Environmental
Geotechnical
Specialists

RGS

PHASE 2

GEO-ENVIRONMENTAL REPORT

job number	C5092/25/E/7765_Rev1
date	28.11.2025
site address	Land at Reinwood Road, Reinwood Road, Huddersfield, West Yorkshire, HD3 4DS
written by	S. Hale
checked by	S. Alexander
issued by	S. Hale

Please consider the environment before printing this report.

Constructionline
A UK GOVERNMENT CERTIFICATION SERVICE

QMS ISO 9001 : 2015 REGISTERED Cert No. 14123657

QMS ISO 14001 : 2015 REGISTERED Cert No. 14127804

QMS ISO 45001 : 2018 REGISTERED Cert No. 14130281

CITATION APPROVED HEALTH & SAFETY SYSTEMS Registered Member

UKAS United Kingdom Accreditation Service

<ENVIRONMENTAL><GEOTECHNICAL>

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

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
	4.5	Machine-dug Trial Pts and Trenches	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	6
	7.3	Gas and Water Level Monitoring	6
	7.4	Soakaway Testing	7
	7.5	Landfill Investigation	7
8.		Laboratory Testing - Geotechnical	8
9.		Laboratory Testing - Environmental	9
10.		Discussion of Ground Conditions - Geotechnical	9
	10.1	Foundations	9
	10.2	General Comments for Excavations	9
	10.3	Ground-floors	10
	10.4	Hard-standing Areas	10
	10.5	Effect of Sulphates	10
	10.6	Soakaway Suitability	11
11.		Discussion of Ground Conditions - Environmental	11
	11.1	Discussion of Test Results	11
	11.1.1	Soil Samples	11
	11.1.2	Gas Concentrations	13
	11.2	Site Specific Risk Assessment	13
	11.2.1	Approach	13
	11.2.2	Conceptual Ground Model and Risk Assessment	14
	11.3	Remediation Strategy	17
	11.3.1	Remediation Objectives	17
	11.3.2	Development Requirements	17
	11.3.3	Outline Strategy	18

Please consider the environment before printing this report.

11.4	Fill Materials	19
11.5	Verification Report	21
12.	Recommendations for Further Work	21
13.	References	22

Appendices

1.	Site Plan
2.	Borehole Records
3.	Dynamic Probing Records
4.	Trial Pit Records and Photographs
5.	Gas Monitoring Sheets
6.	Laboratory Testing
7.	Fill Screening Values

Please consider the environment before printing this report.

Report on a Phase 2 Geo-environmental Investigation

Location:	Land at Reinwood Road Reinwood Road, Huddersfield, West Yorkshire, HD3 4DS		
For:	HRB Investments Ltd		
Report No.	C5092/25/E/7765_Rev1	Report date:	November 2025

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

Steven Hale BSc FGS
Geo-environmental Engineer

Scott Alexander BSc FGS
Senior Geo-environmental Engineer

Report Summary[1]

Item	Comments	Section
Development	Construction of a new residential development.	1.
Geology	Superficial geology – None. Solid geology – Rough Rock.	5.
Strata Conditions	Topsoil overlying weathered Rough Rock within all positions except WS01. In this case, topsoil overlying made ground was encountered to a depth of 2.30m, whereupon clay was revealed to termination depth.	6.
Groundwater	None encountered during investigation.	6.2
Foundation Design	Shallow foundation solution.	10.1
Effect of Sulphates	DC-1 concrete.	10.5
Soakaway Suitability	Not recommended due to reliance on fractures within underlying sandstone which may be inconsistent.	10.6
Contamination	Lead and asbestos contamination revealed within WS01. Landfill encountered straddling the northeast boundary.	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 at Reinwood Road is to be developed by the construction of a new residential development with associated parking and soft landscaping. 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 C5092/25/E/7764 in September 2025. This report has been used extensively during the current intrusive investigation.

4. Fieldworks

The fieldworks were undertaken on the 15th October and the 26th November 2025 and included the following:

- Five windowless sample boreholes.
- Standard penetration tests within two boreholes.
- Eight dynamic probes.
- Three gas monitoring standpipes.
- Two trial pits with soakaway tests.
- Seven trial trenches to investigate the extent of the landfill on site.

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, 67mm and 57mm 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 boreholes WS01 and WS02. 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 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 at depths of between 0.8m and 4.0m depth within WS01, WS02 and WS04 with the installation details shown on the appropriate borehole records. In all cases, the monitoring standpipe consisted of a perforated pipe from the base of the borehole to a determined depth 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.

4.5 Machine-dug Trial Pits and Trenches

Two trial pits were excavated in order to undertake soakaway testing and seven trenches were excavated to investigate the historical landfill anticipated to be present along the northeast border, the positions of which are shown in Appendix 1. The soakaway tests were undertaken at the base of the pit at depths rational to the construction of soakaways. The soils exposed in the trial pits 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 4 alongside photographs of the pits

Once excavations were completed, the trial pits and trenches were carefully re-instated with the arisings. Whilst every care was taken during the infilling process, including compacting of the infill at

regular intervals with the arm of the excavator, it should be appreciated that some mounding of the surface may have resulted. Moreover, the infilled soils may be subjected to settlement over time, such that a depression in the surface may also occur. Therefore, the locations of any pits or trenches undertaken in this investigation should be conveyed to the current site user, as the mounds or depressions associated with the pits may present a risk to current site operations. Furthermore, it must be realised that the infilled pits or trenches represent an area of disturbance within the site soils, thus the soils at the pit locations may vary characteristically compared to the undisturbed ground. As such, foundations placed in this disturbed material may not perform as anticipated.

5. Geology

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

Table 1: Geological Data for the Site

Strata Type	Strata Name[2]	Previous Name[3]	Description[3]
Superficial Geology	N/A	N/A	Not indicated to underlie the site.
Solid Geology	Pennine Lower Coal Measures Formation	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.
	Rough Rock	Rough Rock Formation	Coarse-grained feldspathic sandstone.

6. Strata Conditions

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

Table 2: Generalised Strata Profile

Depth m below ground level to underside of layer	**Strata Type**	**Positions Encountered**	**Groundwater Strikes** m below ground level
0.30 – 0.50	TOPSOIL (Dark brown, silty, slightly gravelly SAND)	All	None
2.30	MADE GROUND (Loose becoming medium dense, brown, silty, sandy GRAVEL)	WS01	None
+0.51 – +1.10	Yellowish brown, silty, sandy GRAVEL RESIDUAL SOFT BED FLAGS	WS02 – WS05, SA01 & SA02	None
3.20	Firm, grey, slightly gravelly, silty CLAY RESIDUAL PENNINE LOWER COAL MEASURES FORMATION	WS01	None

[2] Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield; Solid and Drift Edition, and GeoIndex Onshore 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*]

3.50	Black, carbonaceous MUDSTONE RESIDUAL PENNINE LOWER COAL MEASURES FORMATION	WS01	None
+4.45	Firm, grey, thinly laminated, slightly gravelly, silty CLAY RESIDUAL PENNINE LOWER COAL MEASURES FORMATION	WS01	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

6.1 General Strata

In general, the borehole records indicate that beneath a 0.30m to 0.50m capping of granular topsoil, yellowish brown, silty, sandy gravels were encountered to termination depths within all boreholes except WS01. It is anticipated that this gravel represents the weathered base of the Soft Bed Flags shown to outcrop just to the north-east of the site.

It should be appreciated that during the Phase 1 Desk Study, it was revealed that the site is present with a historical landfill straddling the north-eastern boundary. WS01 was undertaken in order to investigate the existence of this landfill. The borehole records revealed that beneath a 0.50m capping of the same topsoil, made ground consisting of silty, sandy gravel was encountered to a depth of 2.30m below ground level (begl). Following this made ground, firm, grey, slightly gravelly, silty clay was recorded to termination depth of 4.45m begl. It should be appreciated that a horizon of dark grey and black, carbonaceous mudstone was encountered at depths of between 3.20m and 3.50m begl. The soil revealed beneath the made ground is anticipated to represent the undifferentiated base of the Pennine Lower Coal Measures Formation as it transitions into the top of the Rough Rock with the dark grey and black carbonaceous mudstone likely representing the Subcrenatum Marine Band.

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 in WS01 and WS02 are summarised in the following table:

Table 3: Summary of Standard Penetration Tests

Strata	Depth Range (m)	SPT 'N' (Blows/300mm)		Comments
		Granular soils	Cohesive soils	
MADE GROUND (Silty, sandy GRAVEL)	1.00 to 1.45 2.00 to 2.45	4 21	-	Insitu testing indicates that made ground is present in a loose becoming medium dense condition.
Slightly gravelly, silty CLAY	3.00 to 3.45 4.00 to 4.45	-	26 28	Testing indicates that cohesive material is present in a stiff insitu condition.

Silty, sandy GRAVEL	1.00 to 1.10	+50	-	Testing indicates refusal within the weathered bedrock at the base of the borehole.

7.2 Dynamic Penetration Tests

Dynamic penetration tests were undertaken to positions noted on the site plan. A summary of the results is presented below:

Table 4: Summary of Dynamic Penetration Tests

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	5.2	5.85	Abrupt	Initial low blow counts, increasing to moderate with a rapid increase to high and then refusal.
DP02	0.2	0.9	1.025	Abrupt	
DP03	0.7	1.0	1.03	Abrupt	
DP04	0.6	0.8	0.82	Abrupt	
DP05	0.6	0.8	0.8	Abrupt	
DPA	0.4	0.6	1.08	Abrupt	
DPB	1.9	5.0	5.75	Abrupt	
DPC	0.9	1.5	1.5	Abrupt	

7.3 Gas and Water Level Monitoring

The standpipes were monitored between the 30th October and the 6th November 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/h)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS01	30.10.2025	0.0	0.5	20.2	0.0	986 ↑	Dry	4.00
	06.11.2025	0.0	0.6	20.1	0.0	985 ↑	Dry	
	20.11.2025	0.0	0.4	20.1	0.0	1015 ↑	Dry	

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

WS02	30.10.2025	0.0	0.9	19.9	0.0	986 ↑	Dry	0.90
	06.11.2025	0.0	0.9	19.8	0.0	985 ↑	Dry	
	20.11.2025	0.0	0.9	19.7	0.0	1015 ↑	Dry	
WS04	30.10.2025	0.0	0.6	20.2	0.0	986 ↑	Dry	0.80
	06.11.2025	0.0	0.9	19.6	0.0	985 ↑	Dry	
	20.11.2025	0.0	0.5	20.1	0.0	1015 ↑	Dry	

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

This work was undertaken using a GFM Series (Serial No 13747/270525) which was last calibrated on the 27th May 2025.

7.4 Soakaway Testing

On reaching the elected soakaway test depth, the pit was trimmed and squared as much as practicable. Water was then introduced into the pit at a controlled rate to prevent collapse of the sides and the level monitored at time intervals relative to a reference bar at ground level. The results obtained from the soakaway tests are presented at Appendix 4 and are summarised below:

Table 6: Soakaway Test Results

Location	Soakage Area Dimensions (average) (m)	Depths of soaked strata (m)	Soil Description (of soaked strata)	Infiltration Rate (m/sec)	*Drainage Characteristics
SA01	0.3 x 1.75	0.44 to 0.51	Side – Silty sandy GRAVEL Base – *As above*	N/A	Poor
SA02	0.3 x 1.7	0.55 to 0.62	Side – Silty sandy GRAVEL Base – *As above*	8.1×10^{-6} 7.3×10^{-6}	Good

*Based on the most onerous results for each test.

It should be appreciated that shallow sandstone prevented deep investigation for soakaway suitability. During the soakaway tests the water level did not achieve a fall from 75% to 25% of the effective depth of the storage volume in SA01. During this test, the water level movement ceased at a depth of 0.46m. It is considered that the initial movement was observed as water filled any gaps and fissures within the residual sandstone at the side of the pit. On this basis, the test could not be completed within the scope of the method provided in BRE Digest 365 due to the poor soakage rate of the exposed soils. Due to the negligible water movement it was not possbile to extrapolate the results obtained in order to obtain a soil infiltration rate. The tests were fully completed within trial pit SA02.

7.5 Landfill Investigation

During the Phase 1 Desk Study, it became apparent that an historic refuse tip was noted to be straddle the northeast border of the site. As such, an investigation into its extent on the site was commisioned which included the excavation of seven slit trenches perpendicular to the northeast border. These trenches identified the landfill within all locations along with where it terminated. The table below summarises the extent of the landfill onto the site, as well as the GPS coordinates for the approximate termination point. Additionally, photographs are presented within Appendix 5 which show the trenches and the extent of landfill.

Table 7: Soakaway Test Results				
Location	**Easting (m)**	**Northing (m)**	**Ground Level (m)**	**Distance Landfill Terminates from Northeast Boundary (m)**
LF01	411805.090	416833.269	173.062	3.10
LF02	411816.291	416819.809	171.725	2.20
LF03	411828.027	416806.329	170.939	1.10
LF04	411836.979	416796.069	170.318	1.50
LF05	411844.764	416784.440	169.988	3.00
LF06	411854.084	416772.027	169.213	2.30
LF07	411861.037	416758.675	169.006	3.20

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 8: Summary of Geotechnical Test Results				
Test type	**Number of tests**	**Range of results**		**Comments**
Water content determinations	1	19%		Well below the liquid and plastic limits.
Index properties (4 Point)	1	LL PL PI	49% 31% 18%	Clay of intermediate plasticity. Consistency index 1.7 NHBC Class - Low
Soluble sulphate & pH	2	SO_4 pH	0.02 & 0.12g/l 7.0 & 7.6	

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 SO_4^{2-}.
- 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

It is understood that the site is to be developed by the construction of a new residential development with associated parking and soft landscaping. At the time of writing this report the precise layout and method of construction is not known, thus the discussion below is of a generalised nature.

10.1 Foundations

It cannot be recommended that foundations be constructed directly within the made ground or topsoil revealed at this site. These soils are present in a weak and variable condition such that excessive total and or differential settlement could occur under moderately light surface loading.

On this basis, it is considered that foundations could include the provision of strip and spread footings. The results of this investigation indicate that bedrock will be revealed at depths of around 0.80m. This material would possess a significant bearing capacity, probably being in excess of 100kN/m^2. Therefore, at a typical foundation load for a house the factor of safety against general shear failure will be high, probably exceeding 10. In addition, it is considered that nominal settlements will occur under the action of the proposed increase in load.

The client should be aware that made ground deposits of the adjacent landfill encroach onto the north-eastern edge of the site coincident with WS01 and DPB, and care should be taken to ensure that foundations do not span the highwall of the filled ground where differential settlements could be induced.

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. This expedient will reduce loosening or softening of the underling soil due to both physical disturbance and the ingress of surface water.

10.2 General Comments for Excavations

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.

Should the excavations be required to stand open, it is considered that a blinding layer of lean-mixed concrete be placed over the sub-grade. This expedient will reduce loosening or softening of the underling soil due to both physical disturbance and the ingress of surface water.

Should seepage of groundwater be encountered it is considered that it 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.

10.3 Ground-floors

On the basis of the relatively competent soils 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 the near surface soils are adequately compacted. Where soils with a cohesive fraction are observed at a shallow depth, it is considered that a granular expedient could be placed beneath the floors to protect against heave.

However, due to the radon risk present on site, it is likely that a sub-floor void will be required. As such, it may be necessary to suspend floors between foundation positions, such that the floor loads are transmitted via the foundations to competent soils at depth and a void can be included.

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 2% could be employed in the pavement design[5]. 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 C2[6], 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-2 requirements. Assuming mobile groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1.

[5] Table 11.1, *Reproduction of TRRL Report LR1132 (1984)*, Smith (2006), Smith's Elements of Soil Mechanics, 8th ed.
[6] Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[7], 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.

10.6 Soakaway Suitability

The soils encountered beneath the topsoil were found to be typical of the weathered fraction of the underlying Soft Bed Flags. While the strata conditions appear to be comparable across the site, soakaways implemented will be reliant on the infiltration rates of the underlying bedrock. In this instance, fractures within the sandstone will be the main route of infiltration which may be inconsistent. Therefore, unless a suitable design can be created by a suitable competent person then soakaways cannot be recommended at this site and an alternative form of drainage should be adopted.

The client should be aware that borehole data from elsewhere on the site shows that generally cohesive deposits of predominantly weathered mudstone has been encountered at depth, and any soakaway design should be cognisant of the underlying potential stratigraphic succession. It is estimated that at a suitable invert level of around 2.50m the strata may not be as suitable as has been recorded at or close to the surface. Due to the density of the sandstone at the near surface to fully determine the potential for soakaways, heavy plant with ability to rip bedrock may be required, however due to the required plant and depth of excavations such soakaways may not be economic for the development.

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 a new residential development with associated parking and soft landscaping. 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 0.3% and 7.3%. 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 website[8] 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:

[7] 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.*
[8] http://www.atrisksoil.co.uk/pages/general/subscribers.asp

Table 9: Summary of Contaminated Areas		
Location	**Depth (m)**	**Contaminants found to be exceeding SSVs (Residential with plant uptake)**
WS01	1.20	Asbestos, Lead, PAHs: Chrysene, Benzo(a)pyrene, Indeno(1,2,3-c,d)Pyrene & Benzo (g,h,i)perylene.
WS02	0.20	PAHs: Chrysene, Benzo(a)pyrene, Indeno(1,2,3-c,d)Pyrene & Benzo (g,h,i)perylene.
WS03	0.70	None.
WS05	0.20	PAHs: Benzo (g,h,i)perylene.

Concentrations of chromium^{VI}, selenium, free cyanide, phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C10; aromatic C5 to C12) 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.

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 criterion[9]. 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 10: Summary of Areas Contaminated by PAHs & TPHs		
Location	**Depth (m)**	**Contaminants found to be exceeding SSVs (Residential with Plant Uptake)**
WS01	1.20	None.
WS02	0.20	None.
WS03	0.70	None.
WS05	0.20	None.

On the basis of the above information, the results of the investigation have concluded that the landfill deposits are contaminated. Indeed, lead contamination has been observed to exceed the appropriate screening values by 110mg/kg (55% above appropriate SSV) within the position of WS01. Additionally, loose asbestos fibres were detected within the made ground of WS01 which was quantified and found to make up 0.006% of the sample.

As such, it is recommended that the boundary of the landfill should be identified and separated from the remainder of the site. It should be appreciated that the rest of the site was found to be uncontaminated in regards to the intended end use.

[9] Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 6% SOM, Residential without home grown produce land use, 23.06.17.

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 0.4% and 0.9%, in association with oxygen levels of between 19.6% and 20.2%. 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 0.0 litres per hour was recorded, as such, an assumed flow rate of 0.1% will be considered and 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 1015mb.

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 negligible methane was recorded along with 0.9% (0.009) carbon dioxide, in association with a maximum flow rate of 0.1 l/hr. This results in a negligible GSV for methane and a GSV of 0.0009 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 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)[10]. Accepting that the proposed development is of high sensitivity and that the generation potential is moderate, these tables suggest that 12 readings could be undertaken over a period of 6 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 3 monitoring visits were undertaken over a two-week time period and for the purpose of this assessment, it is considered that the site can be provisionally classified as Characteristic Situation Level 1. However, it should be appreciated that a further three ground gas monitoring visits are still to be undertaken. Additionally, it is not considered that the make-up of the landfill encountered within WS01 represents a generative source.

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 Agency[11] advice on the assessment of risks arising from the presence of

[10] Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings, p60.*
[11] 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'.

contamination in soils and using the source-pathway-receptor approach.[12] 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.'[13]

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 11. Sources of contamination include the following:

On-site – Made Ground (Lead and asbestos).

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 11.

[12] 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.
[13] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

Table 11: Conceptual Site Model and Site-Specific Risk Assessment				
Conceptual Site Model			**Site Specific Risk Assessment**	
Pathways	**Receptor**	**Linkage Present?**	**Risk Rating**	**Actions Required**
Direct contact/dermal absorption/soil ingestion	Operative	Yes – contamination was found to be present within the landfill encountered at the edge of the site, however, the remaining area of the site was found to be uncontaminated. Contact with soil likely during works.	High	Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways.
	End User	Yes – contamination was found to be present within the landfill encountered at the edge of the site, however, the remaining area of the site was found to be uncontaminated. Site to be developed into a residential development with landscaped areas.	High	
	Neighbours	Yes – contamination was found to be present within the landfill encountered at the edge of the site, however, the remaining area of the site was found to be uncontaminated. Populated residential area is present within 250m of the site. However, site is anticipated to be secured during the development phase. Contamination is not anticipated to affect neighbours.	Low	
Inhalation of Dust/Vapours	Operative	Yes – contamination was found to be present within the landfill encountered at the edge of the site, however, the remaining area of the site was found to be uncontaminated. Dust may be derived from soils contaminated with asbestos.	High	Some contamination is present underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways. Measures to minimise dust generation.
	End User	Yes – contamination was found to be present within the landfill encountered at the edge of the site, however, the remaining area of the site was found to be uncontaminated. Dust may be derived from soils contaminated with asbestos.	High	
	Neighbours	Yes – contamination was found to be present within the landfill encountered at the edge of the site, however, the remaining area of the site was found to be uncontaminated. Residential properties located within 250m radius of the site and possible inhalation of dust containing asbestos during the works. Asbestos may migrate to offsite receptors.	High	
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	Some contamination is present underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways. However, the contamination at the site is considered to be of limited mobility, therefore the likelihood of contamination affecting neighbouring gardens is considered low risk.
	End User	Yes – contamination was found to be present within the landfill encountered at the edge of the site, however, the remaining area of the site was found to be uncontaminated. Site is to be developed into a residential development with landscaped areas.	High	
	Neighbours	Yes – contamination found to be present at the site and residential areas adjoin the site.	Low	
Migration of hazardous gases via permeable strata or shallow mining activity	Operative	No – low concentrations of methane and carbon dioxide have been found to be present at the site (assuming *Characteristic Situation Level 1*).	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	
	Neighbours	No – whilst concentrations of ground gas have been found to be present at the site (assuming *Characteristic Situation Level 1*), no structures directly adjoin the site, therefore gases migrating from the site would vent to atmosphere before reaching neighbouring structures. Moreover, carbon dioxide may be derived from the chalk below the site.	N/A	
Spillage/loss/run off direct to receiving water	Controlled Waters	No – there are no controlled waters within 250m of the site.	N/A	Some contamination is present underlying the site. Remediation will be required to either remove the contamination or break pathways. Infiltration testing recommended to determine the permeability of the underlying soils. Old services to be removed or capped.
Migration via permeable unsaturated strata	Controlled Waters	Yes – a secondary A aquifers is present beneath the site. The site is underlain by granular soils. Contamination by lead and asbestos is not anticipated to be significantly mobile.	Low	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site. The site is underlain by granular soils. Contamination by lead and asbestos is not anticipated to be significantly mobile.	Low	
Direct contact with contaminated soils	Plants	Yes – contamination was found to be present within the landfill encountered at the edge of the site, however, the remaining area of the site was found to be uncontaminated. Contamination by lead and asbestos is not anticipated to be significantly mobile.	Moderate	Some contamination is present underlying the site. Remediation will be required to either remove the contamination or break pathways.
Uptake via root system			Moderate	
Direct contact with contaminated soils	Building Materials	Yes – elevated levels of PAHs revealed at the site may represent a risk to building materials or plastic water pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1.	Moderate (plastic services) Low (buried concrete)	Please see section 11.3.3 for information on good building practice.
Direct contact with contaminated groundwater				
Exposure to Radon	Operative	Yes – site currently indicated to be present in a radon affected area[14].	Moderate	Between 3% and 5% of properties are affected. The publication BR211 states that basic protection measures are necessary.
	End User			
UXO Risk	Operative	No – it is considered that the activities of the end users are unlikely to affect any UXO devices that may be present below the site.	Low	No further action required.
	End User			

[14] Radon interactive map [*online resource https://www.ukradon.org/radonmaps/*] It should be appreciated that radon maps are subject to change and are updated regularly.

11.3 Indicative Remediation Strategy

In view of the site-specific risk assessment it is considered that some remediation may be required at this site. Further to this, a phased remediation strategy should be undertaken which includes further investigation in order to delineate the existing contaminated landfill from the rest of the uncontaminated 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 site operatives during the construction process from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust and vapours.
- To protect the end user from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust and vapours.
- To protect end users and neighbours from the ingestion or inhalation of asbestos fibres during or post construction period.
- To protect the end user from the elevated levels of carbon dioxide.
- To protect neighbours from the inhalation and ingestion dust during the construction process.
- To protect operatives, end users and neighbours from the ingestion of contaminated fruit and vegetables.
- To protect plants from direct contact with contamination and prevent uptake via root system.
- To ensure that contamination cannot reach controlled waters via surface run-off or permeable strata.
- To ensure that contamination cannot enter the former services occupying the site which may return to controlled waters.
- To protect plastic services from being penetrated by, or degrading due to the presence of, contamination in the soil or groundwaters.
- Delineate the existing landfill on site in order to determine the extent of any potential contamination.

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 a new residential development with associated parking and soft landscaping. 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 hazards of working with contaminated soils and the potential hazards associated with materials containing volatile hydrocarbons.
- 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.

Landscaped Areas

In view of the potential contamination on site, it is considered that landscaped areas in the area of the landfill will require some remediation. This could include the provision of a clean cover system including a capping layer of say 500mm of inert material, which will put the contaminated ground out of the end users' dig range. At the base of this layer, a granular capillary break of say 100mm of free draining granular soil should be placed in order to prevent mobile contamination rising upward. This expedient should also provide a suitable root barrier to isolate the plants from the underlying contaminated ground.

Alternatively, the area of landfill anticipated to be straddling the north-eastern boundary of the site could either be permanently fenced off or sealed beneath hardstanding in order to sever the pathway.

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 YALPAG[15] 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 12: 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 500m³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH.

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

		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 13: 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

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:

- The assessment of the extents of any contamination 'hot-spots' identified including the details of sampling points, such as location and descriptive logs, and the results of any chemical testing.
- The extents of any areas where made ground has been wholly removed.
- 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.

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.
- Completion and reporting of recommended additional gas monitoring.
- Completion of any remedial works if required.
- 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.
- Produce a validation report to demonstrate that the geo-environmental risks discussed in this report have been mitigated.
- 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.
  - GeoIndex Onshore 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


LF01
WS01
DPC
LF02
WS02
LF03
WS03
DPB
LF04
DPA
LF05
WS04
LF06
WS05
LF07
SA02
SA01
Reinwood Rd
Google Earth
N
50 m

Appendix 2

Borehole Records

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS01** Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords: 411808.05E - 416831.29N	Hole Type WLS
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level: 172.68m aOD	Scale 1:25
Client: Satnam Singh		Dates: 15/10/2025	Logged By SH

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				87	90		0.50	172.18		TOPSOIL (Dark brown, silty, slightly gravelly, fine to coarse SAND. Gravel is angular to sub-angular and fine to coarse of sandstone).
		1.00	SPT			N=4 (2,1/1,1,1,1)				MADE GROUND (Brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone and mudstone. Sand is fine to coarse).
				77	100					
		2.00 - 2.45	D							
		2.00	SPT			N=21 (3,3/5,5,5,6)				
				67	80		2.30	170.38		Firm, grey, slightly gravelly, silty CLAY. Gravel is tabular and fine to coarse of mudstone. [RESIDUAL PENNINE LOWER COAL MEASURES FORMATION]
		2.80	D							
		3.00	SPT			N=26 (5,6/8,5,6,7)				
							3.20	169.48		Black, carbonaceous MUDSTONE recovered as a sandy gravel. [RESIDUAL PENNINE LOWER COAL MEASURES FORMATION]
				57	70		3.50	169.18		Firm, grey, , thinly laminated, slightly gravelly, silty CLAY. Gravel is tabular and fine to coarse of mudstone. [RESIDUAL PENNINE LOWER COAL MEASURES FORMATION]
		4.00	SPT			N=28 (4,6/6,6,7,9)				
							4.45	168.23		End of Borehole at 4.45m

Remarks

1. Position scanned for services using CAT and Genny. 2. No groundwater encountered.

AGS

Borehole Log

Borehole No. **WS02**

Sheet 1 of 1

Project Name:	Reinwood Road	Project No. C5092/25/E/7765	Co-ords: 411790.33E - 416813.65N
Location:	Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level: 173.86m aOD
Client:	Satnam Singh		Dates: 15/10/2025

Hole Type: WLS

Scale: 1:25

Logged By: SH

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				87	100		0.30	173.56		TOPSOIL (Dark brown, silty, slightly gravelly, fine to coarse SAND. Gravel is angular to sub-angular and fine to coarse of sandstone).
		1.00 - 1.10 1.00	D SPT			50 (25 for 50mm/50 for 40mm)	1.10	172.76		Yellowish brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone. Sand is fine to coarse. [RESIDUAL SOFT BED FLAGS] End of Borehole at 1.10m

1 2 3 4 5

Remarks

1. Position scanned for services using CAT and Genny. 2. No groundwater encountered.

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS03**

Sheet 1 of 1

Project Name:	Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	411814.08E - 416803.66N	Hole Type WLS
Location:	Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	172.03m aOD	Scale 1:25
Client:	Satnam Singh		Dates:	15/10/2025	Logged By SH

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
							0.40	171.63		TOPSOIL (Dark brown, silty, slightly gravelly, fine to coarse SAND. Gravel is angular to sub-angular and fine to coarse of sandstone).
				87	100		0.90	171.13		Yellowish brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone. Sand is fine to coarse. [RESIDUAL SOFT BED FLAGS]
										End of Borehole at 0.90m

Remarks

1. Position scanned for services using CAT and Genny. 2. No groundwater encountered.

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS04**

Sheet 1 of 1

Project Name:	Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	411831.42E - 416781.13N	Hole Type WLS
Location:	Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	170.42m aOD	Scale 1:25
Client:	Satnam Singh		Dates:	15/10/2025	Logged By SH

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				87	90		0.40	170.02		TOPSOIL (Dark brown, silty, slightly gravelly, fine to coarse SAND. Gravel is angular to sub-angular and fine to coarse of sandstone).
							0.80	169.62		Yellowish brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone. Sand is fine to coarse. [RESIDUAL SOFT BED FLAGS]
										End of Borehole at 0.80m

Remarks

1. Position scanned for services using CAT and Genny. 2. No groundwater encountered.

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS05**

Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type WLS
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:25
Client: Satnam Singh		Dates: 15/10/2025	Logged By SH

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				87	100		0.40			TOPSOIL (Dark brown, silty, slightly gravelly, fine to coarse SAND. Gravel is angular to sub-angular and fine to coarse of sandstone).
							0.80			Yellowish brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone. Sand is fine to coarse. [RESIDUAL SOFT BED FLAGS]
										End of Borehole at 0.80m

1 2 3 4 5

Remarks

1. Position scanned for services using CAT and Genny. 2. No groundwater encountered.

AGS

Appendix 3

Dynamic Probing Records

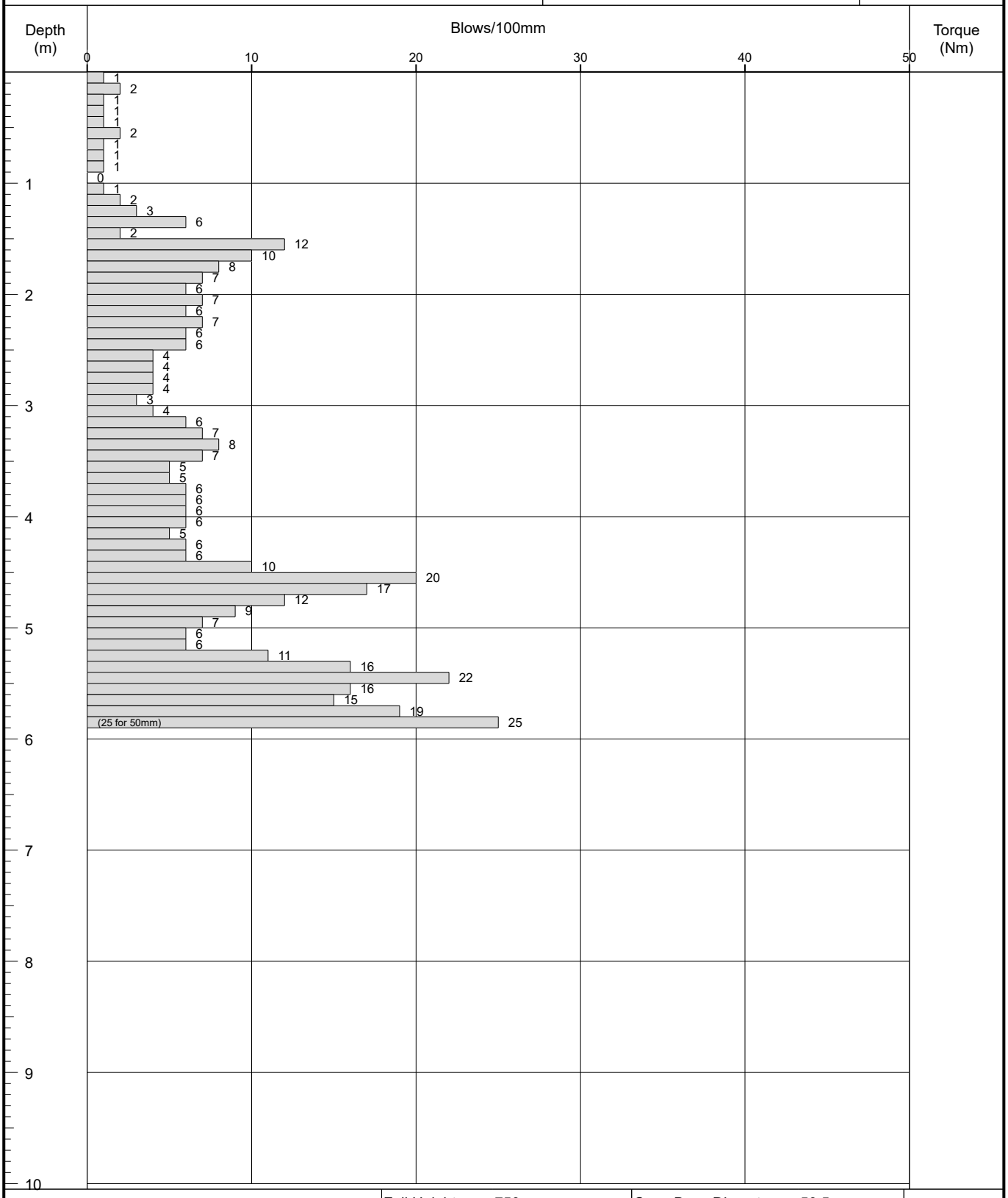
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP01**

Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type DCP
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:50
Client: Satnam Singh		Dates: 15/10/2025	Logged By GH



Remarks:
1. Position scanned for services using CAT and Genny.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	5.85m
Probe Type	DPSH-B		

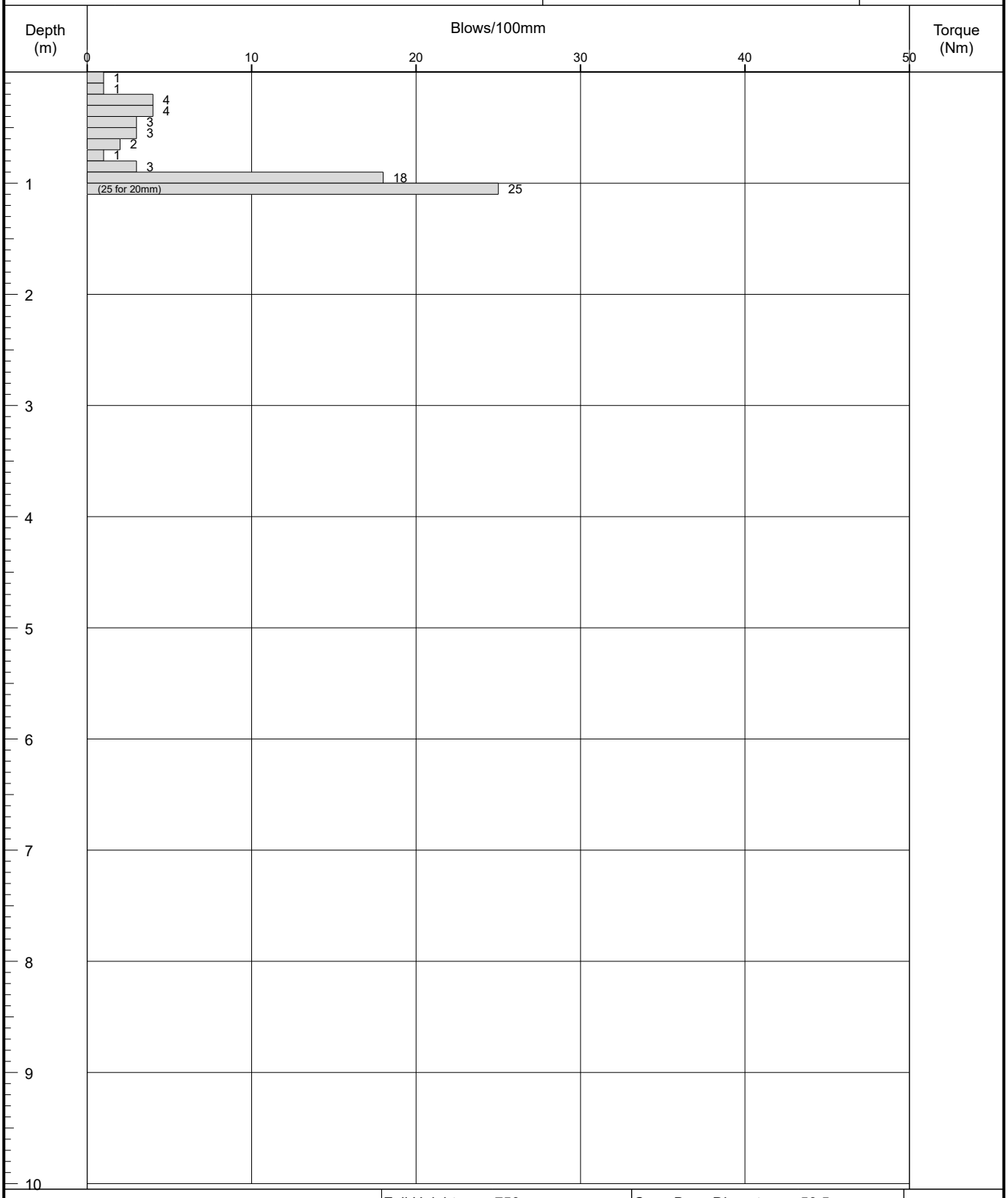
AGS

Probe Log

Probe No. **DP02**

Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type DCP
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:50
Client: Satnam Singh		Dates: 15/10/2025	Logged By GH



Remarks:
1. Position scanned for services using CAT and Genny.

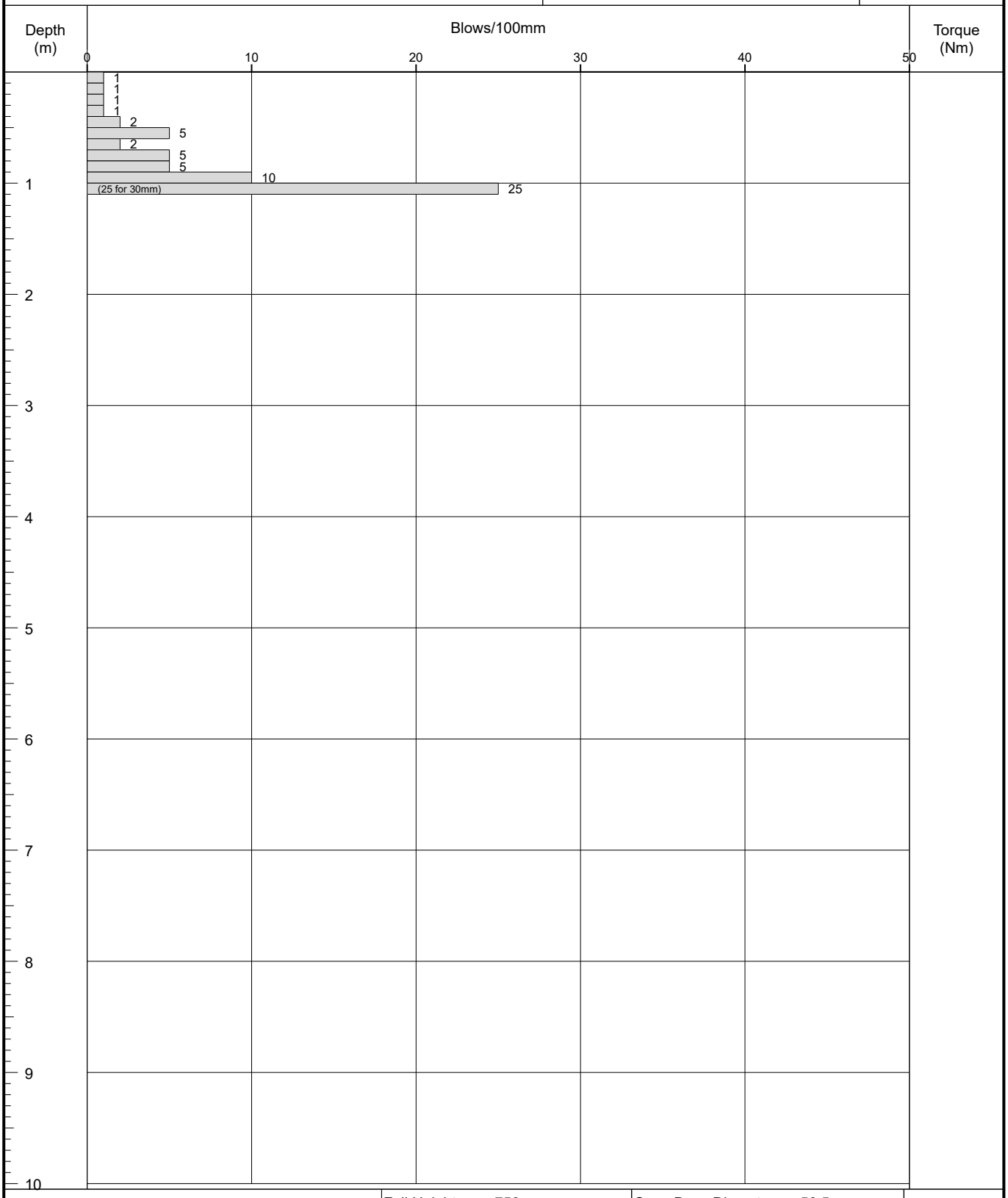
Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	1.02m
Probe Type	DPSH-B		

RGS Environmental Geotechnical Specialists

Probe Log

Probe No.
DP03
Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type DCP
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:50
Client: Satnam Singh		Dates: 15/10/2025	Logged By GH



Remarks:
1. Position scanned for services using CAT and Genny.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	1.03m
Probe Type	DPSH-B		

AGS

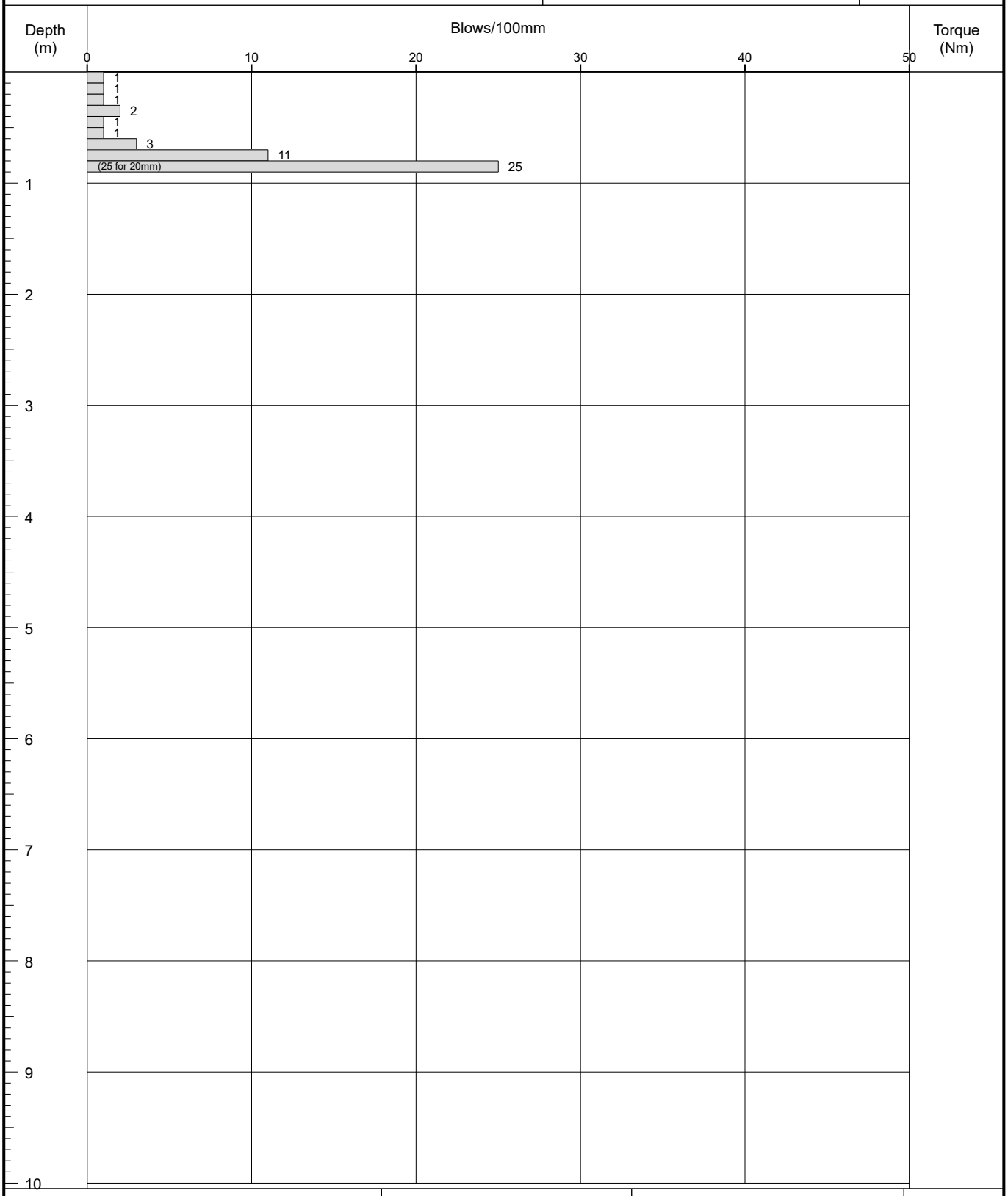
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP04**

Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type DCP
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:50
Client: Satnam Singh		Dates: 15/10/2025	Logged By GH



Remarks:
1. Position scanned for services using CAT and Genny.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	0.82m
Probe Type	DPSH-B		

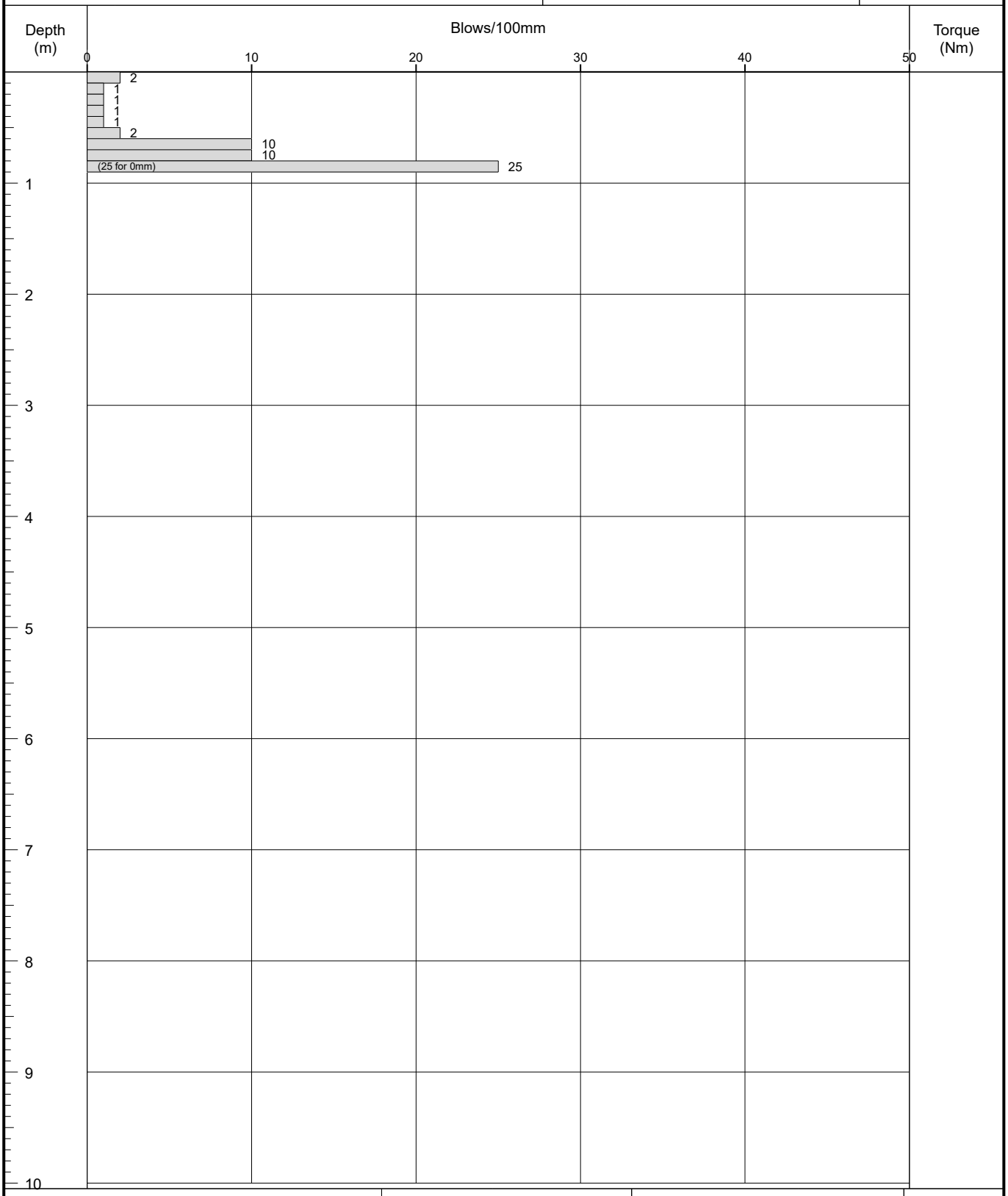
AGS

Probe Log

Probe No. **DP05**

Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type DCP
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:50
Client: Satnam Singh		Dates: 15/10/2025	Logged By GH



Remarks:
1. Position scanned for services using CAT and Genny.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	0.8m
Probe Type	DPSH-B		

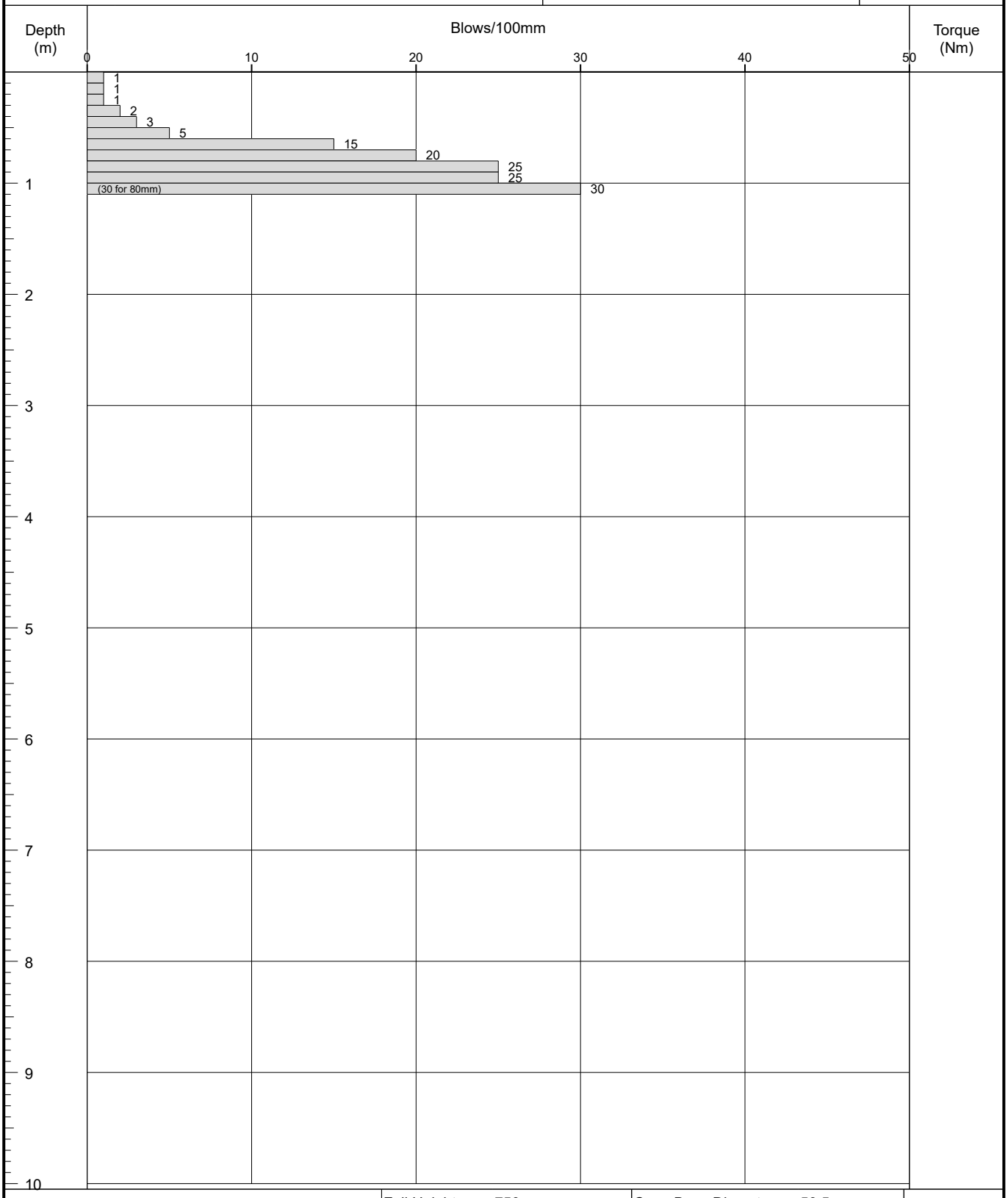
Probe Log

Environmental Geotechnical Specialists

Probe No. **DPA**

Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type DCP
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:50
Client: Satnam Singh		Dates: 15/10/2025	Logged By GH



Remarks:
1. Position scanned for services using CAT and Genny.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	1.08m
Probe Type	DPSH-B		

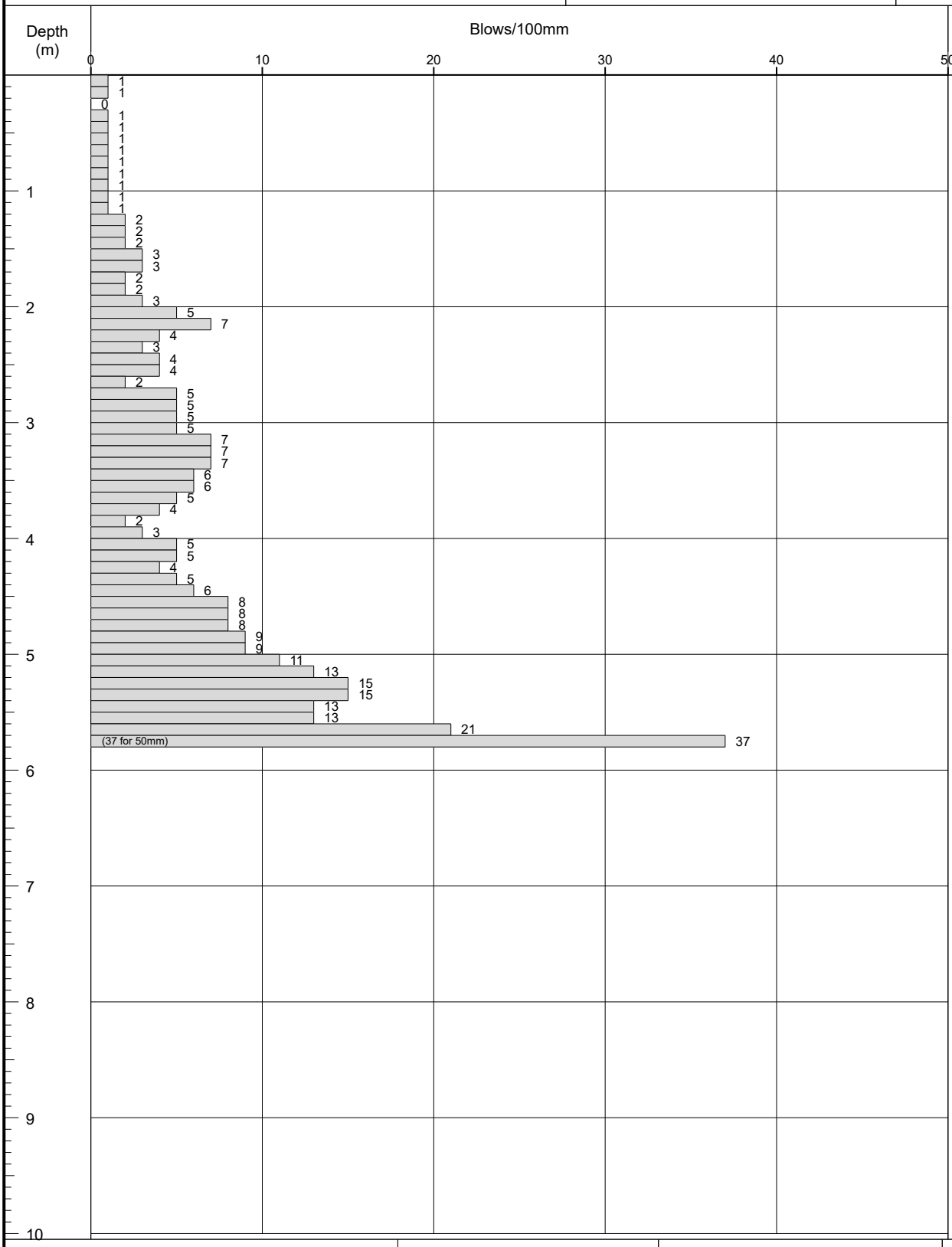
AGS

RGS Environmental Geotechnical Specialists

Probe Log

Probe No.
DPB
Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type DCP
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:50
Client: Satnam Singh		Dates: 15/10/2025	Logged By GH



Remarks:
1. Position scanned for services using CAT and Genny.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	5.75m
Probe Type	DPSH-B		

AGS

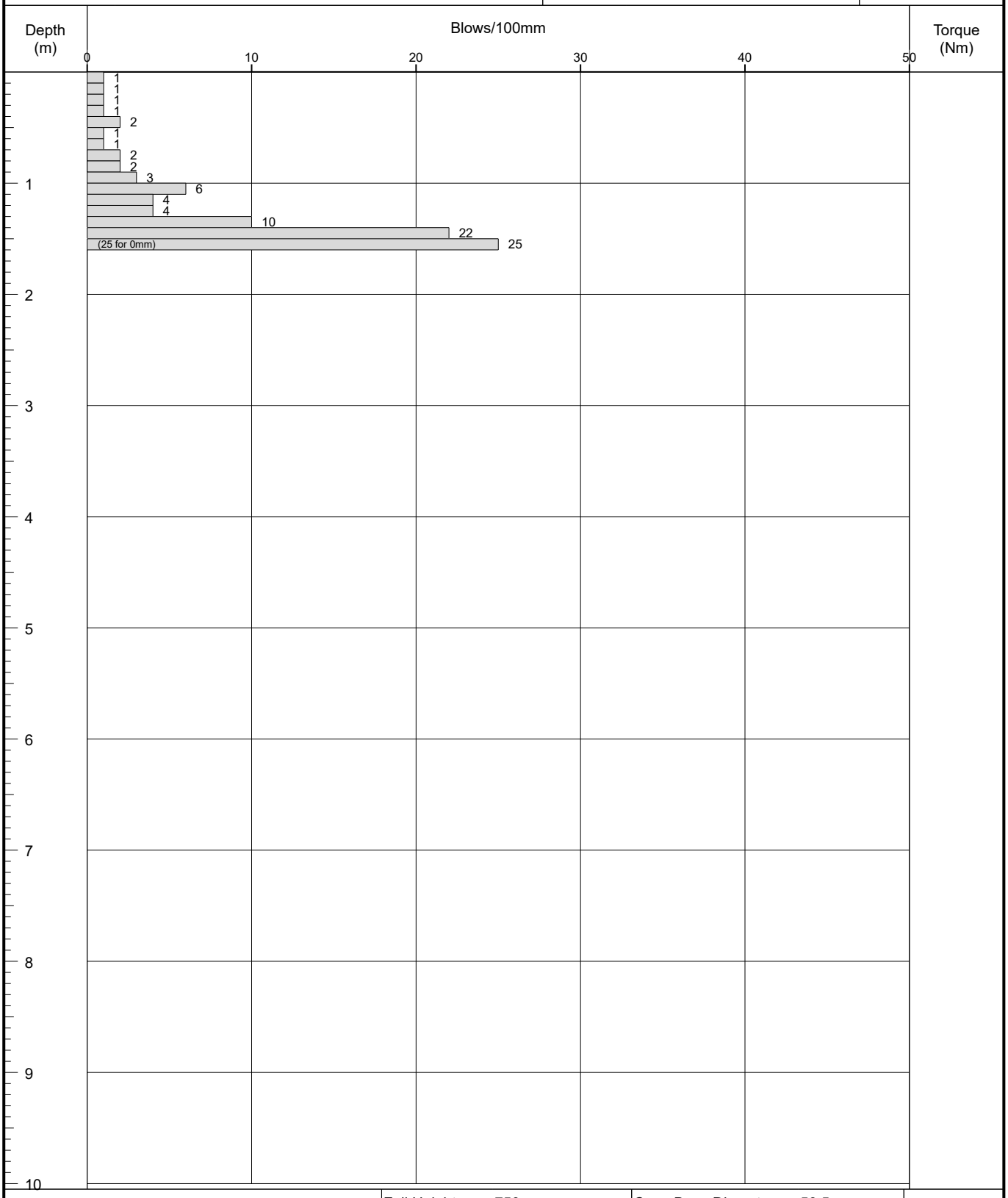
Probe Log

Environmental Geotechnical Specialists

Probe No. **DPC**

Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords:	Hole Type DCP
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Level:	Scale 1:50
Client: Satnam Singh		Dates: 15/10/2025	Logged By GH



Remarks:
1. Position scanned for services using CAT and Genny.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	1.5m
Probe Type	DPSH-B		

AGS

Appendix 4

Trial Pit Records, Soakaway Results and Photographs

Trial Pit Log

Trialpit No **SA01**

Sheet 1 of 1

Project Name: Reinwood Road	Project No. C5092/25/E/7765	Co-ords: 411846.54 - 416748.86 Level: 169.44	Date 26/11/2025
Location: Reinwood, Huddersfield, West Yorkshire, HD3 4DS		Dimensions (m): Depth 0.51 — 1.75 × 0.3	Scale 1:25
Client: Satnam Singh			Logged SH

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.35	169.09		TOPSOIL (Dark brown, silty, slightly gravelly, fine to coarse SAND with moderate cobble content. Gravel is angular to subangular and fine to coarse of brick and sandstone. Cobbles are angular of whole bricks).
				0.51	168.93		Yellowish brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone. Sand is fine to coarse. [RESIDUAL SOFT BED FLAGS] End of pit at 0.51 m

Remarks: 1. Position scanned for services using CAT and Genny.

Stability: Stable



Photo 1: SA01



Photo 2: SA01 during testing

RGS Environmental Geotechnical Specialists

Site Name:

Reinwood Road

Job No:

C5092/25/E/7765

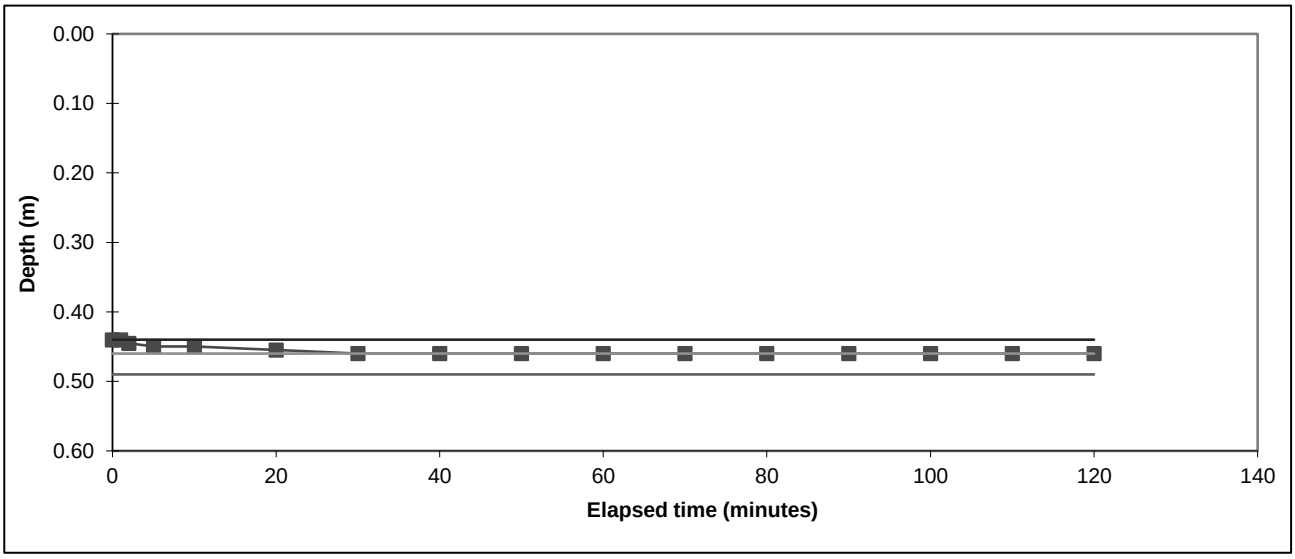
t. 0843 50 666 87
www.rogersgeotech.co.uk

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	SA01	Test No:	1	Date:	26.11.2025
Length (m):	1.750		Datum Height:	0.00	m agl
Width (m):	0.30		Granular infill:	None	
Depth (m):	0.51		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.440	110	0.460
1	0.440	120	0.460
2	0.445		
5	0.450		
10	0.450		
20	0.455		
30	0.460		
40	0.460		
50	0.460		
60	0.460		
70	0.460		
80	0.460		
90	0.460		
100	0.460		



Start water depth for analysis (mbgl):	0.44		
75% effective depth (mbgl):	0.46	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.48		
25% effective depth (mbgl):	0.49	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	0.51		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):			0.65
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).
Test failed due to negligible infiltration.

Client:	HRB Investments Ltd	**Job No:**
Site:	Land at Reinwood Road, Reinwood	C5092/25/E/7765

Trial Pit Log

Trialpit No **SA02**

Sheet 1 of 1

Project Name:	Reinwood Road	Project No. C5092/25/E/7765	Co-ords: 411856.45 - 416754.53 Level: 169.06
Location:	Reinwood, Huddersfield, West Yorkshire, HD3 4DS	Dimensions (m): Depth 0.62	1.7 × 0.3
Client:	Satnam Singh		Date 26/11/2025 Scale 1:25 Logged SH

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40	168.66		TOPSOIL (Dark brown, silty, slightly gravelly, fine to coarse SAND with moderate cobble content. Gravel is angular to subangular and fine to coarse of brick and sandstone. Cobbles are angular of whole bricks).
				0.62	168.44		Yellowish brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone. Sand is fine to coarse. [RESIDUAL SOFT BED FLAGS] End of pit at 0.62 m

Remarks: 1. Position scanned for services using CAT and Genny.

Stability: Stable



Photo 1: SA02



Photo 2: SA02 during testing

RGS Environmental Geotechnical Specialists

Site Name:

Reinwood Road

Job No:

C5092/25/E/7765

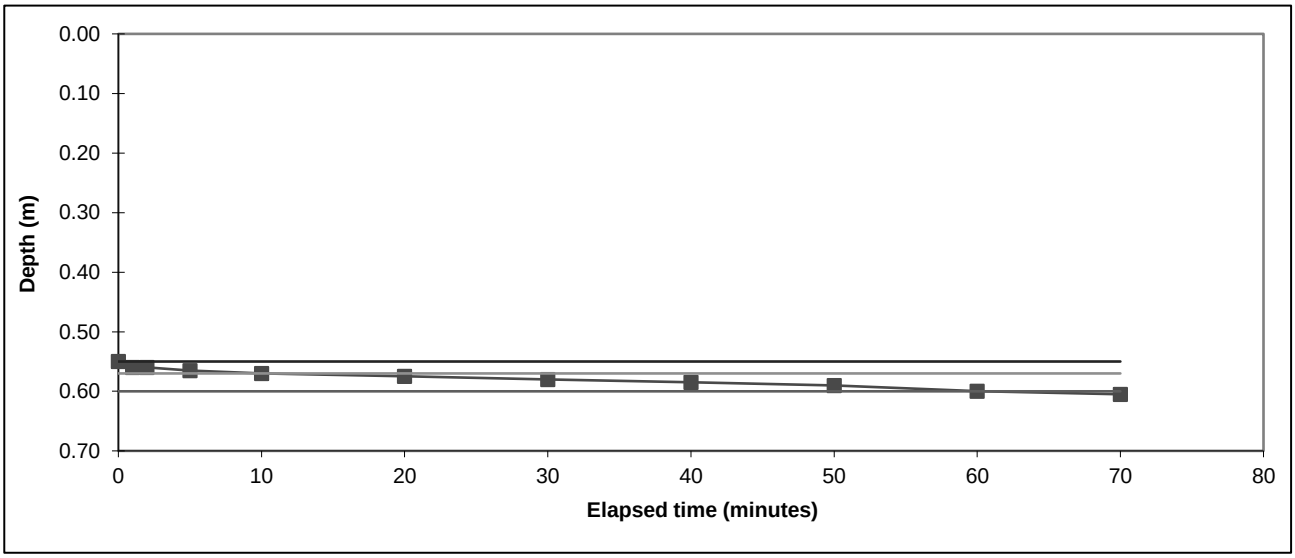
t. 0843 50 666 87
www.rogersgeotech.co.uk

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	SA02	Test No:	1	Date:	26.11.2025
Length (m):	1.700		Datum Height:	0.00	m agl
Width (m):	0.30		Granular infill:	None	
Depth (m):	0.62		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.550		
1	0.560		
2	0.560		
5	0.565		
10	0.570		
20	0.575		
30	0.580		
40	0.585		
50	0.590		
60	0.600		
70	0.605		



Start water depth for analysis (mbgl):	0.55		
75% effective depth (mbgl):	0.57	Elapsed time (mins):	10.0
50% effective depth (mbgl):	0.59		
25% effective depth (mbgl):	0.60	Elapsed time (mins):	60.0
Base of soakage zone (mbgl):	0.62		

Volume outflow between 75% and 25% effective depth (m^3):	0.015
Mean surface area of outflow (m^2):	0.63
(side area at 50% effective depth + base area)	
Time for outflow between 75% and 25% effective depth (mins):	50.0

Soil infiltration rate (m/s):	**8.1E-6**

Remarks Results processed following BRE 365 (2007).

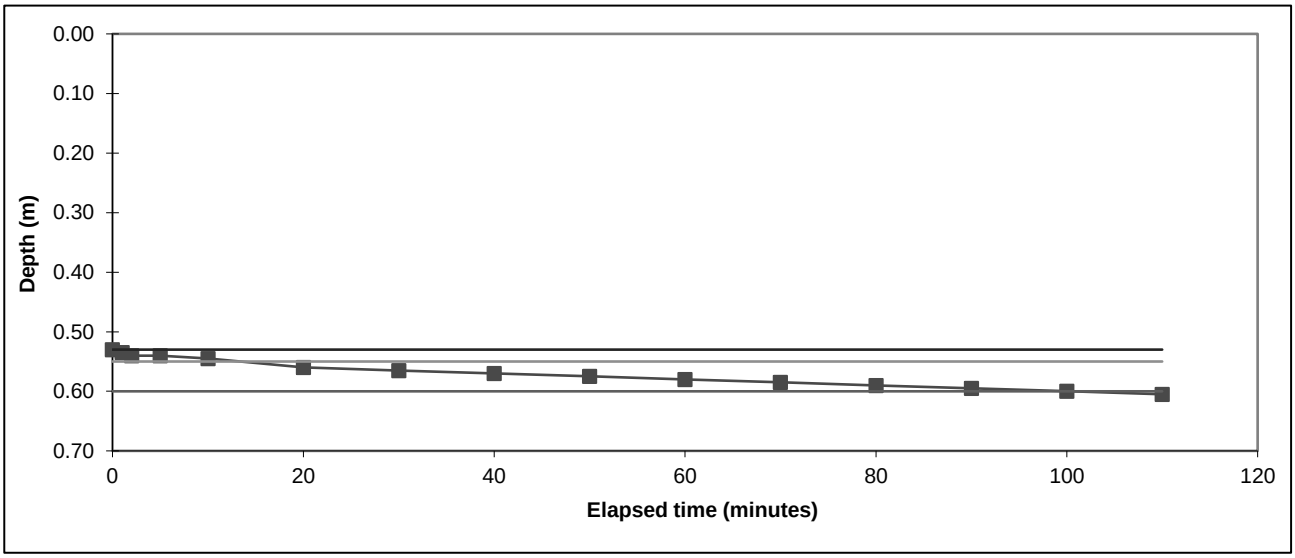
Client:	HRB Investments Ltd	**Job No:**
Site:	Land at Reinwood Road, Reinwood	C5092/25/E/7765

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	SA02	Test No:	2	Date:	26.11.2025
Length (m):	1.700		Datum Height:	0.00	m agl
Width (m):	0.30		Granular infill:	None	
Depth (m):	0.62		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.530	110	0.605
1	0.535		
2	0.540		
5	0.540		
10	0.545		
20	0.560		
30	0.565		
40	0.570		
50	0.575		
60	0.580		
70	0.585		
80	0.590		
90	0.595		
100	0.600		



Start water depth for analysis (mbgl):	0.53		
75% effective depth (mbgl):	0.55	Elapsed time (mins):	13.3
50% effective depth (mbgl):	0.58		
25% effective depth (mbgl):	0.60	Elapsed time (mins):	100.0
Base of soakage zone (mbgl):	0.62		

Volume outflow between 75% and 25% effective depth (m^3):	0.026
Mean surface area of outflow (m^2):	0.67
(side area at 50% effective depth + base area)	
Time for outflow between 75% and 25% effective depth (mins):	86.7

Soil infiltration rate (m/s):	**7.3E-6**

Remarks Results processed following BRE 365 (2007).

Client:	HRB Investments Ltd	**Job No:**
Site:	Land at Reinwood Road, Reinwood	C5092/25/E/7765

Appendix 5

Gas Monitoring Sheets

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/5092/25/E/7765	Client:	Satnam Singh	Visit:	1	Of	6
Site:	Land at Reinwood Road, Huddersfield HD3 4DS	Date:	30.10.2025				

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0.0		0.5		0		0		20.2				0.0		DRY		1.08	
3	0.0		0.9		0		0		19.9				0.0		DRY		1.14	
4	0.0		0.6		0		0		20.2				0.0		DRY		0.90	
Max.	0.0	0.0	0.9	0.0	0	0	0	0	20.2	0.0	0	0	0.0	0.0	0.00			
Min.	0.0	0.0	0.5	0.0	0	0	0	0	19.9	0.0	0	0	0.0	0.0	0.00			

ND - Not detected

DRY - No water in well

NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	Wet
Precipitation	0l/m2 in last 6 hours
Wind	4
Temperature	10
Barometric Pressure	
Pressure Trend	

Monitor Technical Specifications								
Gas Monitor Used:	GFM Series							
Serial No:	13747/270525							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	27.05.2025							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4	0.0	0.0
Max CO_2	0.9	0.0
Max CO	0	0
Max H_2S	0	0
Max O_2	20.2	0.0
Min O_2	19.9	0.0
Flow rate	0.0	0.0

	Start	End
Barometric Pressure	986	986

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/5092/25/E/7765	Client:	Satnam Singh	Visit:	2	Of	6
Site:	Land at Reinwood Road, Huddersfield HD3 4DS	Date:	06.11.2025				

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0.0		0.6		0		0		20.1				0.0		DRY		1.08	
3	0.0		0.9		0		0		19.8				0.0		DRY		1.14	
4	0.0		0.9		0		0		19.6				0.0		DRY		0.90	
Max.	0.0	0.0	0.9	0.0	0	0	0	0	20.1	0.0	0	0	0.0	0.0	0.00			
Min.	0.0	0.0	0.6	0.0	0	0	0	0	19.6	0.0	0	0	0.0	0.0	0.00			

ND - Not detected

DRY - No water in well

NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	Wet
Precipitation	0.2l/m2 in last 12 hours
Wind	4
Temperature	10
Barometric Pressure	
Pressure Trend	

Monitor Technical Specifications								
Gas Monitor Used:	GFM Series							
Serial No:	13747/270525							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	27.05.2025							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4	0.0	0.0
Max CO_2	0.9	0.0
Max CO	0	0
Max H_2S	0	0
Max O_2	20.1	0.0
Min O_2	19.7	0.0
Flow rate	0.0	0.0

	Start	End
Barometric Pressure	984	985

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/5092/25/E/7765	Client:	Satnam Singh	Visit:	3	Of	6
Site:	Land at Reinwood Road, Huddersfield HD3 4DS	Date:	20.11.2025				

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0.0		0.4		0.0		0		20.1				0.0		DRY		1.08	
3	0.0		0.9		0.0		0		19.7				0.0		DRY		1.14	
4	0.0		0.5		0.0		0		20.1				0.0		DRY		0.90	
Max	0.0	0.0	0.9	0.0	0.0	0.0	0	0	20.1	0.0	0	0	0.0	0.0				
Min.	0.0	0.0	0.4	0.0	0.0	0.0	0	0	19.7	0.0	0	0	0.0	0.0				

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

Meteorological & Site Information	
General Ground Condition	DRY
Precipitation	4l/m2 in last 12 hours
Wind	6
Temperature	3
Barometric Pressure	
Pressure Trend	

Monitor Technical Specifications								
Gas Monitor Used:	GFM Series							
Serial No:	13747/270525							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	27.05.2025							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4	0.0	0.0
Max CO_2	0.9	0.0
Max CO	0	0
Max H_2S	0	0
Max O_2	20.1	0.0
Min O_2	19.7	0.0
Flow rate	0.0	0.0

	Start	End
Barometric Pressure	1015	1015

Operative Details.	M.Tuck

Appendix 6

Laboratory Testing

Environmental
Geotechnical
Specialists



LABORATORY REPORT

job number C5092/25/E/7765	client ref
site address Land at Reinwood Road, Reinwood Road, Huddersfield, West Yorkshire, HD3 4DS	client address HRB Investments Ltd 93 Westbourne Road Huddersfield West Yorkshire HD1 4LG
consultant	
date scheduled 05/11/2025	date issued 18/11/2025
issued by S. Hale	job title Laboratory Manage

Rogers Geotechnical Services Ltd Telephone **01484 607 977**
Email **harry.letch@rogersgeotech.co.uk** **www.rogersgeotech.co.uk** Unit
Unit 1 Manor Croft Works
Skelmanthorpe
HD89DS

Constructionline
QMS ISO 9001 REGISTERED
QMS ISO 14001 REGISTERED
QMS OHSAS 18001 REGISTERED

GEOTECHNICAL ENVIRONMENTAL

UKAS
United Kingdom Accreditation Service

8948

Schedule of UKAS Accredited Laboratory Tests

RGS

1. CLASSIFICATION OF SOIL	BS 1377-2:1990	BS EN 150 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		U
ii. Saturation m/c of chalk	Pt 2 : 3.3			U
1.2 Index Properties				
i. Liquid limit – cone penetrometer	Pt 2 : 4.3			U
ii. Plastic limit	Pt 2 : 5.3			U
iii. Shrinkage limit	Pt 2 : 6.3			U
iv. Linear shrinkage	Pt 2 : 6.5			U
1.3 Particle Density				
i. Gas jar	Pt 2 : 8.2			U
ii. Large pyknometer	Pt 2 : 8.3			U
iii. Small pyknometer	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		U
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		U
ii. Wet Sieve	Pt 2 : 9.3	Pt 4 : 2016 : 5.2		U
iii. Sedimentation by pipette	Pt 2 : 9.4	Pt 4 : 2016 : 5.3 / 5.4		U
iv. Sedimentation by hydrometer	Pt 2 : 9.5			U
2. CHEMICAL TESTS	**BS 1377-3:2018**			
ii. Mass loss on ignition	Pt 3 : 4			U
3. COMPACTION RELATED TESTS	**BS 1377-4:1990**			
3.1 Dry density/moisture relationship				
i. 2.5kg rammer – 1 litre mould	Pt 4 : 3			U
- CBR mould	Pt 4 : 3			U
ii. 4.5kg rammer – 1 litre mould	Pt 4 : 3			U
- CBR mould	Pt 4 : 3			U
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			U
ii. Recompacted sample	Pt 5 : 7			U
iii. Soaked, inc measurement of swell	Pt 5 : 7			U
4. COMPRESSIBILITY OF SOIL	**BS 1377-5:1990**			
i. One dimensional consolidation	Pt 5 : 3			U
ii. Swelling pressure test	Pt 5 : 3			U
5. SHEAR STRENGTH OF SOIL	**BS 1377-7:1990**			
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			U
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

Disclaimer

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

Constructionline
A UK GOVERNMENT CERTIFICATION SERVICE
QMS ISO 9001 : 2015 REGISTERED Cert No. 14123657
QMS ISO 14001 : 2015 REGISTERED Cert No. 14127804
QMS ISO 45001 : 2018 REGISTERED Cert No. 14130281
CIVATION APPROVED Registered Member
UKAS United Kingdom Accreditation Service

<ENVIRONMENTAL><GEOTECHNICAL>

Environmental
Geotechnical
Specialists

RGS

GEOTECHNICAL
LAB RESULTS

GEOTECHNICAL
ENVIRONMENTAL

Environmental
Geotechnical
Specialists

RGS

Blank Page

GEOTECHNICAL
ENVIRONMENTAL

Rogers Geotechnical Services Ltd
Office 1 & 2 Barncliffe Business Park,
Near Bank, Shelley, Huddersfield, HD8 8LU

Telephone 01484 607977
Company No: 5130864

Summary of Classification Test Results

Project No.	Project Name
C5092/25/E/7765	Land at Reinwood Road

Hole No.	Sample				Soil Description	Density bulk Mg/m^3	Density dry Mg/m^3	*w* %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m^3	1pt/4pt	Date	Increase/Decrease
	Ref	Top	Base	Type												
WS01	1	2.80		D	Brown slightly gravelly silty CLAY.			19	90	49	31	18		4pt	05-Nov	Increase

All Water Content Tests perfromed to BS EN ISO 17892-1:2014+A1:2022 Unless specified Otherwise
All Index Property testing preformed to BS EN ISO 17892-12 2018+A2:2022 Unless Specified Otherwise
All Liquid Limit Tests performed on a 80g/30 Degree Cone unless specified otherwise

Key

Density test — Linear measurement unless : wd - water displacement; wi - immersion in water

Liquid Limit — 4pt cone unless : cas - Casagrande method; 1pt - single point test

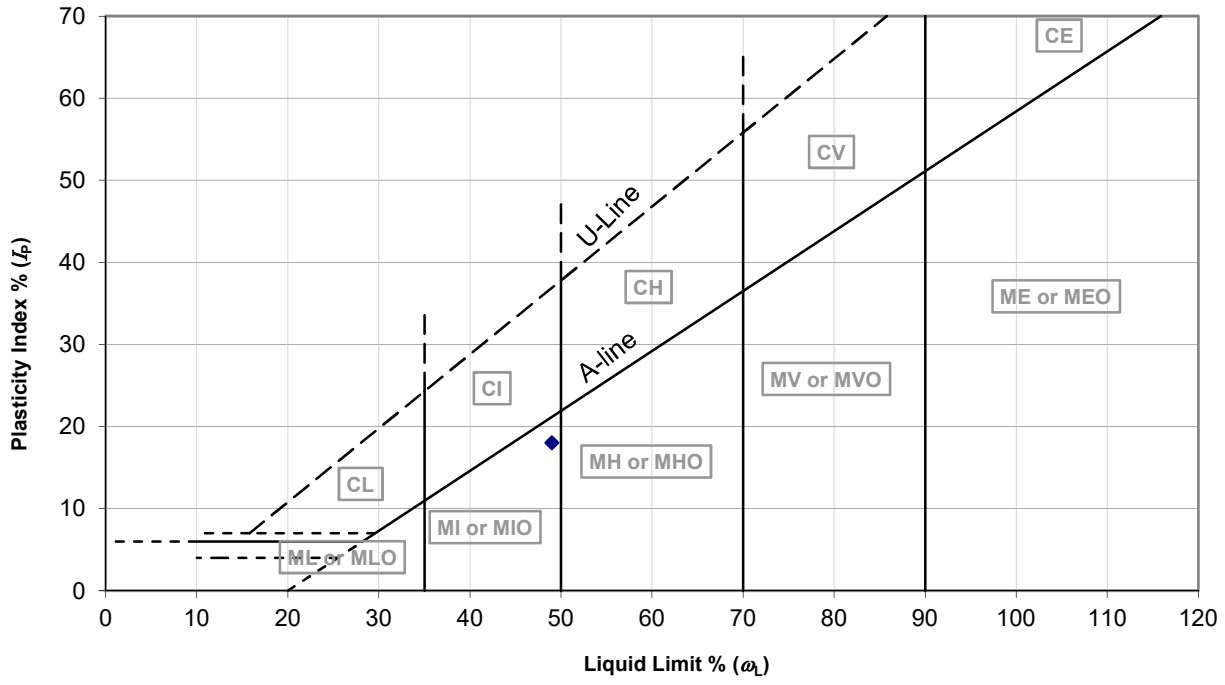
Particle density — sp - small pyknometer; gj - gas jar

Date Printed	Approved By	Table
18/11/2025	EC	1
		sheet 1

Rogers Geotechnical Services Ltd. Offices 1&2, Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU	**Classification of Index Properties**	**C5092/25/E/7765**
Project Name: Land at Reinwood Road	**BS EN ISO 17892-12 2018+A2:2022**	Fig. 2 / Sheet. 1
Location: Huddersfield		Input By: EC
Client: HRB Investments Ltd		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 (I_L) (%)	Liquidity/ Consistency (I_C) (%)	Casagrande Class	N.H.B.C Class (%)
WS01	2.80	19	49	31	18	10	21	16	-0.7	1.7	M I	LOW

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



Summary of Geotechnical Chemical Test Results

Project No.: C5092/25/E/7765

Project Name: Land at Reinwood Road

Hole No.	Sample				Soil Description	Org	LOI	pH	Sulphate as SO_4			Chloride, Cl		CO_2	TDS	<2mm	Remarks
	Ref	Top	Base	Type					Total acid sol.	2:1 water :soil	ground water	water sol.	acid sol.				
						%	%		%	g/l	g/l	%	%	%	mg/l	%	
BH01	1	2.00	2.45	D	Dark brown slightly gravelly silty CLAY.			7		0.12						80	
BH02	1	1.00	1.10	D	Brown sandy GRAVEL.			7.6		0.02						37	

Key

Tests performed in accordance with BS 1377 unless annotated otherwise

Org Organic matter content

LOI Mass loss on ignition at 440°C

Cl Chloride content

CO_2 Carbonate content (rapid titration)

TDS Total Dissolved Solids

Date Printed: 18/11/2025

Approved By: HJL

Table 3

sheet 1

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

t: 01484 604354

e: harry.letch@rogersgeotech.co.uk

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

t: 01923 225404
f: 01923 237404
e: info-i2analytical@normecgroup.com

Analytical Report Number : 25-060276

Project / Site name:	Reinwood Road	**Samples received on:**	06/11/2025
Your job number:	C5092	**Samples instructed on/ Analysis started on:**	06/11/2025
Your order number:		**Analysis completed by:**	14/11/2025
Report Issue Number:	1	**Report issued on:**	14/11/2025
Samples Analysed:	4 soil samples		

Joanna Biolik

Signed:

Joanna Biolik
Senior 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
air	- once the analysis is complete

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

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.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-060276
Project / Site name: Reinwood Road

Lab Sample Number				742082	742083	742084	742085
Sample Reference				WS01-ES1	WS02-ES2	WS03-ES3	WS05-ES4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A
Depth (m)				1.20	0.20	0.70	0.20
Date Sampled				04/11/2025	04/11/2025	04/11/2025	04/11/2025
Time Taken				None Supplied	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	51.9	< 0.1
Moisture Content	%	0.01	NONE	7	18	5.6	13
Total mass of sample received	kg	0.1	NONE	1	0.8	1.1	1
Asbestos							
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MJN	MJN	MJN	MJN
Analysis completed	N/A	N/A	N/A	13/11/2025	13/11/2025	13/11/2025	13/11/2025
Actinolite detected	Type	N/A	ISO 17025	Not-detected	-	-	-
Amosite detected	Type	N/A	ISO 17025	Detected	-	-	-
Anthophyllite detected	Type	N/A	ISO 17025	Not-detected	-	-	-
Chrysotile detected	Type	N/A	ISO 17025	Not-detected	-	-	-
Crocidolite detected	Type	N/A	ISO 17025	Not-detected	-	-	-
Tremolite detected	Type	N/A	ISO 17025	Not-detected	-	-	-
Asbestos % by hand picking/weighing	%	0.001	ISO 17025	0.006	-	-	-
Asbestos Containing Material Types Detected (ACM)	Type	N/A	ISO 17025	Loose Fibres	-	-	-
General Inorganics							
pH (L099)	pH Units	N/A	MCERTS	7.6	6.5	7.4	5.5
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO_4	%	0.005	MCERTS	0.192	0.098	0.019	0.061
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	1200	23	33	14
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	596	11.2	16.3	6.73
Organic Matter (automated)	%	0.1	MCERTS	3	7.3	0.3	4
Total Phenols							
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs							
Naphthalene	mg/kg	0.05	MCERTS	0.3	0.54	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.25	0.06	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.56	0.53	< 0.05	0.05
Fluorene	mg/kg	0.05	MCERTS	0.77	0.32	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	7.4	3.5	0.05	0.59
Anthracene	mg/kg	0.05	MCERTS	1.9	0.88	< 0.05	0.1
Fluoranthene	mg/kg	0.05	MCERTS	9.4	5.4	0.08	0.86
Pyrene	mg/kg	0.05	MCERTS	8.2	5	0.08	0.75
Benzo(a)anthracene	mg/kg	0.05	MCERTS	4.1	2.6	0.06	0.38
Chrysene	mg/kg	0.05	MCERTS	4.1	2.7	0.09	0.44
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	4.3	3.3	0.06	0.57
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	2.1	1.3	< 0.05	0.17
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.7	2.7	< 0.05	0.4
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.9	1.2	< 0.05	0.19
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.36	0.24	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.1	1.5	< 0.05	0.22

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-060276
Project / Site name: Reinwood Road

Lab Sample Number				742082	742083	742084	742085
Sample Reference				WS01-ES1	WS02-ES2	WS03-ES3	WS05-ES4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A
Depth (m)				1.20	0.20	0.70	0.20
Date Sampled				04/11/2025	04/11/2025	04/11/2025	04/11/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status				
Total PAH							
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	51.3	31.5	< 0.80	4.73
Heavy Metals / Metalloids							
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	19	23	2	11
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	0.3	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	U/S *U/S g	U/S *U/S g	< 1.8	U/S *U/S g
Chromium (VI) by IC	mg/kg	1.8	NONE	< 1.80	< 1.80	-	< 1.80
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	28	23	17	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	67	33	20	38
Lead (aqua regia extractable)	mg/kg	1	MCERTS	310	77	14	67
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.3	0.9	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	28	13	14	13
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	25	29	15	30
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	230	89	40	92
Petroleum Hydrocarbons							
TPHCWG - Aliphatic >EC5 - EC6 $_{HS_1D_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 $_{HS_1D_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 $_{HS_1D_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 $_{EH_CU_1D_AL}$	mg/kg	1	MCERTS	1.4	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 $_{EH_CU_1D_AL}$	mg/kg	2	MCERTS	2.6	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	8.1	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	68	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC5 - EC35 $_{EH_CU+HS_1D_AL}$	mg/kg	10	NONE	80	< 10	< 10	< 10
TPHCWG - Aromatic >EC5 - EC7 $_{HS_1D_AR}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 $_{HS_1D_AR}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 $_{HS_1D_AR}$	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 $_{EH_CU_1D_AR}$	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 $_{EH_CU_1D_AR}$	mg/kg	2	MCERTS	4.7	< 2.0	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	43	16	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	85	44	< 10	15
TPHCWG - Aromatic >EC5 - EC35 $_{EH_CU+HS_1D_AR}$	mg/kg	10	NONE	130	60	< 10	15
VOCs							
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

UKAS TESTING
4041

Normec i2 Analytical

Analytical Report Number: **25-060276**
Project / Site name: **Reinwood Road**
Your Order No:

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample	Analysis completed	Analyst ID
742082	WS01-ES1	1.20-	229	Loose Fibres	**Amosite**	0.006	**0.006**	13/11/2025	MJN

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 25-060276
Project / Site name: Reinwood Road

* 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 *
742082	WS01-ES1	None Supplied	1.2	Brown loam with gravel and vegetation
742083	WS02-ES2	None Supplied	0.2	Brown loam with gravel and vegetation
742084	WS03-ES3	None Supplied	0.7	Brown loam with gravel and stones
742085	WS05-ES4	None Supplied	0.2	Brown loam and clay with gravel and vegetation

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 25-060276
Project / Site name: Reinwood Road

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
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references	HSE Report No: 83/1996, HSG 248 (2021), HSG 264 (2012) & SCA Blue Book (draft)	A006B	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
Cr(VI) in soils by Ion chromatography	Determination of hexavalent chromium in alkaline soil extract by use of ion chromatography with spectrophotometric detection	In-house method	L130B	W	NONE
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 in soil	Determination of total petroleum hydrocarbons in soil by GC-FID with carbon banding aliphatic and aromatic	In-house method	L076B	D	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil (Summed Bands)	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic (Summed Bands).	Calculation	L076B/L088-PL	D/W	NONE
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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 25-060276
Project / Site name: Reinwood Road

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
Total petroleum hydrocarbons with carbon banding by HS-GC/MS in soil	Determination of total petroleum hydrocarbons in soil by HS-GC/MS with carbon banding aliphatic and aromatic	In-house method	L088-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
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

*U/S g- Unsuitable for analysis due to high colour intensity.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Environmental
Geotechnical
Specialists

End of Report

GEOTECHNICAL
ENVIRONMENTAL

Rogers Geotechnical Services Ltd
Office 1 & 2 Barncliffe Business Park,
Near Bank, Shelley, Huddersfield, HD8 8LU

Telephone 01484 607977
Company No: 5130864

Appendix 7

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
	Metals	**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+
	Semi and Non Metals					
1	Arsenic	37		37		C
10	Selenium	375		375		A
	Free Cyanide	34		34		A
9	Phenols (total)	267		1200		A
	Poly Aromatic Hydrocarbons	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
	Petroleum Hydrocarbons					
	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+
Others						
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 = Catergory 4 Screening Levels (C4SLs).						
D = SSV provided is for Methyl Mercury.						