the chemical testing and details of the development proposals are provided to the utility company for their comment, prior to installation of any pipework.

Stress Relief

Risk associated with stress relief is considered to be low.

Anticipated Foundation Type

It should be noted that it was the intention of the works reported herein to confirm the geotechnical condition of the underlying soils, not to specify the actual foundations that are to be adopted. Such decisions are to be made following further discussion with the Designing Engineer, taking account of the ground conditions, their strength profile and characteristics, and where other pertinent factors (such as any nearby trees and Abdy Coal) have a direct influence on the choice of foundation that can be used. That said, the nature and observed condition of the underlying Coal Measures soils would suggest that traditional reinforced spread foundations should be suitable, subject to finished development levels and there being

no other influencing factors. If other factors rule out the use of spread foundations, then a pile and ground-beam arrangement would likely be required; the ground and laboratory data provided herein would have been needed to facilitate a piled foundation design anyway as the depth to competent strata and the plasticity of the soils would have needed to be known.

All foundations will need to be taken down through any unsuitable material(s) to be founded at the correct depth(s) on undisturbed natural strata of sufficient load carrying capacity.

If spread foundations can be used, given that variation in the nature and condition of the underlying soils has been recorded, it is anticipated that they could likely end up straddling strata of varying type. This could lead to the occurrence of some small differential settlement, which will need to be accounted for in design (e.g. via widening, thickening, deepening and/or providing additional reinforcement). It would be advisable for a bearing capacity assessment to also be completed by the Designing Engineer during the foundation design stage to ensure that the serviceability limit state of the structure is not compromised. Although considered to be a low risk, this should take account the amount of total and/or differential settlement that could potentially occur.

Piled foundations should be designed to insulate the supported structure from any potential ground movement and to withstand any additional loading and down-drag (i.e. negative skin friction) in addition to any uplift forces that may be generated from movement within the surrounding ground. Independent field tests should be completed by a piling contractor to confirm production parameters, load/compressive strength tests, and pile diameters. Pre-drilling may be required to facilitate pile installation.

Ground Slab

To be confirmed with the Designing Engineer, subject to the foundation solution to be adopted.

Heave Precautions

The geotechnical test results indicate that the on-Site cohesive soils have a worst-case intermediate Volume Change Potential ('VCP') when assessed in accordance with the Modified Plasticity Index.

Precautions in construction would need to be taken where foundations lie within influencing distance of existing, removed, and/or proposed planting and trees when in cohesive soils (as defined by NHBC Standards, Chapter 4.2) or where seasonally desiccated soils are present at the time of construction. Further consultation should be made with the Designing Engineer to ensure that the correct level of protection is provided, with this being in conjunction with the foundation solution(s) to be adopted. A tree survey will be required to assist with this.

Slopes

Global slope stability problems are not expected. However, due consideration to potential problems associated with adjacent land impacting on the Site should always be made.

The general instability of loose and/or weathered soils should be expected during the works, particularly during prolonged periods of wet weather and/or where excavations are left open for protracted periods. Excavations, particularly where very weak highly weathered soils are encountered, will need to be undertaken with care as it would be expected for these soils to fracture further and deteriorate. Such disturbance will also affect the stiffness and strength of these soils, which in turn will affect earth pressures.

Obstructions & Excavation

In-ground obstructions were not encountered during the ground investigation.

Where deep excavations are required (e.g. for foul water service connections), however, it should be noted that some difficulty could potentially be encountered given the presence of very stiff clays and mudstone at shallow depth. Machinery of sufficient size and strength should therefore be allowed for.

No entry into any unsupported excavations shall be allowed without an appropriate risk assessment. All excavation works shall be carried out in accordance with current HSE guidance, 'Structural Stability During Excavation' [20].

Superstructure Precautions

The need for superstructure precaution, such as masonry reinforcement, is not anticipated, although further consultation should be made with the Designing Engineer as required.

Surface Water Drainage

It is considered that the use of soakaways [21] for the discharge of surface water would not be possible in development given that the Site is underlain by stiff clays and mudstone which will have negligible infiltration potential. Further consultation with a specialist drainage consultant should be made as required, although at this stage it is anticipated that a piped connection will need to be implemented.

All drainage proposals will be subject to obtaining the necessary approvals from the Regulatory Authorities.

Pavement

The design of the driveway area in development will need to be such that it allows for the effects of any soft underlying materials and for the potential reduction in the strength of any replacement material to its long-term CBR value. A minimum permitted design CBR of 2.5% should be allowed for at this stage, given the observed condition and anticipated load carrying capabilities of the underlying soils.

6 INFORMATION SOURCES

The following references have been cited in the production of this report:

1 BS 5930 (2015+A1:2020). Code of Practice for Ground Investigations

2 BS 10175 (2011+A2:2017). Investigation of Potentially Contaminated Sites. Code of practice

3 BS EN 1997-1 (2004+A1:2013). Eurocode 7. Geotechnical Design. General Rules.

4 BS EN 1997-2 (2007). Eurocode 7. Geotechnical Design. Ground Investigation and Testing.

5 BS EN ISO 14688-1 (2002+A1:2013). Geotechnical Investigation and Testing — Identification and Classification of Soil — Part 1: Identification and Description.

6 BS EN ISO 14688-2 (2017). Geotechnical Investigation and Testing. Identification and Classification of Soil. Principles for a Classification.

7 BS EN ISO 14689 (2003). Geotechnical Investigation and Testing. Identification, Description and Classification of Rock. Part 1: Identification and Description.

8 BS 1377-2 (2022). Methods of Test for Soils for Civil Engineering Purposes. Part 2: Classification Tests and Determination of Geotechnical Properties.

9 BS EN ISO 17892-1 (2014+A1:2022). Geotechnical Investigation and Testing – Laboratory Testing of Soil. Part 1: Determination of Water Content.

10 BS EN ISO 17892-12 (2018+A2:2022). Geotechnical Investigation and Testing – Laboratory Testing of Soil. Part 12: Liquid and Plastic Limits.

11 BS EN ISO 22476-3 (2005+A1:2011). Geotechnical Investigation and Testing – Field Testing. Part 3: Standard Penetration Test (SPT).

12 NHBC (2019). Technical Standards.

13 Stroud, M.A (1974). The Standard Penetration Test in Insensitive Clays and Soft Rocks. In, Proceedings of the European Symposium on Penetration Testing, Stockholm, pp 367-375.

14 Stroud, M.A. and Butler, F.G. (1975). The Standard Penetration Test and the Engineering Properties of Glacial Materials. In, Proceedings of the Symposium of Glacial Materials, University of Birmingham, April.

15 Charles, J.A. (2005). Geotechnics for Building Professionals. Watford. British Research Establishment.

16 Tomlinson, M.J. (2001). Foundation Design and Construction. 7th Edition. Pearson Prentice Hall, pp 11.

17 BRE Special Digest 1, Third Edition (2005). Concrete in Aggressive Ground.

18 UKWIR (2011). Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. Ref. 10/WM/03/21).

19 BS8588 (2017). Polyethylene pressure pipe with an aluminium barrier layer and associated fittings for potable water supply in contaminated land – Specification. February.

20 HSE (2020). https:// www.hse.gov.uk/construction/safetytopics/excavations.htm.

21 Building Research Establishment (2003). Digest 365, Soakaway Design.

7 REPORTING LIMITS

The findings and opinions provided in this Report are given in good faith and are subject to the limitations and constraints imposed by the methods and information sources described.

Factual information contained within the Report has been obtained from a variety of sources. Where third party data has been used, Groundsmiths assumes that this is reliable but cannot independently confirm this as the validity and accuracy of this information is outside our control. No guarantee can therefore be given as to the completeness of the information gathered during the study and no responsibility is accepted for errors or omissions in the third party information used. Groundsmiths' professional judgement and experience is however used to ensure that uncertainties are reduced to a level appropriate to the site conditions, the purpose of the assessment and the resources devoted to it by the Client.

Whilst every effort has been made to carry out an assessment that enables a realistic characterisation of the environmental and geotechnical parameters to be identified, the likelihood of variation in actual ground and groundwater conditions between investigation positions cannot be discounted. The findings and opinions presented in this Report are relevant to the time this assessment was undertaken but should not necessarily be relied upon to represent conditions at a substantially later date. Further information, supplementary ground investigation, construction activities, change of site use, or the passage of time may reveal conditions that were not indicated in the data presented herein and therefore could not have been considered in the preparation of this Report. Where such information might impact upon stated opinions, Groundsmiths reserve the right to modify the opinions expressed in this Report.

Where opinions expressed in this Report are based on current available guidelines and legislation, no liability can be accepted for the effects of any future changes to such guidelines and legislation. New information or improved practices and changes in legislation may require reinterpretation of the Report as a whole, or in part.

The recommendations presented in this Report are based on the site-specific assessment but utilising third party-provided information as appropriate. They are, however, limited to those that could be reasonably made at the time the assessment was undertaken. Where assessments of site areas affected in particular ways are given, these are approximate.

This Report does not constitute an archaeological, ecological, arboriculturalist / invasive plant species or UXO survey. Any comment given in relation to these is for information only. Further assessments to assess these may be required as part of any planning condition and should therefore be undertaken by suitably qualified experts as required.

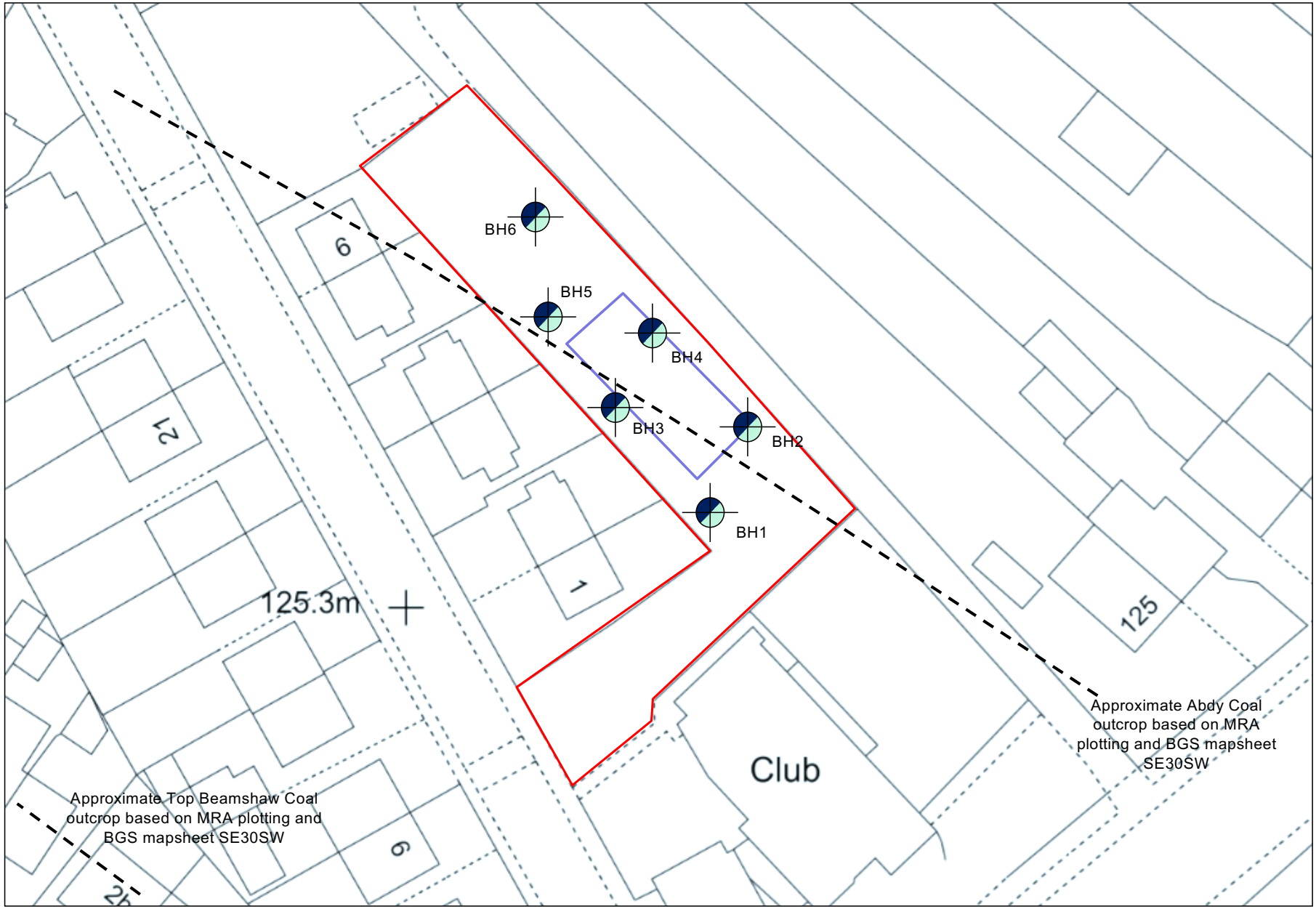
Groundsmiths reserve the right to edit and / or retract any conclusion or recommendation made in this Report should any further information, with respect to the Site, become available.

Groundsmiths disclaim any obligation to update the Report for events taking place after the time during which the assessment was carried out.

Groundsmiths accept no responsibility if any findings given in this Report are not implemented by the Client.

Groundsmiths accept no responsibility if any further works, as requested by the Local Planning Authority or other such body in the discharge of their duty of care, are not implemented by the Client.

FIGURES & DRAWINGS



Project: Highstone Lane, Worsbrough		Client: Mr M. Hague	
Drawing: Investigation Location Plan		Drawn/Checked: AJS	GROUNDSMITHS GEOTECHNICAL ENGINEERS
Project No: 0925-01	Drawing No: 004	Date: Dec. 2025	

APPENDIX A

Ground Investigation Records

GROUNDSMITHS
GEOTECHNICAL ENGINEERS

PERCUSSIVE SAMPLER BOREHOLE RECORD

BH1

Sheet 1 of 1

Project: Residential Development	**Project No:** GUK-0925-01	**Approx. Coordinates:** 434836, 404542	
Location: Highstone Lane, Worsbrough		**Approx. Level:** 127.20 mAOD	**Plant** 110
Client: Mr M. Hague		**Date:** 28/11/2025	**Logged By** AS

Well	Water (m bgl)	Samples & Field Testing: Depth (m)		Type	SPT (N)	Water Content & Plasticity Indices*: Water Content (%)	Liquid Limit (wL)	Plasticity Index (Ip)	Plastic Limit (Wp)	Depth (m bgl)	Level (mAOD)	Stratum Description
										0.0-1.3	127.20	Stiff becoming very stiff yellow-brown-grey mottled thinly laminated CLAY with mudstone lithorelicts. Medium becoming high undrained shear strength. Intermediate plasticity (COAL MEASURES).
		1.0			2,1 - 2,3,5,6 (16)							
										1.3-1.6	125.90	Shaley COAL. Poor quality (COAL MEASURES).
										1.6-2.0	125.60	Extremely weak light brown-grey clayey thinly laminated weathered MUDSTONE with lithorelicts. High undrained shear strength. Intermediate plasticity (COAL MEASURES).
		1.8		DS1		9.7	42	21	21			
		2.0	2.0	ES1	20,30 - 50/16mm (50)							Borehole complete at 2.0m bgl

Boring Progress and Water Observations

Date	Water Depth	Casing Depth	Casing Dia. mm
	none	-	-

Chiselling From	To	Hours

General Remarks

ES - Environmental Sample
D - Small Disturbed Sample
B - Large Disturbed Sample

Strength and/or plasticity denoted indicate field observations only

SPT 'N' is uncorrected

*Plasticity data is non-modified

GROUNDSMITHS
GEOTECHNICAL ENGINEERS

PERCUSSIVE SAMPLER BOREHOLE RECORD

BH2

Sheet 1 of 1

Project: Residential Development	**Project No:** GUK-0925-01	**Approx. Coordinates:** 434840, 404549	
Location: Highstone Lane, Worsbrough		**Approx. Level:** 127.20 mAOD	**Plant** 110
Client: Mr M. Hague		**Date:** 28/11/2025	**Logged By** AS

Well	Water (m bgl)	Samples & Field Testing: Depth (m)		Type	SPT (N)	Water Content & Plasticity Indices*: Water Content (%)	Liquid Limit (wL)	Plasticity Index (Ip)	Plastic Limit (Wp)	Depth (m bgl)	Level (mAOD)	Stratum Description
										0.0-0.5	127.20	Stiff yellow-grey-brown mottled thinly laminated CLAY with sandstone fragments. Medium to high undrained shear strength. Intermediate plasticity (COAL MEASURES).
		0.5								0.5-1.8	126.70	Extremely weak becoming weak brown-grey slightly clayey thinly laminated weathered MUDSTONE with lithorelicts. High undrained shear strength. Intermediate plasticity (COAL MEASURES).
		1.0	0.9	DS1	3,3 - 5,5,4,6 (20)	16.9	58	32	26			
		1.5	1.5	ES1								
			1.8	DS2		18	61	36	25	1.8-2.0	125.40	
		2.0			18,22 - 24,26/55mm (50)							Shaley COAL. Poor quality (COAL MEASURES).
												Borehole complete at 2.0m bgl
		2.5										
		3.0										
		3.5										
		4.0										
		4.5										
		5.0										
		5.5										
		6.0										
		6.5										
		7.0										

Boring Progress and Water Observations

Date	Water Depth	Casing Depth	Casing Dia. mm
	none	-	-

Chiselling From	To	Hours

General Remarks

ES - Environmental Sample
D - Small Disturbed Sample
B - Large Disturbed Sample

Strength and/or plasticity denoted indicate field observations only

SPT 'N' is uncorrected

*Plasticity data is non-modified

GROUNDSMITHS
GEOTECHNICAL ENGINEERS

PERCUSSIVE SAMPLER BOREHOLE RECORD

BH3

Sheet 1 of 1

Project: Residential Development	**Project No:** GUK-0925-01	**Approx. Coordinates:** 434828, 404551	
Location: Highstone Lane, Worsbrough		**Approx. Level:** 127.20 mAOD	**Plant** 110
Client: Mr M. Hague		**Date:** 28/11/2025	**Logged By** AS

Well	Water (m bgl)	Samples & Field Testing: Depth (m)	Type	SPT (N)	Water Content & Plasticity Indices*: Water Content (%)	Liquid Limit (wL)	Plasticity Index (Ip)	Plastic Limit (Wp)	Depth (m bgl)	Level (mAOD)	Stratum Description
		0.2	ES1						0.3-1.0	127.20	Very stiff grey-brown mottled thinly laminated CLAY with angular sandstone fragments. High undrained shear strength. Intermediate plasticity (COAL MEASURES).
		0.8	DS1								
		1.0		2,5 - 6,7,16,21 (50)					1.0	126.20	Shaley COAL. Poor quality (COAL MEASURES).
											Borehole complete at 1.0m bgl

Boring Progress and Water Observations

Date	Water Depth	Casing Depth	Casing Dia. mm
	none	-	-

Chiselling From	To	Hours

General Remarks

ES - Environmental Sample
D - Small Disturbed Sample
B - Large Disturbed Sample

Strength and/or plasticity denoted indicate field observations only

SPT 'N' is uncorrected

*Plasticity data is non-modified

GROUNDSMITHS
GEOTECHNICAL ENGINEERS

PERCUSSIVE SAMPLER BOREHOLE RECORD

BH4

Sheet 1 of 1

Project: Residential Development	**Project No:** GUK-0925-01	**Approx. Coordinates:** 434831, 404559	
Location: Highstone Lane, Worsbrough		**Approx. Level:** 127.20 mAOD	**Plant** 110
Client: Mr M. Hague		**Date:** 28/11/2025	**Logged By** AS

Well	Water (m bgl)	Samples & Field Testing: Depth (m)		Type	SPT (N)	Water Content & Plasticity Indices*: Water Content (%)	Liquid Limit (wL)	Plasticity Index (Ip)	Plastic Limit (Wp)	Depth (m bgl)	Level (mAOD)	Stratum Description
		0.5	0.5	ES1						0.0-1.0	127.20	Stiff becoming very stiff yellow-brown-grey mottled thinly laminated CLAY with mudstone lithorelicts. Medium becoming high undrained shear strength. Non-plastic (COAL MEASURES).
		0.9		DS1		11.1	30	11	19			
		1.0			2,3 - 4,4,4,4 (16)					1.0-2.0	126.20	Very weak brown-grey slightly clayey thinly laminated weathered MUDSTONE with lithorelicts. High undrained shear strength. Intermediate plasticity (COAL MEASURES).
		1.5	1.5	DS2		17.7	59	34	25			
			1.5	ES2								
		2.0			10,15 - 15,20,15 (50)					2.0	125.20	Shaley COAL. Poor quality (COAL MEASURES).
												Borehole complete at 2.0m bgl
		2.5										
		3.0										
		3.5										
		4.0										
		4.5										
		5.0										
		5.5										
		6.0										
		6.5										
		7.0										

Boring Progress and Water Observations

Date	Water Depth	Casing Depth	Casing Dia. mm	Chiselling From	Chiselling To	Chiselling Hours
	none	-	-			

General Remarks

ES - Environmental Sample
D - Small Disturbed Sample
B - Large Disturbed Sample

Strength and/or plasticity denoted indicate field observations only

SPT 'N' is uncorrected

*Plasticity data is non-modified

GROUNDSMITHS
GEOTECHNICAL ENGINEERS

PERCUSSIVE SAMPLER BOREHOLE RECORD

BH5

Sheet 1 of 1

Project: Residential Development	**Project No:** GUK-0925-01	**Approx. Coordinates:** 434821, 404560	
Location: Highstone Lane, Worsbrough		**Approx. Level:** 129.20 mAOD	**Plant** 110
Client: Mr M. Hague		**Date:** 28/11/2025	**Logged By** AS

Well	Water (m bgl)	Samples & Field Testing: Depth (m)		Type	SPT (N)	Water Content & Plasticity Indices*: Water Content (%)	Liquid Limit (wL)	Plasticity Index (lp)	Plastic Limit (Wp)	Depth (m bgl)	Level (mAOD)	Stratum Description
		0.5	0.5	ES1						0.0-0.3	129.20	Soft grey-brown weathered MUDSTONE (COAL MEASURES).
		1.0	1.0	DS1	2,3 - 6,12,14,18 (50)	22	60	33	27	0.3-1.0	128.90	Very stiff yellow-brown-grey mottled thinly laminated CLAY with mudstone lithorelicts. Medium becoming high undrained shear strength. Intermediate plasticity (COAL MEASURES).
												Borehole complete at 1.0m bgl

1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Boring Progress and Water Observations

Date	Water Depth	Casing Depth	Casing Dia. mm
	none	-	-

Chiselling From	To	Hours

General Remarks

ES - Environmental Sample
D - Small Disturbed Sample
B - Large Disturbed Sample

Strength and/or plasticity denoted indicate field observations only

SPT 'N' is uncorrected

*Plasticity data is non-modified

GROUNDSMITHS
GEOTECHNICAL ENGINEERS

PERCUSSIVE SAMPLER BOREHOLE RECORD

BH6

Sheet 1 of 1

Project: Residential Development	**Project No:** GUK-0925-01	**Approx. Coordinates:** 434819, 404571	
Location: Highstone Lane, Worsbrough		**Approx. Level:** 130.00 mAOD	**Plant** 110
Client: Mr M. Hague		**Date:** 28/11/2025	**Logged By** AS

Well	Water (m bgl)	Samples & Field Testing: Depth (m)		Type	SPT (N)	Water Content & Plasticity Indices*: Water Content (%)	Liquid Limit (wL)	Plasticity Index (Ip)	Plastic Limit (Wp)	Depth (m bgl)	Level (mAOD)	Stratum Description
		0.5	0.5	ES1						0.0-1.1	130.00	Stiff becoming very stiff yellow-brown-grey mottled thinly laminated CLAY with mudstone lithorelicts. Medium becoming high undrained shear strength. Low plasticity (COAL MEASURES).
		0.9		DS1	4,5 - 5,5,5,5 (20)	15	38	17	21			
		1.5	1.5	ES2						1.1-2.0	128.90	Extremely weak brown-grey slightly clayey thinly laminated weathered MUDSTONE with lithorelicts. High undrained shear strength. Intermediate plasticity (COAL MEASURES).
		2.0	2.0	DS2	6,1 - 4,8,7,11 (30)	21.2	62	36	26	2.0-3.0	128.00	Shaley COAL. Poor quality (COAL MEASURES).
		3.0			11,9 - 50/20mm (50)					3.0	127.00	Extremely weak brown-grey slightly clayey thinly laminated weathered MUDSTONE with lithorelicts. High undrained shear strength. Intermediate plasticity (COAL MEASURES).
												Borehole complete at 3.0m bgl

Boring Progress and Water Observations

Date	Water Depth	Casing Depth	Casing Dia. mm	Chiselling From	Chiselling To	Chiselling Hours
	none	-	-			

General Remarks

ES - Environmental Sample
D - Small Disturbed Sample
B - Large Disturbed Sample

Strength and/or plasticity denoted indicate field observations only

SPT 'N' is uncorrected

*Plasticity data is non-modified

APPENDIX B

Laboratory Geotechnical Test Results

LABORATORY REPORT

Contract Number: PSL25/9462

Report Date: 09 January 2026

Client's Reference: GUK-0925-01

Client Name: Groundsmiths UK Ltd
12 Spruce Close
Brampton
Chesterfield
S40 3FG

For the attention of: -

Contract Title: Highstone Lane, Worsbrough

Date Received: 4/12/2025
Date Commenced: 4/12/2025
Date Completed: 9/1/2026

Notes: Opinions and Interpretations are outside the UKAS Accreditation

Checked and Approved Signatories:

A Watkins (Managing Director)
R Berriman (Associate Director)
S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)
S Eyre (Senior Technician)
T Watkins (Senior Technician)

5 – 7 Hexthorpe Road,
Hexthorpe,
Doncaster,
DN4 0AR
Tel: 01302 768098
Email: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH1	DS1		1.80		Brown mottled grey hightly weathered MUDSTONE.
BH2	DS1		0.90		Brown mottled grey hightly weathered MUDSTONE.
BH2	DS2		1.80		Brown mottled grey hightly weathered MUDSTONE.
BH4	DS1		0.90		Brown mottled grey hightly weathered MUDSTONE.
BH4	DS2		1.50		Brown mottled grey hightly weathered MUDSTONE.
BH5	DS1		1.00		Brown mottled grey hightly weathered MUDSTONE.
BH6	DS1		0.90		Brown mottled grey hightly weathered MUDSTONE.
BH6	DS2		2.00		Brown mottled grey hightly weathered MUDSTONE.

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Highstone Lane, Worsbrough

Contract No:

PSL25/9462

Client Ref:

GUK-0925-01

SUMMARY OF SOIL CLASSIFICATION TESTS

BS 1377 - Part 2 : 2022 in accordance with BS EN ISO 17892 (as below)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Water Content %	Linear Shrinkage	Particle Density Mg/m^3	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 0.425mm %	Remarks
BH1	DS1		1.80		9.7			42	21	21	96	Medium Plasticity CIM
BH2	DS1		0.90		16.9			58	26	32	94	High Plasticity CIH
BH2	DS2		1.80		18.0			61	25	36	95	High Plasticity CIH
BH4	DS1		0.90		11.1			30	19	11	79	Low Plasticity CIL
BH4	DS2		1.50		17.7			59	25	34	93	High Plasticity CIH
BH5	DS1		1.00		22.0			60	27	33	88	High Plasticity CIH
BH6	DS1		0.90		15.0			38	21	17	97	Medium Plasticity CIM
BH6	DS2		2.00		21.2			62	26	36	98	High Plasticity CIH

Water Content - BS 1377 - Part 2 : 2022 : Clause 4 in accordance with BS EN ISO 17892 - 1 : 2014 + A1 : 2022
Linear Shrinkage - BS 1377 - Part 2 : 2022 : Clause 7
Particle Density (Gas Jar method) - BS 1377 - Part 2 : 2022 : Clause 9
Liquid, Plastic Limit & Plasticity Index - BS 1377 - Part 2 : 2022 : Clause 5 & 6 in accordance with BS EN ISO 17892 - 12 : 2018 + A2 : 2022

SYMBOLS : NP = Non Plastic

UKAS TESTING 4043

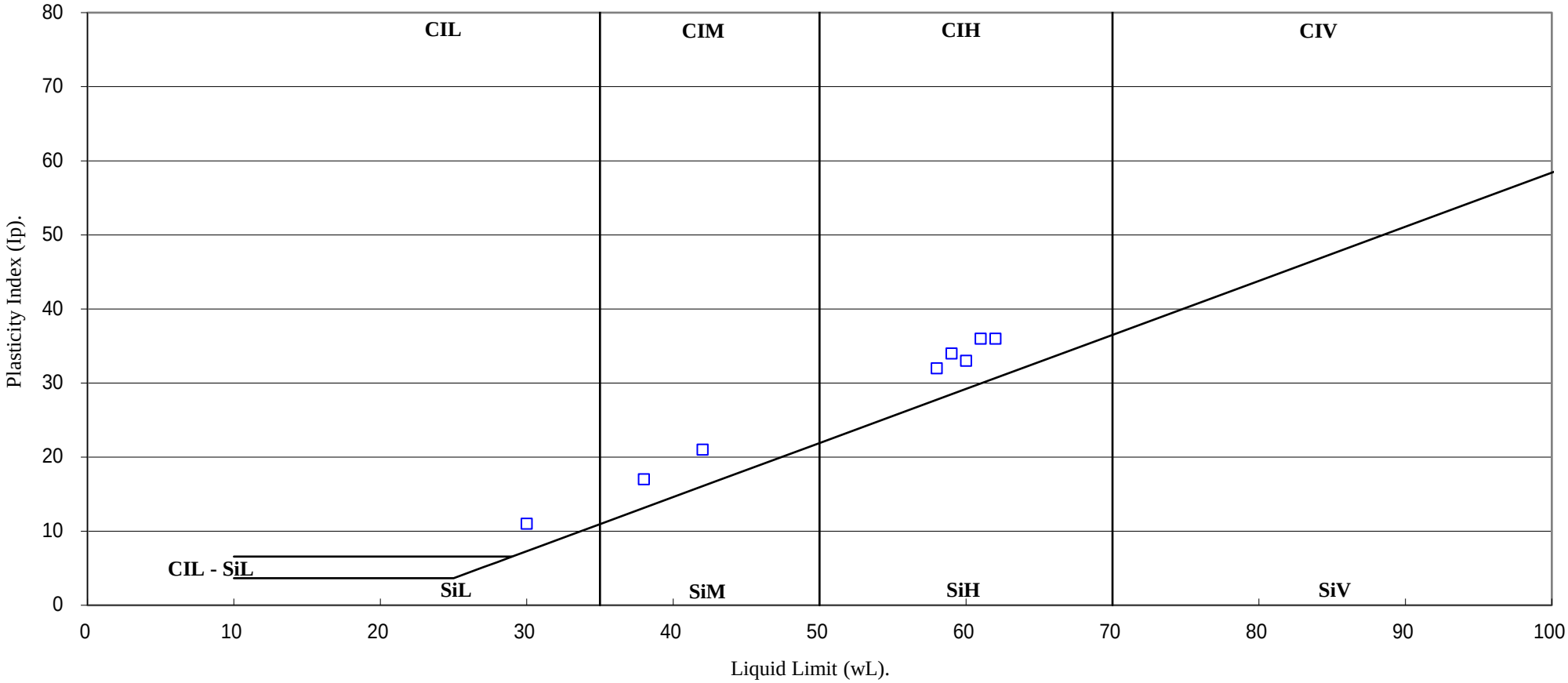
PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Highstone Lane, Worsbrough

Contract No:
PSL25/9462
Client Ref:
GUK-0925-01

PLASTICITY CHART

BS EN ISO 14688-2:2017 Clause 4.4



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Highstone Lane, Worsbrough**	**Contract No:**
		PSL25/9462
		Client Ref:
		GUK-0925-01

APPENDIX C

Laboratory Chemical Test Results

Groundsmiths (UK) Ltd
12 Spruce Close
S40 3FG

7 - 11 Harding Street
Leicester
LE1 4DH

Analytical Test Report: L25/13372/GRS - 25-94747

Your Project Reference:	**Highhstone Lane, Worsborough GUK-0925-01**		
Your Order Number:	11	Samples Received / Instructed:	08/12/2025 / 08/12/2025
Report Issue Number:	1	Sample Tested:	08/12 to 30/12/2025
Samples Analysed:	8 sample(s)	Report issued:	30/12/2025

Signed

Emily Blissett
Report Manager
CTS

Notes:

General

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report with the exception of the asbestos test portion which is held for 6 months unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30˚C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with CTS method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Asbestos

Please note: Where futher analaysis is required samples identified as containing asbestos are screened and tested on an as recevied basis. No correction is made for moisture content and other than the asbestos test(s) these results are not covered by our accrediation

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

This report shall not be reproduce except in full

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

UKAS accreditation on waters only covers the Ground water and Surface water matrices

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CONSTRUCTION TESTING SOLUTIONS
A PHENNA GROUP COMPANY

7 - 11 Harding Street
Leicester
LE1 4DH

L25/13372/GRS - 25-94747

Project Reference - Highhstone Lane, Worsborough GUK-0925-01

Analytical Test Results - Solid

Lab Reference			660108	660109	660110	660111	660112	660113
Client Sample ID			ES1	ES1	ES1	ES2	ES1	ES2
Client Sample Location			BH1	BH2	BH4	BH4	BH5	BH6
Client Sample Type			-	-	-	-	-	-
Client Sample Number			-	-	-	-	-	-
Depth - Top (m)			2.00	1.50	0.50	1.50	0.50	1.50
Depth - Bottom (m)			2.00	1.50	0.50	1.50	0.50	1.50
Date of Sampling			28/11/2025	28/11/2025	28/11/2025	28/11/2025	28/11/2025	28/11/2025
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Clay	Clay	Clay	Clay	Clay
Determinant	**Units**	**Accreditation**						
Arsenic	(mg/kg)	MCERTS	< 10	< 10	< 10	< 10	11	< 10
Barium	(mg/kg)	MCERTS	74	120	110	350	190	110
Boron (w/s)	(mg/kg)	u	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
Cadmium	(mg/kg)	MCERTS	1.6	1.5	1.5	1.5	0.7	0.6
Chromium (Total)	(mg/kg)	UKAS	2.5	3.1	3.6	3.6	< 1.0	< 1.0
Copper	(mg/kg)	MCERTS	36	32	21	31	42	42
Lead	(mg/kg)	MCERTS	21	17	7.8	17	15	30
Mercury	(mg/kg)	UKAS	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
Nickel	(mg/kg)	MCERTS	33	41	22	45	15	38
Selenium	(mg/kg)	u	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Zinc	(mg/kg)	MCERTS	98	61	51	52	33	74
Total Phenols	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chromium (Hexavalent)	(mg/kg)	u	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Sulphate (Acid Soluble)	(%)	u	< 0.01	< 0.01	0.02	0.01	0.04	0.02
pH	pH Units	MCERTS	7.3	7.0	5.2	6.9	5.3	6.4
Sulphate (Water soluble as SO_4)	(mg/l)	u	30	18	21	17	40	51
Sulphide	(mg/kg)	u	< 15	< 15	< 15	< 15	< 15	< 15
Sulphur (Total)	(%)	UKAS	0.01	0.01	0.01	0.01	0.03	0.01
Total Potential Sulphate	(%)	u	0.04	0.04	0.04	0.04	0.09	0.04
Thiocyanate	(mg/kg)	u	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Acenaphthene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Acenaphthylene	(mg/kg)	UKAS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Anthracene	(mg/kg)	UKAS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo (a) anthracene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo (a) pyrene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo (b) fluoranthene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo (k) fluoranthene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Chrysene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Fluoranthene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Fluorene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Naphthalene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Phenanthrene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Pyrene	(mg/kg)	MCERTS	< 0.02	0.05	< 0.02	< 0.02	< 0.02	< 0.02
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	< 0.32	0.40	< 0.32	< 0.32	< 0.32	< 0.32
TOC	(%)	MCERTS	0.7	0.6	< 0.5	0.6	1.9	1.1
SOM (via TOC)	(%)	UKAS	1.2	1.1	< 0.9	1.0	3.3	1.9
Asbestos	-	UKAS	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Conductivity	(µs/cm)	u	32	42	48	59	74	50
Redox	(mV)	u	184	192	230	216	256	224

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7 - 11 Harding Street
Leicester
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L25/13372/GRS - 25-94747

Project Reference - Highhstone Lane, Worsborough GUK-0925-01

Analytical Test Results - VPH / EPH

Lab Reference			660108	660111	660113
Client Sample ID			ES1	ES2	ES2
Client Sample Location			BH1	BH4	BH6
Client Sample Type			-	-	-
Client Sample Number			-	-	-
Depth - Top (m)			2.00	1.50	1.50
Depth - Bottom (m)			2.00	1.50	1.50
Date of Sampling			28/11/2025	28/11/2025	28/11/2025
Time of Sampling			-	-	-
Sample Matrix			Clay	Clay	Clay
Determinant	**Units**	**Accreditation**			
Benzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Toluene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Ethylbenzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
m&p Xylene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02
o-Xylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
MTBE	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Aliphatic >C_5 to C_6 [HS_MS_1D_AL]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06
Aliphatic >C_6 to C_8 [HS_MS_1D_AL]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06
Aliphatic >C_8 to C_{10} [HS_MS_1D_AL]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06
Aliphatic >C_{10} to C_{12} [EH_2D_AL]	(mg/kg)	MCERTS	1.4	1.3	1.3
Aliphatic >C_{12} to C_{16} [EH_2D_AL]	(mg/kg)	MCERTS	2.2	1.9	2.0
Aliphatic >C_{16} to C_{21} [EH_2D_AL]	(mg/kg)	MCERTS	3.8	3.4	3.7
Aliphatic >C_{21} to C_{35} [EH_2D_AL]	(mg/kg)	MCERTS	7.5	6.5	7.0
Aliphatic >C_{35} to C_{44} [EH_2D_AL]	(mg/kg)	u	< 5.0	< 5.0	< 5.0
Aromatic >C_5 to C_7 [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Aromatic >C_7 to C_8 [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Aromatic >C_8 to C_{10} [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06
Aromatic >C_{10} to C_{12} [EH_2D_AR]	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0
Aromatic >C_{12} to C_{16} [EH_2D_AR]	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0
Aromatic >C_{16} to C_{21} [EH_2D_AR]	(mg/kg)	MCERTS	2.7	2.8	2.9
Aromatic >C_{21} to C_{35} [EH_2D_AR]	(mg/kg)	MCERTS	3.7	< 2.0	< 2.0
Aromatic >C_{35} to C_{44} [EH_2D_AR]	(mg/kg)	u	< 5.0	< 5.0	< 5.0
Total >C_5 to C_{35} [EH_2D+HS_1D_Total]	(mg/kg)	MCERTS	21	16	17
Total >C_5 to C_{40} [EH_2D+HS_1D_Total]	(mg/kg)	MCERTS	24	18	19

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L25/13372/GRS - 25-94747

Project Reference - Highhstone Lane, Worsborou

Analytical Test Results - VOC

Lab Reference			660108	660111	660113
Client Sample ID			ES1	ES2	ES2
Client Sample Location			BH1	BH4	BH6
Client Sample Type			-	-	-
Client Sample Number			-	-	-
Depth - Top (m)			2.00	1.50	1.50
Depth - Bottom (m)			2.00	1.50	1.50
Date of Sampling			28/11/2025	28/11/2025	28/11/2025
Time of Sampling			-	-	-
Sample Matrix			Clay	Clay	Clay
Determinant	**Units**	**Accreditation**			
Benzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Toluene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Ethylbenzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
m&p Xylene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02
o-Xylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Dichlorodifluoromethane	(mg/kg)	UKAS	< 0.05	< 0.05	< 0.05
Chloromethane	(mg/kg)	UKAS	< 0.02	< 0.02	< 0.02
Vinyl Chloride	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02
Bromomethane	(mg/kg)	u	< 0.05	< 0.05	< 0.05
Chloroethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Trichlorofluoromethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,1-Dichloroethylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Dichloromethane	(mg/kg)	u	0.01	0.01	0.01
MTBE	(mg/kg)	MCERTS	<0.01	< 0.01	< 0.01
trans-1,2,-dichloroethylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,1-Dichloroethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
2,2-Dichloropropane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
cis--1,2,-dichloroethylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Bromochloromethane	(mg/kg)	MCERTS	< 0.05	< 0.05	< 0.05
Chloroform	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,1,1-Trichloroethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,1-Dichloropropene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Carbon Tetrachloride	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02
Trichloroethylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,2-Dichloropropane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Dibromomethane	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02
Bromodichloromethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
cis-1,2-dichloropropylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,1,2-Trichloroethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,3-Dichloropropane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Chlorodibromomethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,2-Dibromoethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Chlorobenzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Styrene	(mg/kg)	UKAS	< 0.01	< 0.01	< 0.01
Isopropylbenzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Bromoform	(mg/kg)	MCERTS	< 0.05	< 0.05	< 0.05
1,1,2,2-Tetrachloroethane	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,2,3-Trichloropropane	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02
n-Propylbenzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
Bromobenzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,3,5-Trimethylbenzene	(mg/kg)	UKAS	< 0.01	< 0.01	< 0.01
2-chlorotoluene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
4-chlorotoluene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
tert-butylbenzene	(mg/kg)	UKAS	< 0.01	< 0.01	< 0.01
1,2,4-trimethylbenzene	(mg/kg)	UKAS	< 0.01	< 0.01	< 0.01
sec-Butylbenzene	(mg/kg)	UKAS	< 0.01	< 0.01	< 0.01
4-Isopropyltoluene (P-Cymene)	(mg/kg)	UKAS	< 0.01	< 0.01	< 0.01
1,3-Dichlorobenzene	(mg/kg)	u	< 0.01	< 0.01	< 0.01
1,4-Dichlorobenzene	(mg/kg)	u	< 0.01	< 0.01	< 0.01
n-Butylbenzene	(mg/kg)	UKAS	< 0.01	< 0.01	< 0.01
1,2-Dichlorobenzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01
1,2-Dibromo-3-chloropropane	(mg/kg)	u	< 0.05	< 0.05	< 0.05
1,2,4-Trichlorobenzene	(mg/kg)	u	< 0.05	< 0.05	< 0.05
Hexachlorobutadiene	(mg/kg)	u	< 0.05	< 0.05	< 0.05
Naphthalene	(mg/kg)	u	< 0.05	< 0.05	< 0.05
1,2,3-Trichlorobenzene	(mg/kg)	u	< 0.05	< 0.05	< 0.05

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L25/13372/GRS - 25-94747
Project Reference - Highhstone Lane, Worsborou
Analytical Test Results - SVOC

Lab Reference			660108	660111	660113
Client Sample ID			ES1	ES2	ES2
Client Sample Location			BH1	BH4	BH6
Client Sample Type			-	-	-
Client Sample Number			-	-	-
Depth - Top (m)			2.00	1.50	1.50
Depth - Bottom (m)			2.00	1.50	1.50
Date of Sampling			28/11/2025	28/11/2025	28/11/2025
Time of Sampling			-	-	-
Sample Matrix			Clay	Clay	Clay
Determinant	**Units**	**Accreditation**			
1,2,4-Trichlorobenzene	(mg/kg)	u	< 0.2	< 0.2	< 0.2
1,2-Dichlorobenzene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
1,3-Dichlorobenzene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
1,4-Dichlorobenzene	(mg/kg)	u	< 0.2	< 0.2	< 0.2
1-Chloronaphthalene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	(mg/kg)	u	< 0.6	< 0.6	< 0.6
2,4,5-Trichlorophenol	(mg/kg)	u	< 0.2	< 0.2	< 0.2
2,4,6-Trichlorophenol	(mg/kg)	u	< 0.3	< 0.3	< 0.3
2,4-Dichorophenol	(mg/kg)	u	< 0.2	< 0.2	< 0.2
2,4-Dimethyphenol	(mg/kg)	u	< 0.2	< 0.2	< 0.2
2,4-Dinitrophenol	(mg/kg)	u	< 2.0	< 2.0	< 2.0
2,6-Dichorophenol	(mg/kg)	u	< 0.3	< 0.3	< 0.3
2,6-Dinitrotoluene	(mg/kg)	u	< 0.6	< 0.6	< 0.6
2-Chlorophenol	(mg/kg)	u	< 0.2	< 0.2	< 0.2
2-Methylnaphthalene	(mg/kg)	u	< 0.2	< 0.2	< 0.2
2-Methylphenol	(mg/kg)	u	< 0.2	< 0.2	< 0.2
2-Nitroaniline	(mg/kg)	u	< 0.4	< 0.4	< 0.4
2-Nitrophenol	(mg/kg)	u	< 0.6	< 0.6	< 0.6
3,3-Dichlorobenzidine	(mg/kg)	u	< 0.3	< 0.3	< 0.3
3/4-Methylphenol	(mg/kg)	u	< 0.2	< 0.2	< 0.2
3-Nitroaniline	(mg/kg)	u	< 0.6	< 0.6	< 0.6
4 Chlorophenyl phenyl ether	(mg/kg)	u	< 0.2	< 0.2	< 0.2
4,6-Dinitro-2-methylphenol	(mg/kg)	u	< 1.0	< 1.0	< 1.0
4-Bromophenyl phenyl ether	(mg/kg)	u	< 0.2	< 0.2	< 0.2
4-Chloro-3-methylphenol	(mg/kg)	u	< 0.2	< 0.2	< 0.2
4-Chloroaniline	(mg/kg)	u	< 0.2	< 0.2	< 0.2
4-Nitroaniline	(mg/kg)	u	< 0.3	< 0.3	< 0.3
4-Nitrophenol	(mg/kg)	u	< 0.6	< 0.6	< 0.6
Acenaphthene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Acenaphthylene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Aniline	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Anthracene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Azobenzene	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Benz[a]anthracene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Benzo[a]pyrene	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Benzo[b]fluoranthene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Benzo[k]fluoranthene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Benzyl Alcohol	(mg/kg)	u	< 0.3	< 0.3	< 0.3
Benzyl butyl phthalate	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Bis(2-chloroethoxy)methane	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Bis(2-chloroethyl)ether	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Bis(2-chloroisopropyl)ether	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Bis(2-ethylhexyl) phthalate	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Chrysene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Dibenzofuran	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Dibutyl phthalate	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Diethyl Phthalate	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Dimethyl phthalate	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Di-n-octyl phthalate	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Diphenylamine	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Fluoranthene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Fluorene	(mg/kg)	u	< 0.1	0.1	< 0.1
Hexachlorobenzene	(mg/kg)	u	< 0.3	< 0.3	< 0.3
Hexachlorobutadiene	(mg/kg)	u	< 0.3	< 0.3	< 0.3
Hexachlorocyclopentadiene	(mg/kg)	u	< 1.0	< 1.0	< 1.0
Hexachloroethane	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Indeno[1,2,3-cd]pyrene	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Isophorone	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Methyl Methanesulfonate	(mg/kg)	u	< 0.3	< 0.3	< 0.3
Naphthalene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
NitroBenzene	(mg/kg)	u	< 0.3	< 0.3	< 0.3
N-Nitrosodimethylamine	(mg/kg)	u	< 0.2	< 0.2	< 0.2
Pentachlorophenol	(mg/kg)	u	< 1.0	< 1.0	< 1.0
Phenanthrene	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Phenol	(mg/kg)	u	< 0.1	< 0.1	< 0.1
Pyrene	(mg/kg)	u	< 0.1	< 0.1	< 0.1

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Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
660108	ES1	BH1	-	-	Dark brown sandyclay	14	< 0.1	100
660109	ES1	BH2	-	-	Dark brown sandy silty clay	16	< 0.1	100
660110	ES1	BH4	-	-	Brown sandy silty clay with rare organic matter	11	< 0.1	100
660111	ES2	BH4	-	-	Dark brown sandy silty clay	16	< 0.1	100
660112	ES1	BH5	-	-	Brown sandy silty clay with rare organic matter	20	< 0.1	100
660113	ES2	BH6	-	-	Dark brown sandy silty clay	19	< 0.1	100

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Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
660108	ES1	BH1	-	-	VPH/BTEX - Sample taken from container with headspace. VOC - Sample taken from container with headspace.
660109	ES1	BH2	-	-	
660110	ES1	BH4	-	-	
660111	ES2	BH4	-	-	VPH/BTEX - Sample taken from container with headspace. VOC - Sample taken from container with headspace.
660112	ES1	BH5	-	-	
660113	ES2	BH6	-	-	VPH/BTEX - Sample taken from container with headspace. VOC - Sample taken from container with headspace.

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Analysis Methodologies - Please refer to sample comments page (if present) for any changes to methods

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
CONDS	MS - CL - pH & Conductivity	As received	Passing 10mm test sieve	Determination of conductivity in soils by probe measurement
SKALARHCS	MS - CL - Hexavalent Chromium by Skalar	As received	Passing 10mm test sieve	Determination of hexavalent chromium in soil using Skalar segmented flow analyser
ICPMETS	MS - CL - ICP Metals	Air dried	Passing 10mm test sieve	Determination of metals in soils via ICP
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
PAHASRDS	MS - CL - PAH (As Received)	As received	Passing 10mm test sieve	Determination of Polyaromatic hydrocarbons in soil via GC-MS
SULPHIDES	MS - CL - Sulphide in Soils	Air Dried	Passing 10mm test sieve	Determination of sulphide in soil via titration
SVOCS	MS - CL - Semi VOC	As received	Passing 10mm test sieve	Determination of Semi volatile organic compounds in soil via GC-MS
SKALARPHS	MS - CL - Phenols by Skalar	As received	Passing 10mm test sieve	Determination of total phenols in soil using Skalar segmented flow analyser
ASSO4S	MS - CL - Acid Soluble Sulphate	Oven Dried	Passing 2mm test sieve	Determination of total sulphate in soils by acid extraction followed by ICP analysis
TOCS	MS - CL - TOC Eltra	Air Dried	Passing 10mm test sieve	Determination of Total Organic Carbon in soils
GCXGCS	MS - CL - TPH & EPH by GCXGC	As received	Passing 10mm test sieve	Determination of TPH and EPH in soils via GCxGC-FID
CWGS	Calculation from VPH-S and EPH-S	As received	Passing 10mm test sieve	Determination of TPH CWG (Volatile Petroleum Hydrocarbons and Extractable Petroleum Hydrocarbons) in soils via Headspace-GC-MS and GC-GC-FID respectively
VOCS	MS - CL - VOC and MBTEX	As received	Passing 10mm test sieve	Determination of VOCs (inc BTEX) in soils via Headspace-GC-MS
VPHS	MS - CL - VPH	As received	Passing 10mm test sieve	Determination of VPH in soils via Headspace-GC-MS
WSBORONS	MS - CL - WS Boron	Air dried	Passing 10mm test sieve	Determination of Water soluble Boron in soils via ICP
ASB	MS - AS - Asbestos	-	-	Fibre identification is in accordance with in house documented methods which are based on the procedure documented in the HSE Document HSG 248 "Asbestos: The analysts guide for sampling, analysis and clearance procedures"
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis
1377TS-ELT	BS1377 Total Sulphur Content by HTC	Oven dried	BS1377 : Part 1 : 2016	Total Sulphur Content testing of Soil in accordance with BS 1377 : Part 3 : 2018 + A1 : 2021 Clause 7.10 (using Eltra CS-800 Analyser)

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Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided
W - No time of sampling provided for water sample
C - Received in inappropriate container
H - Contains headspace
T - Temperature on receipt exceeds storage temperature
R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
660108	ES1	BH1	-	-	MS - CL - pH in Soils	
660108	ES1	BH1	-	-	MS - CL - PAH (As Received)	
660108	ES1	BH1	-	-	MS - CL - Phenols by Skalar	
660108	ES1	BH1	-	-	MS - CL - Semi VOC	
660108	ES1	BH1	-	-	MS - CL - TPH & EPH by GCXGC	
660108	ES1	BH1	-	-	MS - CL - VOC and MBTEX	
660108	ES1	BH1	-	-	MS - CL - VPH	
660109	ES1	BH2	-	-	MS - CL - pH in Soils	
660109	ES1	BH2	-	-	MS - CL - PAH (As Received)	
660109	ES1	BH2	-	-	MS - CL - Phenols by Skalar	
660110	ES1	BH4	-	-	MS - CL - pH in Soils	
660110	ES1	BH4	-	-	MS - CL - PAH (As Received)	
660110	ES1	BH4	-	-	MS - CL - Phenols by Skalar	
660111	ES2	BH4	-	-	MS - CL - pH in Soils	
660111	ES2	BH4	-	-	MS - CL - PAH (As Received)	
660111	ES2	BH4	-	-	MS - CL - Phenols by Skalar	
660111	ES2	BH4	-	-	MS - CL - Semi VOC	
660111	ES2	BH4	-	-	MS - CL - TPH & EPH by GCXGC	
660111	ES2	BH4	-	-	MS - CL - VOC and MBTEX	
660111	ES2	BH4	-	-	MS - CL - VPH	
660112	ES1	BH5	-	-	MS - CL - pH in Soils	
660112	ES1	BH5	-	-	MS - CL - PAH (As Received)	
660112	ES1	BH5	-	-	MS - CL - Phenols by Skalar	
660113	ES2	BH6	-	-	MS - CL - pH in Soils	
660113	ES2	BH6	-	-	MS - CL - PAH (As Received)	
660113	ES2	BH6	-	-	MS - CL - Phenols by Skalar	
660113	ES2	BH6	-	-	MS - CL - Semi VOC	
660113	ES2	BH6	-	-	MS - CL - TPH & EPH by GCXGC	
660113	ES2	BH6	-	-	MS - CL - VOC and MBTEX	
660113	ES2	BH6	-	-	MS - CL - VPH	

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HWOL TPH Acronym Index

Acronym	Description
HS	Headspace Analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics and Aromatics
AL	Aliphatics Only
AR	Aromatics Only
2D	GC-GC - Double Coil Gas Chromatography
#1	EH_Total but with humics mathmatically subtracted
#2	EH_Total but with fatty acids mathmatically subtracted
_	Operator - underscore to separate acronyms (except for +)
+	Operator to indicate cumlative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry

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