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PHASE 2 GEO-ENVIRONMENTAL REPORT

job number C2213/21/E/3266	date 12.07.22

site address
Site A - Yew Tree Road/Burn Road
Birchencliffe,
Huddersfield, HD2 2EQ
Planning ref: 2021/61/94363/W

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Report on a Phase 2 Geo-environmental Investigation

Location:	Site A, Yew Tree Road & Burn Road Birchencliffe, Huddersfield,HD2 2EQ
For:	North Park (Shelley) Ltd.
Report No.	C2213/21/E/3266 Report date: July 2022
Planning Application No:	2021/61/94363/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	that localised deposits of made ground was identified in some areas of the site This material shows considerable variability These deposits do not appear to be laterally continuous across the site This investigation has concluded that the natural strata conditions across the site show some variability, which is largely attributed to the change in geology across the site, and also may be intrinsically linked to the faulting within the area.	6.0
Groundwater	Encountered at depths ranging between 3m and 9m 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 piles.	11.
Effect of Sulphates	DC-1 concrete.	11.5
Contamination	Localised PAH contamination identified within the topsoil. Some remediation will be required	12.1
Gas	Gas monitoring is ongoing. Initial readings would suggest that CS2 conditions will be met, such that gas protection measures will be required.	12.1.2

[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 A' 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. Site A forms the western 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 north-western corner, adjacent to 208 Yew Tree Road; the eastern field, referred to as 'Site B', 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. Desk Study

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. 2550/1, November 2016.

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

- This 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). 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.

- It should be noted that the report makes reference to fly tipped waste, but such materials have been stockpiled to the rear (south) of the site.

3.2 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. That assessment was mainly related to 'site B'. However, there remains some risk, albeit likely low, 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.

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4. Fieldworks

The fieldworks was undertaken in the spring and early summer of 2022[2], over numerous visits and included the following:

- Six windowless sample boreholes (WS01 – WS06).
- Standard penetration tests within three boreholes (WS01, WS05, WS06).
- Dynamic probes from surface within three boreholes (WS02, WS03, WS04).
- Three gas monitoring standpipes (WS01, WS03, and WS05).
- Six water flush rotary open hole boreholes to prove presence of potential coal workings (R01, R02, R04, R05, R07, R08).
- Four machine excavated trial pits.
- Two machine excavated trial pits for soakaway tests.

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 A 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.

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.

[2] The site was observed to be very wet and boggy during the Spring, which inhibited completing the program of site investigation.

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4.3 Standard Penetration Tests

Standard penetration tests (SPT) were undertaken at regular depth increments within windowless sample borehole WS01, WS05 and WS06. 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 WS02, WS03 and WS04, 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 2.1m and 3.1m depth in WS01, WS03 and WS05, 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

6 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 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 6 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

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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 at locations TPSA01 and TPSA02. 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.

5. Geology

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

Table 1: Geological Data for the Site

Strata Type	Strata Name[3]	Previous Name[4]	Description[3]
Superficial Geology	No superficial deposits recorded.		
Solid Geology	Stanningley Rock (Northern majority of site)		Fine-grained, thinly bedded, commonly ganisteroid sandstone
	Pennine Lower Coal Measures Formation (Southern extent of site)		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

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

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the site is underlain by Stanningley Rock Sandstone. It should be noted that the local area is heavily faulted, which somewhat complicates 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 at a maximum thickness of 0.6m is unlikely to be of any significance with respect to 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.

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 – 0.4	TOPSOIL (Firm dark brown slightly sandy silty CLAY with rare gravel of plastic and glass).	WS02, WS03, WS04 TP02, TP03, TP04 TPSA 01, TPSA 02	None
+4.0	Residual Cohesive soils Firm greyish brown sandy gravelly laminated CLAY. Gravel is angular to sub rounded fine to coarse of relict sandstone. [Residual Stanningley Rock] Or Residual Cohesive soils (Typically Firm locally stiff gravelly silty CLAY. Gravel is sub angular to rounded medium to coarse of sandstone and rare coal) [Pennine Lower Coal Measures Formation]	WS02, WS03, WS04 TP01, TP02, TP04 WS07, WS08, TP03, TPSA 04	None
+4.0	Locally: Potentially reworked Cohesive soils 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.	WS05, WS06	None
+15 - +30	Interbedded horizons of Sandstone and Mudstone [Pennine Lower Coal Measures Formation]	RO1, RO2, RO4, RO5, RO7, RO8	3.0 (RO3, RO8) 4.0 (RO7) 8.0 (RO5) 9.0 (RO2)

'+' 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

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6.1 General Strata

Firstly, it should be appreciated that localised deposits of made ground was identified in some areas of the site (WS01 – 1.0m bgl, WS02 – 2.85m bgl, WS03 – 1.05m bgl, TP01 – 0.45m bgl, TPSA01, 0.4m bgl, TPSA 02 – 1.1m bgl). This material shows considerable variability in composition between investigation locations, albeit is largely present as a soft to stiff gravelly cohesive soil. In some locations, anthropogenic inclusions of ceramic brick and concrete were observed. These deposits do not appear to be laterally continuous across the site, and therefore are likely to represent localised lenses of material, possibly attributed to previous structures or anthropogenic activity on the site previously.

This investigation has concluded that the natural strata conditions across the site show some variability, which is largely attributed to the change in geology across the site, and also may be 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.

With this regard, under 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 (WS02, WS03, WS04, TP01, TP02, TP04). These soils largely consisted of soft to firm (locally stiff) silty clays. It is suggested that these soils can be attributed to the upper weathered fraction of the Stanningley Rock.

Typically, in the central and southern quadrants of the site, cohesive soils were noted to contain gravels 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.

Groundwater strikes were recorded between 3m and 9m 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 - 25	Soils in a firm in-situ condition. Locally, stiff conditions have also been identified.
Residual cohesive soils (Pennine Lower Coal Measures Formation)	2 – 2.45		40	Soils in a stiff in-situ condition.
Extremely weak SANDSTONE/ SILTSTONE	3 – 3.45	+50		SPT 'N' value of + 50 blows indicates refusal.

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)[5]	Comments
	0 - 2	3 - 10	10+		
	Depth to which blow count range was observed (m)				
DP02	1.4	4.1	4.4	Abrupt.	Typically low blow counts recorded to around 1.4m bgl. followed by a variable becoming higher blow counts recorded until abrupt refusal is met.
DP03	1.8	2.1	2.6	Abrupt	Typically low low counts recorded to depths of around 1.8m, at which point a significant increase in blow count is met before refusal is encountered.
DP04	1.0	3.1	3.5	Abrupt.	Typically low blow counts recorded to around 1.0m bgl. followed by a variable becoming higher blow counts recorded until abrupt refusal is met.

[5] 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)
WS01	14.04.22	0.1	1.3	20.4	0.2	1001↑	0.97	3.1
	22.04.22	0.1	1.4	20.5	0.4	992↓	0.95	
	29.04.22	0.1	1.4	20.7	0.0	1012↓	1.13	
	06.05.22	0.1	1.7	20.1	0.1	1002↓	1.26	
	21.06.22	0.1	6.9	15.3	0.0	994↔	1.98	
WS03	14.04.22	0.1	0.9	19.3	2.1	1001↑	0.95	2.1
	22.04.22	0.1	0.6	21.2	1.2	993↓	0.20	
	29.04.22	0.1	4.0	21.2	0.0	1013↓	0.31	
	06.05.22	0.1	0.9	20.5	0.0	1003↓	0.49	
	21.06.22	0.0	1.2	19.8	0.4	994↔	1.00	
WS05	14.04.22	0.1	0.4	20.8	0.2	1001↑	0.65	3.0
	22.04.22	0.1	0.2	20.8	0.2	993↓	0.63	
	29.04.22	0.1	0.6	20.9	0.1	1013↓	0.77	
	06.05.22	0.1	0.6	20.5	0.2	1003↓	1.11	
	21.06.22	0.0	2.8	17.3	0.0	995↔	1.68	

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

This work was undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 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
TAPSA01	1.7 x 2.2	1.9 – 2.5	Stiff brown mottled grey slightly sandy slightly gravelly CLAY	*	Practically Impermeable
TAPSA02	2.5 x 1.6	2.04 – 2.5	Stiff brown mottled grey slightly sandy slightly gravelly CLAY	*	Practically Impermeable

*Based on the most onerous results for each test.

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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.

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	4	13% - 20%		Modified water contents fall within the same value range.
Index properties (1 Point)	4	LL PL PI	40% - 49% 18% - 24% 22% - 25%	Clay of low to intermediate plasticity. Consistency index 1.0 – 1.2 NHBC Class – Medium.
Soluble sulphate & pH	6	SO_4 pH	0.019 – 0.14g/l 5.2 – 8.9	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[6] of 25% could be employed, which suggests an f_1 value of 4.5 and an f_2 value of 0.45.

[6] See paragraph 6.2 'Index Property Tests'

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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)

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.

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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 to Moderate

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

There remains some risk of unrecorded mine entries of exploratory shafts, albeit the risk is deemed to be low. 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.

10.4 Risks Posed by Migration of Hazardous Ground Gas

In this case, it is evidence that shallow mining are 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 CS2 conditions have been identified. As such, a low to moderate risk rating has been assigned; 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 lithorelicts (coal, carbonaceous mudstone, sandstone and siltstone) with little obvious structure.

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 made ground, 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, as well as prevention of positioning footings in localised deposits of made ground.

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.

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

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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 made ground beneath the site has 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 the Chapter 4.2 of the NHBC standards[7]. 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[8], 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.

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

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In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[9], which can be found in Part D, *Specifying concrete for general cast-in-situ use,* of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-1 is required.

11.7 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 site A. 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 A' 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 0.81% and 13%. On this basis, it is considered that the screening values associated with 1% SOM should be adopted (as these values are considered the most conservative). 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[10] 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)
WS01	0.2	Aliphatic TPH >C12-C16
WS02	2.5	
WS03	0.2	
WS06	0.5	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

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

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TP03	0.6	Benzo[a]anthracene, Chrysene, Benzo[k]fluoranthene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene
TP04	0.3	Chrysene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene

Concentrations of chromium^{VI}, total phenols, free cyanide and total petroleum hydrocarbons (aliphatic C5 to C10; aromatic C5 to C21) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values. In addition, no asbestos was detected within the 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[11]. 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)
WS01	0.2	
WS02	2.5	
WS03	0.2	
WS06	0.5	Naphthalene, Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[a]pyrene, Indeno(1,2,3-c,d)Pyrene, Benzo[g,h,i]perylene
TP03	0.6	Dibenz(a,h)Anthracene
TP04	0.3	Dibenz(a,h)Anthracene

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 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 0.2% and 6.9%, in association with oxygen levels of between 15.3% and 21.2%. 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 2.1 litres per hour was recorded and will be employed in the following calculations.

[11] 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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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 992mb 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 6.9% (0.069) carbon dioxide, in association with a maximum flow rate of 2.1 l/hr. This results in a GSV of 0.0021 l/hr for methane and a GSV of 0.15 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 2.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)[12]. Accepting that the proposed development is of high sensitivity and that the generation potential is 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 2. One further monitoring visits 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[13] advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.[14] This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'[15]

[12] Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings, p60.*
[13] R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.
[14] The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.
[15] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

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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.

The results of the risk assessment are presented in Table 13.

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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 a residential estate with 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 likely 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 edible plants or contained water sources in the area of the proposed new works.	N/A	Some contamination is present underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways. However, the contamination at the site is considered to be of limited mobility, therefore the likelihood of contamination affecting neighbouring gardens is considered low risk.
	End User	Yes – contamination 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 2*). Gas monitoring is ongoing.	Moderate	Concentrations of harmful gases (methane and carbon dioxide) were detected at the site. Gas precautionary measures are deemed to be required. Gas monitoring is currently ongoing.
	End User		Moderate	
	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	No – Not in a radon affected area.	N/A	Less than 1% of properties are above the action level. No radon protection measures required.
	End User			

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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 operatives and end users from elevated levels of ground gas, specifically carbon dioxide.
- 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 A’ 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 determinand specification contamination testing may be necessary.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1.

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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.

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

In order to achieve this score the following shall be undertaken.

Table 14: Combination of protection elements (BS8485: 2015) for CS2

Reference	Protection Element	Score
Table 5	Precast suspended segmental subfloor (i.e. beam and block)	0
Table 6 *Either option is appropriate*	Passive sub-floor dispersal layer: good performance (**Note 1**) (see Annex B of the Code for detail)	*1.5*
Table 7	*Gas resistant membrane complying with the requirements given in Table 7 (**Note 2**)*	2
	Total Score	**Max: 3.5**

Note 1:
As beam and block floors are likely to be adopted at this site it is considered that a clear void with air bricks in the external walls be utilised. The details of the system to be implemented shall be included on the technical drawings provided by the engineer/architect.

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Note 2:
The gas resistant membrane shall meet the following criteria:

- Sufficiently impervious (methane gas transmission rate <40.0ml/day/m^2/atm (average) BS ISO 15105-1 manometric method).
- Sufficiently durable and strong to remain serviceable for the anticipated life of the building, to withstand in-service stresses and installation process.
- Capable, after installation, of providing a complete barrier to the entry of the relevant gas.
- Verified in accordance with CIRIA C735: 2014: *Good practice on the testing and verification of protection systems of buildings against hazardous ground gasses.*

In addition to the above, the following points shall be considered.

- Technical drawings of the incorporation of the gas protection measures into the sub-structure will be provided by a suitably qualified engineer/architect and produced in accordance with the guidance given in BRE 414.
- The sequence of construction indicating when the gas protection system will be installed will be included with the remediation statement. Where possible the installation of membranes will take place as a unique activity on site and shall not take place until sub-structure construction is complete.
- During and following the installation of the membrane, all parties in attendance at the site shall be made aware that a gas protection system is to be employed within the construction. Such communications should include, but not be limited to, the CDM documentation for the site and site inductions.
- The installation of the membrane shall be carried out only by suitable personnel and the qualifications or experience/training will be included as part of the remediation statement. The suitability of personnel will be assessed in accordance with Annex 1 of CIRIA C735.
- The installation shall be in strict accordance with manufacturer specifications and recommendations, which shall also be included as part of the remediation statement.
- The membrane system employed will not be an ensemble (i.e. a system comprising a mixture of products from different manufacturers will not be employed).
- Membranes shall be supplied to site on a single wound roll, creased product will not be accepted or employed.
- Whilst membranes are exposed, signage will be provided to indicate the access to the installation area is prohibited unless authorised. Footwear will be checked prior to accessing the membrane surface to ensure no sharp objects are apparent, such as stones caught in treads. The use of sharp objects or hot-works around the exposed membrane will be strictly prohibited unless the risk of damaging the membrane has been full assessed and mitigated.
- Non-conformance of manufacturer recommendations shall be discussed and agreed as acceptable, in writing, with a suitably qualified person from the manufacturer.

Verification of the installation of the gas protection system will be carried out on each plot, unless agreed with any statutory authorities prior to construction.

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.

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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[16] documentation and may be used as a guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

Table 15: Validation Sampling and Testing

Fill Type	Frequency	Minimum Determinands
Virgin Quarried Material	**1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.**	**Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn)**
Crushed Hardcore, Stone, Brick	Minimum 1 per 500m³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH. 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)..

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

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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 16: 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.

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

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reference boards to prove the location and date taken. A measurement reference should be visible in the photographs to substantiate the thickness of material placed. Please note that it may also be necessary to undertake a topographical survey and the requirement for which should be checked with any statutory authorities.

- Evidence that suitable gas protection measures have been implemented and installed in accordance with manufacturer's instructions. The evidence should also demonstrate that all joints and penetrations have been adequately sealed.

The 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.

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.
- Discussions with contractors in relation to the suitability of materials and installation methods for gas barriers, if required.
- 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

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Appendix 1

Site Plan

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LEGEND

- SITE A
- Trial Pit (SITE A)
- Windowless Sample (SITE A)
- Rotary Open Hole (SITE A)

FOR INFORMATION

Yew Tree Road/Burn Road - SITE B
Birchencliffe, Huddersfield, HD2 2EQ

BOREHOLE LOCATION PLAN

Environmental Geotechnical Specialists

JOB NUMBER: C2113/21/E/3266

DATE: 07.07.2022

DRAWING NUMBER: 01

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- SITE A
- Trial Pit (SITE A)
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FOR INFORMATION

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BOREHOLE LOCATION PLAN

RGS Environmental Geotechnical Specialists

JOB NUMBER: C2113/21/E/3266

DATE: 07.07.2022

DRAWING NUMBER: 01

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:

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Appendix 3

Windowless Sample Borehole Records

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Borehole Log

Borehole No. **WS01**

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: 08/04/2022	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
		0.20 - 0.40	ES							MADE GROUND. (Stiff brown mottled dark and light brown sandy gravelly CLAY. Gravel is angular to sub rounded fine to coarse of sandstone, mudstone and coal. Band of coarse angular sandstone gravel from 0.42-0.45m).
		0.60	D	85	100		0.45			
		1.00	SPT			N=13 (2,2/2,3,4,4)	0.90			
		1.20	D				1.00			MADE GROUND. (Firm light yellowish brown mottled grey slightly sandy gravelly CLAY. gravel is angular to sub rounded fine to coarse of sandstone and coal.) [Reworked cohesive material]
				75	100		1.30 1.50			
		2.00	SPT			N=40 (3,4/6,6,5,23)				MADE GROUND. (Dark grey slightly sandy slightly gravelly silty CLAY. Occasional plant matter. Organic and decomposition odour.) [Possible relict topsoil]
				65	100		2.30			Firm brown mottled grey slightly sandy gravelly CLAY. Gravel is angular to sub rounded fine to coarse of sandstone, mudstone and coal.
		3.00	SPT	55	100	N=65 (18,13/14,13,18,20)	3.44			Firm brown mottled grey sandy slightly gravelly CLAY. Gravel is angular to sub rounded fine to coarse of sandstone, mudstone and coal.
										Firm light brown mottled light grey very sandy slightly gravelly laminated CLAY. Gravel is angular to sub rounded fine to coarse of relict sandstone. [relict sandstone]
										Extremely weak greyish brown completely weathered thickly laminated to very thinly bedded SANDSTONE recovered as slightly gravelly fine to coarse sand. Gravel is angular to sub angular of relict sandstone. STANNINGLEY ROCK]

End of Borehole at 3.44m

Remarks

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

Borehole Log

Borehole No. **WS02**

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: 08/04/2022	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
				85	100		0.40			TOPSOIL. (Dark grey slightly sandy gravelly CLAY. Occasional plant matter.)
							1.00			MADE GROUND (Firm light yellowish brown mottled grey slightly sandy gravelly CLAY. gravel is angular to sub rounded fine to coarse of sandstone and coal.) [Reworked cohesive material]
				75	100					Firm to stiff mixed dark brown and grey sandy gravelly CLAY. Gravel is angular to sub rounded fine to coarse of sandstone and coal. Hydrocarbon odour from 2.00m, visible sheen on gravel from 2.50m).
		2.50	ES	65	100					
				55	100		2.85			Firm greyish brown sandy gravelly laminated CLAY. Gravel is angular to sub rounded fine to coarse of relict sandstone. [Residual Stanningly Rock]
							3.30			Yellow gravelly fine to coarse SAND. Gravel is fine to medium of relict sandstone. [Residual Stanningly Rock]
							3.35			Stiff 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]
							4.00			End of Borehole at 4.00m

Remarks

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

Borehole Log

Borehole No.
WS03
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: 08/04/2022	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
		0.20 - 0.40	ES				0.15			TOPSOIL. (Dark grey slightly sandy gravelly CLAY. Occasional plant matter.)
				85	100		0.50			MADE GROUND. (Firm light yellowish brown mottled grey slightly sandy gravelly CLAY. Gravel is angular to sub rounded fine to coarse of sandstone and coal. Rare plant rootlets.)
		1.20	D	75	100		1.05			MADE GROUND. (Stiff mixed brown and grey slightly sandy gravelly CLAY. Gravel is angular to sub rounded fine to coarse of sandstone and coal.)
							2.00			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]

End of Borehole at 2.00m

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

Borehole Log

Borehole No. **WS04**

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: 08/04/2022	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
							0.25			TOPSOIL (Brown slightly organic silty fine SAND)
		1.00	D	85	100					Firm dark brown mottled grey silty CLAY with rare rootlets and rare angular tabular gravels of sandstone. [Residual Stanningly Rock]
				75	100		1.70			Firm dark brown locally dark grey gravelly silty CLAY. Gravel is angular tabular fine of siltstone and rare coal. [Residual Pennine Lower Coal Measures Formation]
				65	100		2.40			Stiff/hard friable thinly laminated dark grey silty CLAY with rare angular tabular fine to medium siltstone lithorelicts. [Residual PLCM]
							3.00			End of Borehole at 3.00m

Remarks

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

Borehole Log

Borehole No.
WS05
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 CM

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.50	D	85	100		0.75			Firm orangish brown mottled light grey silty CLAY [Residual Pennine Lower Coal Measures Formation]
		1.00 1.00	SPT			HVP=55 N=9 (2,2/2,3,2,2)				Stiff dark grey locally mottled dark brown slightly gravelly silty CLAY. Gravel is sub angular tabular fine to medium of mixed sandtone and rare coal/ carbonaceous mudstone flecks [Residual Pennine Lower Coal Measures Formation] [Possibly reworked - fault zone 'gauge']
	▼	1.50		75	100		1.45			
		2.00 2.00	SPT			HVP=67 N=34 (5,7/8,9,8,9)				Firm locally stiff thinly laminated dark blush grey silty CLAY with rare angular tabular fine siltstone lithorelicts [[Residual Pennine Lower Coal Measures Formation] [Possibly reworked - fault zone 'gauge']
				65	100		2.60			Extremely weak thinly to thickly laminated dark grey micaceous SILTSTONE
		3.00	SPT			N=51 (7,7/10,12,16,13)	3.45			End of Borehole at 3.45m

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

Borehole Log

Borehole No.
WS06
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 CM

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.00		85	100					Firm locally stiff dark brown mottled orangish brown brown light grey and ark grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is sub rounded to angular fine to medium of mixed lithologies including sandstone siltstoen rare coal rare carboaceous mudstone. Rare angular tabular cobbles of sandstone at 0.65m and 1.45m. Rare rounded quartzite gravel at 2.35m) [Residual Pennine Lower Coal Measures Formation] [Possibly reworked - fault zone 'gauge']
		1.00	SPT			N=16 (2,3/3,5,4,4)				
				75	100					
		2.00	SPT			N=24 (3,4/8,6,4,6)				
				65	100					
							3.00			End of Borehole at 3.00m

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

Appendix 4

Dynamic Probes

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

Probe Log

Probe No. **DP02** 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 4.25m
	Probe Type	DPSH-B	

Probe Log

Probe No. **DP03** 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	2.6m
Probe Type	DPSH-B		

Probe Log

Probe No. **DP04** 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: 20/12/2021	Logged By AB

Remarks:	Fall Height	750mm	Cone Base Diameter 50.5mm
	Hammer Wt	63.5kg	Final Depth 3.5m
	Probe Type	DPSH-B	

Appendix 5

Rotary Borehole Records

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

Borehole Log

Borehole No. **RO1**

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
					0.30			Dark Brown CLAY (Drillers notes) [Residual Pennine Lower Coal Measures Formation]
								Light Brown SANDSTONE (Drillers Notes) [Stanningly Rock]
					8.00			Light brown grading into light cream SANDSTONE (Drillers Notes) (Hard Drilling) [Stanningly Rock]
								Continued on Next Sheet

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to3m.
3) DAYWORKS: Borehole set-up 1hrs, Fetching water 0.5 hrs,

5) Borehole backed filled with Gravel.

Borehole Log

Borehole No.
RO1
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	
									11
					12.00			Light grey becoming dark grey MUDSTONE (Drillers Notes)	12
									13
									14
					15.00			End of Borehole at 15.00m	15
									16
									17
									18
									19
									20

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to3m.
3) DAYWORKS: Borehole set-up 1hrs, Fetching water 0.5 hrs,

5) Borehole backed filled with Gravel.

Borehole Log

Borehole No.
RO2
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: 09/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
								TOPSOIL (Drillers Notes)	
					0.50			Dark brown CLAY (Drillers Notes)	1
					2.00				2
					2.10			Obstruction (Possible concete pad) (Drillers Notes)	
								Dark brown CLAY (Drillers Notes)	
					3.00			Light brown SANDSTONE (Drillers Notes) [Stanningly Rock]	3
									4
									5
									6
									7
					8.00			Light grey MUDSTONE (Drillers Notes)	8
	▼	9.00							9
									10

Continued on Next Sheet

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) Borehole backed filled with Gravel

Borehole Log

Borehole No. **RO2**

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: 09/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
									11
					12.00			Water Strike. Material recovered of coarse gravel of SANDSTONE (Hard Drilling noted within this horizon. No loss of flush or drilling resistance)	12
					13.00			Very dark grey MUDSTONE (Drillers Notes)	13
									14
					15.00			Dark grey MUDSTONE (Drillers Notes)	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) Borehole backed filled with Gravel

Borehole Log

Borehole No.
RO2
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: 09/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
									21
									22
									23
									24
									25
									26
									27
									28
									29
					30.00			End of Borehole at 30.00m	30

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
3) Borehole backed filled with Gravel

Borehole Log

Borehole No.
RO4
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	
								Dark brown CLAY (Drillers Notes)	1, 2
					2.50			Dark brown grading to light brown SANDSTONE (Drillers Notes)	
	▼	3.00			3.00			Light brown SANDSTONE (Drillers Notes)	3, 4, 5
					6.00			Light grey MUDSTONE (Drillers Notes)	6, 7, 8, 9, 10

Continued on Next Sheet

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
4) DAYWORKS: Borehole set-up 1hrs, Fetching water 1hrs,

5) Borehole backed filled with Gravel/Arisings/Installation and re-instated like-for-like/With flush cover.

Borehole Log

Borehole No. **RO4**

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
					14.00			Very white very hard SANDSTONE. (Drillers Notes)	14
									15
					16.00			Very dark grey grading to black carbonaceous MUDSTONE (Drillers Notes)	16
									17
									18
									19
					20.00			Continued on Next Sheet	20

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
4) DAYWORKS: Borehole set-up 1hrs, Fetching water 1hrs,

5) Borehole backed filled with Gravel/Arisings/Installation and re-instated like-for-like/With flush cover.

Borehole Log

Borehole No.
RO4
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	
								Light grey MUDSTONE (Drillers Notes)	21 22 23 24 25 26 27 28 29
					30.00			End of Borehole at 30.00m	30

Remarks

1) Cat scanned prior to breaking ground - no services identified.
2) Casing installed to 3m.
4) DAYWORKS: Borehole set-up 1hrs, Fetching water 1hrs,

5) Borehole backed filled with Gravel/Arisings/Installation and re-instated like-for-like/With flush cover.

Borehole Log

Borehole No. **RO5**

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)	11, 12, 13
					14.00			Dark grey MUDSTONE (Drillers Notes)	14
					15.00			End of Borehole at 15.00m	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.
RO7
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: 30/05/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								TOPSOIL (Drillers notes)
					0.50			Light brown CLAY (Drillers notes)
					1.00			Dark brown CLAY (Drillers notes)
					2.50			Light grey MUDSTONE (Drillers notes)
	▼	4.00						

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. **RO7**

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: 30/05/2022	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
	▼	15.00			15.00			Light grey MUDSTONE (Drillers notes)	15
									16
									17
									18
									19
								Continued on Next Sheet	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. **RO7** 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: 30/05/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
									21
									22
									23
									24
									25
									26
									27
									28
									29
					30.00			End of Borehole at 30.00m	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. **RO8**

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: 06/06/2022	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			3.00			Dark brown SANDSTONE (Drillers notes)
					4.00			Light brown SANDSTONE (Drillers notes)
					4.40			GRAVEL of sandstone (slow drilling) (Drillers notes)
					5.80			Medium strong to strong light yellowish brown locally white coarse-grained quartz rich SANDSTONE (Possible ganiseroid) (Hard drilling, poor core recovery)
					7.50			Dark grey / black 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.
RO8
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: 06/06/2022	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
					15.00			Dark grey becoming light grey MUDSTONE (Drillers notes)	15
									16
									17
									18
									19
								Continued on Next Sheet	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.
RO8
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: 06/06/2022	Logged By ABK

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
									21
									22
									23
									24
									25
									26
									27
									28
									29
					30.00			End of Borehole at 30.00m	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
TPSA 01
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords: - Level:	Date 07/06/2022
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Dimensions (m): 2.2 × 1.7 Depth 2.50	Scale 1:50
Client: North Park Shelley Ltd			Logged SA

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.15			TOPSOIL (Dark grey slightly clayey slightly gravelly fine to coarse SAND with plant matter. Gravel is angular to sub rounded fine to coarse of sandstone, mudstone, coal, brick and concrete. Common plant and tree roots. Occasional plastic, ceramic, wire and paper).
				0.40			MADE GROUND (Yellowish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone, mudstone, coal, brick, and concrete. Common plant matter, rootlets, and tree bark. Rare ceramic.) [Fill. Noted to become deeper towards the east, to approximately 0.80m].
							Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular and fine to coarse of siltstone and mudstone. [Completely weathered mudstone and siltstone].
				2.50			End of pit at 2.50 m

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

Stability: sTABLE

Trial Pit Log

Trialpit No
TPSA 02
Sheet 1 of 1

Project Name: Yew Tree Rd/Burn Rd	Project No. C2113/21/E/3266	Co-ords: - Level:	Date 07/06/2022
Location: Birchencliffe, Huddersfield, , HD2 2EQ		Dimensions (m): 2.5 × 1.6 Depth 2.50	Scale 1:50
Client: North Park Shelley Ltd			Logged SA

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.15			TOPSOIL (Grey slightly clayey slightly gravelly fine to coarse SAND with plant matter. Gravel is angular to sub rounded fine to coarse of sandstone, mudstone, coal, brick and concrete. Common plant and tree roots. Occasional plastic, ceramic, wire and paper).
				1.10			MADE GROUND (Soft to stiff, orangish brow and brownish grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone, mudstone, coal, brick, and concrete. Cobbles are rounded sandstone. Common plant matter, rootlets, and tree bark. Rare ceramic).
				2.50			Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular and fine to coarse of siltstone and mudstone. [Completely weathered mudstone and siltstone].
							End of pit at 2.50 m

1 2 3 4 5 6 7 8 9 10

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

Stability: Stable

Trial Pit Log

Trialpit No
TP01
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): 1.8 × 0.9	Scale 1:50
Client: North Park Shelley Ltd		Depth 0.30	Logged RAP

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.45			MADE GROUND (Firm dark brown slightly sandy slightly gravelly silty CLAY. Gravel is sub-rounded to angular fine to coarse of mudstone siltstone sandstone coal glass and pottery).
				0.60			Soft to 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 0.30 m

1 2 3 4 5 6 7 8 9 10

Remarks:

Stability:

Trial Pit Log

Trialpit No **TP02**

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): 1.8 × 0.9 Depth 2.60	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
				0.40			TOPSOIL (Firm dark brown slightly sandy silty CLAY with rare gravel of plastic and glass).
				2.60			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 2.60 m

Remarks:

Stability:

Trial Pit Log

Trialpit No
TP03
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 0.70	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
				0.10			TOPSOIL (Firm dark brown organic silty CLAY).
				0.70			Firm grey mottled brown slightly gravelly silty CLAY. Gravel is sub-angular fine and medium of sandstone and mudstone. [Residual Pennine Lower Coal Measures Formation]
							End of pit at 0.70 m

Remarks:

Stability:

Trial Pit Log

Trialpit No **TP04**

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 0.70	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
				0.35			TOPSOIL (Soft to firm dark brown organic silty CLAY with rare pottery brick and glass).
				0.70			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 Pennine Lower Coal Measures Formation]

End of pit at 0.70 m

Remarks:

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:	TPSA01	Test No:	1	Date:	07/06/2022
Length (m):	2.200		Datum Height:	0.00	m agl
Width (m):	1.70		Granular infill:	None	
Depth (m):	2.50		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.980		
5	1.980		
10	1.980		
20	1.980		
30	1.980		
60	1.980		
90	1.980		

Start water depth for analysis (mbgl):	1.98		
75% effective depth (mbgl):	2.11	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	2.24		
25% effective depth (mbgl):	2.37	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	2.50		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		5.77	
(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

Rogers Geotechnical Services Ltd

Soakaway Test

Trial Pit No:	TPSA02	Test No:	1	Date:	07/06/2022
Length (m):	2.500		Datum Height:	0.00	m agl
Width (m):	1.60		Granular infill:	None	
Depth (m):	2.50		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	2.040		
5	2.040		
10	2.040		
20	2.040		
40	2.040		
60	2.040		
90	2.040		

Start water depth for analysis (mbgl):	2.04		
75% effective depth (mbgl):	2.16	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	2.27		
25% effective depth (mbgl):	2.39	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	2.50		

Volume outflow between 75% and 25% effective depth (m^3):
Mean surface area of outflow (m^2): 5.89
(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 ref
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.

QMS ISO 9001 : 2015 REGISTERED Cert No. 14123657
QMS ISO 14001 : 2015 REGISTERED Cert No. 14127804
QMS ISO 45001 : 2018 REGISTERED Cert No. 14130281
Registered Member
UKAS TESTING

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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

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Rogers Geotechnical Services Ltd
Office 1 & 2 Barncliffe Business Park,
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Company No: 5130864

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GEOTECHNICAL LAB RESULTS

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Disclaimer

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

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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 Ref	Sample Top	Sample Base	Sample Type	Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Cone 80g/30° 60g/60°	Water Increase Decrease	Date
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 (m)	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 (%)
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	*

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ENVIRONMENTAL LAB RESULTS

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Rogers Geotechnical Services Ltd
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Telephone 01484 607977
Company No: 5130864

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	Allkaline 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

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd		Soil Screening Value (SSV) Comparison Sheet						
Job Number	C2113/21/E	A = WS Atkins PLC, Atrisk Soil Screening Values. A+ = Values updated June 2017. A* = Atrisk's SSV is lower than Chemtest's detectable limit for this compound. B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report. C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter. D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a				KEY Exceeds SSV Exceeds 2017, Below 2015 Below limit of detection (LOD)		
Job Name	Yew Tree Lane - Site A							
Date	08.06.22	**Sample Location**	WS01	WS02	WS03	WS06	TP03	TP04
Client	Ben Marsden	Depth Top	0.2	2.5	0.2	0.5	0.6	0.3
		Depth Base						

Determinand	Units	Ref	LOD	Residential With Plant Uptake 1%							
				Atrisk 2015 (No Free Product	Atrisk 2017						
Cadmium	mg/kg	C	0.10		22.1	0.14	0.18	< 0.10	0.39	0.20	0.14
Chromium (Hexavalent)	mg/kg	B/C	0.5	20.5	3.62	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Copper	mg/kg	A+	0.50		4730	20	25	16	45	16	25
Mercury	mg/kg	A/D	0.10		8.81	0.10	0.08	0.05	0.14	< 0.05	< 0.05
Nickel	mg/kg	A+	0.50		136	20	32	19	15	8.7	10
Lead	mg/kg	C	0.50		200	27	43	24	180	55	18
Zinc	mg/kg	A+	0.50		20000	55	120	55	180	62	48
Vanadium	mg/kg	A+	5.0		136	18	24	31	24	8.5	10
Arsenic	mg/kg	C	1.0		37	3.7	4.6	4.9	12	5.1	6.9
Selenium	mg/kg	A	0.20		375	1.6	1.4	1.2	0.90	< 0.20	0.63
Cyanide (Free)	mg/kg	A	0.50		34	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Phenols	mg/kg	A	0.1		267	< 0.10	< 0.10	< 0.10	< 0.10		
Naphthalene	mg/kg	A+	0.10		0.829	< 0.10	< 0.10	< 0.10	1.0	0.51	0.39
Acenaphthylene	mg/kg		0.10			< 0.10	< 0.10	< 0.10	0.56	1.0	0.36
Acenaphthene	mg/kg	A+	0.10	608	157	< 0.10	< 0.10	< 0.10	1.3	0.60	0.70
Fluorene	mg/kg	A+	0.10		735	< 0.10	< 0.10	< 0.10	1.1	0.42	0.71
Phenanthrene	mg/kg		0.10			< 0.10	< 0.10	< 0.10	11	1.3	1.3
Anthracene	mg/kg	A+	0.10		10200	< 0.10	< 0.10	< 0.10	2.8	0.31	0.17
Fluoranthene	mg/kg	A+	0.10		983	< 0.10	< 0.10	< 0.10	22	1.6	1.9
Pyrene	mg/kg	A+	0.10		668	< 0.10	< 0.10	< 0.10	22	1.7	1.9
Benzo[a]anthracene	mg/kg	A	0.10	4.52	1.71	< 0.10	< 0.10	< 0.10	10	3.3	1.5
Chrysene	mg/kg	A	0.10	585	0.44	< 0.10	< 0.10	< 0.10	10	2.2	1.4
Benzo[b]fluoranthene	mg/kg	A	0.10	7.72	1.22	< 0.10	< 0.10	< 0.10	9.2	1.0	1.6
Benzo[k]fluoranthene	mg/kg	A	0.10	84.4	0.686	< 0.10	< 0.10	< 0.10	6.1	2.9	0.56
Benzo[a]pyrene	mg/kg	B/C	0.10	4.95	1.51	< 0.10	< 0.10	< 0.10	12	0.86	1.1
Indeno(1,2,3-c,d)Pyrene	mg/kg	A*	0.10	7.31	0.0614	< 0.10	< 0.10	< 0.10	7.2	3.4	2.3
Dibenz(a,h)Anthracene	mg/kg	A	0.10	0.838	0.00393	< 0.10	< 0.10	< 0.10	2.2	2.2	2.0
Benzo[g,h,i]perylene	mg/kg	A	0.10	96.2	0.0187	< 0.10	< 0.10	< 0.10	7.1	3.8	3.2
Total Of 16 PAH's	mg/kg		2.0			< 2.0	< 2.0	< 2.0	130	27	21
Aliphatic TPH >C5-C6	mg/kg	A+	1.0		42.7	< 1.0	< 1.0	< 1.0	< 1.0		
Aliphatic TPH >C6-C8	mg/kg	A+	1.0		99.3	< 1.0	< 1.0	< 1.0	< 1.0		
Aliphatic TPH >C8-C10	mg/kg	A+	1.0		13.9	< 1.0	< 1.0	< 1.0	< 1.0		
Aliphatic TPH >C10-C12	mg/kg	A+	1.0	81.7	49.9	7.5	< 1.0	< 1.0	7.5		
Aliphatic TPH >C12-C16	mg/kg	A+	1.0	385	20.9	28	5.8	< 1.0	8.1		
Aliphatic TPH >C16-C21	mg/kg	A+	1.0		210000	< 1.0	< 1.0	< 1.0	< 1.0		
Aliphatic TPH >C21-C35	mg/kg	A+	1.0		210000	27	< 1.0	< 1.0	70		
Aliphatic TPH >C35-C44	mg/kg		1.0			< 1.0	< 1.0	< 1.0	< 1.0		
Total Aliphatic Hydrocarbons	mg/kg		5.0			62	5.8	< 5.0	86		
Aromatic TPH >C5-C7	mg/kg	A+	1.0		0.137	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C7-C8	mg/kg	A+	1.0		113	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C8-C10	mg/kg	A+	1.0		20.5	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C10-C12	mg/kg	A+	1.0		70	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C12-C16	mg/kg	A+	1.0	165	155	< 1.0	< 1.0	< 1.0	< 1.0		
Aromatic TPH >C16-C21	mg/kg	A+	1.0		319	< 1.0	< 1.0	< 1.0	38		
Aromatic TPH >C21-C35	mg/kg	A+	1.0		1120	< 1.0	13	< 1.0	280		
Aromatic TPH >C35-C44	mg/kg		1.0			< 1.0	< 1.0	< 1.0	< 1.0		
Total Aromatic Hydrocarbons	mg/kg		5.0			< 5.0	13	< 5.0	310		
Total Petroleum Hydrocarbons	mg/kg		10.0			62	19	< 10	400		
pH			N/A			6.4	7.8	**8.9**	7.4	**5.2**	6.3
Sulphate (2:1 Water Soluble) as SO4	g/l		0.010			0.088	**0.14**	**0.019**	0.029		
ACM Type			N/A			-	-	-	-	-	-
Asbestos Identification	%		0.001			No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	%		0.020			12	10	21	27	30	22
Soil Colour			N/A			Brown	Brown	Brown	Black	Brown	Brown
Other Material			N/A			None	Stones	None	Stones	Roots	Stones and
Soil Texture			N/A			Clay	Loam	Clay	Clay	Sand	Sand
Sulphate (Total)	%		0.010			0.012	0.011	0.014	0.068		
Organic Matter	%		0.40			1.1	< 0.40	**0.81**	**13**	10	14

Rogers Geotechnical Services Ltd Telephone 0843 50 666 87
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End of Report

GEOTECHNICAL
ENVIRONMENTAL

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Telephone 01484 607977
Company No: 5130864

Appendix 9

Soil Screening Values

Rogers Geotechnical Services Ltd Telephone 0843 50 666 87 Fax 0843 51 599 30
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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)fluoranthene	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.