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GEOTECHNICAL ENVIRONMENTAL

PHASE 2 GEO-ENVIRONMENTAL REPORT

job number	date
C2213/21/E/3374	08.07.2022

site address
Site B - Yew Tree Road/Burn Road
Birchencliffe,
Huddersfield, HD2 2EQ
Planning ref: 2021/61/91933/W

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Report on a Phase 2 Geo-environmental Investigation

Location:	Site B - Yew Tree Road/Burn Road Birchencliffe, Huddersfield, HD2 2EQ
For:	North Park (Shelley) Ltd
Report No.	C2213/21/E/3374 Date: July 2022
Planning Application No:	2021/61/91933/W

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

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Report Summary[1]

Item	Comments	Section
Development	North Park (Shelley) Ltd, propose to develop the land adjacent to Yew Tree Road/Burn Road, Birchencliffe, Huddersfield, HD2 2EQ by the construction of a series of residential dwellings.	1.0
Geology	Superficial geology – None. Solid geology – Pennine Lower Coal Measures Formation. The site is split by an east-west trending fault.	5.0
Strata Conditions	This investigation indicates that the ground conditions across the site exhibit some variability both laterally and vertically. Particularly, there is some ambiguity as to whether cohesive soils have been reworked. Under the residual soils competent layers of the Pennine Lower Coal Measures Formation were revealed to a depth of 30m, comprising interbedded layers light grey sandstone and siltstone/mudstone.	6.0
Groundwater	Encountered at depths ranging between 6m and 8m bgl.	6.0
Coal Mining Legacy.	No evidence of coal seams, or coal workings have been identified. A Low risk rating has been assigned.	10.0
Foundation Design	Due to variability of ground conditions encountered on site, it is recommended that a pragmatic approach be taken to the foundations for the houses, and are considered on a plot by plot basis. In view of the above, in broad terms, it is considered that the foundation solutions could include shallow footings in areas where natural clays are present in at least a firm in-situ condition. Alternatively, consideration could also be directed towards placing plots on mini piles.	12.1
Effect of Sulphates	DC-1 concrete.	12.5
Contamination	Localised PAH contamination identified within the topsoil. Some remediation will be required.	13.5
Gas	Gas monitoring is ongoing. Initial readings would suggest that CS1 conditions will be met, such that gas protection measures will not be required.	13.1.2

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

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1. Introduction

It is understood that the land at 'Site B' Yew Tree Road & Burn Road, Birchencliffe, Huddersfield, HD2 2EQ is to be developed by the construction of a series of residential houses with front and rear gardens and access roads. Site B forms the eastern section of a large field, with a dry stone wall present on all four boundary lines. Access to the site is gained via an entrance point in the field to the west; the western field, referred to as 'Site A', is being assessed under a separate planning application.

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, the viability of soakaways, and the risks posed by historic coal mining activity.

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. Previous Works

3.1 Previous Ground Investigation

For the proposed development area, the following reports have been reviewed:

- Lithos, Preliminary Environmental Investigation, Land at Burn Road, Birchencliffe, Report No. 2898/1, January 2018. This report investigated the eastern portion of the site as a whole (now referred to as site B).

The main issues considered in this report, and in particular in Sections 3 and 4, are based on a review of historical maps and available geological/environmental data, including data obtained by Lithos during investigation of adjacent land. This report provides an assessment of Geoenvironmental issues and implications associated with the proposed residential redevelopment

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of the site, together with any implications for current use of the site. The report makes the following concluding remarks:

- The published geological data suggests that the site is underlain by Stanningley Rock Sandstone in the north, with undifferentiated Lower Coal Measures in the south. There are no drift deposits shown on the geological map. Moreover, given the findings of Lithos' investigation on adjacent land, natural soils are likely to comprise firm/stiff clays or medium dense gravels, with bedrock likely present within 2m to 3m of current ground levels

- The north-west area of the site is located within a Coal Mining Development High Risk Area (an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc). The remainder of the site is located within a Low Risk Area. If old mine workings are present in the Hard Bed coal seam, and are considered to pose a significant risk to surface stability, mitigation of the risks posed will be required

- It is considered possible that the site could be affected by sources of hazardous gas, and therefore a monitoring programme (likely 9 visits over a 6-month period) will be required, with the issue of a Gas Risk Assessment upon completion of the monitoring.

- Given anticipated ground conditions, soakaways may provide a viable solution for the disposal of surface water, subject to in-situ testing.

- The site's environmental setting is considered to be of moderate sensitivity. With respect to human health, the proposed end use (residential) is also considered sensitive. Localised made ground may be present associated with quarrying to the north and (limited) numbers of former structures. Any associated contamination is unlikely to be of great significance, nonetheless, this should be proved by a ground investigation (trial pitting) and sampling where appropriate.

3.2 Mine Entry Data Sheets

A Mine Entry Data Sheet for the shaft 412418-002 was obtained. From this data, the following assumptions have been made about the shaft in order to aid future investigation.

- The given grid refence highlights that the shaft is on the very edge of the eastern site boundary (E 412022, N 418983).
- Based on the source information, the shaft may lie within an 8m departure zone.
- The shaft has an assumed diameter of ~2m.
- In accordance with the information within section 3.1, the Coal Authority confirm that 'This mine entry was searched for but not found by Lithos Consulting in 2015'.

3.3 Mine Entry Risk Assessment

A mine Entry Risk Assessment was undertaken by RGS in February 2022, the results of which were presented as report number C3113/21/E/3266. The works comprised an investigation to determine the risk posed to the future development from the mine entry, as well as to determine the nature of the soils the site. The report drew the following conclusions:

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- From the investigation carried out, no evidence of mine entries or ground workings have been proven within the area investigated.
- In addition to the above, the Coal Authority confirm that 'This mine entry was searched for but not found by Lithos Consulting in 2015'.

Regardless of the above, there remains some risk of unrecorded mine entries of exploratory shafts. In order to mitigate this risk any anomalously deep made ground encountered during future ground investigations would be suspect and should be investigated further. All excavations to natural ground completed during the development of the site should be inspected for anomalous made ground that could represent unrecorded mine entries and if encountered should be investigated accordingly under CA licence.

4. Fieldworks

The fieldworks were undertaken predominantly in the spring through to early summer of 2022 and included the following:

- 4 windowless sample boreholes.
- Standard Penetration Tests (SPTs) at regular intervals within WS08 and WS10
- Dynamic probes adjacent to WS08 and WS09. A stand-alone probe was sunk at location DP11.
- Installation of 2 gas monitoring standpipes within WS08 and WS10.
- 5 rotary open hole boreholes (RO3, RO5, RO5, RO6, RO9, RO10).
- 7 mechanically excavated trial pits (TP05, TP06, TP06A, TP07, TP08, TPSA03, TPSA04).
- Soakaway tests within 1 location (TPSA03).

It should be appreciated that whilst Site A and Site B are being assessed under separate planning applications, both sites were investigated simultaneously. As such, the borehole nomenclature is systematic and covers all works over both sites, albeit the investigation locations that were sunk within Site B are summarised above. The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report.

4.1 Acquisition of Coal Authority Permit

In order to undertake this investigation, it was necessary to obtain permission to enter or disturb Coal Authority interests. This permission was granted in November 2021 as permit reference number 24130, which is presented in Appendix 2 to this report. In accordance with the joint Coal Authority and Health and Safety Executive positioning statement, and under the requirements of the permit, the works were undertaken employing water flush drilling techniques with gas monitoring of the boreholes during the fieldworks.

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4.2 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 90mm for the first 1m through 80mm, 70mm and 60mm 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 3. Also included on these records are the core diameters and percentages of core recovered.

4.3 Standard Penetration Tests

Standard penetration tests (SPT) were undertaken at regular depth increments within windowless sample borehole WS08 and WS10. 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.

4.4 Dynamic Probes

Dynamic penetration tests were undertaken adjacent to the windowless sample boreholes WS08 and WS09, as well as at the stand-alone position DP11, 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 4.

4.5 Gas Monitoring Standpipes

Gas monitoring standpipes were installed between 1.5m and 3.9m depth in all of the boreholes and the installation details are shown on the appropriate borehole records. In all cases, the monitoring standpipe consisted of a perforated pipe from the base of the borehole to 1.0m below surface, with a non-perforated pipe to ground level. The response zone was filled with pea gravel, with a bentonite seal at the base and above, and the installation was capped with a stop box cover in a concrete surround.

4.6 Rotary Open-hole Boreholes

5 boreholes were sunk using a Comacchio 205 rotary drilling rig using rotary open-hole drilling techniques and employing 130mm diameter drag and tricone roller bits. Where necessary, 140mm diameter casing was temporarily installed through the overburden to support the bore. The investigation was undertaken using water flush drilling techniques in accordance with the Coal Authority and Health and Safety Executive positioning statement. Drill chippings brought to surface

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in the flush returns were inspected by the driller on a screen, which forms part of the re-circulation tanks. The borehole positions are shown on the site plan, which is presented in Appendix 1 and the strata conditions are presented on the borehole records in Appendix 5.

4.7 Trial Pits

A total of 7 trial pits were excavated in order to reveal the nature of the near surface soils. The soils were logged on site in general accordance with BS5930: 2015+A1: 2020, and full descriptions are given on the trialpit records which are presented in Appendix 6. At regular intervals throughout the excavation of the pits, samples were taken for geotechnical testing. The test specimens were retained in the appropriate air tight containers within cool boxes for onward transition to the laboratory.

Once excavations were completed, the trial pits 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 back-acting 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 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 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.

4.8 Soakaway Tests

Soakaway tests were conducted within the location of TPSA03. At the elected test depths, the pit was trimmed and squared as much as practicable. Water was then pumped into the pit and the level monitored at timed intervals relative to a reference bar at ground level. These tests were conducted and calculated in general accordance with the method given by BRE Digest 365 and the results are presented in Appendix 7.

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5. Geology

The appropriate 1: 50,000 map sheet for the site and the geology viewer has been examined and the following table presents the indicated geology:

Table 1: Geological Data for the Site

Strata Type	Strata Name[2]	Previous Name[3]	Description[3]
Made Ground/Fill	N/A	N/A	Not indicated on site.
Superficial Geology	N/A	N/A	Not indicated to underlie the site.
Solid Geology	Within the northern fault block		
	Stanningley Rock	36 Yard Coal	The Stanningley Rock, or 36 Yard Rock, is a fine-grained, thinly bedded, commonly ganisteroid sandstone.
	Within the southern fault block		
	Pennine Lower Coal Measures Formation	-	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.

The geological appraisal, as outlined within the Lithos report, states the following:

Geological maps suggest that the Hard Bed Coal seam (up to 0.6m thick) could underlie the site at shallow depth, especially in the south of the site, which is underlain by undifferentiated Lower Coal Measure strata. This coal seam should be deeper in the north (around 25m to 30m depth), where the site is underlain by Stanningley Rock Sandstone. It should be noted that the local area is heavily faulted, which somewhat complicates the local geology.

Approximately 10m below the Hard Bed Coal Seam lies the Middle Band Coal, which is mapped as a discontinuous 'thin' seam, and thus is unlikely to have been worked. The Soft Bed Coal is present approximately 20m below the Hard Bed, but generally present at a maximum thickness of 0.6m is deemed unlikely to be of any significance with respect to site surface subsidence, even if worked.

The Coal Authority have also provided an abandonment plan for the Soft Bed Coal which shows workings approximately 100m north of this site and north of the fault shown on the geological maps. These recorded workings are likely to lie at depths in excess of 30m, and therefore be overlain by a sufficient thick of competent cover (i.e. >10x seam thickness). It should be noted that the data on this abandonment plan does not extend beneath this site, thus it is unlikely that any abandonment plans are available for this site.

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

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In summary, the presence of mine workings associated with the 36 Yard Seam in the northern fault block is highly unlikely, and any workings within the underlying Hard Bed seam should be at sufficient depth to not pose a significant risk of subsidence. However, the possibility of unrecorded shallow mine workings in the Hard Bed Coal within the southern fault block cannot be entirely discounted.

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
0.15 – 0.3	TOPSOIL (Dark brown organic silty fine SAND).	All	None
+1.2 - +3.0	Residual Cohesive soils (Typically soft to firm silty CLAY with lithorelicts of sandstone) Or Residual Cohesive soils (Typically Firm locally stiff brown locally mottled dark brown silty gravelly CLAY. Gravel is sub angular to rounded medium to coarse of sandstone and rare coal)	TP05, TP07, TP08 WS07, WS08, TPSA 04	None
1.4 – 2.3	Locally: Potentially reworked Cohesive soils Soft to stiff brown mottled grey and orangish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to sub rounded fine to coarse of sandstone, mudstone and coal.	WS09, WS10, TPSA 03	None
+15 - +30	Interbedded horizons of Sandstone and Mudstone [Pennine Lower Coal Measures Formation]	RO3, RO5, RO6, RO9, RO10	6.0 (RO6) 8.0 (RO5)

'+' 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

Firstly, it should be appreciated that within the location of TP06 and TP06a, evidence of previous structures was observed, and comprised 'bound macadam', anticipated to have a tar binder, as well as a series of brick sets. Furthermore, evidence of a sump was observed at the location of TPSA 04 (Brick wall in west of the pit running with clean water, trial pit expanded to observe deposits and thought to be infilled waste sump. Odour of decomposition from the sump. Concrete block up to 0.30m depth in NW corner of trial pit).

This investigation has concluded that the strata conditions across the site show some variability, which is largely attributed to the change in geology across the site, and also intrinsically linked to the faulting within the area. A site plan showing the 1:50,000 solid geology, in relation to the borehole locations is presented within Appendix 1.

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Taking this into consideration, below a capping of topsoil, residual cohesive soils that predominantly comprised lithorelicts of sandstone were typically found at shallow depth in the north of the site (TP05, TP07, TP08). These soils largely consisted of soft to firm (locally stiff) gravelly silty clays. It is suggested that these soils can be attributed to the upper weathered fraction of the Stanningley Rock.

In the central and southern quadrants of the site, cohesive soils were noted to contain lithorelicts of other materials, such as siltstone, mudstone, carbonaceous mudstone and rare coal. Furthermore, some evidence of significant mottling of colour was recorded locally. Given the geology of the site, there is some ambiguity as to whether these soils represent the residual soils of the Pennine Lower Coal Measures Formation, or soils that could represent 'fault gauge' (naturally reworked soils) associated with the fault. However, there is no obvious linear trend that links mottled/disturbed looking soils to the fault bisecting the site. Furthermore, all cohesive soils were recorded to be predominantly in a 'firm' in-situ condition, with no obvious evidence of anthropogenic material, or voidage. With that regard, it should be appreciated that some natural variability in the composition of residual soils should be expected.

Below this stratum, competent layers of the Pennine Lower Coal Measures Formation were revealed to a depth of 30m, comprising interbedded layers of mudstones and sandstone. No coal seams or evidence of coal workings (loss of flush or drilling resistance, obvious voidance or worked ground) were identified in any borehole, regardless of which side of the fault plane the borehole was sunk.

However, momentarily flush was lost within borehole RO9 at a depth of 5m in material described as 'light grey mudstone'. It should be noted, however, that no loss of drilling resistance was recorded, suggesting that this feature does not represent voided ground. Furthermore, no loss of flush or drilling resistance was noted within the other boreholes at similar depths and within the corresponding strata. Therefore, considering the depth of this feature, and the fact that the surrounding strata appears to be intact and comprises mudstone only, it is anticipated that this feature may represent a localised zone of naturally fractured rock, and not a zone of illicit mining activity.

Groundwater strikes were recorded between 6m and 8m during drilling. However, it is possible that the use of water flushing techniques may have masked the presence of any water strikes within the other borehole locations. In any event, it should be appreciated that groundwater levels are subject to seasonal variation or changes in local drainage conditions.

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7. Insitu Testing

7.1 Standard Penetration Tests

The standard penetration tests carried out 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 (Cohesive)	1 – 1.45	-	13 - 15	Soils in a firm in-situ condition.
bluish grey mottled light brown gravelly silty CLAY	3 – 4.45	-	12 – 14	Soils in a firm becoming stiff in-situ condition.

7.2 Dynamic Penetration Tests

Dynamic penetration tests were undertaken adjacent to the corresponding windowless sample borehole positions. 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)				
DP08	1.1	2.5	2.6	Abrupt	Low blow counts recorded until abrupt refusal encountered.
DP09	0.7	0.8	1.0	Abrupt	Low blow counts recorded until abrupt refusal encountered.
DP11	1.3	3.4	3.5	Abrupt	Low blow counts recorded until abrupt refusal encountered.

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

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7.3 Gas and Water Level Monitoring

The monitoring of standpipes commenced on the 14th April 2022 and is currently ongoing (regime of 6 readings over 3 months is proposed). The results of the gas monitoring undertaken to date are tabulated below.

Table 5: Gas Monitoring

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/h)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS08	14.04.22	0.1	1.2	19.1	0.0	1002↑	_	1.5
	22.04.22	0.1	3.1	18.8	0.0	993↓	1.38	
	29.04.22	0.1	4.0	18.3	0.0	1013↓	–	
	06.05.22	0.1	4.2	17.9	0.1	1004↓	_	
	21.06.22	0.0	3.4	18.0	0.0	995↔		
	*							
WS10	14.04.22	0.1	0.9	19.2	0.0	1002↑	3.38	3.9
	22.04.22	0.1	1.2	18.8	0.0	993↓	3.30	
	29.04.22	0.1	1.6	18.3	0.0	1013↓	3.46	
	06.05.22	0.1	2.2	16.5	0.1	1003↓	3.46	
	21.06.22	0.0	2.1	7.3	0.0	995↔		
	*							

↑ - rising pressure ↓ - falling pressure ↔ -steady pressure * - 6th reading to be completed in July 2022

This work was undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 5th May 2021.

7.4 Soakaway Test

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 7 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
TAPSA03	1.8 x 1.5	1.67 – 2.1	Stiff brown mottled grey slightly sandy slightly gravelly CLAY	*	Practically Impermeable

*Based on the most onerous results for each test.

During the soakaway tests the water level did not achieve a fall from 75% to 25% of the effective depth of the storage volume. On this basis, the tests 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.

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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 8 and are summarised below:

Table 7: Summary of Geotechnical Test Results

Test type	Number of tests	Range of results		Comments
Water content determinations	2		11% - 27%	-
Index properties (1 Point)	2	LL PL PI	28% - 32% 17% - 18% 11% - 14%	Clay of low to intermediate plasticity. Consistency index 0.4 – 1.2 NHBC Class – Medium.
Soluble sulphate & pH	5	SO_4 pH	0.025 – 0.52g/l 6.5 – 6.9	AC-1s Concrete classification

In cohesive soil the approximate cohesion, c_u, and coefficient of consolidation, m_v, may be obtained from the equivalent SPT 'N' value using the following expressions (Stroud 1975).

$c_u = f_1 N$

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

where:

c = cohesion (kN/m^2).
m_v = Coefficient of consolidation (m^2/MN).
f_1 & f_2 = factors based on plasticity index.
N = SPT 'N_{300}' value.

For the cohesive soils revealed at this site the highest (worst case) plasticity index[5] of 14% could be employed, which suggests an f_1 value of 6.5 and an f_2 value of 0.65.

8.1 Geotechnical Properties

The idealised geotechnical properties employed in design are summarised below.

Table 8: Summary of Geotechnical Properties

Property	Range of values		Comments
Volume change potential (NHBC)	Medium		Residual cohesive soils
Shear strength parameters (at proposed foundation level – in residual cohesive soils)	c_u γ	50kN/m^2 20kN/m^3	Based on SPT 'N' values, and observations made during logging.
Concrete classification	DC1		Natural ground locations (Static water)

[5] See paragraph 6.2 'Index Property Tests'

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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 Eurofins Chemtest Ltd and the results of all of the chemical testing are presented in Appendix 8 of this report.

10. Risk Assessment – Mining Instability

In light of the findings of this investigation, the risk to the proposed development is considered with reference to the following ratings and definitions:

Low - The possibility of instability is unlikely therefore no further action is necessary.

Moderate - The possibility of instability is likely and further investigation or remedial action may be required.

High - The possibility of instability is highly likely and further investigation or remedial action will be necessary.

Table 9: Development Specific Risk Assessment

Item	Risk of Instability	Location	Risk Rating
10.1	Shallow coal seams (recorded and unrecorded)	Within Northern Fault Block	Low
		Within Southern Fault Block	Low
10.2	Coal workings at depth	The site is not within a surface area that could be affected by past underground mining.	Low
10.3	Mine shafts	Mine Shaft 412418-002	Low
10.4	Mine Gas	Associated with Shallow Workings	Low

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10.1 Risks Posed by Shallow Mining (recorded and unrecorded Mining).

The results of rotary probing confirm that there is no evidence of coal seams, brecciated or broken ground beneath the site, on either side of the fault plane, to a depth of 30m bgl. Consequently, it is considered that it is highly unlikely that shallow coal workings are present beneath or in close proximity to the area of the proposed development. As such, a low risk rating has been assigned and no further action is required.

10.2 Coal Workings at Depth

In regard to deeper mining which could affect the site, no further coal seams, or voids were encountered within the strata or to a depth of 30m bgl. Furthermore, the Coal Authority report as presented within the Lithos report states, 'The site is not within a surface area that could be affected by past underground mining. As such, a low risk rating has been assigned and no further action is required.

10.3 Mine Shafts

A mine Entry Risk Assessment was undertaken by RGS in February 2022, the results of which were presented as report number C2113/21/E/3266. The works comprised an investigation to determine the risk posed to the future development from the mine entry, as well as to determine the nature of the soils beneath the site. The report drew the following conclusions:

- From the investigation carried out, no evidence of mine entries or ground workings have been proven within the area investigated.
- In addition to the above, the Coal Authority confirm that 'This mine entry was searched for but not found by Lithos Consulting in 2015.

Regardless of the above, there remains some risk of unrecorded mine entries or exploratory shafts.

In order to mitigate this risk, any anomalously deep made ground encountered during future ground investigations or groundworks would be suspect and should be investigated further. All excavations to natural ground completed during the development of the site should be inspected for anomalous made ground that could represent unrecorded mine entries and if encountered should be investigated accordingly under a Coal Authority licence.

10.4 Risks Posed by Migration of Hazardous Ground Gas

In this case, it is evidence that shallow mining is not present beneath the proposed development. It should be appreciated that a regime of gas monitoring is ongoing as part of the Geo-environmental Assessment. Initial findings would suggest that CS1 conditions have been identified. As such, a low risk rating has been assigned and no further action is required; see section 12.1.2 for further details.

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11. Discussion of Ground Conditions - Geotechnical

North Park (Shelley) Ltd, propose to develop the land adjacent to Yew Tree Road/Burn Road, Birchencliffe, Huddersfield, HD2 2EQ by the construction of a series of residential dwellings. 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.

11.1 Geotechnical Discussion

This investigation indicates that the ground conditions across the site exhibit some variability both laterally and vertically. Particularly, there is some ambiguity as to whether cohesive soils have been reworked by historic fault movement (which could cause a melange of soils close to the fault plane). Indeed, some cohesive soils are recorded to be mottled and comprise gravels of a mix of coal measures lithorelcits (coal, carbonaceous mudstone, sandstone and siltstone) with little obvious structure. Furthermore, it should be appreciated that as the site is in an area of historical mining (pre-1876) and particularly as there are potentially shallow unrecorded workings indicated in the Coal Authority report, there will be a potential risk of unrecorded mine entries of exploratory shafts. In order to mitigate this risk, any anomalously deep made ground encountered during future groundworks would be suspect and should be investigated further.

Due to variability of ground conditions encountered on site, it is recommended that a pragmatic approach be taken to the foundations for the houses, and are considered on a plot by plot basis. It cannot be recommended that footings for a singular plot be placed in reworked soils, or span both cohesive soil and rock due to the potential for differential settlements. It is therefore recommended that careful inspection takes place during the excavation of footings to ensure that foundations are placed wholly within materials of similar competency.

In view of the above, in broad terms, it is considered that the foundation solutions could include the traditional footings in areas where natural clays are present in at least a firm Insitu condition. Alternatively, consideration could also be directed towards placing all plots on a mini piled foundation solution, which could have the advantage of limiting differential settlement across the plots.

11.2 Shallow Foundations

In areas of the site where the upper weathered fraction of the Coal Measures will be exposed, which generally consists of firm to stiff clay, it is considered that this material will provide a suitable bearing stratum, provided that the foundations are placed within soil generally described as being present in a firm insitu condition. It is considered that strip or spread foundations constructed within this material at a minimum depth of say 1.2m (or, locally depended in areas of the site in which reworked soils are expected) could be designed assuming an allowable increase in load given in the following table.

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Table 10: Allowable Increase in Stress							
Foundation type		**Strip Footings**			**Spread Footings**		
Foundation Breadth	B (m)	0.6	0.9	1.2	1.0	2.0	3.0
Foundation Depth	D (m)		1.2			1.2	
Allowable Increase in Stress	(kN/m²)	90	85	85	100	95	90

The allowable increase in stress given above assumes a factor of safety of 3 against general shear failure, with cohesion of 50kN/m^2 at the foundation depths. Settlements at the above loading intensities should remain within tolerable limits for the type of structure proposed provided that the underlying soils are carefully inspected immediately final trimming has taken place.

Given the volume change potential of the soils, it is not recommended that ground bearing ground floor slabs be employed. In this instance it would be necessary to suspend floors between foundation positions, such that the floor loads are transmitted via the foundations to competent soils at depth.

Should any soft or weak material be encountered they should be locally removed and replaced with lean-mix concrete or compacted granular soil. In addition, if the excavations are required to stand open for any period of time then a blinding layer of lean-mix concrete should be placed in the excavation bases. This expedient will reduce softening or loosening of the sub-grade due to the ingress of surface water.

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

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

11.3 Mini Piles

Given the geology of the site, there is some ambiguity as to whether the ground conditions within the vicinity of the fault zone represent the residual soils of the Pennine Lower Coal Measures Formation, or soils that could represent 'fault gauge' (naturally reworked soils) associated with the fault may be present locally. Whilst the soils within this zone are typically 'firm', it should be appreciated that disturbed soils may not perform as anticipated should traditional footings be placed within them. As such, it is considered that it could be pragmatic to utilise a mini pile solution for plots within ~10m of the fault zone, in order to avoid the potential for differential settlement to occur. It is considered that precast concrete driven piles are likely to represent the most economical solution. In view of the relatively weak near surface soils it may be necessary to construct a working platform for the piling rig and any other plant required during the works.

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11.4 Volume Change

It should be appreciated that in this instance, the cohesive soils beneath the site have been found to possess volume change potential under the guidance of the NHBC standards. Therefore, it is will be necessary to ensure that foundations placed within this cohesive soil, which was found to have a medium volume change potential, are designed in accordance with Chapter 4.2 of the NHBC standards[6]. The methodology provided in the guidance will require the identification of any trees, still present at or recently removed from, the site and the distance from the proposed foundations. This may result in shallow foundation depths greater than those given above and the requirement for heave protection to be employed against foundations. Piles should be able to cater to for shrinkage or swelling of cohesive ground should they be installed within the zone of influence of any existing or proposed trees and shrubs. For design purposes, in particular the derivation of heave forces on the piles, the zone of desiccation may be considered as equivalent to the minimum foundation depth recommended for a shallow footing in the NHBC Standards.

11.5 Access Roads, Drive-ways and Hard-standing

It is considered that any roads or hard-standing at the site could be constructed employing traditional pavement design. Once topsoil is stripped from the site, the majority of residual soils will act as a sub-grade. In parts of the site in which residual soils comprise clay, CBR values of 2% would be appropriate. 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. In situ CBR testing could be employed following sub-grade preparation to confirm the provisional design values presented above.

11.6 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[7], 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 static groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1s.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[8], 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.

[6] NHBC Standards, Chapter 4.2, *Building near trees*
[7] Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*
[8] 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.*

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11.7 Soakaway Construction

In areas of the site where residual cohesive soils were encountered at depths rational for soakaway construction, practically impermeable drainage characteristics were recorded, such that soakaways cannot be recommended for these areas. As such, an alternative drainage system will need to be designed for the discharge of surface water.

12. Discussion of Ground Conditions - Environmental

12.1 Discussion of Test Results

'Site B' Yew Tree Road, is proposed to be developed by the construction of a new residential estate. Consequently, the site may be classified as residential with plant uptake.

12.1.1 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 1.6% and 15%. 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[9] 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 8. These results indicate the following:

Table 11: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
TP06A	0.7	Benzo[a]anthracene, Chrysene
TP07	0.1	Naphthalene, Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene
TP08	0.3	Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene
WS07	0.1	Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene
WS08	0.2	Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene

Concentrations of chromium^{VI}, free cyanide and total petroleum hydrocarbons (aliphatic C5 to C10; aromatic C5 to C16) were below the detection limits for the tests. Detectable levels of all other

[9] http://www.atrisksoil.co.uk/pages/general/subscribers.asp

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contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values. In addition, no asbestos was detected within the soil samples tested.

It should be appreciated that the soil screening values for PAHs and TPHs (where appropriate) represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure, which is unlikely to significantly affect the combined assessment criterion[10]. 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 12: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
TP06A	0.7	None
TP07	0.1	Naphthalene, Benzo[b]fluoranthene, Dibenz(a,h)Anthracene.
TP08	0.3	None
WS07	0.1	None
WS08	0.2	None

On the basis of the above information, it can be concluded that the site is locally contaminated by PAH's. A Double PAH ratio analysis suggests that the source of contaminated is largely related to combustion and coal derived products. This contamination is also noted to be within the topsoil at the site; near surface residual soils appear to be generally uncontaminated.

12.1.2 Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated a maximum concentration of 0.1% methane, with concentrations of carbon dioxide ranging between 0.9% and 4.2%, in association with oxygen levels of between 17.30% and 19.2%. It should be appreciated that on uncontaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide. In addition, a maximum flow rate of 0.1 litres per hour was recorded and will be employed in the following calculations.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of between 993mb and 1013mb.

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case 0.1% (0.001) methane was recorded along with 4.2% (0.042) carbon dioxide, in association with a

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

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maximum flow rate of 0.1 l/hr. This results in a GSV of 0.0001 l/hr for methane and a GSV of 0.0042 l/hr for carbon dioxide.

In accordance with Table 8.5, Modified Wilson and Card classification of the CIRIA report C665, Assessing risks posed by ground gasses to building, the site may be characterised, with respect to the GSV, as Situation Level 1.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)[11]. Accepting that the proposed development is of high sensitivity and that the generation potential is low to very low, these tables suggest that 6 readings could be undertaken over a period of 3 months. However, C665 notes that *not all sites will require gas monitoring for the period and frequency indicated in Tables 5.5a and 5.5b.*

In this case, a total of 5 monitoring visits were undertaken over a 2 month time period and for the purpose of this assessment, it is considered that the site can be provisionally classified as Characteristic Situation Level 1. One further monitoring visit should be undertaken as per the guidance, in order to fully classify the site.

12.2 Site Specific Risk Assessment

12.2.1 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[12] advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.[13] 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.'[14]

[11] Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings, p60.*
[12] 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'.
[13] 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.
[14] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

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12.3.2 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 13. 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.

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Table 13: Conceptual Site Model and Site-Specific Risk Assessment [Contamination: PAHs]

Conceptual Site Model			Site Specific Risk Assessment	
Pathways	**Receptor**	**Linkage Present?**	**Risk Rating**	**Notes**
Direct contact/dermal absorption/soil ingestion	Operative	Yes – contamination found to be present at the site and contact with soil likely during works.	High	Some contamination is present in the soils 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, as the site is anticipated to be secured during the development phase, contamination is not anticipated to affect neighbours.
	End User	Yes – contamination found to be present at the site and site to be developed into residential estate with garden and landscaped areas.	High	
	Neighbours	Yes – contamination found to be present at the site and a populated residential and commercial area surrounds the site.	Low	
Inhalation of Dust/Vapours	Operative	Yes – dust may be derived from contaminated soils. In addition, some PAH contamination found is l kely to represent a vapour risk.	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.
	End User	Yes – dust may be derived from contaminated soils.	High	
	Neighbours	Yes – contamination found to be present at the site and residential properties located within 250m radius of the site and possible inhalation of dust during the works.	High	
Ingestion of fruit/vegetables and/or waters	Operative	No – no ed ble 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 l kelihood of contamination affecting neighbouring gardens is considered low risk.
	End User	Yes – contamination found to be present at the site and site to be developed into a residential estate with garden areas.	Moderate	
	Neighbours	Yes – contamination found to be present at the site and residential area adjoins the site.	Low	
Migration of hazardous gases via permeable strata or shallow mining activity	Operative	Yes – low concentrations of methane and carbon dioxide have been found to be present at the site (assuming *Characteristic Situation Level 1*). Gas monitoring is ongoing.	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		N/A	

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Spillage/loss/run off direct to receiving water	Controlled Waters	Yes – known controlled waters within 250m. However, the site is underlain by cohesive soils of low permeability. Contamination by PAH is not anticipated to be significantly mobile.	Low	Old services to be removed or capped.
Migration via permeable unsaturated strata	Controlled Waters	Yes – a secondary A aquifers is present beneath the site. However, the site is underlain by cohesive soils of low permeability. Contamination by PAH is not anticipated to be significantly mobile.	Low	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site. However, the site is underlain by cohesive soils of low permeability. Contamination by lead is not anticipated to be significantly mobile.	Low	
Direct contact with contaminated soils	Plants	Yes – significant contamination present at the site which may affect plants.	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 – minor PAH contamination revealed at the site may represent a significant risk to building materials or plastic water pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1s.	Moderate (plastic services)	Please see section 12.3.3 for information on good building practice.
Direct contact with contaminated groundwater			Low (buried concrete)	
Exposure to Radon	Operative / End User	No – Not in a radon affected area.	N/A	Less than 1% of properties are above the action level. No radon protection measures required.

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12.3 Indicative Remediation Strategy

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

12.3.1 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 neighbours from the inhalation and ingestion of dust during the construction process.
- To protect 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 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 groundwater.

12.3.2 Development Requirements

It is understood that the land at ‘Site B’ Yew Tree Road & Burn Road, Birchencliffe, Huddersfield, HD2 2EQ to be developed by the construction of a series of residential houses with front and rear gardens and access roads. 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.

12.3.3 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.

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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.
- 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 determinant 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-2.

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Garden and Landscaped Areas

It is proposed that the development will include garden areas. In view of this and the potential contamination on site, it is considered that landscaped areas 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.

Gas Protection Measures

Gas monitoring is currently ongoing. The final risk assessment should take into consideration the current site conditions, and should be subject to reassessment after the formulation and/ or completion of any remedial measures, and proposed foundation solution. These documents should be prepared by a suitably experienced and qualified specialist.

12.4 Fill Materials

It should also be appreciated that any fill material, either site-won (which could be classified as virgin quarried materials) 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 agree with any regulatory bodies (such as the Local Authority).

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

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Table 14: Validation Sampling and Testing		
Fill Type	**Frequency**	**Minimum Determinants**
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. 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 50m³ and 1 per 250m³	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 50m³ and 1 per 100m³	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 15: 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 9 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.

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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.

12.5 Verification Report

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

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

- Characterisation of the suitability of the clean material including the derivation of the material, comments from a visual screen, the tests results of chemical screening, delivery tickets where appropriate and the conditions by which the clean material has been stored and handled on site.
- Photographic and logged evidence the clean material has been handled on site and placed in a sufficient thickness. 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.

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13. 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.
- Produce a validation report to demonstrate that the environmental risks discussed in this report have been mitigated.
- Hold discussions with piling contractors, if necessary.
- 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.

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14. References

- British Geological Survey (NERC) (2022), BGS, Keyworth.
  - Geology of Britain Viewer: (*http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html)*
  - Lexicon of Named Rock Units:
  - (*http://www.bgs.ac.uk/lexicon/)*
- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-2: *Geotechnical investigation and testing – Field testing, Part 2: Dynamic Probing,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-3: *Geotechnical investigation and testing – Field testing, Part 3: Standard penetration test,* B.S.I., London.
- British Standards Institution (2015 +A1: 2020) BS 5930: *Code of practice for ground investigations,* B.S.I., London.
- British Standards Institution (2011), BS 10175: *Investigation of potentially contaminated sites – Code of Practice,* British Standards Institute.
- British Standards Institution (2015 +A1:2019) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* B.S.I., London.
- British Standards Institution (2013), BS 8576 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds.
- British Standards Institution (2017) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil*, B.S.I., London.
- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: Concrete in aggressive ground, BRE Press, Garston.
  - Part C: *Assessing the aggressive chemical environment.*
  - Part D: *Specifying concrete for general cast-in-situ use.*
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.
- Wilson S, Oliver S, Mallet H, Hutchings H, Card G, *Assessing risks posed by ground gasses to buildings,* CIRIA Report C665.

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Appendix 1

Site Plan

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Notes:

Investigation positions approximated from site operative's notes.

Departure Zone

Mine Entry Search Excavation

Inferred Fault - BGS

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RGS

Rogers Geotechnical Services Ltd

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Near Bank,
Shelley,
Huddersfield,
HD8 8LU

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www.rogersgeotech.co.uk

Client:

North Park (Shelley) Ltd

Job Number:

C2113/21/E

Project Details:

SITE B, Yew Tree Rd

Scale: Not to scale - reference only

WORK IN PROGRESS

Rev	Description	Date	By	Rvw
P01	Preliminary Issue	25.10.21	MC	–

Residential Development

at Yew Tree Road
Birchencliffe
Huddersfield

for NORTH PARK

Farrar Bamforth Associates Ltd.

Architectural Consultants

51 Trinity Street, Huddersfield, HD1 4DN
Tel. (01484) 424008 Fax: (01484) 512305
E-mail: design@farrarbamforth.co.uk
Website: www.farrarbamforth.co.uk

Master Site Layout

Project	Originator	Zone	Level	Type	Role	Number	Revision
21D44	FBA	ZZ	XX	DR	A	9903	P01

Drawn	Date	Suitability	Revision Status	Scale at A3
MC	Oct 21	S2	Preliminary	1 : 500

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Appendix 2

Coal Authority Permit

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The Coal Authority

Permit to Enter or Disturb Coal Authority Interests

Permit 24130

Name and Address of Permit Holder:

North Park (Shelley) Ltd
West House
Kings Cross Road
Halifax
HX1 1EB

Site Location:

Land off
Yew Tree Road - Burn Road
Birchencliffe
Huddersfield
HD2 2EQ

This certificate hereby grants the above named Permit Holder a Permit to carry out:-

Ground investigation by ten boreholes to 30m or as required to assess shallow mining risk to development and locate one recorded mine entry (shaft, Coal Authority Reference 412418-002) by excavation all within the Authority's interests at the identified site location above as shown on the Grant Permit Boundary (overleaf) for the period of 12 months from the granted date shown below. *The granting of this Permit does not constitute advice given by the Authority in relation to the proposed operations. It is the Permit Holder's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.*

Conditions:

- *Manned entry (i.e.) into mine entries/workings) is strictly prohibited.*
- *Water flush drilling only*
- *Gas Monitoring for CO, CH_4, CO_2, O_2, H_2S at the borehole and rig*
- *Operators undertaking the work must be in possession of this certificate and the Permit boundary plan at the time of works*
- *Appropriate borehole reinstatement and sealing without delay and to withstand site level changes*

Signed: Leigh Sharpe Granted Date: ***19/11/2021***

For and on behalf of The Coal Authority

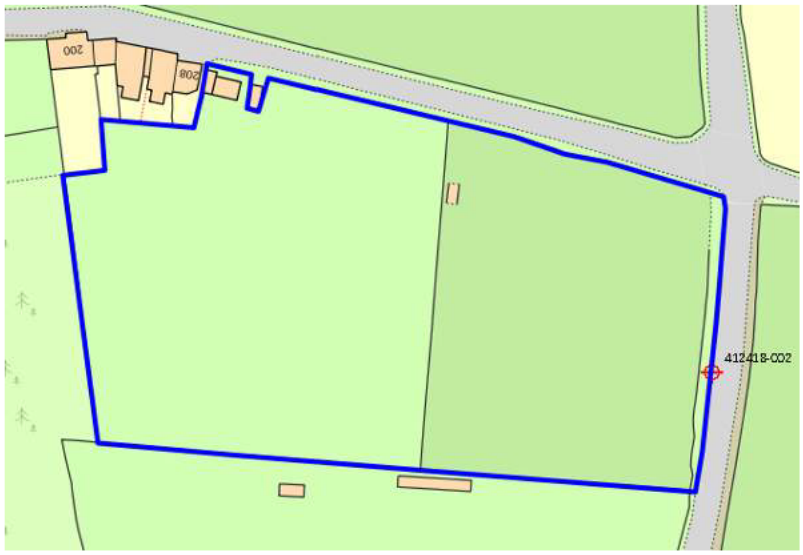
Nominated Representative: Leigh Sharpe, Permitting Manager;
The Coal Authority, Permitting Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG
Tel: 01623 637450; E-Mail: permissions@coal.gov.uk

The Coal Authority

Granted Permit Boundary

Permit Ref: 24130

Permit Boundary:



The Coal Authority

Issued by:
The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG
Website: www.groundstability.com Phone: 0345 762 6848

ROGERS GEOTECHNICAL SERVICES LTD
BARNCLIFFE MILLS
NEAR BANK
SHELLEY
HUDDERSFIELD
KIRKLEES
HD8 8LU

Our reference:	**51002945752001**
Your reference:	**C/2113/21/E/3266**
Date of your enquiry:	**09 February 2022**
Date we received your enquiry:	**09 February 2022**
Date of issue:	**09 February 2022**

This report is for the property described in the address below and the attached plan.

Shaft Plan and Data Sheets

YEW TREE ROAD/BURN ROAD, BIRCHENCLIFFE, HUDDERSFIELD, KIRKLEES, HD2 2EQ

I refer to the enquiry dated 09 February 2022, received 09 February 2022, in connection with the above.

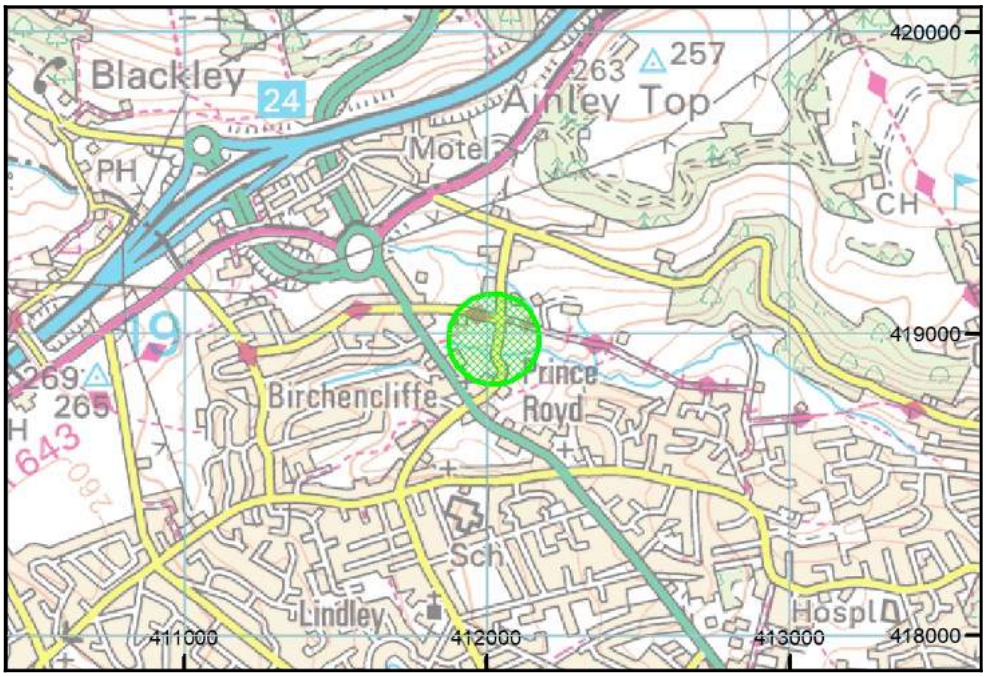
As requested I enclose the mine entry data sheet(s) held for the mine entry/entries referred to.

Mine Entry Data

Shaft/adit:	Shaft
Reference:	412418-002
Source:	Former British Coal Records (R.C. Plan that was held at North Yorkshire Area HQ)
Colliery name:	Unknown
Entry name:	Unknown
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	Unknown
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	This mine entry was searched for but not found by Lithos Consulting in 2015
Conveyance:	Not Applicable
Easting:	412022
Northing:	418983
Other information:	None

Location map

Approximate position of enquiry



This plan shows the approximate location of the disused mine entry / entries referred to in the attached mining report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan.

Property owners have the benefit of statutory protection (under the Coal Mining Subsidence Act 1991). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by visiting www.groundstability.com.

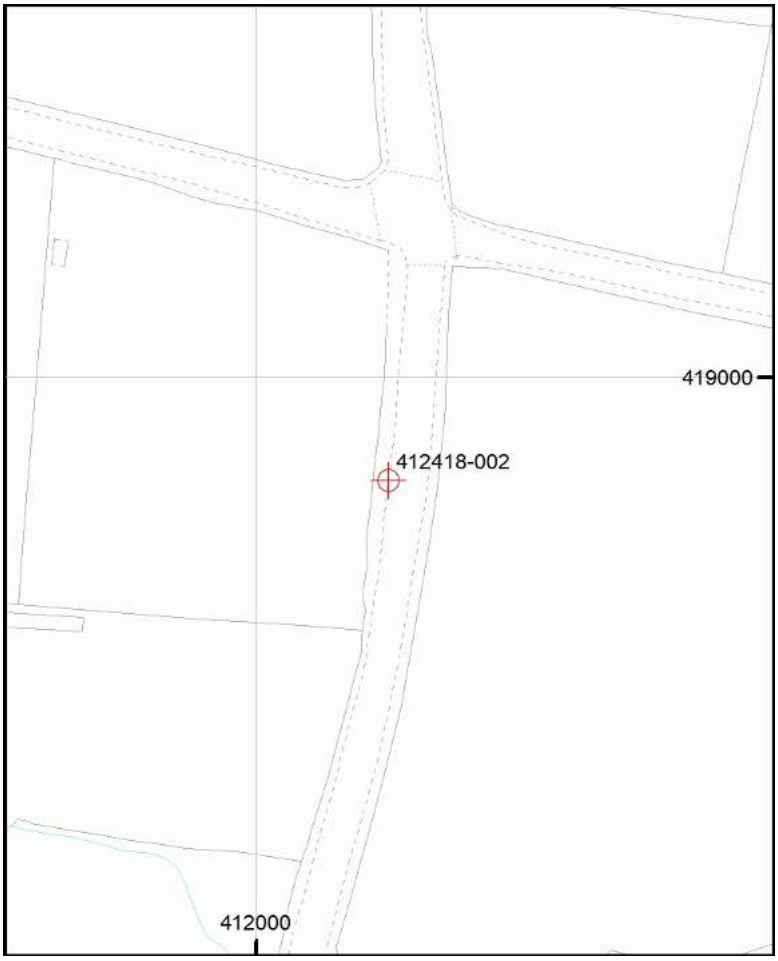
If you wish to discuss the relevance of any of the information contained in this report, you should seek the advice of a qualified mining engineer or surveyor. If you or your advisor wish to examine the source plans from which the information has been taken, these are available to view, free of charge, at our Head Office in Mansfield. To book an appointment please ring 01623 637225. Should you or your advisor wish to carry out a physical investigation that may enter, disturb or interfere with any disused mine entry, prior permission of the owner must be sought. For coal mine entries, the owner will normally be the Coal Authority.

The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries).

Our emergency telephone number is 01623 646333.

Key

Disused Adit or Mineshaft



Mapping sourced from Ordnance Survey

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Appendix 3

Windowless Sample Borehole Records

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Borehole Log

Borehole No. **WS07**

Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type WLS
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 12/04/2022	Logged By SA

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.10 - 0.20	ES	85	100		0.40			TOPSOIL. (Dark grey slightly sandy gravelly CLAY. Common plant matter.)
		1.00	SPT	75	100	N=15 (1,3/3,4,4,4)	0.90			Firm light yellowish brown mottled grey slightly sandy gravelly CLAY. Gravel is angular to sub rounded fine to coarse of sandstone and coal. [Residual Pennine Lower Coal Measures Formation] [Possibly reworked - fault zone 'gauge']
		2.00	SPT	65	100	N=27 (3,3/3,4,5,15)	1.90			Stiff mixed brown and grey slightly sandy gravelly CLAY. Gravel is angular to sub rounded fine to coarse of sandstone and coal. Occasional plant matter. [Residual Stanningly Rock]
		2.20	D							Soft to firm grey and brown thinly laminated to very thinly bedded sandy slightly gravelly friable CLAY. Gravel is angular to sub rounded fine to coarse of relict sandstone. {□{Residual Stanningly Rock]
		3.00	SPT			51 (7,11/13,18,20,)	3.38			End of Borehole at 3.38m

Remarks

1) CAT scan prior to breaking ground - no services identified.

Borehole Log

Borehole No. **WS08**

Sheet 1 of 1

Project Name:	Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:
Location:	Birchencliffe, Huddersfield, , HD2 2EQ		Level:
Client:	North Park Shelley Ltd		Dates: 12/04/2022

Hole Type: WLS

Scale: 1:50

Logged By: CM

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.20	ES				0.35			TOPSOIL (Dark brown organic silty CLAY. Strong organic odour)
		0.50		85	100	HVP=55				Firm locally stiff brown locally mottled dark brown silty gravelly CLAY. Gravel is sub angular to rounded medium to coarse of sandstone and rare coal. [Residual Stanningly Rock
		1.00	D							
				75	100					
		1.50					1.50			End of Borehole at 1.50m

Remarks

1) CAT scan prior to breaking ground - no services identified.

Borehole Log

Borehole No. **WS09**

Sheet 1 of 1

Project Name:	Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:
Location:	Birchencliffe, Huddersfield, , HD2 2EQ		Level:
Client:	North Park Shelley Ltd		Dates: 12/04/2022

Hole Type: WLS

Scale: 1:50

Logged By: CM

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				85	100		0.30			TOPSOIL (Dark brown organic silty fine sand with some clay lenses).
										Firm locally stiff light yellowish grey silty CLAY.
				75	100		1.00			Firm locally stiff dark brown mottled orangish brown brown light grey and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is sub rounded to angular fine to medium of mixed lithologies including sandstone siltstone rare coal rare carbonaceous mudstone [Residual Pennine Lower Coal Measures Formation] [Possibly reworked - fault zone 'gauge']
							2.00			End of Borehole at 2.00m

Remarks

1) CAT scan prior to breaking ground - no services identified.

Borehole Log

Borehole No. **WS10**

Sheet 1 of 1

Project Name:	Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:
Location:	Birchencliffe, Huddersfield, , HD2 2EQ		Level:
Client:	North Park Shelley Ltd		Dates: 12/04/2022

Hole Type: WLS

Scale: 1:50

Logged By: CM

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				85	100		0.30			TOPSOIL (Dark brown organic silty fine SAND).
		1.00	SPT			N=13 (2,2/3,3,3,4)				Firm locally stiff dark brown mottled orangish brown brown light grey and dark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is sub rounded to angular fine to medium of mixed lithologies including sandstone siltstone rare coal rare carbonaceous mudstone. Large white sandstone cobble at 1.9m). [Residual Pennine Lower Coal Measures Formation] [Possibly reworked - fault zone 'gauge']
				75	100					
		2.00	SPT			14 (3,2/14 for 228mm)				
		2.50	D	65	100		2.30			Stiff friable bluish grey mottled light brown gravelly silty CLAY. Gravel is angular tabular fine to medium of micaceous siltstone. [Residual Pennine Lower Coal Measures Formation]
		3.00	SPT			N=14 (2,3/3,3,4,4)				
				55	100					
		4.00	SPT			N=12 (2,2/2,2,4,4)	3.95			Extremely weak thinly laminated brown locally irons stained micaceous SILTSTONE.
							4.00			End of Borehole at 4.07m

Remarks

1) CAT scan prior to breaking ground - no services identified.

Appendix 4

Dynamic Probes

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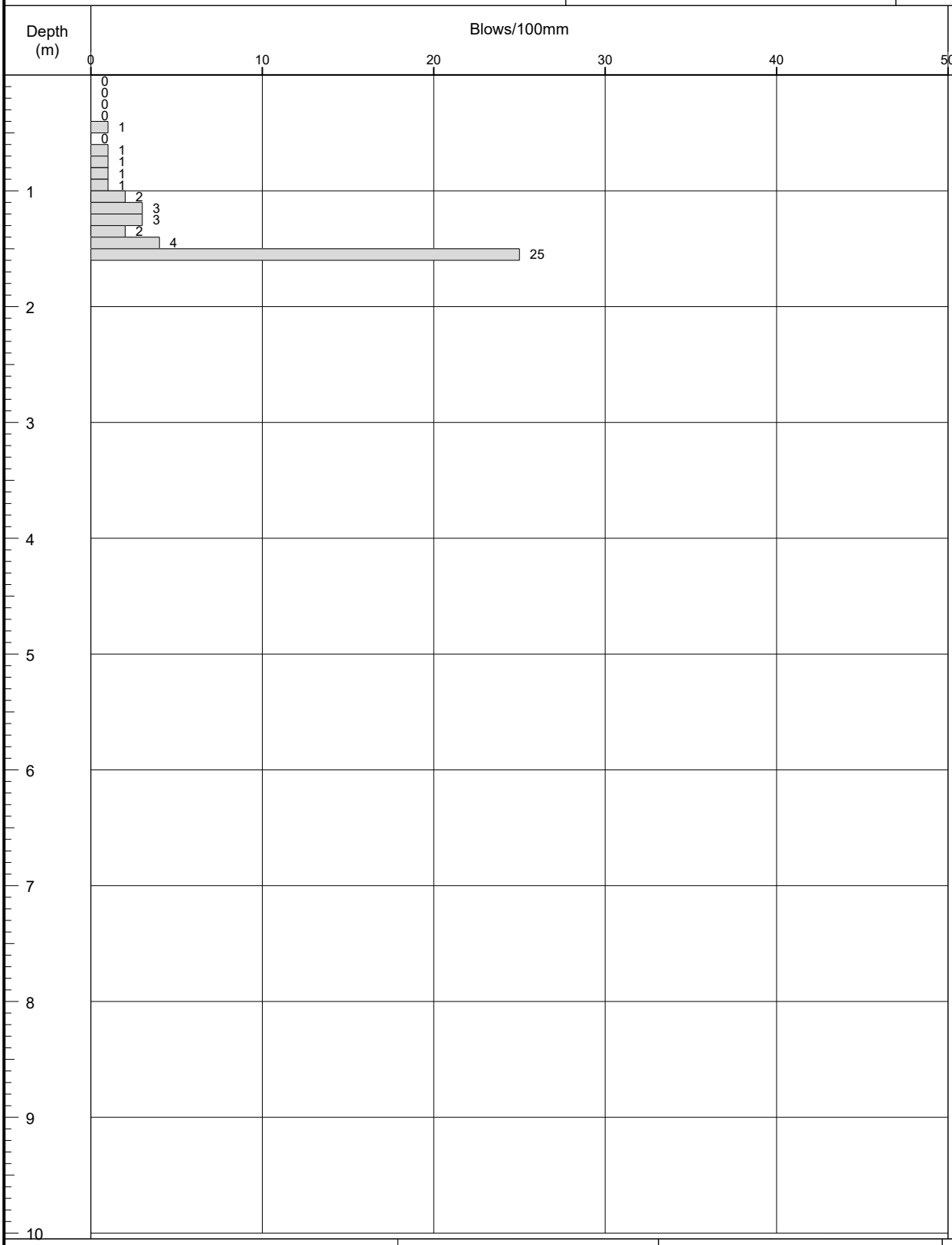
Probe Log

Probe No.
DP08
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type DCP
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 08/04/2022	Logged By AB



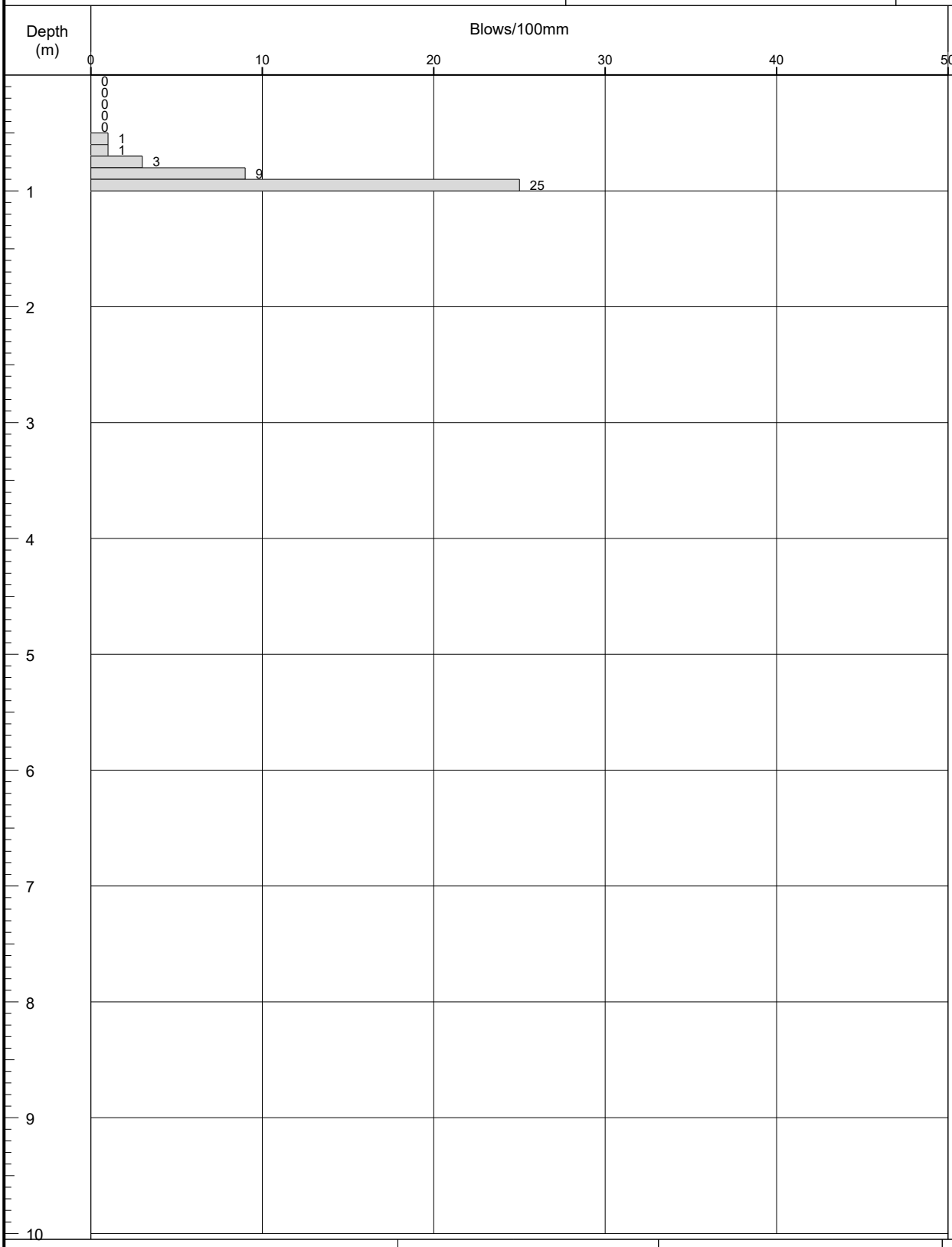
Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	1.6m
Probe Type	DPSH-B		

Probe Log

Probe No.
DP09
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type DCP
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 08/04/2022	Logged By AB



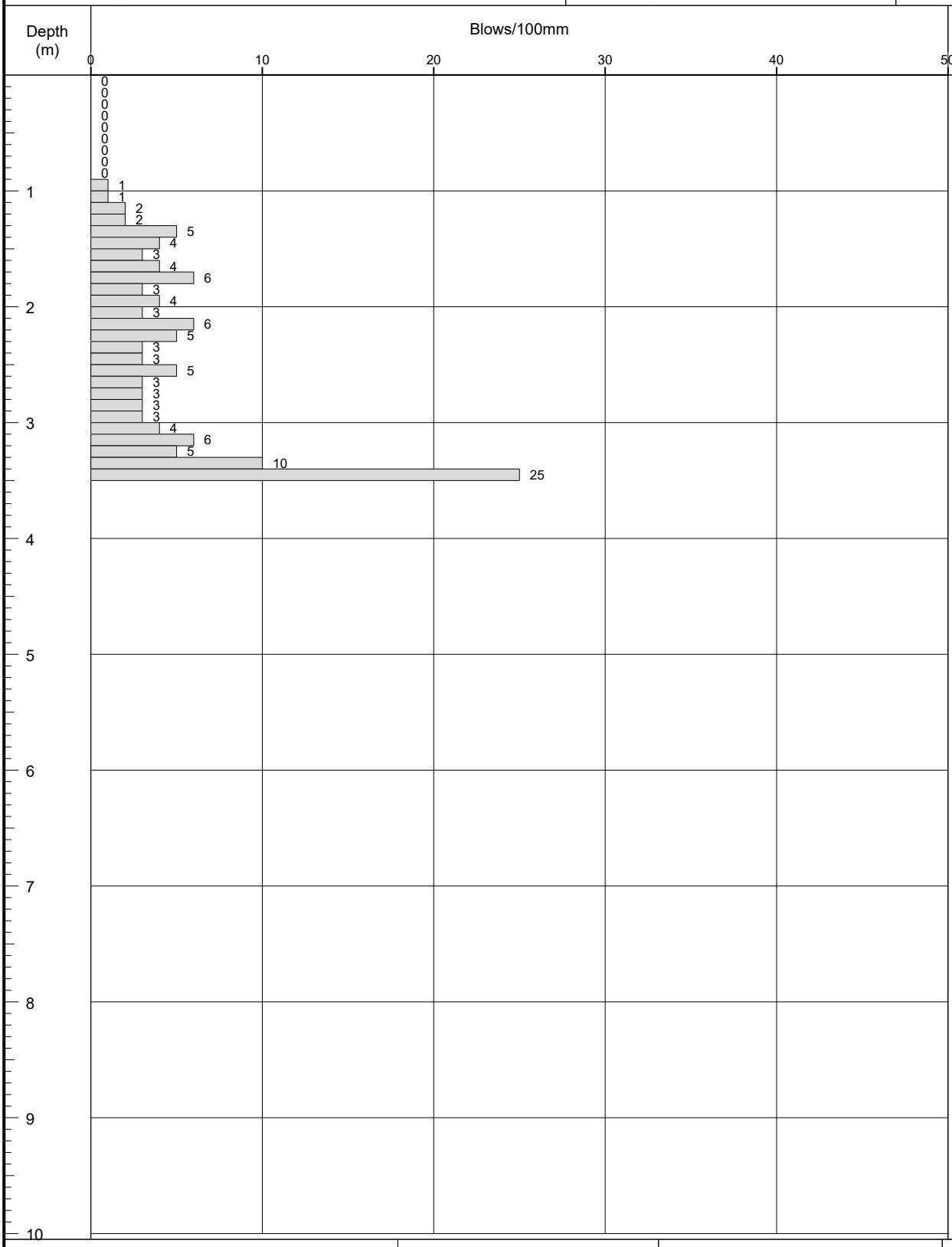
Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	0.9m
Probe Type	DPSH-B		

Probe Log

Probe No.
DP11
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type DP
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 12/04/2022	Logged By AB



Remarks:
1) CAT scan prior to breaking ground - no services identified.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	3.33m
Probe Type	DPSH-B		

Appendix 5

Rotary Borehole Records

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Borehole Log

Borehole No. **RO3**

Sheet 1 of 2

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 10/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								TOPSOIL
					0.50			Light brown CLAY (Drillers Notes)
					3.00			Light brown SANDSTONE (Drillers Notes) [Stanningly Rock]
	▼	6.00			6.00			Light grey/white SANDSTONE. Very hard drilling (Drillers Notes)
					9.00			Light grey MUDSTONE
					9.20			Light brown SANDSTONE
								Continued on Next Sheet

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Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, Fetching water 0.5hrs,
4) Borehole backed filled with Gravel/Arisings/Installation and re-instated like-for-like/With flush cover.

Borehole Log

Borehole No. **RO3**

Sheet 2 of 2

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 10/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					11.00			Very dark grey MUDSTONE
					15.00			End of Borehole at 15.00m

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, Fetching water 0.5hrs,
4) Borehole backed filled with Gravel/Arisings/Installation and re-instated like-for-like/With flush cover.

Borehole Log

Borehole No. **RO5**

Sheet 1 of 2

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 07/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								Dark brown CLAY (Drillers Notes)
					3.00			Dark brown SANDSTONE (Drillers Notes)
					4.00			Dark grey MUDSTONE (Drillers Notes)
					5.00			Light grey MUDSTONE (Drillers Notes)
	▼	8.00			8.00			Interbedded light brown and white SANDSTONE (Very hard Drilling) (Drillers Notes)
					10.00			Continued on Next Sheet

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO5**

Sheet 2 of 2

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 07/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								White SANDSTONE (Drillers Notes)
					14.00			Dark grey MUDSTONE (Drillers Notes)
					15.00			End of Borehole at 15.00m

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO6**

Sheet 1 of 3

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 10/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								MADE GROUND (Drillers notes)
					0.50			Dark brown CLAY (Drillers Notes)
					2.50			Light brown SANDSTONE (Drillers Notes)
	▼	6.00						
					8.50			Dark grey MUDSTONE (Drillers notes)
								Continued on Next Sheet

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO6**

Sheet 2 of 3

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 10/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description

11
12
13
14
15
16
17
18
19
20

Continued on Next Sheet

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO6**

Sheet 3 of 3

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 10/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					30.00			End of Borehole at 30.00m

21 22 23 24 25 26 27 28 29 30

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO9**

Sheet 1 of 2

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 14/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								Brown CLAY (Drillers notes)
					3.00			Dark brown SANDSTONE (Drillers notes)
					4.00			Light grey MUDSTONE (Drillers notes)
					5.00			Poss ble fracture within MUDSTONE (rods dropped, momentarily lost flush) (Drillers notes)
					6.00			Light grey MUDSTONE
								Continued on Next Sheet

1 2 3 4 5 6 7 8 9 10

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO9**

Sheet 2 of 2

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 14/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					15.00			End of Borehole at 15.00m

11 12 13 14 15 16 17 18 19 20

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO10**

Sheet 1 of 3

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 13/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								MADE GROUND (Brown CLAY) (Drillers notes)
					3.00			Dark brown SANDSTONE (Drillers notes)
					4.50			Light grey MUDSTONE (Drillers notes)
					8.00			Dark grey MUDSTONE (Drillers notes)
								Continued on Next Sheet

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO10**

Sheet 2 of 3

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 13/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								Continued on Next Sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO10**

Sheet 3 of 3

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords:	Hole Type RO
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Level:	Scale 1:50
Client: North Park Shelley Ltd		Dates: 13/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					30.00			End of Borehole at 30.00m

21 22 23 24 25 26 27 28 29 30

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) DAYWORKS: Borehole set-up 1hrs, fetching water 0.5hrs.
4) Borehole backed filled with Gravel

Appendix 6

Trial Pit Records

Rogers Geotechnical Services Ltd Telephone 0843 50 666 87 Fax 0843 51 599 30
Email enquiries@rogersgeotech.co.uk www.rogersgeotech.co.uk

Trial Pit Log

Trialpit No **TP05**

Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords: - Level:	Date 08/06/2022
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Dimensions (m): 1.2 × 0.9 Depth 1.20	Scale 1:50
Client: North Park Shelley Ltd			Logged RAP

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			TOPSOIL (Soft to firm dark brown organic slightly gravelly silty CLAY. Gravel is sub-angular fine to coarse of brick mortar and pottery. Loose plastic sheeting also present).
				1.20			Firm brownish grey mottled brown slightly gravelly silty CLAY. Gravel is sub-angular fine to coarse of sandstone. Low cobble content of sub-angular and tabular sandstone. [Residual Stanningly Rock]
							End of pit at 1 20 m

Remarks:

Stability:

Trial Pit Log

Trialpit No
TP06
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords: - Level:	Date 08/06/2022
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Dimensions (m): Depth 0.10 (0.9 × 0.9)	Scale 1:50
Client: North Park Shelley Ltd			Logged RAP

Water Str ke	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.10			MADE GROUND (Black top material - too hard to break. Distinct tar odour). End of pit at 0.10 m

Remarks:

Stability:

Trial Pit Log

Trialpit No
TP06A
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords: - Level:	Date 08/06/2022
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Dimensions (m): Depth 0.60 — 1 × 0.6	Scale 1:50
Client: North Park Shelley Ltd			Logged RAP

Water Str ke	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.15			MADE GROUND (Black-top material. Distinct tar odour).
				0.40			MADE GROUND (Bricks).
				0.60			Firm brownish grey mottled brown slightly gravelly silty CLAY. Gravel is sub-angular fine to coarse of sandstone. [Residual Stanningly Rock]
							End of pit at 0 60 m

Remarks: See associated photos within report appendices.

Stability:

Trial Pit Log

Trialpit No
TP07
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords: - Level:	Date 08/06/2022
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Dimensions (m): Depth 0.70 — 1 × 0.9	Scale 1:50
Client: North Park Shelley Ltd			Logged RAP

Water Str ke	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.25			TOPSOIL (Soft to firm dark brown organic slightly gravelly silty CLAY. Gravel is sub-angular fine to coarse of sandstone and brick).
				0.70			Firm brownish grey mottled brown slightly gravelly silty CLAY. Gravel is sub-angular fine to coarse of sandstone. [Residual Stanningly Rock]
							End of pit at 0.70 m

Remarks:

Stability:

Trial Pit Log

Trialpit No
TP08
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords: - Level:	Date 08/06/2022
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Dimensions (m): 1 × 0.9 Depth 0.40	Scale 1:50
Client: North Park Shelley Ltd			Logged RAP

Water Str ke	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.15			TOPSOIL (Soft dark brown organic slightly sandy silty CLAY).
				0.40			Firm brownish grey mottled brown slightly gravelly silty CLAY. Gravel is sub-angular fine to coarse of sandstone. [Residual Pennine Lower Coal Measures Formation]
							End of pit at 0.40 m

Remarks: Trialpit utilised to examine brick feature on site - see associated photos within report appendices.

Stability:

Appendix 7

Soakaway Test Results

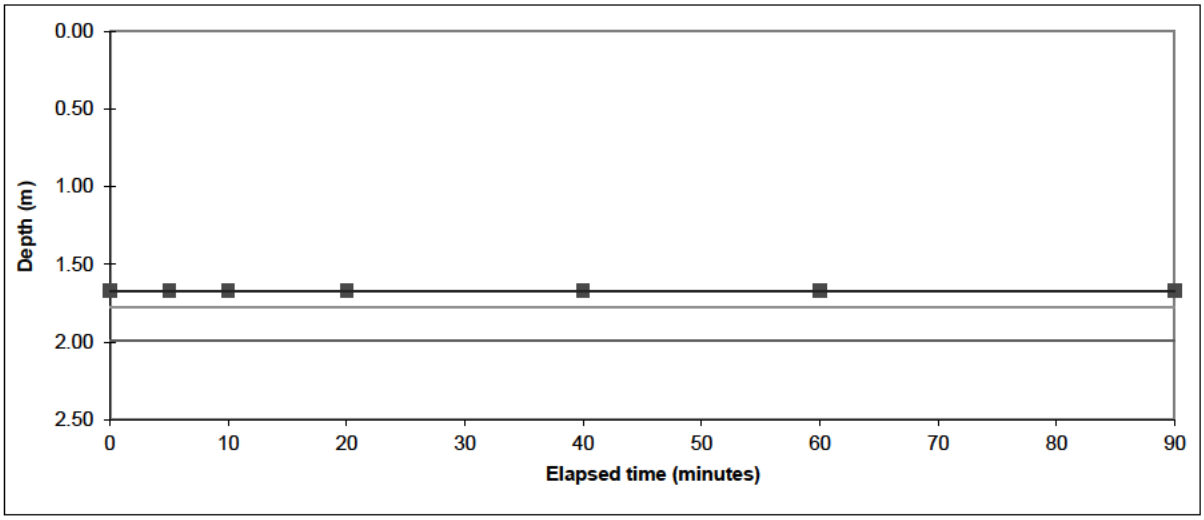
Rogers Geotechnical Services Ltd Telephone 0843 50 666 87 Fax 0843 51 599 30
Email enquiries@rogersgeotech.co.uk www.rogersgeotech.co.uk

Rogers Geotechnical Services Ltd

Soakaway Test

Trial Pit No:	TPSA03	Test No:	1	Date:	07/06/2022
Length (m):	1.800		Datum Height:	0.00	m agl
Width (m):	1.50		Granular infill:	None	
Depth (m):	2.10		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.670		
5	1.670		
10	1.670		
20	1.670		
40	1.670		
60	1.670		
90	1.670		



Start water depth for analysis (mbgl):	1.67		
75% effective depth (mbgl):	1.78	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.89		
25% effective depth (mbgl):	1.99	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	2.10		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):			4.09
(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).

Client:	Weetwood Services Ltd	**Job No:**
Site:	Yew Tree Road / Burn Road, Birchencliffe	C2113/21/E/3266

Appendix 8

Laboratory Testing

Rogers Geotechnical Services Ltd Telephone 0843 50 666 87 Fax 0843 51 599 30
Email enquiries@rogersgeotech.co.uk www.rogersgeotech.co.uk

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LABORATORY REPORT

job number C/2113/21/E/3266	client re
site address Yew Tree Road/ Burn Road Birchencliffe, Huddersfield, HD2 2EQ	client address North Park (Shelley) Ltd West House, Kings Cross Rd, Halifax, , HX1 1EB
consultant	
date scheduled 26/04/2022	date issued 10/05/2022
issued by H J Letch	job title Technical Manager
checked by T Merry	

Rogers Geotechnical Services Ltd **Telephone** **01484 607 977**
Email **enquiries@rogersgeotech.co.uk** **www.rogersgeotech.co.uk**
Unit 4, Barncliffe Business Park, Near Bank, Shelley, Huddersfield, West Yorkshire HD8 8LU.

ISO 9001 : 2015 REGISTERED
ISO 14001 : 2015 REGISTERED
ISO 45001 : 2018 REGISTERED
Registered Member
UKAS TESTING

GEOTECHNICAL ENVIRONMENTAL

Schedule of UKAS Accredited Laboratory Tests

1. CLASSIFICATION OF SOIL	BS 1377-2:1990	BS EN ISO 17892	Accredited (A)	Unaccredited (U)
1.1 Moisture / Water content determination				
i. Oven drying	Pt 2 : 3.2	Pt 1 : 2014	A	
ii. Saturation m/c of chalk	Pt 2 : 3.3			U
1.2 Index Properties				
i. Liquid limit – cone penetrometer	Pt 2 : 4.3	Pt 12 : 2018 : 5.3 / 5.5	A	
ii. Plastic limit	Pt 2 : 5.3		A	
iii. Shrinkage limit	Pt 2 : 6.3			U
iv. Linear shrinkage	Pt 2 : 6.5		A	
1.3 Particle Density				
i. Gas jar	Pt 2 : 8.2			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	A	
ii. Immersion in water	Pt 2 : 7.3	Pt 2 : 2014 : 5.2		U
iii. Fluid / Water displacement	Pt 2 : 7.4	Pt 2 : 2014 : 5.3		U
iv. Sand replacement	Pt 9 : 2.1, 2 2			U
v. Core cutter	Pt 9 : 2.4			U
1.5 Particle Size Distribution				
i. Dry Sieve	Pt 2 : 9.2	Pt 4 : 2016 : 5.2	A	
ii. Wet Sieve	Pt 2 : 9.3	Pt 4 : 2016 : 5.2	A	
iii. Sedimentation by pipette	Pt 2 : 9.4	Pt 4 : 2016 : 5.3 / 5.4	A	
iv. Sedimentation by hydrometer	Pt 2 : 9.5			U
2. CHEMICAL TESTS	**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

GEOTECHNICAL ENVIRONMENTAL

Rogers Geotechnical Services Ltd
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Company No: 5130864

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RGS

GEOTECHNICAL
LAB RESULTS

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Disclaimer

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

Rogers Geotechnical Services Ltd
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Summary of Classification Test Results

Project No.	Project Name
C2113/21/E/3266	Yew Tree Rd/Burn Rd

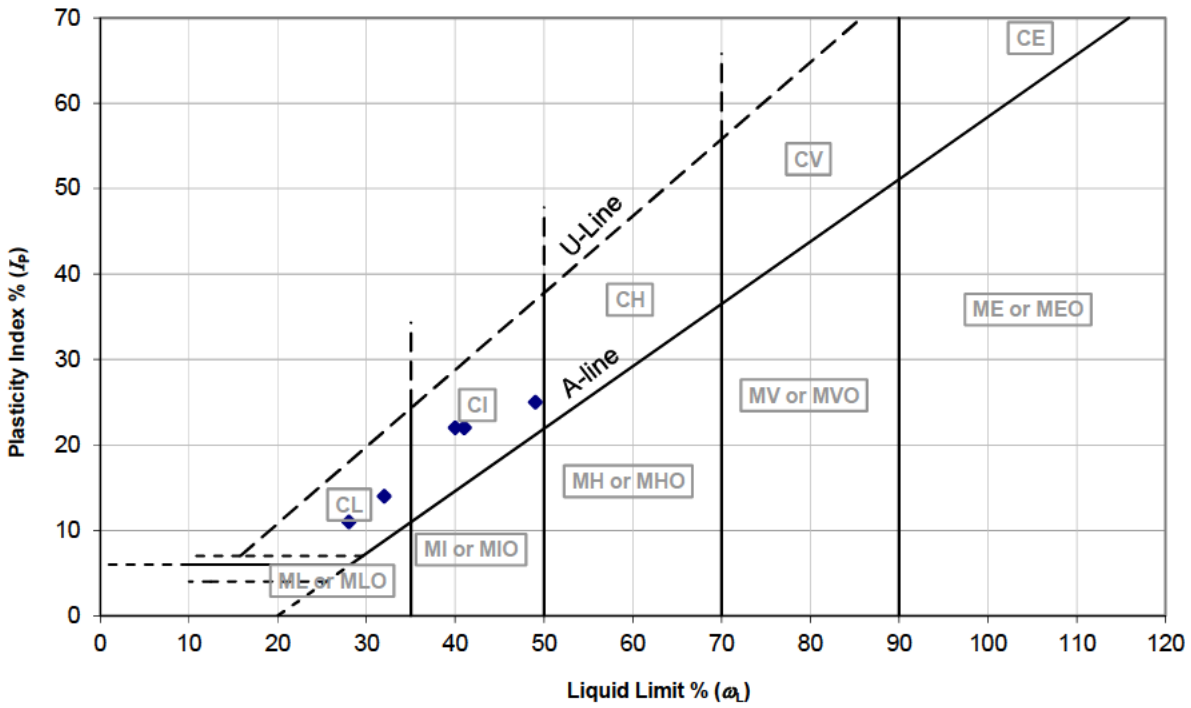
Hole No.	Sample				Soil Description	Density bulk / dry		w	Passing 425µm	LL	PL	PI	Particle density	Cone 80g/30° 60g/60°	Water Increase Decrease	Date
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3			
WS01	D	1.20		D	Brown slightly gravelly CLAY			16.0	98	41 -1pt	19	22		80g/30deg	increacing	21-Apr
WS03	d	1.20		D	Brown CLAY.			20.0	98	41 -1pt	19	22		80g/30deg	increacing	21-Apr
WS04	1	1.00		D	Firm brown mottled grey silty sandy CLAY.			13.0	100	40 -1pt	18	22		80g/30deg	increacing	21-Apr
WS05	1	0.50		D	Orangish brown CLAY			19.0	99	49 -1pt	24	25		80g/30deg	increacing	21-Apr
WS07	D	2.20		D	Greyish brown silty sandy CLAY.			27.0	100	32 -1pt	18	14		80g/30deg	increacing	21-Apr
WS10	1	2.50		D	Stiff brown silty gravelly CAY.			11.0	68	28 -1pt	17	11		80g/30deg	increacing	21-Apr

All tests performed in accordance with BS EN ISO 17892 unless specified otherwise

Key			Date Printed	Approved By	Table
Density test	Liquid Limit	Particle density			1
Linear measurement unless :	4pt cone unless :	sp - small pyknometer	10/05/2022		
wd - water displacement	cas - Casagrande method	gj - gas jar			sheet
wi - immersion in water	1pt - single point test			Harry	1

Rogers Geotechnical Services Ltd. Offices 1&2, Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU	**Classification of Index Properties**	**C2113/21/E/3266**
Project Name: Yew Tree Rd/Burn Rd	**BS EN ISO: 17892: Parts 1, 12**	Fig. 2 Sheet. 1
Location:		Input By: Harry
Client: North Park Shelley Ltd		Check By: Harry

Location	Depth	Moisture Content (w)	Liquid Limit (wL)	Plastic Limit (wP)	Plasticity Index (IP)	Retained by 0.425mm	Modified (w) (w')	Modified (IP) (IP')	Liquidity/ Consistency (IL)	Liquidity/ Consistency (IC)	Casagrande Class	N.H.B.C Class
	(m)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)		(%)
WS01	1.20	16	41	19	22	2	16	22	-0.1	1.1	C I	MEDIUM
WS03	1.20	19.8	41	19	22	2	20	22	0.0	1.0	C I	MEDIUM
WS04	1.00	12.7	40	18	22	0	13	22	-0.2	1.2	C I	MEDIUM
WS05	0.50	19	49	24	25	1	19	25	-0.2	1.2	C I	MEDIUM
WS07	2.20	26.5	32	18	14	0	27	14	0.6	0.4	C L	LOW
WS10	2.50	10.8	28	17	11	32	16	7	-0.6	1.6	C L	*



Environmental
Geotechnical
Specialists

RGS

ENVIRONMENTAL LAB RESULTS

GEOTECHNICAL
ENVIRONMENTAL

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

Telephone 01484 607977
Company No: 5130864

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-16031-1		
Initial Date of Issue:	06-May-2022		
Client	Rogers Geotechnical Services Ltd		
Client Address:	Offices 1&2, Barncliffe Business Park Near Bank Shelley Huddersfield West Yorkshire HD8 8LU		
Contact(s):	Harry Letch		
Project	Yew Tree		
Quotation No.:		**Date Received:**	29-Apr-2022
Order No.:	C2113/21/E/3266	**Date Instructed:**	29-Apr-2022
No. of Samples:	9		
Turnaround (Wkdays):	5	**Results Due:**	06-May-2022
Date Approved:	06-May-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: Yew Tree

Client: Rogers Geotechnical Services Ltd		Chemtest Job No.:			22-16031	22-16031	22-16031	22-16031	22-16031	22-16031	22-16031	22-16031
Quotation No.:		Chemtest Sample ID.:			1420350	1420351	1420352	1420353	1420354	1420355	1420356	1420357
		Sample Location:			WS01	WS02	WS03	WS07	WS06	WS08	WS08	WS01
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.2	2.5	0.2	0.1	0.5	0.2	1.0	0.6
		Bottom Depth (m):			0.4		0.4	0.2	0.6			
		Date Sampled:			26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022
		Asbestos Lab:			DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Cadmium	M	2455	mg/kg	0.10	0.14	0.18	< 0.10	0.39	0.13	0.26		
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50		
Copper	M	2455	mg/kg	0.50	20	25	16	45	31	29		
Mercury	M	2455	mg/kg	0.05	0.10	0.08	0.05	0.14	< 0.05	0.14		
Nickel	M	2455	mg/kg	0.50	20	32	19	15	39	13		
Lead	M	2455	mg/kg	0.50	27	43	24	180	26	82		
Zinc	M	2455	mg/kg	0.50	55	120	55	180	86	120		
Vanadium	U	2455	mg/kg	0.5	18	24	31	24	35	28		
Arsenic	M	2455	mg/kg	0.5	3.7	4.6	4.9	12	6.0	17		
Selenium	M	2455	mg/kg	0.25	1.6	1.4	1.2	0.90	2.1	0.86		
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50		
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10		
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.0	< 0.10	0.19		
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	0.56	< 0.10	0.15		
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.3	< 0.10	0.20		
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.1	< 0.10	0.28		
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	11	< 0.10	1.3		
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	2.8	< 0.10	0.24		
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	22	< 0.10	3.1		
Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	22	< 0.10	3.3		
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	10	< 0.10	2.0		
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	10	< 0.10	3.0		
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	9.2	< 0.10	2.5		
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	6.1	< 0.10	1.9		
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	12	< 0.10	2.0		
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	7.2	< 0.10	1.1		
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	2.2	< 0.10	0.59		
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	7.1	< 0.10	1.2		
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	130	< 2.0	23		
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	7.5	< 1.0	< 1.0	7.5	6.4	< 1.0		
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	28	5.8	< 1.0	8.1	5.8	7.8		
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	27	< 1.0	< 1.0	70	20	< 1.0		
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		

Results - Soil

Project: Yew Tree

Client: Rogers Geotechnical Services Ltd		Chemtest Job No.:			22-16031	22-16031	22-16031	22-16031	22-16031	22-16031	22-16031	22-16031
Quotation No.:		Chemtest Sample ID.:			1420350	1420351	1420352	1420353	1420354	1420355	1420356	1420357
		Sample Location:			WS01	WS02	WS03	WS07	WS06	WS08	WS08	WS01
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.2	2.5	0.2	0.1	0.5	0.2	1.0	0.6
		Bottom Depth (m):			0.4		0.4	0.2	0.6			
		Date Sampled:			26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022
		Asbestos Lab:			DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	62	5.8	< 5.0	86	32	7.8		
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	38	< 1.0	< 1.0		
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	13	< 1.0	280	< 1.0	33		
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	13	< 5.0	310	< 5.0	33		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	62	19	< 10	400	32	41		
pH	M	2010		4.0	6.4	7.8	8.9	7.4	6.6	6.9	7.8	6.0
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.088	0.14	0.019	0.029	0.032	0.063	0.041	0.024
ACM Type	U	2192		N/A	-	-	-	-	-	-		
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		
Moisture	N	2030	%	0.020	12	10	21	27	15	29	14	30
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Black	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	None	Stones	None	Stones	None	Roots	None	None
Soil Texture	N	2040		N/A	Clay	Loam	Clay	Clay	Clay	Loam	Clay	Clay
Sulphate (Total)	U	2430	%	0.010	0.012	0.011	0.014	0.068	0.011	0.043		
Organic Matter	M	2625	%	0.40	1.1	< 0.40	0.81	13	2.2	12		
Demeton-O	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Phorate	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Demeton-S	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Disulfoton	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Fenthion	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Trichloronate	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Prothiofos	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Fensulphothion	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Sulprofos	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Azinphos-Methyl	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Coumaphos	N	2820	mg/kg	0.20				< 0.20		< 0.20		
Atraton	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Prometon	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Simazine	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Atrazine	N	2830	mg/kg	0.20				< 0.20		< 0.20		

Results - Soil

Project: Yew Tree

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			22-16031	22-16031	22-16031	22-16031	22-16031	22-16031	22-16031	22-16031
Quotation No.:		**Chemtest Sample ID.:**			1420350	1420351	1420352	1420353	1420354	1420355	1420356	1420357
		Sample Location:			WS01	WS02	WS03	WS07	WS06	WS08	WS08	WS01
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.2	2.5	0.2	0.1	0.5	0.2	1.0	0.6
		Bottom Depth (m):			0.4		0.4	0.2	0.6			
		Date Sampled:			26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022	26-Apr-2022
		Asbestos Lab:			DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Propazine	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Terbuthylazine	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Secbumeton	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Simetryn	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Ametryn	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Prometryn	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Terbutryn	N	2830	mg/kg	0.20				< 0.20		< 0.20		
Alpha-HCH	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Gamma-HCH (Lindane)	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Beta-HCH	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Delta-HCH	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Heptachlor	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Aldrin	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Heptachlor Epoxide	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Gamma-Chlordane	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Alpha-Chlordane	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Endosulfan I	N	2840	mg/kg	0.20				< 0.20		< 0.20		
4,4-DDE	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Dieldrin	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Endrin	N	2840	mg/kg	0.20				< 0.20		< 0.20		
4,4-DDD	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Endosulfan II	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Endrin Aldehyde	N	2840	mg/kg	0.20				< 0.20		< 0.20		
4,4-DDT	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Endosulfan Sulphate	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Methoxychlor	N	2840	mg/kg	0.20				< 0.20		< 0.20		
Endrin Ketone	N	2840	mg/kg	0.20				< 0.20		< 0.20		

Results - Soil

Project: Yew Tree

Client: Rogers Geotechnical Services Ltd			**Chemtest Job No.:**		22-16031
Quotation No.:			**Chemtest Sample ID.:**		1420358
			Sample Location:		WS03
			Sample Type:		SOIL
			Top Depth (m):		1.2
			Bottom Depth (m):		
			Date Sampled:		26-Apr-2022
			Asbestos Lab:		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Cadmium	M	2455	mg/kg	0.10	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	
Copper	M	2455	mg/kg	0.50	
Mercury	M	2455	mg/kg	0.05	
Nickel	M	2455	mg/kg	0.50	
Lead	M	2455	mg/kg	0.50	
Zinc	M	2455	mg/kg	0.50	
Vanadium	U	2455	mg/kg	0.5	
Arsenic	M	2455	mg/kg	0.5	
Selenium	M	2455	mg/kg	0.25	
Cyanide (Free)	M	2300	mg/kg	0.50	
Total Phenols	M	2920	mg/kg	0.10	
Naphthalene	M	2700	mg/kg	0.10	
Acenaphthylene	M	2700	mg/kg	0.10	
Acenaphthene	M	2700	mg/kg	0.10	
Fluorene	M	2700	mg/kg	0.10	
Phenanthrene	M	2700	mg/kg	0.10	
Anthracene	M	2700	mg/kg	0.10	
Fluoranthene	M	2700	mg/kg	0.10	
Pyrene	M	2700	mg/kg	0.10	
Benzo[a]anthracene	M	2700	mg/kg	0.10	
Chrysene	M	2700	mg/kg	0.10	
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	
Benzo[a]pyrene	M	2700	mg/kg	0.10	
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	
Total Of 16 PAH's	M	2700	mg/kg	2.0	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	

Results - Soil

Project: Yew Tree

Client: Rogers Geotechnical Services Ltd			**Chemtest Job No.:**		22-16031
Quotation No.:			**Chemtest Sample ID.:**		1420358
			Sample Location:		WS03
			Sample Type:		SOIL
			Top Depth (m):		1.2
			Bottom Depth (m):		
			Date Sampled:		26-Apr-2022
			Asbestos Lab:		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	
pH	M	2010		4.0	6.6
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.020
ACM Type	U	2192		N/A	
Asbestos Identification	U	2192		N/A	
Moisture	N	2030	%	0.020	18
Soil Colour	N	2040		N/A	Brown
Other Material	N	2040		N/A	None
Soil Texture	N	2040		N/A	Clay
Sulphate (Total)	U	2430	%	0.010	
Organic Matter	M	2625	%	0.40	
Demeton-O	N	2820	mg/kg	0.20	
Phorate	N	2820	mg/kg	0.20	
Demeton-S	N	2820	mg/kg	0.20	
Disulfoton	N	2820	mg/kg	0.20	
Fenthion	N	2820	mg/kg	0.20	
Trichloronate	N	2820	mg/kg	0.20	
Prothiofos	N	2820	mg/kg	0.20	
Fensulphothion	N	2820	mg/kg	0.20	
Sulprofos	N	2820	mg/kg	0.20	
Azinphos-Methyl	N	2820	mg/kg	0.20	
Coumaphos	N	2820	mg/kg	0.20	
Atraton	N	2830	mg/kg	0.20	
Prometon	N	2830	mg/kg	0.20	
Simazine	N	2830	mg/kg	0.20	
Atrazine	N	2830	mg/kg	0.20	

Results - Soil

Project: Yew Tree

Client: Rogers Geotechnical Services Ltd			**Chemtest Job No.:**		22-16031
Quotation No.:			**Chemtest Sample ID.:**		1420358
			Sample Location:		WS03
			Sample Type:		SOIL
			Top Depth (m):		1.2
			Bottom Depth (m):		
			Date Sampled:		26-Apr-2022
			Asbestos Lab:		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Propazine	N	2830	mg/kg	0.20	
Terbuthylazine	N	2830	mg/kg	0.20	
Secbumeton	N	2830	mg/kg	0.20	
Simetryn	N	2830	mg/kg	0.20	
Ametryn	N	2830	mg/kg	0.20	
Prometryn	N	2830	mg/kg	0.20	
Terbutryn	N	2830	mg/kg	0.20	
Alpha-HCH	N	2840	mg/kg	0.20	
Gamma-HCH (Lindane)	N	2840	mg/kg	0.20	
Beta-HCH	N	2840	mg/kg	0.20	
Delta-HCH	N	2840	mg/kg	0.20	
Heptachlor	N	2840	mg/kg	0.20	
Aldrin	N	2840	mg/kg	0.20	
Heptachlor Epoxide	N	2840	mg/kg	0.20	
Gamma-Chlordane	N	2840	mg/kg	0.20	
Alpha-Chlordane	N	2840	mg/kg	0.20	
Endosulfan I	N	2840	mg/kg	0.20	
4,4-DDE	N	2840	mg/kg	0.20	
Dieldrin	N	2840	mg/kg	0.20	
Endrin	N	2840	mg/kg	0.20	
4,4-DDD	N	2840	mg/kg	0.20	
Endosulfan II	N	2840	mg/kg	0.20	
Endrin Aldehyde	N	2840	mg/kg	0.20	
4,4-DDT	N	2840	mg/kg	0.20	
Endosulfan Sulphate	N	2840	mg/kg	0.20	
Methoxychlor	N	2840	mg/kg	0.20	
Endrin Ketone	N	2840	mg/kg	0.20	

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Al kaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2820	Organophosphorus (O-P) Pesticides in Soils by GC-MS	Organophosphorus pesticide representative suite including Parathion, Malathion etc, plus client specific determinands	Dichloromethane extraction / GC-MS
2830	Organonitrogen (O-N) Pesticides in Soils by GC-MS	Organonitrogen pesticide representative suite including Triazines etc, plus client specific determinands	Dichloromethane extraction / GC-MS
2840	Organochlorine (O-Cl) Pesticides in Soils by GC-MS	Organochlorine pesticide representative suite including DDT and its metabolites, 'drins' and HCH etc, plus client specific determinands	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

End of Report

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Near Bank, Shelley, Huddersfield, HD8 8LU

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Company No: 5130864

Environmental Geotechnical Specialists

Appendix 9

Soil Screening Values

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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	3.62	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	8.54		A
2	Chrysene	0.44	585	2.64	927	A
2	Benzo(b)fluoranthene	1.22	7.72	7.29	9.86	A
2	Benzo(k)fluoran hene	0.686	84.4	4.12	100	A
2	Benzo(a)pyrene	1.51	4.95	0.998	5	B/C
2	Dibenzo(a,h)anthracene	0.00393	0.838	2.05	4.95	A*
2	Indeno(1,2,3-cd)pyrene	0.0614	7.31	0.368	9.75	A
2	Benzo(g,h,i)perylene	0.0187	96.2	0.112	103	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+

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.

Appendix 10

Site Photographs

Rogers Geotechnical Services Ltd Telephone 0843 50 666 87 Fax 0843 51 599 30
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Photo 1: TP06A

Photo 2: Bound macadam material recovered in TP06A.

Photo 3: Brick lined feature.

Photo 4: Feature had no distinct foundation and the inside was filled with soil.