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PHASE 2

GEO-ENVIRONMENTAL REPORT

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Report on a Phase 2 Geo-environmental Investigation

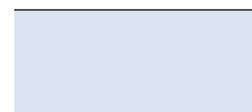
Location:	Land adj.18B Cowlersley Lane Huddersfield, West Yorkshire HD4 5TY	
For:	Luke Stead	
Report No.	C4351/24/E/6664	Report date: August 2024

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

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Redacted



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Report Summary¹

Item	Comments	Section
Development	Construction of two detached properties.	1.
Geology	Solid geology – Huddersfield White Rock.	5.
Strata Conditions	Nominal topsoil on to sandstone bed rock.	6.
Groundwater	None encountered during investigation.	6.2
Site Stability	Site surface is stable and proposed development should not have adverse effects on the adjacent cliff.	10.
Foundation Design	Shallow foundation solution.	10.2
Effect of Sulphates	DC-1 concrete.	10.4
Contamination	Soils suitable for intended site use.	11.
Ground Gas	Characteristic Situation Level 1 – Monitoring ongoing. Radon barrier required.	11.

¹ This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

It is understood that the land adjacent to 18B Cowlersley Lane is to be developed by the construction of two detached residential properties. The site is situated at the top of a steep cliff, with the cliff recorded as a worked quarry wall. Consequently, a site investigation has been undertaken in accordance with the instruction from the client. This work was required in order to determine the nature of the underlying soils, to assess their engineering properties and to assist in the design of safe and economical foundations for the proposed development. This investigation also takes into consideration the risk of any contamination present. This report describes the work undertaken, presents the data obtained and discusses the ground conditions in relation to the proposed works.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Desk Study & Walkover

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services (RGS) and the results were presented as report number C4351/24/E/6662 in June 2024. This report has been used extensively during the current intrusive investigation.

A walkover was completed during the assessment on the 16th June 2024. The site comprised a heavily vegetated plateau at the top of a steep cliff. The desk study revealed that the cliff was likely a quarry wall, formed from quarrying of the local sandstone outcrops. Unfortunately the rock could not be viewed from the site itself. However, from Manchester Road, distinct crags and beds of sandstone could be viewed. Such features are recognisable along Manchester Road, with quarrying quite extensive along that road. Indeed, sandstone is visible behind the lower retaining wall to the north-east of the site.

4. Fieldworks

An initial trial pitting exercise was completed on the 27th of June, with subsequent fieldworks undertaken on the 4th and 5th July 2024 which included the following:

- Three machine excavated trial pits.
- Three rotary boreholes.

- Installation of three gas monitoring standpipes.

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

4.1 Trial Pits

A total of three trial pits were excavated in order to reveal the nature of the near surface soils using a 13 tonne tracked 360° excavator. The soils were logged on site in general accordance with BS5930: 2015+A1: 2020, and full descriptions are given on the trial pit records which are presented in Appendix 2. At regular intervals throughout the excavation of the pits, samples were taken for chemical testing. The test specimens were retained in the appropriate air tight containers within cool boxes for onward transition to the chemical laboratory.

4.2 Rotary Boreholes

In view of the shallow nature of the rock head, these boreholes were initially sunk utilising rotary open-hole drilling techniques. On meeting competent rockhead, two of the boreholes (BH01 and BH02) were progressed by rotary cored drilling techniques utilising air/mist flushing and a 92mm diameter barrel, which recovers an 85mm diameter core.

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

4.3 Gas Monitoring Standpipes

Gas monitoring standpipes were installed between 2.0m and 8.0m depth in all of the boreholes and the installation details are shown on the appropriate borehole records. The response zone was filled with pea gravel, with a bentonite seal at the base and above, and the installation was capped with a stop box cover in a concrete surround.

5. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

Strata Type	Strata Name ²	Parent Group ³	Description ³
Superficial Geology	-	-	None recorded
Solid Geology	Huddersfield White Rock	Millstone Grit Group	The Huddersfield White Rock is a medium- to coarse-grained, massive to flaggy, cross-bedded, micaceous sandstone.

The geological map indicates that the site is underlain by the Huddersfield White Rock. Whilst there are no superficial soils or worked ground deposits on the site itself, downslope and to the north of the site, there are numerous areas of worked ground highlighted. Given the findings of the desk study and walkover, it is anticipated that these worked ground deposits are associated with the quarrying activities that are known to have taken place adjacent to Manchester Road.

6. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

Depth m below ground level to underside of layer	Strata Type	Positions Encountered	Groundwater Strikes m below ground level
0.2 – 0.3	TOPSOIL.	All	None
+0.5 – +0.6	Slightly sandy GRAVEL. [WEATHERED HUDDERSFIELD WHITE ROCK].	TP01, TP02	None
+0.3 – +8.5	Weak to medium strong SANDSTONE. [HUDDERSFIELD WHITE ROCK].	TP03, BH01, BH02, BH03	None

¹'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated

² Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield; Solid and Drift Edition, and Geology of Britain Viewer [online resource from www.bgs.ac.uk]

³ Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [online resource from www.bgs.ac.uk]

6.1 General Strata

In general, below the topsoil, slightly sandy gravel was revealed to 0.5m and 0.6m in TP01 and TP02. From these depths, and from below the topsoil at the remainder of the locations, weak to medium strong very thinly to thinly bedded sandstone was revealed to the base of the boreholes. It should be noted that TP03 refused on sandstone at 0.3m depth. It is considered that this material is representative of the Huddersfield White Rock as indicated by the geological map.

6.2 Groundwater

No groundwater strikes were observed during the site investigation. However, it should be appreciated that the normal rate of boring does not permit the recording of an equilibrium water level for any one strike, moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions.

7. Insitu Testing

7.1 Gas and Water Level Monitoring

The standpipes were monitored between the 12th July and the 2nd August 2024. The results of the gas monitoring undertaken to date are tabulated below and full results are presented in Appendix 4.

Table 3: Gas Monitoring

Location	Date	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
BH01	12.07.2024	0.0	0.1	20.8	0.0	1005↔	DRY	8.3
	19.07.2024	0.0	0.1	20.3	0.0	1002↔	DRY	
	26.07.2024	0.0	0.1	20.5	0.0	995↑	DRY	
	02.08.2024	0.0	0.0	20.2	0.0	996↔	DRY	
BH02	12.07.2024	0.1	0.7	20.1	0.0	1005↔	DRY	3.0
	19.07.2024	0.0	0.5	20.2	0.0	1002↔	DRY	
	26.07.2024	0.1	0.8	20.2	0.0	995↑	DRY	
	02.08.2024	0.1	0.6	19.9	0.0	997↔	DRY	
BH03	12.07.2024	0.0	0.1	20.7	0.0	1005↔	DRY	2.0
	19.07.2024	0.0	0.1	20.5	0.0	1002↔	DRY	
	26.07.2024	0.1	0.1	20.6	0.0	995↑	DRY	
	02.08.2024	0.0	0.3	20.1	0.0	997↔	DRY	

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

This work was undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 20th April 2024.

8. Laboratory Testing - Geotechnical

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

- Soluble sulphate content

BS 1377-3:2018+A1:2021: Pt3: 7.3

- pH value
- Uniaxial Compressive Strength

BS 1377-3:2018+A1:2021: Pt3: 12
ASTM: D2938-95 (2002)

The test results are presented in Appendix 5 and are summarised below:

Table 4: Summary of Geotechnical Test Results				
Test type	Number of tests	Range of results		Comments
Soluble sulphate & pH	3	SO ₄ pH	2.77 to 7.4 g/l 7.6 & 8.1	
Uniaxial Compressive Strength	7	36.7 to 46.9 MPa		Indicative of medium strong rock strength.

9. Laboratory Testing - Environmental

A suite of testing was conducted on samples from across the site and the following regime was undertaken.

- Metals – Cd, Cr^{VI}, Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN⁻ and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total/soluble SO₄²⁻.
- Asbestos.

This testing was undertaken by i2 Analytical Ltd and the results of all of the chemical testing are presented in Appendix 5 of this report.

10. Discussion of Ground Conditions - Geotechnical

10.1 Site Stability

As part of the decision notice for Planning Application 2023/62/90582/W, Condition 15 states the following:

Groundworks shall not commence until a report demonstrating that the works shown on the plan can be undertaken without endangering the stability of the cliff at the northern boundary of the site or any of the land that it supports has been submitted to, and approved in writing by, the Local Planning Authority.

As highlighted within the walkover notes, from a visual inspection it was difficult to gauge the make-up of the cliff. However, nearby adjacent outcrops revealed sandstone crags and beds. Therefore, it was assumed that a similar profile would form the cliff face to the north and below the site.

Indeed, this was demonstrated within the site investigation, with the trial pits initially revealing very shallow rock head. It would appear that the site forms the top of the quarry wall, with topsoil historically placed on top to provide a growing medium for the previous site use.

The rock was formed of weak to medium strong, very thinly to thinly bedded sandstone. It is evident that this sandstone would prove economically viable for extraction and thus it is clear why it has historically been worked along Manchester Road. Given the nature of the bedding, including the horizontal orientation and bedding thickness, it is unlikely that 'sliding' would occur between bedding planes were a load to be introduced above. Furthermore, whilst the development plans are yet to be related to Ordnance Datum, it appears that the plots are to be built in excess of 1m from the crest itself; drawing No. 0724-ROG-11076 suggests this is circa 135m to 137mAOD. This is considered to be a suitable stand-off to mitigate any latent risks, provided that foundations are placed within the rock itself. Consequently, it is considered that the development itself shall not cause instability to the site itself once complete.

Notwithstanding this, care must be taken during the groundworks and construction phase to ensure that no machinery or plant is placed directly on the crest of the slope. As such, before any construction takes place, a visual barrier must be constructed circa 1m from the crest of the slope to prevent the loading of the crest itself. A daily watching brief should be undertaken to assess the cliff.

10.2 Foundations

It is considered that foundations could include the provision of strip footings placed at 1.0m. The results of this investigation indicate that weak to medium strong sandstone will be revealed at depths of around 0.3m to 1.0m. This material would possess a significant bearing capacity, probably being in excess of 250kN/m². Therefore, at a typical foundation load for a house the factor of safety against general shear failure will be high, probably exceeding 10.

Should made ground or any weak zones be revealed in the excavation bases, they should be removed and replaced by suitably compacted granular soil or lean-mixed concrete. Should excavations be required to stand open for any length of time, it will be necessary to place a blinding layer of lean-mixed concrete over the sub-grade.

The stability of the excavation faces cannot be guaranteed thus temporary support to the excavation faces may become necessary unless the foundations are constructed using trench-fill techniques. In this method the foundation trenches should be excavated, inspected and backfilled with concrete as a continuous operation. Under no circumstances should operatives be allowed to enter unsupported excavations.

10.3 Ground-floors

On the basis of the competent strata at shallow depth, it is considered that a ground bearing ground floor slab could be utilised at this site. In this instance it would be necessary to compact the sub-grade using a vibrating roller to ensure any soils present are adequately compacted.

10.4 Effect of Sulphates

In view of the nature of the underlying soils it is considered that the design sulphate class be assessed with reference to Table C2⁴, which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance with Class DS-1 requirements. Assuming static groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1s.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1⁵, which can be found in Part D, *Specifying concrete for general cast-in-situ use*, of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-1 is required.

11. Discussion of Ground Conditions - Environmental

11.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of two residential properties with hard-standing and garden areas. Consequently, the site may be classified as residential with plant uptake.

11.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. With respect to the results it should be appreciated that the soil organic matter (SOM) content for the samples tested was found to range between 4.1% and 6.7%. On this basis, it is considered that the screening values associated with 6% SOM should be adopted. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website⁶ and these include many local authorities.

A comparison of the results of the testing, together with the data given above, can be found within Appendix 5. These results indicate the following:

Table 5: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
TP01	0.2	PAHs (benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene)
TP02	0.2	PAHs (benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene)
TP03	0.1	PAHs (chrysene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene)

⁴ Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*

⁵ Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete.*

⁶ <http://www.atrisksoil.co.uk/pages/general/subscribers.asp>

Concentrations of chromium^{VI}, mercury, free cyanide, phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C35; aromatic C5 to C16) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values. In addition, no asbestos was detected within the soils samples tested.

It should be appreciated that the soil screening values for PAHs and TPHs (where appropriate) represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure, which is unlikely to significantly affect the combined assessment criterion⁷. In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion if free product is not observed, the values for which are also provided on the summary of contamination analysis. It is therefore considered that the criteria for no free product should be adopted for the PAHs and TPHs at this site. The results of the contaminants found to exceed these screening values are tabulated below:

Table 6: Summary of Areas Contaminated by PAHs		
Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with Plant Uptake)
TP01	0.2	None
TP02	0.2	None
TP03	0.1	None

On the basis of the above information, the results of the investigation have concluded that the near surface soils are suitable for intended site use.

11.1.2 Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated a maximum concentration of 0.1% methane, with concentrations of carbon dioxide ranging between 0.1% and 0.8%, in association with oxygen levels of between 19.9% and 20.8%. It should be appreciated that on non-contaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide. In addition, no flow has been detected. Therefore, a flow rate of 0.1 litres per hour will be employed in the following calculations.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of between 995mb and 1005mb.

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case 0.1% (0.001) methane was recorded along with 0.8% (0.008) carbon dioxide, in association with a maximum flow rate of 0.1 l/hr. This results in a GSV of 0.0001 l/hr for methane and a GSV of 0.0008 l/hr for carbon dioxide.

In accordance with Table 2 of BS8485: 2015, *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*, the site may be characterised as *Characteristic Situation Level 1*. It is therefore considered that there is a very low

⁷ Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 6% SOM, Residential with home grown produce land use, 23.06.17.

risk of harm to end users and site operatives and no special precautionary measures are required in accordance to Table 8.6, *Typical scope of gas protection measures*, of CIRIA report C665.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)⁸. Accepting that the proposed development is of high sensitivity and that the generation potential is very low, these tables suggest that 6 readings could be undertaken over a period of 3 months. However, C665 notes that *not all sites will require gas monitoring for the period and frequency indicated in Tables 5.5a and 5.5b*.

In this case, a total of 4 monitoring visits were undertaken over a 1 month time period and for the purpose of this assessment, it is considered that the site can be provisionally classified as Characteristic Situation Level 1. It is recommended that 2 further monitoring visits are undertaken within the next 2 months as recommended by the CIRIA report C665 (2007), preferably during a period when the barometric pressure is falling, which represents a more onerous condition.

In light of the above, it is considered that following the additional monitoring visits, should there be no significant change in ground gas conditions, the site can be fully classified as Characteristic Situation Level 1.

11.2 Site Specific Risk Assessment

11.2.1 Approach

The presence of contamination hazards and the risks associated with them should be assessed in accordance with industry practice and the 'suitable for use' approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency⁹ advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.¹⁰ This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'¹¹

11.2.2 Conceptual Ground Model and Risk Assessment

In view of the results of the chemical testing undertaken the conceptual site model is presented accordingly as Table 7.

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

⁸ Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings*, p60.

⁹ R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.

¹⁰ The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.

¹¹ See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

- N/A -** A source-pathway-receptor linkage is not considered to exist and therefore a risk assessment is not required.
- Low -** A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence.
- Moderate -** The linkage exists but the likelihood of harm occurring is not considered to be significant although remedial action may be necessary
- High -** The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary.

The results of the risk assessment are presented in Table 7.



Table 7: Conceptual Site Model and Site-Specific Risk Assessment

Conceptual Site Model			Site Specific Risk Assessment	
Pathways	Receptor	Linkage Present?	Risk Rating	Notes
Direct contact/dermal absorption/soil ingestion	Operative	Yes – contact with soil likely during works. Contamination falls below screening levels.	Low	Precautionary measures will be required during the construction phase.
	End User	No – contamination falls below screening levels.	N/A	
	Neighbours	No – contamination falls below screening levels.	N/A	
Inhalation of Dust/Vapours	Operative	Yes – contact with soil likely during works. Contamination falls below screening levels.	Low	Precautionary measures will be required during the construction phase.
	End User	No – contamination falls below screening levels.	N/A	
	Neighbours	No – contamination falls below screening levels.	N/A	
Ingestion of fruit/vegetables and/or waters	Operative	No – no edible plants or contained water sources in the area of the proposed new works.	N/A	
	End User	No – contamination falls below screening levels.	N/A	
	Neighbours	No – contamination falls below screening levels.	N/A	
Migration of hazardous gases via permeable strata or shallow mining activity	Operative	Yes – low concentrations of methane and carbon dioxide have been found to be present at the site (assuming <i>Characteristic Situation Level 1</i>).	Low	Low concentrations of harmful gases (methane and carbon dioxide) were detected at the site. If ground gas conditions remain the same, no special precautionary measures are deemed to be required.
	End User		Low to Moderate	

	Neighbours	No – source not identified on site.	N/A	
Spillage/loss/run off direct to receiving water	Controlled Waters	No – contamination falls below screening levels.	N/A	
Migration via permeable unsaturated strata	Controlled Waters	No – contamination falls below screening levels.	N/A	
Run off via drainage/sewers etc	Controlled Waters	No – contamination falls below screening levels.	N/A	
Direct contact with contaminated soils	Plants	No – contamination falls below screening levels.	N/A	
Uptake via root system			N/A	
Direct contact with contaminated soils	Building Materials	No – contamination falls below screening levels.	N/A	
Direct contact with contaminated groundwater				
Exposure to Radon	End User	Yes – the property is in a Radon Affected Area, as between 3 and 5% of properties are above the Action Level.	Moderate	Basic radon protection measures required. This should be discussed with building control.

11.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that it will not be necessary to undertake any specific remediation at this site. It should be appreciated, however, that careful inspection of the subgrade should be made during the groundworks. Should areas of contamination be detected then further testing may become necessary.

It should be noted, however, that a radon barrier is required in any event. This requirement should be discussed with building control.

11.3.1 General Approach to Construction

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be included in the contractor's Health and Safety Plan and site specific Method Statements. These documents should include the following main elements.

- Site operatives at all levels should be made aware of the fundamental principles of identifying potentially contaminated soils and the hazards of working with such soils not identified by the ground investigation.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives encouraged to use them.
- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition, dust masks must be provided to all site operatives for use at all times.
- Where vehicles are transferring soil to landfill site they should be covered to prevent any potential contamination of the surrounding area by dust.
- Any stockpiles of soil should be sheeted over to prevent excessive amounts of airborne dust.
- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer any potential contamination to surrounding areas.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the development the following items are required to protect the structure from the potential contaminants revealed at this site.

- Beneath, pavements and hard-standings clean inert granular sub-base should be employed.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1.
- Installation of a radon barrier.

11.4 Fill Materials

It should also be appreciated that any fill material, either site-won or imported, to be employed at the site should be subjected to the following assessment to determine its suitability.

Fill materials should be initially screened, by a suitably qualified engineer to establish that:

- It is a suitable growing media if it is to be employed as such, including compliance with BS3882 (2015)
- It is free from obvious contamination i.e. visual or olfactory evidence
- It has not come from areas where Japanese Knotweed or other invasive or injurious plants are suspected to be growing
- It is not a statutory nuisance, such as being odorous
- It is free from unsuitable material i.e. whole bricks, brick ties, timber or glass.

It should also be appreciated that any fill should be subjected to validation testing to assess its suitability. The following table has been taken from YALPAG¹² documentation and may be used as a guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

Table 8: Validation Sampling and Testing		
Fill Type	Frequency	Minimum Determinands
Virgin Quarried Material	1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.	Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn)
Crushed Hardcore, Stone, Brick	Minimum 1 per 500m ³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH. Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).
Greenfield/ Manufactured Soils	Minimum 3 Dependent on source and receptor, between 1 per 50m ³ and 1 per 250m ³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)).
Brownfield/ Screened Soils	Minimum 6 Dependent on source and receptor, between 1 per 50m ³ and 1 per 100m ³	Standard metals/ metalloids (as above), PAH (16 USEPA speciation), TPH (CWG banded), asbestos, pH and SOM (or calculated from TOC). Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).

¹² YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V4 .1 Appendix 1a, June 2021

The screening values for the above regime should also be agreed with any regulatory bodies; however, the following is recommended in the first instance.

Table 9: Fill Screening Values

Contaminant	Screening Value (Residential with Plant Uptake) (mg/kg)		Reference
	1% SOM	6% SOM	
As	37	37	Atrisk ^{SOIL} SSVs
Cd	22.1	22.1	Atrisk ^{SOIL} SSVs
Cr(VI)	3.62	3.63	Atrisk ^{SOIL} SSVs
Cu	4730	4790	Atrisk ^{SOIL} SSVs
Hg	8.81	15.8	Atrisk ^{SOIL} SSVs
Ni	136	136	Atrisk ^{SOIL} SSVs
Pb	200	200	Atrisk ^{SOIL} SSVs
V	136	138	Atrisk ^{SOIL} SSVs
Zn	20000	20300	Atrisk ^{SOIL} SSVs

Please see summary sheet within Appendix 6 for full screening values including PAHs & TPHs.

The above screening values should be considered with respect to the Soil Organic Matter (SOM) of the subject material i.e. 1% SOM would be typical for granular fill and 6% SOM for topsoil. Testing should comply with UKAS and MCERTS, where applicable, and undertaken by an accredited laboratory.

Where the material has been derived from a commercial company, certificates or other industry quality protocol compliance i.e. WRAP should be obtained. However, it will be necessary to ensure that this documentation specifically related to the material being imported, it is no more than two months old and complies with the screening and frequency requirements given above.

Suitable fill materials should be either placed immediately or sufficiently quarantined to prevent cross-contamination. If it is necessary, the quarantined material should be placed on appropriate sheeting and covered to prevent it becoming mixed with contaminated soils or dust, or penetrated by mobile contaminants.

11.5 Verification Report

At this stage, a verification report is not required. However, the requirement of a radon barrier should be discussed with, and inspected by, building control.

12. Recommendations for Further Work

- This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
- Completion and reporting of recommended additional gas monitoring.
- Discussions with contractors and building control in relation to the suitability of materials and installation methods for radon barriers.
- Detailed design of the sub-structure.

Clearly Rogers Geotechnical Services Ltd would be happy to offer advice with respect to the above and assist where necessary.

13. References

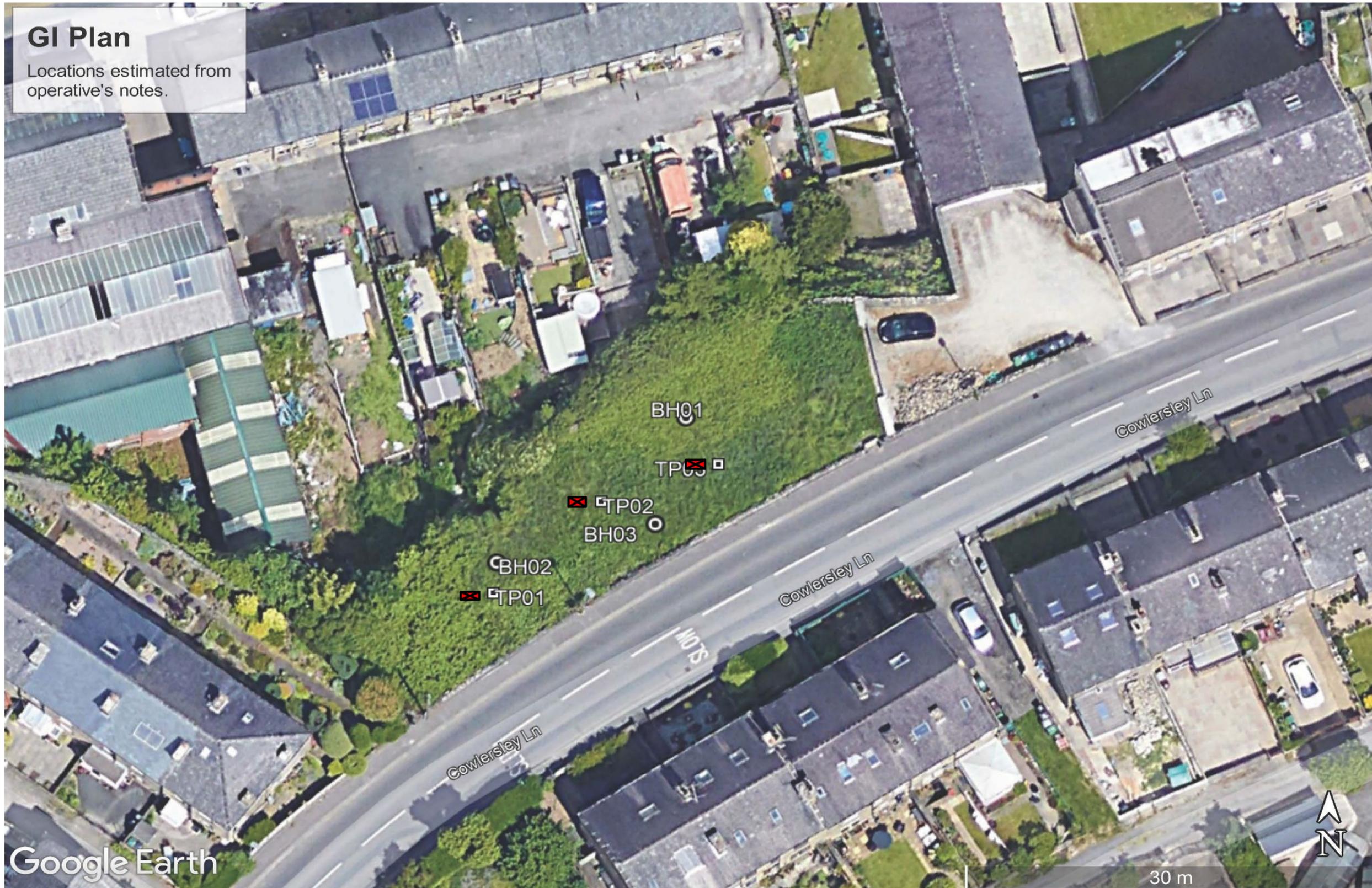
- British Geological Survey (NERC) (2024), BGS, Keyworth.
 - Geology of Britain Viewer:
(http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html)
 - Lexicon of Named Rock Units:
(<http://www.bgs.ac.uk/lexicon/>)
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- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.
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- Wilson S, Oliver S, Mallet H, Hutchings H, Card G, *Assessing risks posed by ground gasses to buildings*, CIRIA Report C665.

Appendix 1

Site Plan

GI Plan

Locations estimated from operative's notes.



Notes:
Investigation positions approximated from site operative's notes.



Rogers Geotechnical Services Ltd

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

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

Client:
Luke Sted

Job Number:
C4351/24/E/6664

Project Details:
Cowlersley Lane

Scale: Not to scale - reference only



Appendix 2

Trial Pit Records



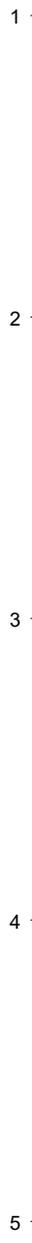
Trial Pit Log

Trialpit No
TP01
Sheet 1 of 1

Project Name: Land adj. 18B Cowlersley Lane Project No. C4351/24/E/6664 Co-ords: - Date 27/06/2024
Level: Level:

Location: Huddersfield HD4 5TY Dimensions (m): 1 Scale 1:25
Client: Luke Stead Depth 0.50 Logged RP

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.20			TOPSOIL (Loose dark brown organic silty SAND).
				0.50			Brown clayey slightly sandy sub-angular fine to coarse GRAVEL of sandstone. Medium cobble content of sandstone. WEATHERED HUDDERSFIELD WHITE ROCK End of pit at 0.50 m



Remarks: Refusal at shallow depth due to rockhead.

Stability:





Trial Pit Log

Trialpit No

TP02

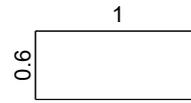
Sheet 1 of 1

Project Name: Land adj. 18B Cowlersley Lane

Project No.
C4351/24/E/6664Co-ords: -
Level:Date
27/06/2024

Location: Huddersfield HD4 5TY

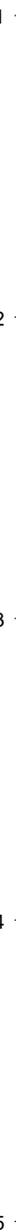
Dimensions (m):

Scale
1:25

Client: Luke Stead

Logged
RP

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30			TOPSOIL (Loose dark brown organic silty SAND).
				0.60			Brown clayey slightly sandy sub-angular fine to coarse GRAVEL of sandstone. Medium cobble content of sandstone. WEATHERED HUDDERSFIELD WHITE ROCK End of pit at 0.60 m



Remarks: Refusal at shallow depth due to rockhead.

Stability:





Trial Pit Log

Trialpit No

TP03

Sheet 1 of 1

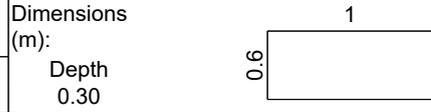
Project Name: Land adj. 18B Cowlersley Lane

Project No. C4351/24/E/6664

Co-ords: -
Level:

Date 27/06/2024

Location: Huddersfield HD4 5TY

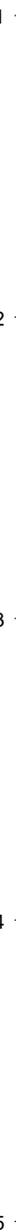


Scale 1:25

Logged RP

Client: Luke Stead

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.30			TOPSOIL (Loose dark brown organic silty SAND).
				0.30			SANDSTONE End of pit at 0.30 m



Remarks: Refusal at shallow depth due to rockhead.

Stability:



Appendix 3

Borehole Records



Borehole Log

Borehole No.

BH01

Sheet 2 of 2

Project Name: Land adj. 18B Cowlersley Lane	Project No. C4351/24/E/6664	Co-ords:	Hole Type RO+RC
Location: Huddersfield HD4 5TY	Level:		Scale 1:25
Client: Luke Stead	Dates: 05/07/2024		Logged By ABk+RP

Well	Water Strikes	Samples and In Situ Testing							Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Dia. (mm)	TCR (%)	SCR (%)	RQD (%)	FS (mm)				
[Well Diagram]	[Water Strikes]	6.50	C		100	57	43	65 162 280	8.50	[Legend]	Weak to medium strong, very thinly to thinly bedded, yellowish brown and grey medium- and coarse-grained quartz-rich SANDSTONE. Very closely to closely spaced. Discontinuities are irregular and rough, with occasional sand and gravel infill. Localised near vertical jointing. HUDDERSFIELD WHITE ROCK	
		6.74	C									
		7.93	C		100	93	79	65 155 265				
											End of Borehole at 8.50m	

5.95m: 100mm vertical joint.

Remarks
1m casing. Borehole dry.





Borehole Log

Borehole No.

BH02

Sheet 1 of 2

Project Name: Land adj. 18B Cowlersley Lane	Project No. C4351/24/E/6664	Co-ords:	Hole Type RO+RC
Location: Huddersfield HD4 5TY	Level:		Scale 1:25
Client: Luke Stead	Dates: 04/07/2024		Logged By ABk+RP

Well	Water Strikes	Samples and In Situ Testing					Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results						
							0.30		 TOPSOIL (Driller's notes).  Yellow SANDSTONE (Driller's notes).	
		2.30	C	100	54	23	1.00		 Weak to medium strong, very thinly bedded grey medium- and coarse-grained quartz-rich SANDSTONE. Very closely to spaced. Discontinuities are irregular and rough, with occasional sand and gravel infill. HUDDERSFIELD WHITE ROCK	
		3.13	C	100	90	49				
				87	43	23	4.70			
									 Weak to medium strong, very thinly to thinly bedded, yellowish brown and grey medium- and coarse-grained quartz-rich	

Remarks
1m casing. Borehole dry.





Borehole Log

Borehole No.

BH02

Sheet 2 of 2

Project Name:	Land adj. 18B Cowlersley Lane	Project No.	C4351/24/E/6664	Co-ords:		Hole Type	RO+RC
Location:	Huddersfield HD4 5TY	Level:		Scale	1:25	Logged By	ABk+RP
Client:	Luke Stead	Dates:	04/07/2024				

Well	Water Strikes	Samples and In Situ Testing							Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Dia. (mm)	TCR (%)	SCR (%)	RQD (%)	FS (mm)					
												Weak to medium strong, very thinly to thinly bedded, yellowish brown and grey medium- and coarse-grained quartz-rich SANDSTONE. Very closely to closely spaced. Discontinuities are irregular and rough, with occasional sand and gravel infill. Localised near vertical jointing. HUDDERSFIELD WHITE ROCK 6.1m: 300mm vertical joint.	
					100	63	49						6
		7.20	C										7
		7.65	C		90	61	56					8	
									8.50			8.50	
												End of Borehole at 8.50m	

Remarks
1m casing. Borehole dry.





Borehole Log

Borehole No.

BH03

Sheet 1 of 1

Project Name:	Land adj. 18B Cowlersley Lane	Project No.	C4351/24/E/6664	Co-ords:		Hole Type	RO
Location:	Huddersfield HD4 5TY	Level:		Scale	1:25	Logged By	ABk
Client:	Luke Stead	Dates:	05/07/2024				

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30		<div style="border: 1px solid black; padding: 2px; width: 50px; height: 20px; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></div> TOPSOIL (Driller's notes).	
					2.00		<div style="border: 1px solid black; padding: 2px; width: 50px; height: 20px; background: radial-gradient(circle, black 1px, transparent 1px); background-size: 4px 4px;"></div> Yellow SANDSTONE (Driller's notes).	
							End of Borehole at 2.00m	

Remarks



Appendix 4

Gas Monitoring Sheets

CERTIFICATION OF CALIBRATION



No. 66916



Certificate Number: G503524_2/35282

Date Of Calibration: 20-Apr-2024

Issued by: QED Environmental Systems Inc.

Customer: QED ENVIRONMENTAL SYSTEMS LIMITED

QED ENVIRONMENTAL SYSTEMS LTD CYAN PARK - UNIT 3 JIMMY HILL WAY COVENTRY, WEST MIDLA CV2 4QP GB

Description:

Model: GA5000

Serial Number: G503524

Accredited Results:

Methane (CH4)

Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.1	5.0	0.42
15.0	14.9	0.66
60.0	59.7	1.03

Carbon Dioxide (CO2)

Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.0	5.0	0.43
15.0	15.0	0.71
40.0	40.0	1.19

Oxygen (O2)

Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
20.9	21.0	0.25

Gas cylinders are traceable and details can be provided if requested.

CH4, CO2 readings recorded at: 31.2 °C/88.1 °F

O2 readings recorded at: 22.1 °C/71.7 °F

Barometric Pressure: 0987 mbar/29.15 "Hg

Method of Test : The analyzer is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure ISP17.

Instrument has passed calibration as the measurement result is within the specification limit. The specification limit takes into account the measurement uncertainty.

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

The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Certification only applies to results shown. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Calibration Instance: 118

IGC Instance: 118

www.qedenv.com Redacted

Page 1 of 3 | L.P015LNANIST-1.1

QED Environmental Systems Inc. 2355 Bishop Circle West, Dexter, MI 48130

CERTIFICATION OF CALIBRATION



Date Of Calibration: 20-Apr-2024

No. 66916

Certificate Number: G503524_2/35282

Issued by: QED Environmental Systems Inc.

Non Accredited results:

Pressure Transducers (inches of water column)					
Transducer	Certified (Low)	Reading (Low)	Certified (High)	Reading (High)	Accuracy
Relative	0"	0"	40"	40.33"	2.0"

Barometer (mbar)	
Reference	Instrument Reading
0987 mbar / 29.15 "Hg	0987 mbar / 29.16 "Hg

As received gas check readings are only recorded if the instrument is received in a working condition. Where the instrument is received damaged no reading can be taken. **Redacted**

Date of Issue : 24 Apr 2024

Approved By Signatory

Linda Ostrowski
Laboratory Inspection

The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Certification only applies to results shown. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Calibration Instance: 118

IGC Instance: 118

www.qedenv.com **Redacted**

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QED Environmental Systems Inc. 2355 Bishop Circle West, Dexter, MI 48130

Appendix 5

Laboratory Testing

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LABORATORY REPORT

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< GEOTECHNICAL >

job number	C4351/24/E/6664	date	23/07/2024
site address	Land adjacent to 18B Cowlersley Lane Huddersfield , West Yorkshire, HD4 5TY		
date scheduled	17/07/2024	date issued	23/07/2024
issued by	H J Letch		



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Geotechnical
Specialists

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Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



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Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



8948

Schedule of UKAS Accredited Laboratory Tests



1. CLASSIFICATION OF SOIL	BS 1377-2:1990	BS EN ISO 17892	Accredited (A)	Unaccredited (U)
1.1 Moisture / Water content determination				
i. Oven drying	Pt 2 : 3.2	Pt 1 : 2014 Pt 12 : 2018 : 5.3 / 5.5	A	
ii. Saturation m/c of chalk	Pt 2 : 3.3			U
1.2 Index Properties				
i. Liquid limit – cone penetrometer	Pt 2 : 4.3		A	
ii. Plastic limit	Pt 2 : 5.3		A	
iii. Shrinkage limit	Pt 2 : 6.3			U
iv. Linear shrinkage	Pt 2 : 6.5		A	
1.3 Particle Density				
i. Gas jar	Pt 2 : 8.2		A	
ii. Large pycnometer	Pt 2 : 8.3			U
iii. Small pycnometer	Pt 2 : 8.4	Pt 3 : 2015 : 5.1		U
1.4 Density Tests				
i. Linear measurement	Pt 2 : 7.2	Pt 2 : 2014 : 5.1	A	
ii. Immersion in water	Pt 2 : 7.3	Pt 2 : 2014 : 5.2		U
iii. Fluid / Water displacement	Pt 2 : 7.4	Pt 2 : 2014 : 5.3		U
iv. Sand replacement	Pt 9 : 2.1, 2.2			U
v. Core cutter	Pt 9 : 2.4			U
1.5 Particle Size Distribution				
i. Dry Sieve	Pt 2 : 9.2	Pt 4 : 2016 : 5.2	A	
ii. Wet Sieve	Pt 2 : 9.3	Pt 4 : 2016 : 5.2	A	
iii. Sedimentation by pipette	Pt 2 : 9.4	Pt 4 : 2016 : 5.3 / 5.4	A	
iv. Sedimentation by hydrometer	Pt 2 : 9.5			U
2. CHEMICAL TESTS				
ii. Mass loss on ignition	Pt 3 : 4			U
3. COMPACTION RELATED TESTS				
3.1 Dry density/moisture relationship				
i. 2.5kg rammer – 1 litre mould	Pt 4 : 3		A	
- CBR mould	Pt 4 : 3		A	
ii. 4.5kg rammer – 1 litre mould	Pt 4 : 3		A	
- CBR mould	Pt 4 : 3		A	
3.2 Moisture Condition Value				
i. Single point test	Pt 4 : 5.4			U
ii. MCV/moisture content relationship	Pt 4 : 5.5			U
3.3 California Bearing Ratio				
i. Undisturbed sample	Pt 5 : 7		A	
ii. Recompacted sample	Pt 5 : 7		A	
iii. Soaked, inc measurement of swell	Pt 5 : 7		A	
4. COMPRESSIBILITY OF SOIL				
ii. Swelling pressure test	Pt 5 : 3		A	
ii. Swelling pressure test	Pt 5 : 3			U
5. SHEAR STRENGTH OF SOIL				
i. Hand shear vane	Makers instructions			U
ii. Shear box (100mm square sample)	BS 1377 : Pt 7 : 4			U
iii. Triaxial – quick undrained	BS 1377 : Pt 7 : 8, 9		A	
6. PERMEABILITY				
i. Falling head	K. H. Head Vol 2			U
ii. Constant head	BS 1377 : Pt 6 : 6			U
iii Triaxial cell	BS 1377 : Pt 6 : 6			U
7. ROCK TESTS				
7.1 Classification Tests				
i. Natural moisture content	-			U
ii. Saturated moisture content	-			U
iii. Natural density	-			U
iv. Porosity	-			U
7.2 Strength Tests				
i. Point load index	ISRM '85			U
ii. Uniaxial compression test	ISRM '81			U

ENVIRONMENTAL & GEOTECHNICAL



Environmental Geotechnical Specialists



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Disclaimer

The results reported herein relate only to the material supplied to the laboratory.

-

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GEOTECHNICAL TESTING RESULTS



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ENVIRONMENTAL TESTING RESULTS



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☎ 01484 604354 Company No. 5130864



Rogers Geotechnical Services Ltd
Offices 1&2 Barncliffe Business Pk
Near Bank, Shelley
Huddersfield
West Yorkshire
HD8 8LU

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

t Redacted

e

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

Analytical Report Number : 24-028075

Project / Site name:	Cowlersley Lane, Huddersfield	Samples received on:	27/06/2024
Your job number:	C4351 24 E 6664	Samples instructed on/ Analysis started on:	01/07/2024
Your order number:		Analysis completed by:	05/07/2024
Report Issue Number:	1	Report issued on:	05/07/2024
Samples Analysed:	3 soil samples		

Redacted

Signed:

Dominika Liana
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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

Analytical Report Number: 24-028075

Project / Site name: Cowlersley Lane, Huddersfield

Lab Sample Number	243129	243130	243131
Sample Reference	TP01	TP02	TP03
Sample Number	None Supplied	None Supplied	None Supplied
Depth (m)	0.20	0.20	0.10
Date Sampled	27/06/2024	27/06/2024	27/06/2024
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	15	13	12
Total mass of sample received	kg	0.1	NONE	0.8	0.8	0.8

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	PDO	PDO	PDO

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	5.2	5.6	6.7
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	%	0.005	MCERTS	0.058	0.061	0.039
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	5.5	12	15
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	2.77	5.87	7.39
Organic Matter (automated)	%	0.1	MCERTS	4.1	5.4	6.7

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.06	0.08	0.07
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.05	0.14
Acenaphthene	mg/kg	0.05	MCERTS	0.15	0.18	0.22
Fluorene	mg/kg	0.05	MCERTS	0.09	0.13	0.21
Phenanthrene	mg/kg	0.05	MCERTS	1.5	2.1	3.1
Anthracene	mg/kg	0.05	MCERTS	0.36	0.37	0.55
Fluoranthene	mg/kg	0.05	MCERTS	3.6	4.2	5.7
Pyrene	mg/kg	0.05	MCERTS	3.2	3.8	4.9
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.6	1.9	2.3
Chrysene	mg/kg	0.05	MCERTS	1.9	2.3	2.8
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	2.2	2.9	3
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.89	0.99	1.2
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.8	2.2	2.5
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1	1.3	1.4
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.24	0.3	0.31
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.1	1.4	1.5

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	19.6	24.1	29.8
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Analytical Report Number: 24-028075

Project / Site name: Cowlersley Lane, Huddersfield

Lab Sample Number	243129	243130	243131
Sample Reference	TP01	TP02	TP03
Sample Number	None Supplied	None Supplied	None Supplied
Depth (m)	0.20	0.20	0.10
Date Sampled	27/06/2024	27/06/2024	27/06/2024
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	18	14
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	< 0.2	0.5
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	16	15
Copper (aqua regia extractable)	mg/kg	1	MCERTS	32	42	33
Lead (aqua regia extractable)	mg/kg	1	MCERTS	90	170	140
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	8.3	9.6	8.6
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.4	1.7	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	28	28	23
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	69	110	110

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.02	NONE	< 0.020	< 0.020	< 0.020
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.02	NONE	< 0.020	< 0.020	< 0.020
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.05	NONE	< 0.050	< 0.050	< 0.050
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC5 - EC35 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10	< 10

TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	NONE	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	NONE	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.05	NONE	< 0.050	< 0.050	< 0.050
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	17	21	24
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	37	40	44
TPHCWG - Aromatic >EC5 - EC35 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	54	61	69

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0

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



Analytical Report Number : 24-028075

Project / Site name: Cowlersley Lane, Huddersfield

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
243129	TP01	None Supplied	0.2	Brown loam and sand with gravel and vegetation
243130	TP02	None Supplied	0.2	Brown loam and sand with gravel and vegetation
243131	TP03	None Supplied	0.1	Brown loam and sand with gravel and vegetation

Analytical Report Number : 24-028075

Project / Site name: Cowlersley Lane, Huddersfield

Water matrix abbreviations:

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088	D/W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS

Analytical Report Number : 24-028075

Project / Site name: Cowlersley Lane, Huddersfield

Water matrix abbreviations:

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution



Rogers Geotechnical Services: Soil Screening Values Comparison Sheet



Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet														
Job Number	C4351/24/E			A = WS Atkins PLC, Atrisk Soil Screening Values. A+ = Values updated June 2017. A* = Atrisk's SSV is lower than I2's detectable limit for this compound. B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report. C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter. D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used.					KEY <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #f4cccc; border: 1px solid black; margin-right: 5px;"></div> Exceeds SSV <div style="width: 20px; height: 20px; background-color: #fff2cc; border: 1px solid black; margin-right: 5px;"></div> Exceeds 2017, Below 2015 <div style="width: 20px; height: 20px; background-color: #d9ead3; border: 1px solid black; margin-right: 5px;"></div> Below limit of detection (LOD) </div>					
Job Name	Land off Cowlersley Lane													
Date	08.07.24			Sample Location	TP01	TP02	TP03							
Client	Luke Stead			Depth Top	0.2	0.2	0.1							
				Depth Base										
Determinand	Units	Ref	LOD	Residential With Plant Uptake 6%										
				Atrisk 2015 (No Free Product)	Atrisk 2017									
Cadmium	mg/kg	C	0.2		22.1	0.4	< 0.2	0.5						
Chromium (Hexavalent)	mg/kg	B/C	1.8	20.5	3.62	< 1.8	< 1.8	< 1.8						
Copper	mg/kg	A+	1.0		4790	32	42	33						
Mercury	mg/kg	A/D	0.3		15.8	< 0.3	< 0.3	< 0.3						
Nickel	mg/kg	A+	1.0		136	8.3	9.6	8.6						
Lead	mg/kg	C	1.0		200	90	170	140						
Zinc	mg/kg	A+	1.0		20300	69	110	110						
Vanadium	mg/kg	A+	1.0		138	28	28	23						
Arsenic	mg/kg	C	1.0		37	17	18	14						
Selenium	mg/kg	A	1.0		375	1.4	1.7	< 1.0						
Cyanide (Free)	mg/kg	A	1.0		34	< 1.0	< 1.0	< 1.0						
Total Phenols	mg/kg	A	1.0		1200	< 1.0	< 1.0	< 1.0						
Naphthalene	mg/kg	A+	0.05		12.2	0.06	0.08	0.07						
Acenaphthylene	mg/kg		0.05			< 0.05	0.05	0.14						
Acenaphthene	mg/kg	A+	0.05	0	2760	0.15	0.18	0.22						
Fluorene	mg/kg	A+	0.05	0	2610	0.09	0.13	0.21						
Phenanthrene	mg/kg		0.05			1.5	2.1	3.1						
Anthracene	mg/kg	A+	0.05		26200	0.36	0.37	0.55						
Fluoranthene	mg/kg	A+	0.05		2980	3.6	4.2	5.7						
Pyrene	mg/kg	A+	0.05		2120	3.2	3.8	4.9						
Benzo[a]anthracene	mg/kg	A	0.05		8.54	1.6	1.9	2.3						
Chrysene	mg/kg	A	0.05	927	2.64	1.9	2.3	2.8						
Benzo[b]fluoranthene	mg/kg	A	0.05	9.86	7.29	2.2	2.9	3						
Benzo[k]fluoranthene	mg/kg	A	0.05	100	4.12	0.89	0.99	1.2						
Benzo[a]pyrene	mg/kg	B/C	0.05	5	0.998	1.8	2.2	2.5						
Indeno(1,2,3-c,d)Pyrene	mg/kg	A*	0.05	9.75	0.368	1	1.3	1.4						
Dibenzo(a,h)Anthracene	mg/kg	A	0.05	4.95	2.05	0.24	0.3	0.31						
Benzo[g,h,i]perylene	mg/kg	A	0.05	103	0.112	1.1	1.4	1.5						
Total Of 16 PAH's	mg/kg		0.8											
Aliphatic TPH >C5-C6	mg/kg	A+	0.02		369	< 0.020	< 0.020	< 0.020						
Aliphatic TPH >C6-C8	mg/kg	A+	0.02	1240	768	< 0.020	< 0.020	< 0.020						
Aliphatic TPH >C8-C10	mg/kg	A+	0.05		204	< 0.050	< 0.050	< 0.050						
Aliphatic TPH >C10-C12	mg/kg	A+	1.0	1180	297	< 1.0	< 1.0	< 1.0						
Aliphatic TPH >C12-C16	mg/kg	A+	2.0	4130	125	< 2.0	< 2.0	< 2.0						
Aliphatic TPH >C16-C21	mg/kg	A+	8.0		210100	< 8.0	< 8.0	< 8.0						
Aliphatic TPH >C21-C35	mg/kg	A+	8.0		210100	< 8.0	< 8.0	< 8.0						
Aliphatic TPH >C35-C44	mg/kg		10.0											
Total Aliphatic Hydrocarbons	mg/kg		10.0											
Aromatic TPH >C5-C7	mg/kg	A+	0.01		0.871	< 0.010	< 0.010	< 0.010						
Aromatic TPH >C7-C8	mg/kg	A+	0.01	0	780	< 0.010	< 0.010	< 0.010						
Aromatic TPH >C8-C10	mg/kg	A+	0.05		232	< 0.050	< 0.050	< 0.050						



Rogers Geotechnical Services: Soil Screening Values Comparison Sheet



Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet												
Job Number	C4351/24/E			A = WS Atkins PLC, Atrisk Soil Screening Values. A+ = Values updated June 2017. A* = Atrisk's SSV is lower than I2's detectable limit for this compound. B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report. C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter. D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used.						KEY		
Job Name	Land off Cowlersley Lane									<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> ■ Exceeds SSV ■ Exceeds 2017, Below 2015 ■ Below limit of detection (LOD) </div> <div style="width: 30%; text-align: right;"> </div> </div>		
Date	08.07.24			Sample Location	TP01	TP02	TP03					
Client	Luke Stead			Depth Top	0.2	0.2	0.1					
				Depth Base								
Determinand	Units	Ref	LOD	Residential With Plant Uptake 6%								
Aromatic TPH >C10-C12	mg/kg	A+	1.0		468	< 1.0	< 1.0	< 1.0				
Aromatic TPH >C12-C16	mg/kg	A+	2.0	830	830	< 2.0	< 2.0	< 2.0				
Aromatic TPH >C16-C21	mg/kg	A+	10.0		1040	17	21	24				
Aromatic TPH >C21-C35	mg/kg	A+	10.0		1710	37	40	44				
Aromatic TPH >C35-C44	mg/kg		10.0									
Total Aromatic Hydrocarbons	mg/kg		10.0									
Total Petroleum Hydrocarbons	mg/kg		10.0									
pH			N/A			5.2	5.6	6.7				
Sulphate (2:1 Water Soluble) as SO4	mg/l		0.00125			2.77	5.87	7.39				
ACM Type			N/A									
Asbestos Identification	%					Not-detected	Not-detected	Not-detected				
ACM Detection Stage			N/A									
Moisture	%		0.01									
Soil Colour			N/A									
Other Material			N/A									
Soil Texture			N/A									
Sulphate (Total)	%		0.005			0.058	0.061	0.039				
Organic Matter	%		0.1			4.1	5.4	6.7				



< ENVIRONMENTAL > < GEOTECHNICAL >

End of Report



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864

Appendix 6

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Residential With Plant Uptake Landuse

Tox Data Report No.	Compound	Residential with Homegrown Produce Landuse (mg/kg)				Reference
		SOM: 1%		SOM: 6%		
<i>Metals</i>						
		SOM: 1%		SOM: 6%		
3	Cadmium	22.1		22.1		C
4	Chromium VI	3.62	20.5	3.63	20.5	B/C
	Copper	4730		4790		A+
7	Mercury	8.81		15.80		A/D
8	Nickel	136		136		A+
	Lead	200		200		C
	Zinc	20000		20300		A+
	Vanadium	136		138		A+
<i>Semi and Non Metals</i>						
1	Arsenic	37		37		C
10	Selenium	375		375		A
	Free Cyanide	34		34		A
9	Phenols (total)	267		1200		A
<i>Poly Aromatic Hydrocarbons</i>						
		Free product	No free product	Free product	No free product	
20	Napthalene	0.829		12.2		A+
	Acenaphthene	157	608	2760		A+
	Fluorene	735		2610		A+
	Anthracene	10200		26200		A+
	Fluoranthene	983		2980		A+
	Pyrene	668		2120		A+
	Benzo(a)anthracene	1.71	4.52			A
2	Chrysene	0.44	585			A
2	Benzo(b)fluoranthene	1.22	7.72			A
2	Benzo(k)fluoranthene	0.686	84.4			A
2	Benzo(a)pyrene	1.51	4.95	2.05	4.95	B/C
2	Dibenzo(a,h)anthracene	0.00393	0.838			A*
2	Indeno(1,2,3-cd)pyrene	0.0614	7.31			A
2	Benzo(g,h,i)perylene	0.0187	96.2			A
<i>Petroleum Hydrocarbons</i>						
	Aliphatic C5-C6	42.7		369		A+
	Aliphatic C6-C8	99.3		768	1240	A+
	Aliphatic C8-C10	13.9		204		A+
	Aliphatic C10-C12	49.9	81.7	297	1180	A+
	Aliphatic C12-C16	20.9	385	125	4130	A+
	Aliphatic C16-C21	210000		210100		A+
	Aliphatic C21-C35	210000		210100		A+
	Aromatic C5-C7 (Benzene)	0.137		0.871		A+
	Aromatic C7-C8 (Toluene)	113		780		A+
	Aromatic C8-C10	20.5		232		A+
	Aromatic C10-C12	70		468		A+
	Aromatic C12-C16	155	165	830		A+
	Aromatic C16-C21	319		1040		A+
	Aromatic C21-C35	1120		1710		A+
<i>Others</i>						
Asbestos Not Detected						
A+ = Values update June 2017.						
A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound.						
B = Health Criterion Values (available from toxicological reviews published in the C4SL project methodology report).						
C = Category 4 Screening Levels (C4SLs).						
D = SSV provided is for Methyl Mercury.						