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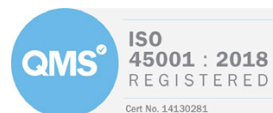
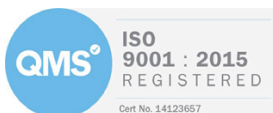
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PHASE 2

GEO-ENVIRONMENTAL REPORT

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Contents

		Page
1.	Introduction	2
2.	Limitations	2
3.	Desk Study	2
4.	Fieldworks	2
4.1	Windowless Sample Boreholes	3
4.2	Standard Penetration Tests	3
4.3	Dynamic Probes	3
4.4	Gas Monitoring Standpipes	3
5.	Geology	4
6.	Strata Conditions	4
6.1	General Strata	5
6.2	Groundwater	5
7.	Insitu Testing	5
7.1	Standard Penetration Tests	5
7.2	Dynamic Penetration Tests	5
7.3	Gas and Water Level Monitoring	6
8.	Laboratory Testing - Geotechnical	6
8.1	Geotechnical Properties	7
9.	Laboratory Testing - Environmental	7
10.	Discussion of Ground Conditions - Geotechnical	8
10.1	Foundations	8
10.2	Volume Change Potential	9
10.3	Ground-floors	9
10.4	Hard-standing Areas	9
10.5	Effect of Sulphates	9
11.	Discussion of Ground Conditions - Environmental	10
11.1	Discussion of Test Results	10
11.1.1	Soil Samples	10
11.1.2	Gas Concentrations	11
11.2	Site Specific Risk Assessment	12
11.2.1	Approach	12
11.2.2	Conceptual Ground Model and Risk Assessment	12
11.3	Indicative Remediation Strategy	15
11.3.1	Remediation Objectives	15
11.3.2	Development Requirements	15
11.3.3	Outline Strategy	15
11.4	Fill Materials	16
11.5	Verification Report	18



12.	Recommendations for Further Work	19
13.	References	14

Appendices

1.	Site Plan
2.	Borehole Records
3.	Dynamic Probing Records
4.	Laboratory Testing
5.	Fill Screening Values



Report on a Phase 2 Geo-environmental Investigation

Location:	Land Adjacent to 21 Westcliffe Rise Cleckheaton, West Yorkshire, BD19 5HX	
For:	Alex Senior	
Report No.	C5245/25/E/8048	Report date: August 2025

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

Imran Sakoor BEng FGS Geo-environmental Engineer	Rob Palmer MSc FGS ACIEH Engineering Director
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Report Summary¹

Item	Comments	Section
Development	Erection of 2no. new residential dwellings with associated garden area and parking.	1.
Geology	Solid geology – Pennine Lower Coal Measures Formation.	5.
Strata Conditions	Made ground present to between 0.5m and 0.8m depth, over firm friable slightly sandy slightly gravelly clay.	6.
Groundwater	None encountered during investigation.	6.2
Foundation Design	Shallow foundation solution.	10.1
Effect of Sulphates	Concrete class DC-1.	10.5
Contamination	The site is uncontaminated in regards to the intended end use.	11.
Ground Gas	Site is Characteristic Situation Level 2 and some remediation measures will be required. <u>Note:</u> A Phase 3 Remediation Strategy and Phase 4 Verification report will be required in relation to a gas protection system.	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 21 Westcliffe Rise is to be developed by the erection of 2no. new residential dwellings with associated garden areas and parking. 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

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services (RGS) and the results were presented as report number C3383/23/E/5124 in May 2023. This report has been used extensively during the current intrusive investigation.

4. Fieldworks

The fieldworks were undertaken on the 19th June 2025 and included the following:

- Four windowless sample boreholes.
- Standard penetration tests within one borehole.
- Four dynamic probes.
- Three gas monitoring standpipes.

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

4.1 Windowless Sample Boreholes

These boreholes were sunk using a drive-in windowless sampler. The cores were undertaken in 1m lengths and reduced in diameter from 87mm for the first 1m through 77mm and 67mm for subsequent 1m increments. 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 windowless sample records which are presented in Appendix 2. Also included on these records are the core diameters and percentages of core recovered.

4.2 Standard Penetration Tests

Standard penetration tests (SPT) were undertaken at regular depth increments within windowless sample borehole WS04. The SPT was conducted in accordance with the procedures given in BS EN ISO 22476: Part 3: 2005 +A1: 2011, and the results are summarised on the borehole record. During this work an automatic trip hammer of 63.5kg falling through 750mm was employed to drive either a cone or split barrel sampler assembly into the ground and the recovered barrel samples were retained in air tight plastic containers.

4.3 Dynamic Probes

Dynamic penetration tests were undertaken adjacent to the windowless sample boreholes in accordance with the procedure given in BS EN ISO 22476: Part 2: 2005 +A1: 2011, using the super heavy penetrometer (DPSH). This probe consists of a 63.5kg mass falling through 750mm onto an anvil, which drives a 50mm diameter cone into the ground. The number of blows required to drive the cone through successive 100mm increments are recorded as the N_{100} values. The results of the dynamic penetration tests are tabulated and presented as bar charts of N_{100} values versus depth in Appendix 3.

4.4 Gas Monitoring Standpipes

Gas monitoring standpipes were installed between 1.6m and 2.8m depth in all of the boreholes and the installation details are shown on the appropriate borehole records. In all cases, the monitoring standpipe consisted of a perforated pipe from the base of the borehole to 1.0m below surface, with a non-perforated pipe to ground level. 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	Previous Name ³	Description ³
Superficial Geology	-	-	None indicated to underlie the site.
Solid Geology	Pennine Lower Coal Measures Formation - Sandstone	Grey Measures of Yorkshire and Nottingham	Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part.

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
0.10 – 0.30	TOPSOIL.	All	None
0.50	MADE GROUND (Slightly gravelly SAND).	WS03	None
0.50 – 0.80	MADE GROUND (Friable slightly gravelly very sandy CLAY).	All	None
1.45 – 1.65	Friable slightly sandy slightly gravelly CLAY.	All	None
+1.70 – +2.90	Thinly laminated SANDSTONE.	All	None

'+' 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, made ground was revealed to depths of between 0.5m and 0.8m below ground level. Then firm friable slightly sandy slightly gravelly clay was encountered to depths of between 1.45m and 1.65m, over extremely weak sandstone. This material is considered to be representative of the residual becoming highly weathered Pennine Lower Coal Measures Formation.

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 Standard Penetration Tests

The standard penetration tests carried out are summarised in the following table:

Strata	Depth Range (m)	SPT 'N' (Blows/300mm)		Comments
		Granular soils	Cohesive soils	
Sandy, slightly gravelly CLAY	1.00m to 1.45m	-	11	Results indicate cohesive material is present in a firm insitu condition.

7.2 Dynamic Penetration Tests

Dynamic penetration tests were undertaken adjacent to the windowless sample borehole positions. A summary of the results is presented below:

Position	Blows/100mm			Refusal type (Effective/ Abrupt) ⁴	Comments
	0 - 2	3 - 10	10+		
	Depth to which blow count range was observed (m)				
DP01	1.5	1.8	1.85	Abrupt	All results indicate initial low blows, increasing to moderate, then high, then rapidly to refusal.
DP02	1.2	2.3	2.44	Abrupt	

⁴ Abrupt refusal: obstruction or bedrock encountered. Effective refusal: +25 blows/100mm.

DP03	1.4	2.5	3.03	Abrupt	
DP04	1.7	2.0	2.61	Abrupt	

7.3 Gas and Water Level Monitoring

The standpipes were monitored between the 1st and 21st July 2025. The results of the gas monitoring undertaken to date are tabulated below and full results are presented in Appendix 4.

Table 5: Gas Monitoring

Location	Date	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS01	01/07/2025	0.0	2.0	19.3	0.0	1003↔	DRY	1.60
	07/07/2025	0.0	1.9	19.1	0.0	1002↑	DRY	
	14/07/2025	0.0	2.1	19.7	0.0	994↔	DRY	
	21/07/2025	0.0	2.3	18.4	0.0	985↓	DRY	
WS02	01/07/2025	0.0	3.8	18.5	0.0	1003↔	DRY	2.00
	07/07/2025	0.0	1.6	19.9	0.0	1002↑	DRY	
	14/07/2025	0.0	4.0	18.6	0.0	994↔	DRY	
	21/07/2025	0.0	4.0	18.1	0.0	985↓	1.98	
WS03	01/07/2025	0.0	4.5	18.4	0.0	1003↔	2.44	2.80
	07/07/2025	0.0	5.1	18.1	0.0	1002↑	2.82	
	14/07/2025	0.0	4.8	18.4	0.0	994↔	2.56	
	21/07/2025	0.0	5.6	17.7	0.0	985↓	2.26	

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

This work was undertaken using a Gas Data GFM Series monitor (serial No: 13747) which was last calibrated on the 27th May 2025.

8. Laboratory Testing - Geotechnical

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

- Determination of water content BS EN ISO 17892-1:2014
- Determination of liquid and plastic limits BS EN ISO 17892-12:2018
- Soluble sulphate content BS 1377-3:2018+A1:2021: Pt3: 7.3
- pH value BS 1377-3:2018+A1:2021: Pt3: 12

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

Table 6: Summary of Geotechnical Test Results

Test type	Number of tests	Range of results		Comments
Water content determinations	3	18% and 20%		Below the plastic limit.
Index properties (1 Point)	3	LL PL PI	39% and 42% 23% and 24% 15% to 19%	Clay of intermediate plasticity. Consistency index: 1.2 and 1.3. NHBC Class: Low.

Soluble sulphate & pH	3	SO ₄ pH	21.2 to 173 mg/l 7.8 & 7.9	
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In cohesive soil the approximate cohesion, c_u , and coefficient of consolidation, m_v , may be obtained from the equivalent SPT 'N' value using the following expressions (Stroud 1975).

$$c_u = f_1 N$$

$$m_v = \frac{1}{f_2 N}$$

where: c = cohesion (kN/m²).
 m_v = Coefficient of consolidation (m²/MN).
 f_1 & f_2 = factors based on plasticity index.
 N = SPT 'N₃₀₀' value.

For the cohesive soils revealed at this site the highest (worst case) plasticity index⁵ of 15% could be employed, which suggests an f_1 value of 6.4 and an f_2 value of 0.64.

8.1 Geotechnical Properties

The idealised geotechnical properties employed in design are summarised below.

Table 7: Summary of Geotechnical Properties			
Property	Range of values		Comments
Volume change potential (NHBC)	Low		Slightly gravelly sandy CLAY.
Shear strength parameters (at proposed foundation level)	c_u	70kN/m ²	Stroud (1974) where $c_u = f_1 N$. SPT 'N' = 11. Cohesion based on Stroud noted to be higher than strata description.
Consolidation characteristics	m_v	0.14m ² /MN	Stroud (1974) where $m_v = 1/f_2 N$.
Concrete classification	DC-1		Natural ground locations (static water).

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 identification.

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.

⁵ See paragraph 6.2 'Index Property Tests'

10. Discussion of Ground Conditions - Geotechnical

It is understood that this site is to be developed by the construction of 2no. residential dwellings with associated garden areas and car parking. The precise structural details are not currently known, thus the discussion below is of a generalised nature.

10.1 Foundations

It cannot be recommended that foundations be placed within the made ground or any soft neat surface strata. Such soils are not deemed suitable to represent suitable bearing strata as they are present in a weak and variable condition such that excessive total and or differential settlement could occur under moderately light loading.

It is considered that the weathered fraction of the Pennine Lower Coal Measures Formation will provide a suitable bearing stratum, provided that the foundations are placed 200mm into soil generally described as being present in at least a firm insitu condition.

It is considered that strip or spread foundations constructed within this material, at a minimum depth of say 1.0m, could be designed assuming an allowable increase in stress given in the following table:

Table 8: Allowable Increase in Stress							
Foundation Type		Strip Footings			Spread/Pad Footings		
Foundation Breadth	B (m)	0.6	1.0	1.5	1.0	1.5	2.0
Foundation Depth	D (m)	1.0			1.0		
Allowable Increase in Stress	(kN/m ²)	110	105	100	125	120	115
Net Allowable Bearing Capacity ⁶	(kN/m ²)	130	125	120	105	100	95

The allowable increase in stress given above assumes a factor of safety of 3 against general shear failure, with cohesion of 50kN/m² at the foundation depths. Settlements at the above loading intensities should remain within tolerable limits for the type of structure proposed provided that the underlying soils are carefully inspected immediately once final trimming has taken place. Should any soft or weak material be encountered they should be locally removed and replaced with lean-mix concrete or compacted granular soil.

The stability of 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.

In addition, if the excavations are required to stand open for any period of time then a blinding layer of lean-mix concrete should be placed in the excavation bases. This expedient will reduce softening or loosening of the sub-grade due to the ingress of surface water.

⁶ Assumes bulk density of material removed from footing excavations to be 20kN/m³

Should seepages of groundwater be encountered it is considered that they could be dealt with using a simple form of de-watering. Such a system could include the excavation of sumps from which the water could be pumped.

10.2 Volume Change Potential

It should be appreciated that the cohesive soils revealed at this site possess a low volume change potential under the guidance of the NHBC standards. Therefore, it will be necessary to ensure that the depths of the foundations are designed in accordance with the Chapter 4.2 of the NHBC standards⁷. The methodology provided in the guidance will require the identification of any trees, still present at, or recently removed from, the site and the distance from the proposed foundations. This may result in foundation depths greater than those given above and the requirement for heave protection to be employed against footings and below the underside of the floors and beams.

10.3 Ground-floors

In light of the made ground and soft near surface soils, it is not recommended that ground bearing ground floor slabs be employed. In this instance it would be necessary to suspend floors between foundation positions, such that the floor loads are transmitted via the foundations to competent soils at depth.

Further to the above, due to the volume change potential at the site, should the floor be placed within the zone of influence of any existing, or proposed, trees and shrubs, an allowance for soil volume change should be included. Further guidance is available in the NHBC standards; however, soil volume change can typically be catered for by providing a suitable void or utilise proprietary materials beneath the floor slab.

10.4 Hard-standing Areas

It is considered that any hard-standing at the site could be constructed employing traditional pavement design. A design California Bearing Ratio (CBR) of 3% could be employed in the pavement design⁸. However, it is recommended that proof rolling of the sub-grade be undertaken to establish the suitability of the soils, to expose any soft or weak ground and to ensure the sub-grade is well compacted prior to construction. Any areas of soft or weak ground should be remediated by increasing the sub-base thickness. Alternatively, weak material could be locally removed and replaced with a compacted granular capping layer. If construction were to be undertaken during the winter or after periods of prolonged rainfall, it may be prudent to employ a geotextile and/or a geogrid between the sub-base and sub-grade.

10.5 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 C2⁹, 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

⁷ NHBC Standards, Chapter 4.2, *Building near trees*

⁸ Table 11.1, *Reproduction of TRRL Report LR1132 (1984)*, Smith (2006), Smith's Elements of Soil Mechanics, 8th ed.

⁹ Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*

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 D1¹⁰, 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 erection of 2No. new residential dwellings with associated garden areas and parking. 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 0.6% and 1.7%. On this basis, it is considered that the screening values associated with 1% 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 website¹¹ 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 9: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
WS01	0.60	None.
WS02	0.60	None.
WS03	0.50	None.

Concentrations of chromium(VI), mercury, free cyanide, phenols (total), polycyclic aromatic hydrocarbons (US EPA16) and total petroleum hydrocarbons (aliphatic C5 to C35; aromatic C5 to C35) 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.

On the basis of the above information, it is considered that the site is not significantly contaminated.

¹⁰ 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.*

¹¹ <http://www.atrisksoil.co.uk/pages/general/subscribers.asp>

11.1.2 Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated a maximum concentration of 0.0% methane, with concentrations of carbon dioxide ranging between 1.9% and 5.6%, in association with oxygen levels of between 17.7% and 19.7%. 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, a maximum 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 985mb and 1003mb.

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 0.0% (0.000) methane was recorded along with 5.6% (0.056) carbon dioxide, in association with a maximum flow rate of 0.1 l/hr. This results in a GSV of zero l/hr for methane and a GSV of 0.0056 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*. However, it should be appreciated that as the level of carbon dioxide is over 5%, therefore this should be upgraded to *Characteristic Situation Level 2*. It is therefore considered that there is a low risk of harm to end users and site operatives and some 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)¹². 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 classified as Characteristic Situation Level 2.

In this context, it should be noted that the gas screening value threshold for Characteristic Situation level 2, is <0.7 l/hr. Assuming the flow rate remains constant at 0.1l/hr the gas concentration would need to exceed 100% to move into the next risk band, which is not possible. Moreover, by keeping the concentration constant, the flow rate would need to increase to 12.5 l/hr which represents a hundred and twenty-five-fold increase. It is considered that these increases are not feasible given the flow rates and gas concentrations encountered.

¹² Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings*, p60.

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 Agency¹³ advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.¹⁴ 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.'¹⁵

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 10. Sources of contamination include the following:

On-site – Made Ground (carbon dioxide).

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

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 10.

¹³ 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'.

¹⁴ 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.

¹⁵ See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

Table 10: Conceptual Site Model and Site-Specific Risk Assessment [Contamination: CO₂]

Conceptual Site Model			Site Specific Risk Assessment	
Pathways	Receptor	Linkage Present?	Risk Rating	Notes
Direct contact/dermal absorption/soil ingestion	Operative	Yes – no significant chemical contamination found to be present at the site. Indeed, the majority of the tested determinands fell below the appropriate SSVs.	Low	No further action required.
	End User	Yes – no significant chemical contamination found to be present at the site. Indeed, the majority of the tested determinands fell below the appropriate SSVs.	Low	
	Neighbours	Yes – no significant chemical contamination found to be present at the site. Indeed, the majority of the tested determinands fell below the appropriate SSVs.	Low	
Inhalation of Dust/Vapours	Operative	Yes – dust may be derived from contaminated soils. However, no significant chemical contamination has been found to be present at the site.	Low	No further action required.
	End User	Yes – dust may be derived from contaminated soils. However, no significant chemical contamination has been found to be present at the site.	Low	
	Neighbours	Yes – dust may be derived from contaminated soils. However, no significant chemical contamination has been found to be present at the site.	Low	
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	No further action required.
	End User	Yes – site is to be developed by the construction of two new residential dwellings with gardens. However, no significant contamination has been revealed.	Low	
	Neighbours	Yes – no significant chemical contamination found to be present at the site. Indeed, the majority of the tested determinands fell below the appropriate SSVs.	Low	
Migration of hazardous gases via permeable strata or shallow mining activity	Operative	Yes – elevated levels of carbon dioxide have been found to be present at the site and site is <i>Characteristic Situation Level 2</i> .	High	Site is Characteristic Situation Level 2 and precautionary measures are required.
	End User		High	Remediation will be required to either remove the contamination or break pathways.
	Neighbours	No – whilst concentrations of ground gas have been found to be present at the site considering <i>Characteristic Situation Level 2</i> , no structures directly adjoin the site, therefore gases migrating from the site would vent to atmosphere before reaching neighbouring structures.	N/A	

Spillage/loss/run off direct to receiving water	Controlled Waters	No – receiving waters are not present within 250m of the site.	N/A	Old services to be removed or capped.
Migration via permeable unsaturated strata	Controlled Waters	Yes – a Secondary A aquifer is present beneath the site. However, no significant contamination has been revealed	Low	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site.	Low	
Direct contact with contaminated soils	Plants	Yes – no significant contamination revealed.	Low	No further action required.
Uptake via root system			Low	
Direct contact with contaminated soils	Building Materials	Yes – some minor PAH contamination may represent a risk to building materials or plastic water pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1s.	Moderate (plastic services)	Please see section 11.3.3 for information on good building practice.
Direct contact with contaminated groundwater			Low (buried concrete)	
Exposure to Radon	Operative	Yes – site in a radon affected area.	Low	Between 1% and 3% of properties are above the action level. No radon protection measures required.
	End User			
UXO Risk	Operative	Yes – the Zetica online UXO maps indicate the site is at low risk from unexploded ordnance.	Low	No further action required.
	End User		Low	

11.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that remediation will be required at this site. Such a strategy should include the following main elements.

11.3.1 Remediation Objectives

Based on the site-specific risk assessment the object of the remediation is likely to be as follows.

- To protect the end user from the elevated levels of carbon dioxide.
- To protect plastic services from being penetrated by, or degrading due to the presence of, contamination in the soil or groundwaters.

11.3.2 Development Requirements

Whilst the precise nature of this development has not been finalised it is understood that it is to be developed by the construction of 2no. new residential dwellings with associated garden areas and parking. In view of the above a site-specific remediation strategy should be undertaken after the proposed development has been finalised. However, for preliminary design and costing the following remediation proposals are offered.

11.3.3 Outline Strategy

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 potential hazards associated with accumulations of carbon dioxide, particularly within confined spaces.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives be 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 in dry weather.
- In order for contaminated soils to be disposed of to an appropriate landfill, it may be necessary to carry out Waste Acceptance Criteria (WAC) testing in accordance with BS EN 12457.
- Any stockpiles of contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust and cross contamination of imported fill.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by 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 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 contract the following items are required to protect the end user from the potential contaminants revealed at this site.

- Beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.
- Any redundant services revealed at this site should be de-commissioned and piped services sealed. Any existing services that are to be employed in the new development should be carefully inspected to ensure that they are serviceable.
- New plastic services should be constructed in a surround of clean inert material and selected in accordance with the recommendation given in the United Kingdom Water Industry Research (UKWIR) website under Report Ref. No. 10/WM/03/21 - 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'. The statutory water authority for the area in which site is located may have a risk assessment form to complete which allows these recommendations to be met. However, further determinand specification contamination testing may be necessary.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1.

Gas Protection Measures

In order to assess the protection measures required BS8485: 2015+A1:2019: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* has been employed. In accordance with Table 3, *Building types*, of the code, the development may be considered to conform to Type A. Therefore, on the basis of Table 4 *Gas protection score by CS and type of building*, the minimum gas protection score (points) is 3.5. The gas protection system should consist of at least two different elements. The elements work independently and collaboratively, and a single element should not be used because there would be no redundancy to allow for defects in the component.

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 YALPAG¹⁶ 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 11: 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).

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 12: 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

¹⁶ YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V4 .1 Appendix 1a, June 2021

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

In order to demonstrate that the remedial works and provision of clean cover has been sufficiently carried out where applicable, it will be necessary to produce a verification report for submission to any statutory authorities.

It will be necessary for this report to include the following:

- Characterisation of the suitability of the clean material including the derivation of the material, comments from a visual screen, the tests results of chemical screening, delivery tickets where appropriate and the conditions by which the clean material has been stored and handled on site.
- Photographic and logged evidence the clean material has been handled on site and placed in a sufficient thickness over areas where made ground remains. This may be either at the time of placement or after placement by means of hand excavated trialpits. Photographs should include visual site references or reference boards to prove the location and date taken. A measurement reference should be visible in the photographs to substantiate the thickness of material placed. Please note that it may also be necessary to undertake a topographical survey and the requirement for which should be checked with any statutory authorities.
- Evidence that suitable gas protection measures have been implemented and installed in accordance with manufacturer's instructions. The evidence should also demonstrate that all joints and penetrations have been adequately sealed. The verification should be undertaken by a suitably qualified specialist.

The report detailed above should be produced by a suitably qualified engineer. The number of verification areas for the development should be confirmed with any statutory authorities for the site.

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.
- Discussions with ground work contractors in relation to the requirement for testing of materials to be disposed off-site (Waste Acceptance Criteria) and the suitability of imported materials.
- Discussions with service providers regarding suitable materials for pipe work given the nature of chemical determinands found within the soils on site.
- Discussions with contractors in relation to the suitability of materials and installation methods for gas protection systems.
- Produce a Phase 3 Remediation strategy to outline the method by which the geo-environmental risks highlighted within this report will be mitigated and approved by the Local Planning Authority.
- Produce a Phase 4 Validation report to demonstrate that the geo-environmental risks discussed have been mitigated in line with the approved Phase 3 Remediation Strategy.
- 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) (2025), 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/>)
- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes*, B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-2: *Geotechnical investigation and testing – Field testing, Part 2: Dynamic Probing*, B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-3: *Geotechnical investigation and testing – Field testing, Part 3: Standard penetration test*, B.S.I., London.
- British Standards Institution (2015 +A1: 2020) BS 5930: *Code of practice for ground investigations*, B.S.I., London.
- British Standards Institution (2011), BS 10175: *Investigation of potentially contaminated sites – Code of Practice*, British Standards Institute.
- British Standards Institution (2015 +A1:2019) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*, B.S.I., London.
- British Standards Institution (2013), BS 8576 *Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds*.

- British Standards Institution (2017) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil*, B.S.I., London.
- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: Concrete in aggressive ground, BRE Press, Garston.
 - Part C: *Assessing the aggressive chemical environment*.
 - Part D: *Specifying concrete for general cast-in-situ use*.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.
- 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.
- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.
- 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



Notes:

Investigation positions approximated from site operative's notes.



Environmental Geotechnical Specialists

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Near Bank,
Shelley,
Huddersfield,
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Telephone: 0843 50 66 87
www.rogersgeotech.co.uk

Client:

Mr Oldroyd

Job Number:

C5245//25/E/8048

Project Details:

Westcliffe Rise, Cleckheaton

Scale: Not to scale - reference only

Appendix 2

Borehole Records



Borehole Log

Borehole No.

WS01

Sheet 1 of 1

Project Name:	Land adjacent to 21 Westcliffe Rise	Project No.	C5245/25/E/8048	Co-ords:		Hole Type	WLS
Location:	Cleckheaton	Level:		Scale	1:25	Logged By	IMY
Client:	Alex Senior	Dates:	19/06/2025				

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Dia. (mm)	TCR (%)					
		0.60	ES	87	95	0.25		<p>TOPSOIL (Dark brown sandy SILT with frequent rootlets).</p>		
		1.30	D	77	90	0.80		<p>MADE GROUND (Firm friable brown slightly gravelly very sandy CLAY. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium of sandstone and brick). REWORKED.</p>		
						1.45		<p>Firm friable light brown mottled grey slightly sandy CLAY with orangish staining. Sand is fine. [RESIDUAL PENNINE LOWER COAL MEASURES FORMATION].</p>	1	
				1.70				<p>Extremely weak thinly laminated light brown mottled grey micaceous SANDSTONE with occasional orangish staining. [HIGHLY WEATHERED PENNINE LOWER COAL MEASURES FORMATION].</p> <p>End of Borehole at 1.70m</p>	2	

Remarks





Borehole Log

Borehole No.

WS02

Sheet 1 of 1

Project Name:	Land adjacent to 21 Westcliffe Rise	Project No.	C5245/25/E/8048	Co-ords:		Hole Type	WLS
Location:	Cleckheaton	Level:		Scale	1:25	Logged By	IMY
Client:	Alex Senior	Dates:	19/06/2025				

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Dia. (mm)	TCR (%)					
		0.30	ES	87	100			<p>TOPSOIL (Dark brown sandy SILT with frequent rootlets).</p>	1	
		0.50						<p>MADE GROUND (Firm friable brown, locally dark brown slightly gravelly very sandy CLAY. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium of sandstone). REWORKED.</p>		
		0.90						<p>Firm light brown mottled grey slightly sandy CLAY with occasional orangish staining. Sand is fine. [RESIDUAL PENNINE LOWER COAL MEASURES FORMATION].</p>		
		1.00						<p>Firm friable light brown mottled grey sandy CLAY with orangish staining. [RESIDUAL PENNINE LOWER COAL MEASURES FORMATION].</p>		
		1.60		67	80			<p>Extremely weak thinly laminated light brown micaceous SANDSTONE. [HIGHLY WEATHERED PENNINE LOWER COAL MEASURES FORMATION].</p>	2	
		2.30		57	100			End of Borehole at 2.30m	3	
Remarks										





Borehole Log

Borehole No.

WS04

Sheet 1 of 1

Project Name:	Land adjacent to 21 Westcliffe Rise	Project No.	C5245/25/E/8048	Co-ords:		Hole Type	WLS
Location:	Cleckheaton	Level:		Scale	1:25	Logged By	IMY
Client:	Alex Senior	Dates:	19/06/2025				

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Dia. (mm)	TCR (%)					
		0.25						TOPSOIL (Dark brown sandy SILT with frequent rootlets).		
		0.55		87	100			MADE GROUND (Firm dark brown and brown silty gravelly CLAY. Gravel is sub-angular to sub-rounded, tabular fine to medium of siltstone, sandstone and rare brick).		
		0.80	D					Firm becoming stiff light brown mottled grey slightly gravelly sandy CLAY. Sand is fine. Gravel is sub-angular to sub-rounded, tabular, fine to medium of sandstone. [RESIDUAL SANDSTONE].		
		1.00	SPT			N=11 (2,2/2,3,3,3)				
		1.60		87	100			Extremely weak thinly laminated brown micaceous SANDSTONE.		
		2.00	SPT			47 (9,12/47 for 160mm)				2
		2.30						End of Borehole at 2.30m		
										3
										4
										5

Remarks



Appendix 3

Dynamic Probing Records



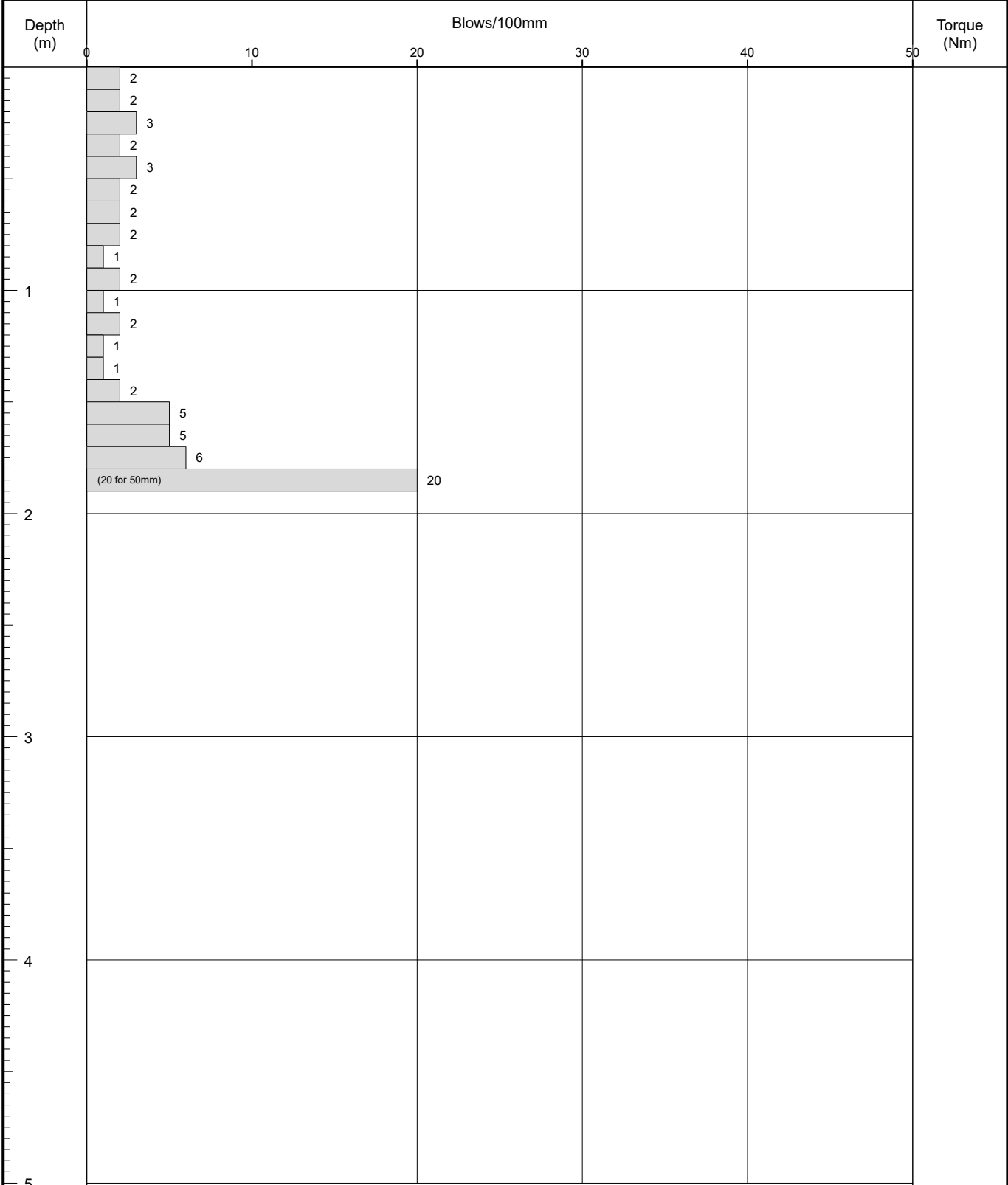
Probe Log

Probe No.

DP01

Sheet 1 of 1

Project Name: Land adjacent to 21 Westcliffe Rise	Project No. C5245/25/E/8048	Co-ords:	Hole Type DCP
Location: Cleckheaton	Level:		Scale 1:25
Client: Mr Oldroyd	Dates: 19/06/2025		Logged By AB



Remarks:	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Wt	63.5kg	Final Depth	1.85m
	Probe Type	DPSH-B		





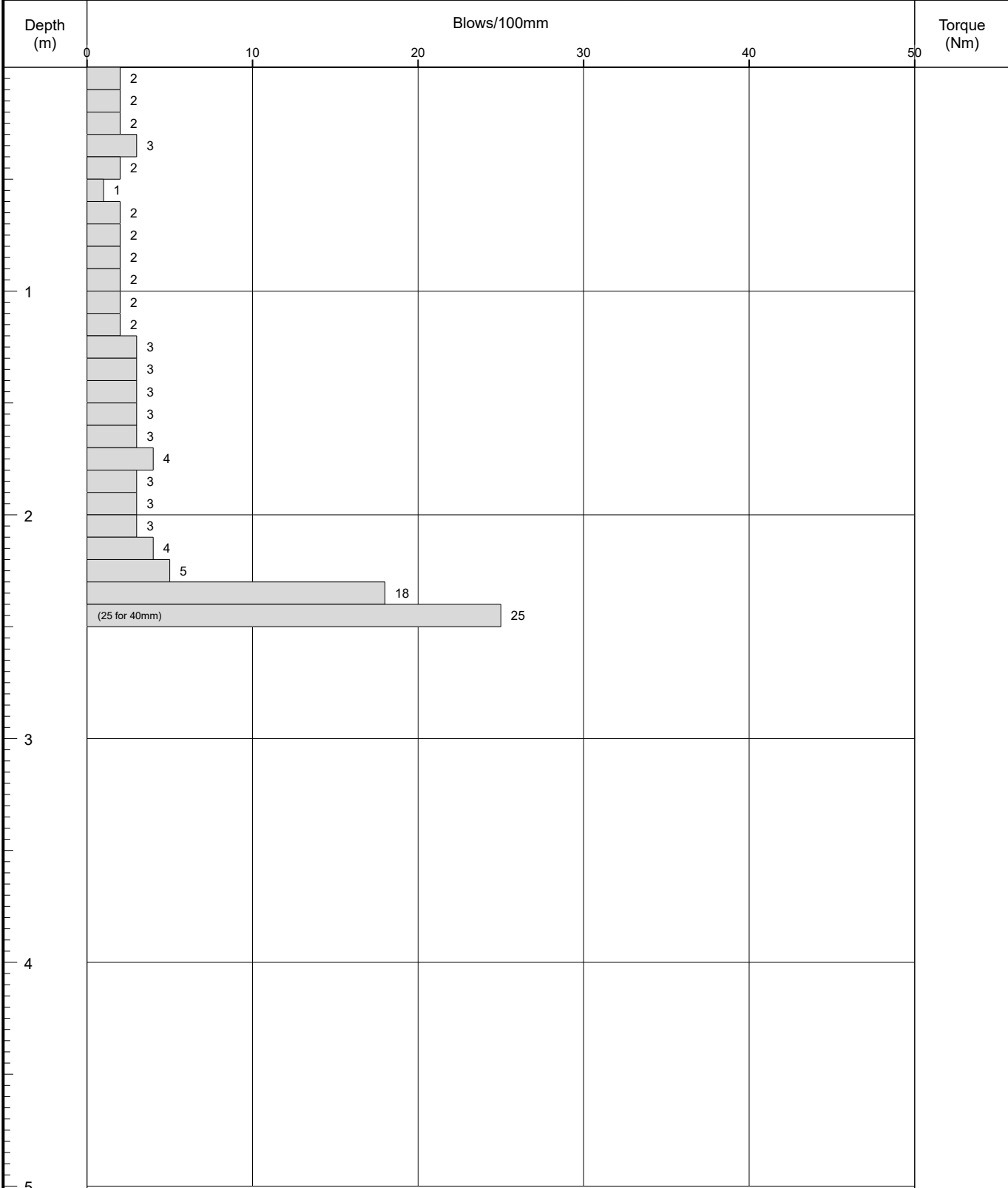
Probe Log

Probe No.

DP02

Sheet 1 of 1

Project Name: Land adjacent to 21 Westcliffe Rise	Project No. C5245/25/E/8048	Co-ords:	Hole Type DCP
Location: Cleckheaton	Level:		Scale 1:25
Client: Mr Oldroyd	Dates: 19/06/2025		Logged By AB



Remarks:	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Wt	63.5kg	Final Depth	2.44m
	Probe Type	DPSH-B		





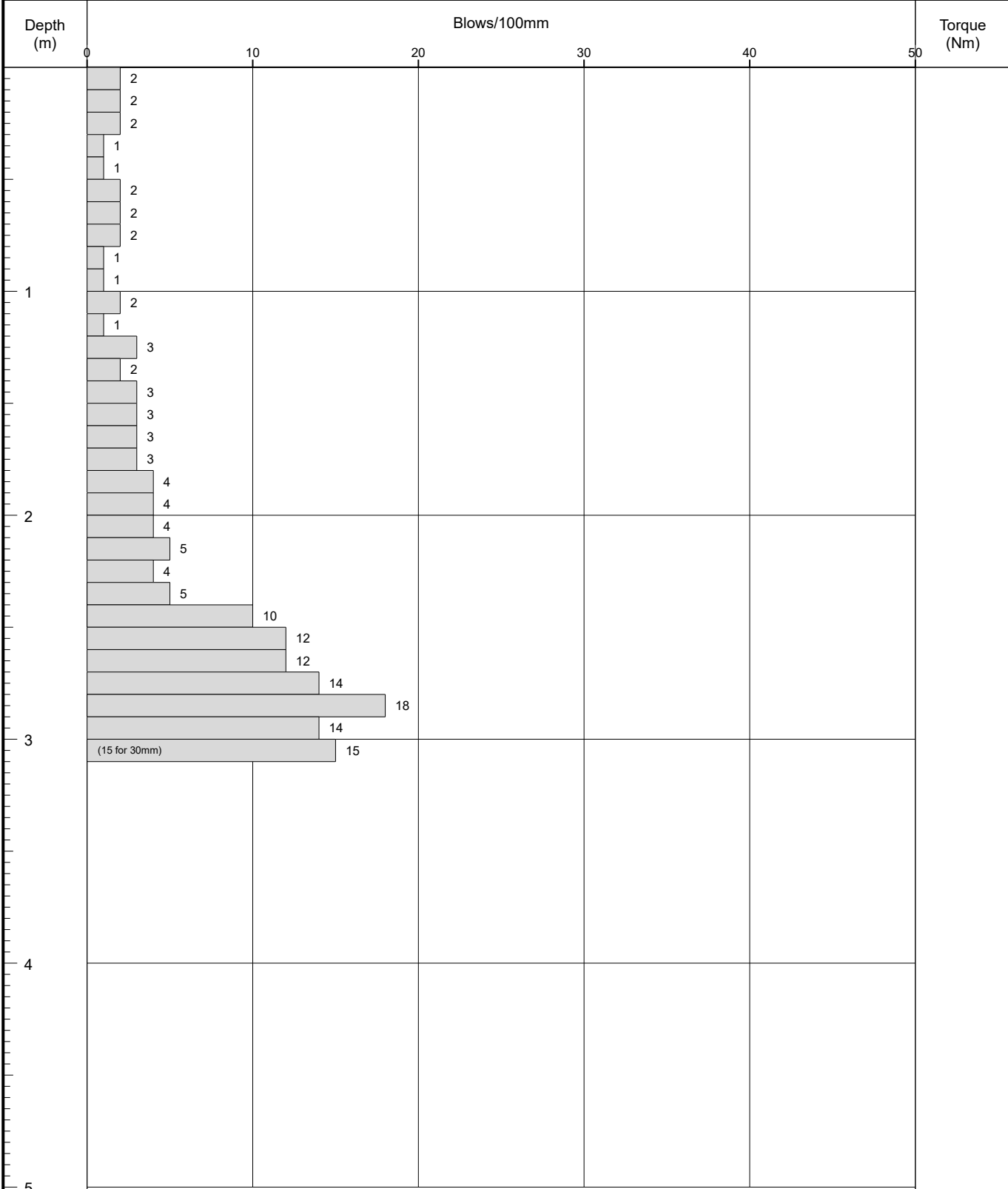
Probe Log

Probe No.

DP03

Sheet 1 of 1

Project Name: Land adjacent to 21 Westcliffe Rise	Project No. C5245/25/E/8048	Co-ords:	Hole Type DCP
Location: Cleckheaton	Level:		Scale 1:25
Client: Mr Oldroyd	Dates: 19/06/2025		Logged By AB



Remarks:	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Wt	63.5kg	Final Depth	3.03m
	Probe Type	DPSH-B		





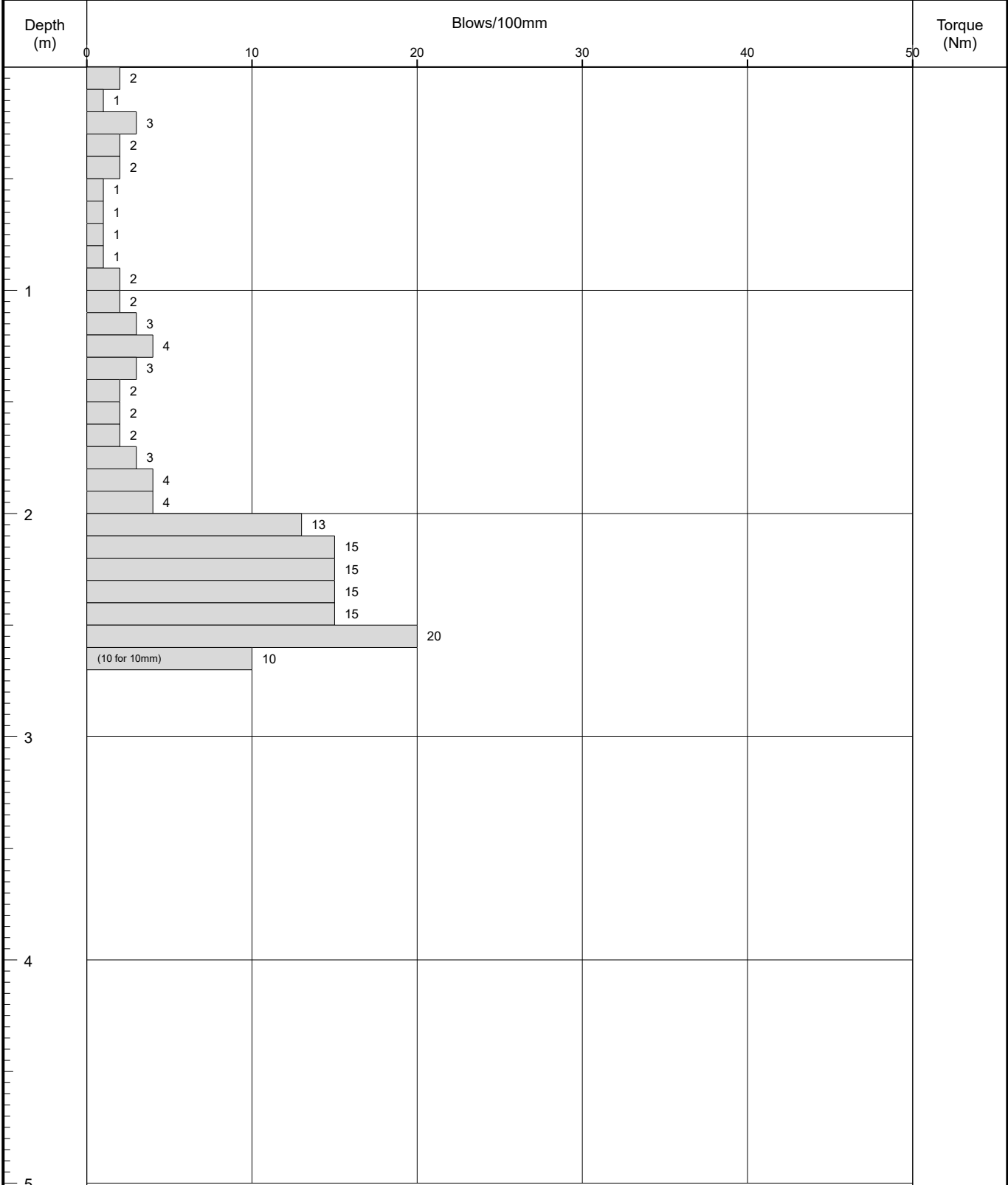
Probe Log

Probe No.

DP04

Sheet 1 of 1

Project Name: Land adjacent to 21 Westcliffe Rise	Project No. C5245/25/E/8048	Co-ords:	Hole Type DCP
Location: Cleckheaton	Level:		Scale 1:25
Client: Mr Oldroyd	Dates: 19/06/2025		Logged By AB



Remarks:	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Wt	63.5kg	Final Depth	2.61m
	Probe Type	DPSH-B		



Appendix 4

Gas Monitoring Sheets

Post Fieldworks Discrete Well Monitoring Site Record



Rogers Geotechnical Services Ltd , Offices 1 & 2
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 Environmental Geotechnical Specialists
 Tel: 01484 604 354
 enquiries@rogersgeotech.co.uk

Job No:	C5245/25/E/8048	Client:	Alex Senior	Visit:	1	Of	4
Site:	Westfield Rise, Cleckheaton	Date:	01.07.2025				

Location ID	Methane (%)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Oxygen (%)	VOCs (ppm)	Flowrate (l/hr)	Water Depth (m)	Installed Depth (m)	Comments
WS01	0.0	2.0	0	0	19.3		0.0	DRY	1.70	
WS02	0.0	3.8	0	0	18.5		0.0	DRY	2.06	
WS03	0.0	4.5	0	0	18.4		0.0	2.44	2.90	

Max.	0.0	4.5	0	0	19.3	-	0.0	2.44	
Min.	0.0	2.0	0	0	18.4	-	0.0	2.44	

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	Dry
Precipitation	0.0l/m2 in last 6 hours
Wind	-
Temperature	17
Barometric Pressure	1003
Pressure Trend	Steady

Monitor Technical Specifications							Monitoring Period Summary (All Visits)		
Gas Monitor Used:	GFM Series						Max CH ₄	Peak	Steady
Serial No:	13747/270525						0.0	0.0	0.0
Monitor Gas Range	CH ₄	5>60	CO ₂	5<40	O ₂	21.2	Max CO ₂	4.5	0.0
Gas Flow Range	0-10 l/hr						Max CO	0	0
Date of Calibration	27.05.2025						Max H ₂ S	0	0
PID Monitor (If used)							Max O ₂	19.9	0.0
PID Monitor Serial No.							Min O ₂	18.4	0.0
Calibration Date.							Flow rate	0.0	0.0

Operative Details.	H. Letch
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	Start	End
Barometric Pressure	1002	1003

Post Fieldworks Discrete Well Monitoring Site Record



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 Environmental Geotechnical Specialists
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 enquiries@rogersgeotech.co.uk

Job No:	C5245/25/E/8048	Client:	Alex Senior	Visit:	2	Of	4
Site:	Westfield Rise, Cleckheaton	Date:	07.07.2025				

Location ID	Methane (%)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Oxygen (%)	VOCs (ppm)	Flowrate (l/hr)	Water Depth (m)	Installed Depth (m)	Comments
WS01	0.0	1.9	0	0	19.1		0.0	DRY	1.70	
WS02	0.0	1.6	0	0	19.9		0.0	DRY	2.06	
WS03	0.0	5.1	0	0	18.1		0.0	2.82	2.90	

Max.	0.0	5.1	0	0	19.9	0	0.0	2.82	
Min.	0.0	1.6	0	0	18.1	0	0.0	2.82	

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	DRY
Precipitation	0l/m2 in last 12 hours
Wind	No data no observable wind
Temperature	20
Barometric Pressure	1002
Pressure Trend	Rising

Monitor Technical Specifications							Monitoring Period Summary (All Visits)		
Gas Monitor Used:	GFM Series						Max CH ₄	Peak	Steady
Serial No:	13747/270525						0.0	0.0	0.0
Monitor Gas Range	CH ₄	5>60	CO ₂	5<40	O ₂	21.2	Max CO ₂	5.6	0.0
Gas Flow Range	0-10 l/hr						Max CO	0	0
Date of Calibration	27.05.2025						Max H ₂ S	0	0
PID Monitor (If used)							Max O ₂	19.9	0.0
PID Monitor Serial No.							Min O ₂	18.4	0.0
Calibration Date.							Flow rate	0.0	0.0

Operative Details.	M.Tuck
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	Start	End
Barometric Pressure	1001	1002

Post Fieldworks Discrete Well Monitoring Site Record



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 Environmental Geotechnical Specialists
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 enquiries@rogersgeotech.co.uk

Job No:	C5245/25/E/8048	Client:	Alex Senior	Visit:	3	Of	4
Site:	Westfield Rise, Cleckheaton	Date:	14.07.2025				

Location ID	Methane (%)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Oxygen (%)	VOCs (ppm)	Flowrate (l/hr)	Water Depth (m)	Installed Depth (m)	Comments
WS01	0.0	2.1	0.0	0	19.7	-	0.0	DRY	1.70	
WS02	0.0	4.0	0.0	0	18.6	-	0.0	DRY	2.06	
WS03	0.0	4.8	0.0	0	18.4	-	0.0	2.56	2.90	
Max	0.0	4.8	0.0	0	19.7	-	0.0	2.56		
Min.	0.0	2.1	0.0	0	18.4	-	0.0	2.56		

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	Dry
Precipitation	0l/m2 in last 12 hours
Wind	6
Temperature	18
Barometric Pressure	994
Pressure Trend	Steady

Monitor Technical Specifications							Monitoring Period Summary (All Visits)		
Gas Monitor Used:	GFM Series						Max CH ₄	Peak	Steady
Serial No:	13747/270525						0.0	0.0	0.0
Monitor Gas Range	CH ₄	5>60	CO ₂	5<40	O ₂	21.2	Max CO ₂	5.6	0.0
Gas Flow Range	0-10 l/hr						Max CO	0	0
Date of Calibration	27.05.2025						Max H ₂ S	0	0
PID Monitor (If used)							Max O ₂	19.9	0.0
PID Monitor Serial No.							Min O ₂	18.4	0.0
Calibration Date.							Flow rate	0.0	0.0

Operative Details.	M.Tuck
---------------------------	--------

	Start	End
Barometric Pressure	994	993

Post Fieldworks Discrete Well Monitoring Site Record



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 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU
 Environmental Geotechnical Specialists
 Tel: 01484 604 354
 enquiries@rogersgeotech.co.uk

Job No:	C5245/25/E/8048	Client:	Alex Senior	Visit:	4	Of	4
Site:	Westfield Rise, Cleckheaton	Date:	21.07.2025				

Location ID	Methane (%)	Carbon Dioxide (%)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Oxygen (%)	VOCs (ppm)	Flowrate (l/hr)	Water Depth (m)	Installed Depth (m)	Comments
WS01	0	2.3	0	0	18.4	-	0	DRY	1.7	
WS02	0	4	0	0	18.1	-	0	1.98	2.06	
WS03	0	5.6	0	0	17.7	-	0	2.26	2.9	

Max	0	5.6	0	0	18.4	-	0		2.26
Min.	0	2.3	0	0	17.7	-	0		1.98

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	WET
Precipitation	2l/m2 in last 6 hours
Wind	4
Temperature	15
Barometric Pressure	985
Pressure Trend	Falling

Monitor Technical Specifications							Monitoring Period Summary (All Visits)		
Gas Monitor Used:	GFM Series						Max CH ₄	Peak	Steady
Serial No:	13747/270525						0.0	0.0	0.0
Monitor Gas Range	CH ₄	5>60	CO ₂	5<40	O ₂	21.2	Max CO ₂	5.6	0.0
Gas Flow Range	0-10 l/hr						Max CO	0	0
Date of Calibration	27.05.2025						Max H ₂ S	0	0
PID Monitor (If used)							Max O ₂	19.9	0.0
PID Monitor Serial No.							Min O ₂	18.4	0.0
Calibration Date.							Flow rate	0.0	0.0

Operative Details.	M.Tuck
---------------------------	--------

	Start	End
Barometric Pressure	985	984



...everything gas detection

Test Certificate

Customer: Ribble Enviro Hire Fleet
Instrument: GFM Series
Job: Pre-Hire Test
Serial number: 13747
Fleet Number: GAS0016
Certificate no: 13747 / 270525
Tested on: 27 May 2025
Tested for: Methane, Carbon Dioxide, Oxygen, hydrogen Sulphide, Carbon Monoxide, Hexane

<u>Applied Gas Concentration:</u>	<u>Cylinder Reference:</u>	<u>Final Sensor Reading</u>	<u>Pass / Fail</u>
Hexane: 0.3% Vol	52687 / 2416	0.275% vol	Pass
CO2: 50% Vol	9750-11-1	50.1% vol	Pass
CO: 500 ppm	199242	460 ppm	Pass
H2S: 50 ppm	199242	60 ppm	Pass
O2: 18% Vol	199242	17.9% vol	Pass
CH4: 2.5% Vol	199242	2.4% vol	Pass


The instrument has been calibrated after re-zeroing and introducing span calibration gas, using gas that is traceable to national standards and has been prepared in accordance with BS EN ISO 6145-6:2017

Calibration Engineer: BRADLEY HAYHURST

Sign: 

TEST DATE AND CONDITIONS			
Date	20/11/2024		
Atmospheric Pressure	992	mB	
Ambient Temperature	21.5	°C	
Enviroics Serial No.	5089		

**GFM436 Final Inspection & Calibration
Check Certificate**

GAS DATA LTD	
Unit D	 GAS DATA <small>LISTEN - ANALYSE - INFORM</small>
Earlplace Business Park	
Fletchamstead Highway	
Coventry	
CV4 9XL	
Tel 02476303311	Fax 02476307711

Customer	Ribble Enviro Ltd
Certificate Number	125695
Order Number	340317

Serial Number	13747
Software Version	G436-00.00/00

Recalibration DUE Date	20/11/25
------------------------	----------

Instrument Checks					
Keyboard	✓		Display Contrast	✓	
Pump Flow In	500	Accept > 200 cc/min	Pump Flow @ -200mB	300	Accept > 200 cc/min
Clock Set / Running	✓		Labels Fitted	✓	

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas Readings %	True Gas Value %	Instrument Gas Readings %	True Gas Value %	Instrument Gas Readings %	True Gas Value %
		60.7 <i>Accept ±3.0</i>	60	39.7 <i>Accept ±3.0</i>	40	20.9 <i>Accept ±0.5</i>
	5.0 <i>Accept ±0.3</i>	5	5.0 <i>Accept ±0.3</i>	5	6.0 <i>Accept ±0.3</i>	6
Zero Reading 100% N ₂	0.0 <i>Accept ±0.0</i>	0	0.0 <i>Accept ±0.0</i>	0	0.0 <i>Accept ±0.1</i>	0

Optional Gas Checks						
Applied Gas & Range		Concentration Tested @ (ppm)	Instrument Readings (ppm)			
Gas Type	Range (ppm)		Zero Reading		Instrument Gas Reading	
H ₂ S	5000	1500	0	<i>Accept ±0.0</i>	1500	<i>Accept ±5.0%</i>
CO	2000	1000	0	<i>Accept ±0.0</i>	1002	<i>Accept ±5.0%</i>
Hexane	2.0%	2.0%	0	<i>Accept ±0.0</i>	1.99	<i>Accept ±10.0%</i>

Cross Gas Effects								
Applied Gas (ppm)		Instrument Readings (ppm)						
Gas Type	Concentration	Toxic 1:	H2S	Toxic 2:	CO	Toxic 3:	HEX	
H2S	1500	1500		0		0		
CO	1000	90		1002		0		
Hexane	2.0%	0		0		1.99		

Pressure Checks			
Atmospheric Pressure [AP] (mB)			
Current Atmospheric Pressure (mB)		Instrument Atmospheric Pressure Reading (mB)	
AP Open Ports		991	Accept ±2.0
AP Port (Internal)	+800 mB	800	Accept ±5.0
	+1200mb	1200	Accept ±5.0

Flow Checks					
Borehole Flow			Differential Pressure		
Applied Reading (l/h)	Instrument Reading (l/h)		Applied Pressure (Pa)	Instrument Reading (Pa)	
-30	-30.1	Accept ±3.0	-432	-436	Accept ±50
-3	-3.0	Accept ±1.0	-19	-19	Accept ±6.0
0	0.0	Accept ±0.0	0	0	Accept ±0.5
3	3.0	Accept ±0.5	16	16	Accept ±3.0
30	29.8	Accept ±3.0	363	360	Accept ±50
60	59.8	Accept ±6.0	1115	1111	Accept ±130
90	91.8	Accept ±9.0	2196	2296	Accept ±250

Temperature Checks		
Calibration Temperature	Instrument Temperature Reading °C	
Applied Temperature °C		
-10	-10.0	Accept ±2.0
0	0.0	Accept ±1.0
30	30.0	Accept ±1.0
60	60.0	Accept ±1.0
100	100.0	Accept ±1.0

Technician:
Jack Rutland

Date Tested:
20/11/2024

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

Appendix 5

Laboratory Testing



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LABORATORY REPORT

job number		date
site address		
date scheduled	date issued	
issued by		

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Schedule of UKAS Accredited Laboratory Tests



1. CLASSIFICATION OF SOIL	BS 1377-2:2022	BS EN ISO 17892	Accredited (A)	Unaccredited (U)
1.1 Moisture / Water content determination				
i. Oven drying	Pt 2	BS EN ISO 17892-1:2014+A1:2022	A	
ii. Saturation m/c of chalk	Pt 2 :			U
1.2 Index Properties				
i. Liquid limit – cone penetrometer	Pt 2	BS EN ISO 17892-12 2018+A2:2022	A	
ii. Plastic limit	Pt 2	BS EN ISO 17892-12 2018+A2:2022	A	
iii. Shrinkage limit	:			U
iv. Linear shrinkage	Pt 2		A	
1.3 Particle Density				
i. Gas jar	Pt 2 :		A	
ii. Large pycnometer	Pt 2			U
iii. Small pycnometer		BS EN SIO 17892-3:2015	A	
1.4 Density Tests				
i. Linear measurement	Pt 2	BS EN ISO 17892-2:2014	A	
ii. Immersion in water	Pt 2	Pt 2 : 2014 : 5.2		U
iii. Fluid / Water displacement	Pt 2	Pt 2 : 2014 : 5.3		U
iv. Sand replacement	Pt 9			U
v. Core cutter	Pt 9			U
1.5 Particle Size Distribution				
i. Dry Sieve	Pt 2	BS EN ISO 17892-4:2016	A	
ii. Wet Sieve	Pt 2	BS EN ISO 17892-4:2016	A	
iii. Sedimentation by pipette	Pt 2	BS EN ISO 17892-4:2016	A	
iv. Sedimentation by hydrometer	Pt 2			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 2		A	
- CBR mould	Pt 2		A	
ii. 4.5kg rammer – 1 litre mould	Pt 2		A	
- CBR mould	Pt 2		A	
3.2 Moisture Condition Value				
i. Single point test	Pt 2			U
ii. MCV/moisture content relationship	Pt 2			U
3.3 California Bearing Ratio				
i. Undisturbed sample	Pt 2		A	
ii. Recompacted sample	Pt 2		A	
iii. Soaked, inc measurement of swell	Pt 2		A	
4. COMPRESSIBILITY OF SOIL				
BS 1377-2:2022				
i. One dimensional consolidation	Pt 2	BS EN ISO 17892-5:2017	A	
ii. Swelling pressure test	Pt 2			U
5. SHEAR STRENGTH OF SOIL				
BS 1377-2:2022				
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 2	BS EN ISO 17892-8:2018	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

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

Classification of Index Properties

C5245/25/E/8048

Project Name: Land adjacent to 21 Westcliffe R

BS EN ISO 17892-12 2018+A2:2022

Fig. 2
 Sheet. 1

Location:

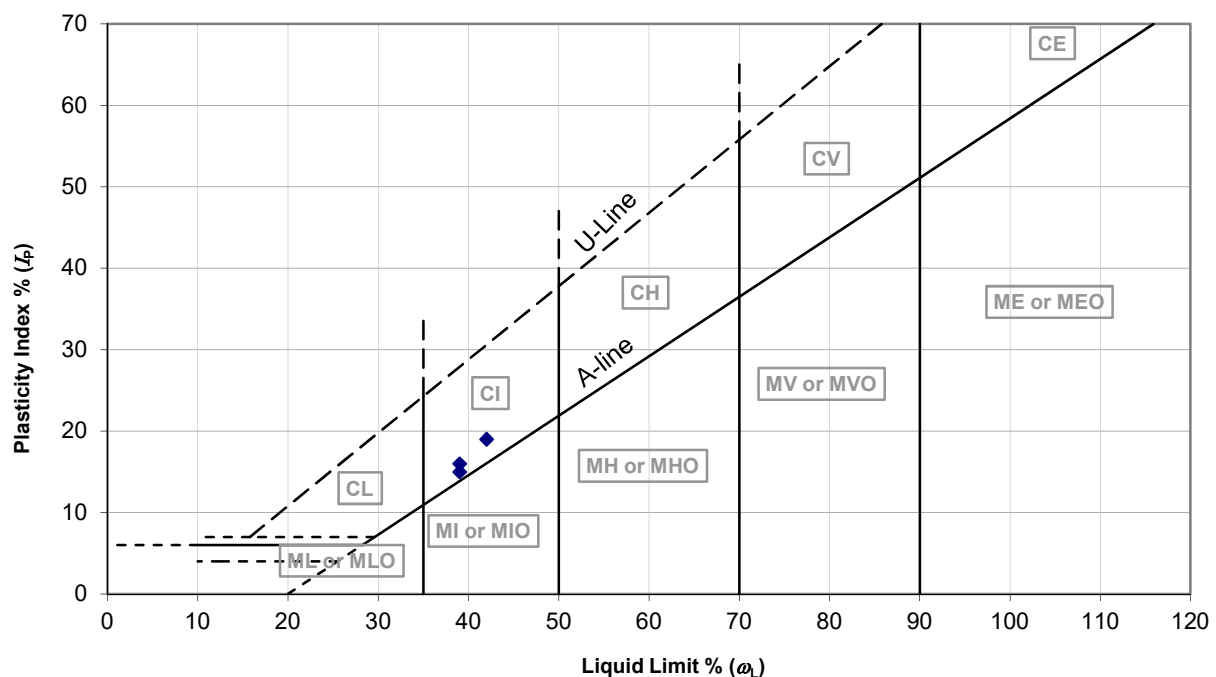
Input By: Harry

Client: Mr Oldroyd

Check By: EC

Location	Depth (m)	Water Content (ω) (%)	Liquid Limit (ω_L) (%)	Plastic Limit (ω_P) (%)	Plasticity Index (I_P) (%)	Retained by 0.425mm (%)	Modified (ω) (ω') (%)	Modified (I_P) (I_P') (%)	Liquidity/ Consistency		Casagrande Class	N.H.B.C Class (%)
									(I_L) (%)	(I_C) (%)		
WS01	1.30	20	39	23	16	23	26	12	-0.2	1.2	C I	LOW
WS02	0.90	20	39	24	15	31	29	10	-0.3	1.3	C I	LOW
WS04	0.80	18	42	23	19	19	22	15	-0.3	1.3	C I	LOW

Interpretation graph based on BS EN ISO 14688-2:2018 any interpretations are expressed outside of our UKAS Accreditation.





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ENVIRONMENTAL TESTING RESULTS



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t: 01484 604354

e: Imran.Sakoor@rogersgeotech.co.uk

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 25-034705

Project / Site name:	Westcliffe Rise, Cleckheaton	Samples received on:	27/06/2025
Your job number:	C5245/25/E	Samples instructed on/ Analysis started on:	01/07/2025
Your order number:		Analysis completed by:	09/07/2025
Report Issue Number:	1	Report issued on:	09/07/2025
Samples Analysed:	3 soil samples		

Signed: _____

Anna Goc
PL Head of Reporting Team
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
air	- once the analysis is complete

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Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

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: 25-034705
Project / Site name: Westcliffe Rise, Cleckheaton

Lab Sample Number		599683	599684	599685
Sample Reference		WS01	WS02	WS03
Sample Number		None Supplied	None Supplied	None Supplied
Water Matrix		N/A	N/A	N/A
Depth (m)		0.6	0.6	0.5
Date Sampled		25/06/2025	25/06/2025	25/06/2025
Time Taken		None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	15	15	16
Total mass of sample received	kg	0.1	NONE	0.6	0.6	0.7

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	DKI	DKI	DKI
Analysis completed	N/A	N/A	N/A	07/07/2025	07/07/2025	07/07/2025

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.9	7.9	7.8
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	%	0.005	MCERTS	0.052	0.036	0.068
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	42	160	350
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	21.2	80.1	173
Organic Matter (automated)	%	0.1	MCERTS	1.7	0.6	1.3

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80
-----------------------------	-------	-----	-----------	--------	--------	--------

Analytical Report Number: 25-034705
Project / Site name: Westcliffe Rise, Cleckheaton

Lab Sample Number	599683	599684	599685
Sample Reference	WS01	WS02	WS03
Sample Number	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A
Depth (m)	0.6	0.6	0.5
Date Sampled	25/06/2025	25/06/2025	25/06/2025
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status

Heavy Metals / Metalloids

Element	Unit	Limit	MCERTS	599683	599684	599685
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7	6.5	7.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	< 0.2	0.3
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	22	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	14	21	12
Lead (aqua regia extractable)	mg/kg	1	MCERTS	36	18	31
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	13	20	20
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	2.1	< 1.0	1.6
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	24	27	28
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	82	66	98

Petroleum Hydrocarbons

Parameter	Unit	Limit	MCERTS	599683	599684	599685
TPHCWG - Aliphatic >EC5 - EC6 _{HS_ID_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 _{HS_ID_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 _{HS_ID_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_ID_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_ID_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_ID_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_ID_AL}	mg/kg	8	MCERTS	16	< 8.0	< 8.0
TPHCWG - Aliphatic >EC5 - EC35 _{EH_CU+HS_ID_AL}	mg/kg	10	NONE	16	< 10	< 10

Parameter	Unit	Limit	MCERTS	599683	599684	599685
TPHCWG - Aromatic >EC5 - EC7 _{HS_ID_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 _{HS_ID_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 _{HS_ID_AR}	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_ID_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_ID_AR}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_ID_AR}	mg/kg	10	MCERTS	< 10	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_ID_AR}	mg/kg	10	MCERTS	< 10	< 10	< 10
TPHCWG - Aromatic >EC5 - EC35 _{EH_CU+HS_ID_AR}	mg/kg	10	NONE	< 10	< 10	< 10

VOCs

Parameter	Unit	Limit	MCERTS	599683	599684	599685
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 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	8	MCERTS	< 8.0	< 8.0	< 8.0
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 : 25-034705

Project / Site name: Westcliffe Rise, Cleckheaton

* 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 *
599683	WS01	None Supplied	0.6	Brown loam and clay with gravel and vegetation
599684	WS02	None Supplied	0.6	Brown clay and sand with gravel
599685	WS03	None Supplied	0.5	Brown loam and clay with gravel and vegetation

Analytical Report Number : 25-034705

Project / Site name: Westcliffe Rise, Cleckheaton

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI 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 SO4 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-PL	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-PL	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-PL	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-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS

Analytical Report Number : 25-034705
 Project / Site name: Westcliffe Rise, Cleckheaton

Water matrix abbreviations:
 Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
 Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

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 30oC.
 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.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
 The result for sum should be interpreted with caution



< ENVIRONMENTAL > < GEOTECHNICAL >

End of Report



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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.						