

REPORT ON PHASE 2 GEO-ENVIRONMENTAL GROUND INVESTIGATION WORKS
UNDERTAKEN ON LAND
BOUNDED BY
CULCHETH LANE AND TANDLEWOOD MEWS, NEWTON HEATH, MANCHESTER
M40 1LU

Prepared for:-

Style Builders Limited

On Behalf of:

M. Kenny Properties Ltd

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**Project Quality Assurance
Information Sheet**

Report on Phase 2 Geo-Environmental Ground Investigation Works undertaken on Land Bounded by Culcheth Lane and Tandlewood Mews, Newton Heath, Manchester M40 1LU.

Job Number : TLC985

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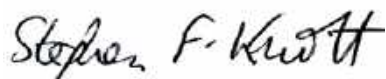
Survey Dates : Site investigation – 17th April 2018
Groundwater monitoring/sampling – 23rd April 2018

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1.0 INTRODUCTION

- 1.1 The Land Consultancy Limited (TLC) has been commissioned by Style Builders Ltd, on behalf of M. Kenny Properties Ltd, to complete Phase 2 geo-environmental ground investigation works on a plot of land situated within the Newton Heath district of east Manchester, which is bounded by Culcheth Lane and Tandlewood Mews; the postcode of the property is M40 1LU.
- 1.2 It is understood that this former public house site, is intended to be redeveloped with 6no. three storey townhouses (Class C3), together with parking and small garden areas. A proposed development plan is presented in Drawing No. TLC985/03 in Appendix A.
- 1.3 The geo-environmental site investigation works carried out by TLC will help discharge contaminated land planning conditions which have been imposed on the redevelopment of the site by Manchester City Council. The planning application number is 111312/FO/2016/N1.
- 1.4 A Phase 1 geo-environmental desk study report has already been completed for the property by Earth Environmental & Geotechnical. The desk study report was referenced A0374/G/1 and was dated February 2014. At the time of writing, the site was intended to be redeveloped with a row of 5no. terraced houses with associated parking areas. The report concluded risks to human health, controlled waters and construction materials from potential contamination and ground gases were low, and advised that Phase 2 contaminated land related site investigation works were not required. The report advised that site investigation works were only required for foundation design purposes only.
- 1.5 Following a review of the Earth Environmental & Geotechnical desk study information, and after considering the current proposed development scheme, TLC considered that there was indeed potential for contaminated soils materials to be present beneath the site (e.g. ash and cinders beneath former hardstood areas) and that Phase 2 contaminated land investigative works should place.
- 1.6 Earth Environmental & Geotechnical's desk study should be consulted for background information if required.
- 1.7 TLC's remit included the following:
 - The sinking of 5no. small diameter windowless sampling boreholes with soil sampling and in-situ testing;
 - The installation of 2no. of the boreholes for groundwater level monitoring/sampling purposes;
 - Logging of the strata encountered in the boreholes and trial pits to BS 5930:2015¹;
 - Obtaining groundwater levels and samples from the installed boreholes; and,
 - The scheduling of soil and groundwater samples for laboratory testing (chemical and geotechnical).
- 1.8 TLC's remit also included:
 - Factually reporting on the works undertaken;
 - Providing advice with respect to contamination and ground gases; and,

¹ BSI Standards Publication BS 5930: 2015 entitled 'Code of practice for ground investigations',

- Providing advice with respect to foundations, floorslab and buried concrete design, excavation stability and groundwater control.

1.9 General

- 1.9.1 It should be noted that the assessment of the factual data obtained as part of this investigation has been undertaken in accordance with generally accepted consulting practice, and in line with currently accepted national and international guidelines.
- 1.9.2 The assessment and recommendations made in this report are limited to those, which can be made based on the findings of the available site investigation data. TLC assumes all third-party data to be true and correct. No responsibility can be accepted by TLC for inaccuracies in the information supplied by any other party.
- 1.9.3 This report assumes that the ground levels intended for the redevelopment will be similar to those existing at present.
- 1.9.4 The interpretation of site investigation data presented in this report involves the interpolation of data in between exploratory holes. No responsibility can be accepted by TLC for any unexpected variations that may occur in the ground conditions between the exploratory holes.
- 1.9.5 This report is written in the context of an agreed scope of works and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may require a re-interpretation of the report in whole or in part after its original submission. TLC reserves the right to alter the conclusions and recommendations made in this report in the light of further information which may become available. This report is provided for the sole use of the client and is confidential to them and their professional advisors.

2.0 SITE LOCATION AND DESCRIPTION

- 2.1 The property is situated within a residential setting within the Newton Heath district of north-east Manchester. Manchester City Centre is located ≈ 4.8 km to the south-west. Culcheth Lane forms the north-eastern boundary to the site; the south-eastern boundary of the site is with a cul-de-sac known as Tandlewood Mews; a path is located at the north-western boundary. The centre of the site is given by the following coordinates: 388346E, 400225N.
- 2.2 General site location plans are presented in Drawing Nos. TLC985/01a and 01b in Appendix A. A more detailed aerial plan of the site is presented in Drawing No. TLC985/02.
- 2.3 The site is triangular in shape (orientated north-east to south-west), has an area of $\approx 775\text{m}^2$ and is situated at an altitude of $\approx 85\text{m}$ AOD. The site surface is approximately level. Land in the general area of the site slopes very gently down to the south.
- 2.4 The south-western tip of the site ($\approx 75\text{m}^2$ in area) comprises of overgrown grass landscaping. This area is separated from the remainder of the site by a concrete post and panel wall. The remainder of the site is surfaced with a mixture of tarmacadam hardstanding (broken in places) and dark brown grey sandy gravelly CLAY rich Made Ground containing abundant brick, sandstone and concrete cobbles and boulders. The north-western and south-eastern boundaries of this area comprise of concrete post and panel walls. A gate and scaffolding supported hoarding are present at the north-eastern boundary.
- 2.5 A public house was formerly present in the northern corner of the site.
- 2.6 Residential development is found to the north-west of the site beyond the path, to the south-east beyond Tandlewood Mews, and to the north-east beyond Culcheth Lane.
- 2.7 No evidence for the presence of any mobile contamination (e.g. hydrocarbon staining) was visible at the site surface. Anthropogenic materials visible in the soil included: concrete, brick, glass, mortar, scrap metal, pottery, ceramic, plastic and occasional timber fragments.
- 2.8 No invasive plant species were observed to be growing at the site (e.g. Japanese Knotweed etc).

3.0 FIELDWORKS

3.1 Introduction

- 3.1.1 A complete record of the soils recovered in the exploratory holes providing descriptions of strata, in-situ testing results and samples obtained is given on the borehole log sheets in Appendix B. The exploratory hole locations are given on Drawing No. TLC985/02 in Appendix A.
- 3.1.2 Each position was scanned using a Cable Avoidance Tool to check for services. Hand pits were also excavated to 1.20m bgl prior to advancing the boreholes as a final check for the presence of services.

3.2 Windowless Sampling Boreholes

- 3.2.1 5no. small diameter windowless sampling boreholes (WS1 to WS5) were sunk using a tracked Archway Competitor Dart rig to depths of between 5.00m (WS1) and 6.45m (WS4). The windowless sampling was carried out on 17th April 2018. Boring commenced from the base of the hand pits excavated at each location. The surface/near surface tarmac present at the locations of WS2 and WS4 was first broken out using a hydraulic breaker prior to excavating the hand pits.
- 3.2.2 The boreholes were positioned for site coverage purposes and no specific areas of concern were highlighted by Earth Environmental and Geotechnical's desk study.
- 3.2.3 Soil cores were recovered from each borehole in plastic liners which were subsequently split for logging and sampling purposes; soil cores were logged by TLC to BS 5930:2015.
- 3.2.4 Standard penetration tests (SPTs or CPTs) were carried out at regular intervals within the boreholes. No corrections have been applied to the 'N' values displayed on the borehole logs. The SPT calibration test certificate is presented in Appendix B. If possible, shear vane testing was also undertaken on samples of the recovered clay core, in order to determine the undrained shear strength (Cu value) of the clay.
- 3.2.5 Standpipe installations (50mm ID uPVC) were placed within boreholes WS2 and WS4 upon their completion, to facilitate subsequent groundwater level monitoring and sampling. WS5 was not backfilled immediately following completion of boring operations; instead it was left open and covered up so that subsequent water level monitoring could take place. WS5 was backfilled with bentonite/arising after groundwater level monitoring had taken place (see below). WS1 and WS3 were backfilled with bentonite/arising immediately following completion of boring operations.

3.3 Groundwater Level Monitoring and Sampling

- 3.3.1 The response zones within the installed boreholes are summarised below:

Hole ID	Response Zone (bgl)	Depth (bgl)	Geology
WS2	0.80 to 3.80m	0.80 to 2.35m	MADE GROUND – Very clayey very gravelly SAND with cobbles.
		2.35 to 3.80m	Glacial Till – Stiff fissured sandy gravelly CLAY.
WS4	0.85 to 3.85m	1.00 to 1.65m	MADE GROUND – Very clayey sandy GRAVEL/very soft very sandy and gravelly clay over very soft very sandy CLAY.
		1.80 to 3.00m	Glacial Till – Firm to stiff or stiff fissured sandy gravelly CLAY.

- 3.3.2 Borehole standing water levels and installation depths were recorded using a dip-meter on 23rd April 2018. A groundwater sample was then obtained from WS2 using a bailer for subsequent laboratory analysis. The groundwater sample was obtained after three well volumes of groundwater had been removed from the borehole.

3.4 Laboratory Testing

- 3.4.1 All of the soil samples to be subjected to contamination testing were transported to the testing laboratory in cool boxes kept <4°C. The majority of the tests undertaken at the laboratory are MCERTS and UKAS accredited.
- 3.4.2 A number of samples were also forwarded onto an UKAS accredited geotechnical testing laboratory for analysis.

4.0 GROUND CONDITIONS

4.1 The desk study indicated that the property was likely to be directly underlain by drift deposits of Devensian Glacial Till (diamicton) over the Collyhurst Sandstone Formation (a Principal Aquifer).

4.2 The strata types encountered during the investigation are summarised below:

4.3 Made Ground

4.3.1 Deposits of Made Ground were recorded within all of the exploratory holes formed. The Made Ground was penetrated at depths of between 1.00m (WS3) and 2.40m (WS1).

4.3.2 Both cohesive and granular horizons of Made Ground were encountered across the site, and with the exception of WS1, multiple layers of Made Ground were recorded. Both cohesive and granular horizons frequently contained significant concentrations of gravel, cobbles and boulders. The Made Ground was often noted to be slightly organic rich.

4.3.3 The colour of the Made Ground was variable, with the following colours being described: dark brownish grey, dark grey, beige, black, yellowish brown and brown.

4.3.4 Ash and cinder rich Made Ground deposits were described at the following locations: WS3 (0.10-0.20m) and WS4 (0.05-1.35m). The Made Ground encountered in WS5 (0.50-1.30m) was described as being probably slightly ashy and contained occasional cinder gravel.

4.3.5 Organic rich clayey topsoil type Made Ground materials were described in WS5 (g.l. to 0.50m). An organic rich horizon of sandy gravelly CLAY was recorded in WS2 (0.75-1.00m) which was associated with a 'burnt' odour.

4.3.6 Tarmac was described in WS2 (0.20-0.25m) and WS4 (g.l. to 0.05m).

4.3.7 Gravel types described within the Made Ground included: brick, concrete, cinders, sandstone, and occasionally slate, mortar, breeze block, siltstone, mudstone, glass, pottery, coal and quartzite. Cobbles and boulders generally comprised of brick, concrete and occasional sandstone. Timber fragments were sometimes noted, as were scrap metal and plastic fragments and rootlets.

4.3.8 The consistency of the clay Made Ground layers ranged from very soft to soft to firm.

4.3.9 SPT N values which were obtained solely within the Made Ground were as follows: WS1 - 0 and 4; WS2 – 1; and WS4 – 1; these indicate that the Made Ground was of extremely low to low strength or in a very loose/loose condition.

4.4 Devensian Glacial Till

4.4.1 Deposits considered to represent Devensian Glacial Till were encountered within each borehole at depths of between 1.00m (WS3) and 2.40m (WS1). With the exception of WS1, the Glacial Till was penetrated at depths of between 4.80m (WS3) to 5.30m (WS4 and WS5). In WS1, the Glacial Till was proven only to 5.00m bgl.

4.4.2 The Glacial Till was typically described as comprising of an extremely closely to very closely fissured dark brown mottled grey sandy gravelly CLAY. Gravels comprised of sandstone, siltstone, mudstone and occasional coal.

4.4.3 The mottling (gleying) and fissuring was absent below depths of between 3.00m to 4.00m.

4.4.4 A horizon of weathered Glacial Till was recorded above more competent strata in WS5 (1.30-1.65m). The colour of this material was yellowish brown, grey and orangish brown. Thin sand horizons ($\leq 10\text{mm}$ thick) were occasional recorded within the Glacial Till clay.

4.4.5 Clay consistency was typically firm to stiff or stiff. However, the weathered Glacial Till in WS5 was soft and soft to firm; firm clay was then described to 1.95m depth.

4.4.6 SPT N values which were obtained within the Glacial Till are summarised in the table below:

SPT Depth (m (bgl))	Borehole SPT N Value				
	WS1	WS2	WS3	WS4	WS5
1.20-1.65m	-	-	8	-	5
2.00-2.45m	-	-	21	16	20
3.00-3.45m	30	22	29	23	28
4.00-4.45m	26	26	27	25	33
5.00-5.45m	-	-	-	44	36

SPT carried out in Glacial Till only
 SPT was carried through the Glacial and underlying possible completely weathered SANDSTONE

4.4.7 For overconsolidated clays (such as Glacial Till), Stroud (1974)² reported good correlations between SPT N values and undrained shear strength (C_u value). Using the graph of C_u/N vs plasticity index correlation published by Stroud, the following C_u values were derived:

- 1.20-1.65m – $C_u = 27\text{kPa}$ and 42kPa (low to medium strength);
- 2.00-2.45m – $C_u = 85\text{kPa}$ to 111kPa (high strength);
- 3.00-3.45m – $C_u = 117\text{kPa}$ to 159kPa (high to very high strength); and,
- 4.00-4.45m – $C_u = 133\text{kPa}$ to 175kPa (high to very high strength).

4.4.7 The C_u values derived from the SPT results are consistent with those derived in-situ using a hand-held shear vane (see below). Plasticity indices for the Glacial Till are presented in section 8.0.

4.4.8 C_u values obtained in-situ within the Glacial Till are summarised in the table below:

Test Depth (m (bgl))	Borehole C_u Value (kPa)				
	WS1	WS2	WS3	WS4	WS5
1.00-1.50m	-	-	92	-	-
1.50-2.00m	-	-	107 & >125	78 & 106	54 & 72
2.00-2.50m	-	-	97	>125 & >125	101
2.50-3.00m	>125 , >125 , >125	>125	108 & >125	>125 & >125	>125 & >125
3.00-3.50m	-	>125 & >125	-	-	-
3.50-4.00m	101 & 104	105, 115 & >125	>125 & >125	98 & 120	101 & 112
4.00-4.50m	-	-	-	-	108
4.50-5.00m	80 & 107	-	103 & 108	100 & 103	120 & >125

C_u Test carried out within Glacial Till

² Stroud, M.A. (1974) 'The Standard Penetration Test in Insensitive Clays and Soft Rocks'. Proc. Eur. Symp. On Penetration Testing (ESOPT I), pp367-375.

4.5.6 The in-situ derived Cu values indicate that the Glacial Till tested was of high strength.

4.6 Sand – Uncertain Provenance

4.6.1 Brown fine and medium grained SAND was recorded beneath the Glacial Till within WS2-WS5 at depths of between 4.80m (WS3) and 5.30m (WS4 and WS5). The sand was proven to a maximum depth of 6.45m in WS4.

4.6.2 The provenance of the sand is uncertain. It may represent completely weathered Collyhurst Sandstone, or the sand may be of glacial origin.

4.6.3 The sand was in a dense or very dense condition. SPT N values carried out at the base of the boreholes ranged from 35 to 56.

4.7 Groundwater

4.7.1 Groundwater observations were made within Made Ground and Glacial Till thin sand bands. Although not recorded in the field, it is also likely that the sand horizon encountered at the base of the boreholes is also water bearing.

4.7.2 Groundwater seepages were recorded within the WS1, WS2, WS4 and WS5 Made Ground deposits at depths of between 0.60m to 2.00m. Rates of ingress were estimated to be 'minor' or were described as 'seepages'.

4.7.3 Saturated thin sand bands were recorded within WS2 (at 2.80m) and WS3 (at 3.90m). Rates of ingress were noted to be 'minor'.

4.7.4 Groundwater level monitoring was undertaken on installed boreholes on 23rd April 2018. The following standing water levels were recorded:

- WS2 – 2.29m bgl
- WS4 – 2.54m bgl
- WS5 – 2.15m bgl

4.8 Contamination Observations

4.8.1 No visual or olfactory observations of potential mobile contamination (e.g. hydrocarbons, solvents etc) were recorded during the fieldworks.

4.8.2 A 'burnt odour' was associated with the Made Ground encountered in WS2 between 0.75-1.00m depth. This Made Ground comprised of dark grey/black sandy gravelly CLAY.

4.8.3 Anthropogenic components recorded within the Made Ground included: ash, cinders, brick, concrete, glass, pottery, plastic, timber, breeze block, mortar and scrap metal fragments. Other naturally derived components to the Made Ground included: sandstone, mudstone, siltstone, coal, slate and limestone.

4.9 Obstructions

4.9.1 Cobbles and boulders of brick, concrete and occasional sandstone, were often recorded within the upper 1m of Made Ground (i.e. within the borehole hand excavated starter pits). No significant obstructions which prevented progress of the drill string were recorded within the Made Ground below ≈1m depth and within the Glacial Till.

5.0 CHEMICAL LABORATORY TESTING

5.1 Selected soil samples were analysed for the determinands indicated in the table below.

Testing Schedule for Soils Samples from Culcheth Lane, Manchester which were taken on 17th April 2018
TLC Job No.: TLC985

Determinand(s)		Units	Samples								Total	
			WS1 0.50m MG	WS2 0.50m MG	WS2 0.85m MG	WS3 0.15m MG	WS4 0.20m MH	WS4 1.00m MG	WS5 0.30m MG	WS1 2.60-2.40m GT	WS2 1.75-1.90m MG	
Soils Screening Suite (see below)		mg/kg	1	-	1	1	1	1	1	-	-	6
Chromium (vi)		mg/kg	1	-	1	1	1	1	1	-	-	6
Asbestos Fibre Screen		-	1	1	-	1	1	-	1	-	-	5
BRE Digest SD-1 reduced Suite		-	-	-	1	1	-	1	-	1	1	5

Any problems with the schedule then please ring:

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M: 07771 800859
T: 01772 610609

Key

MG	Ash and cinder rich Made Ground
MG	General Made Ground
MG	Topsoil Made Ground
GT	Glacial Till

Soil Screening Suite includes:

Arsenic
Cadmium
Chromium (total)
Copper
Lead
Mercury
Nickel
Selenium
Zinc
Boron
pH
Sulphate (total)
TOC
Cyanide
Phenols
TPH (C10-C40)
Speciated PAH

BRE Digest SD-1 Reduced Suite includes:

Total sulphate
Total sulphur
Water soluble sulphate (2:1 extract)
pH value

BRE Digest SD-1 Full Suite includes:

Total sulphate
Total sulphur
Water soluble sulphate (2:1 extract)
pH value
Water soluble chloride (2:1 extract)
Water soluble nitrate (2:1 extract)
Water soluble magnesium (2:1 extract)

5.2 Following receipt of the TPH (C10-C40) testing results, the following samples were analysed for TPHCWG aromatic/aliphatic compounds, BTEX compounds and MTBE: WS2 @ 0.85m; WS4 @ 0.20m and WS5 @ 0.30m.

5.3 Following receipt of the asbestos fibre screening results, the following sample was subject to asbestos in soil quantification analysis: WS4 @ 0.20m.

5.4 The sample of groundwater recovered from WS2 was analysed for pH and sulphate only.

5.5 The chemical testing results obtained are presented in Appendix C.

6.0 CHEMICAL TESTING - RESULTS AND ASSESSMENT

6.1 Generic Quantitative Risk Assessment

6.1.1 Human Health Assessment

- 6.1.1.1 In line with CLR11³, a Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of the measured concentrations of contaminants from the chemical analysis.
- 6.1.1.2 The GQRA comprises the comparison of the measured concentrations with Generic Assessment Criteria (GAC). The GAC used for the assessment of soil concentrations comprise Soil Guideline Values (SGVs) and values that have been derived using the CLEA⁴ model (v 1.06) adopting the appropriate assumptions and input parameters provided in the Environment Agency SR series of reports⁵ and with reference to the LQM/CIEH⁶ and EIC/AGS/CL:AIRE reports⁷. If exceeded, measured concentrations have been compared to the recently produced C4SLs⁸ where available, with the exception of lead where the C4SL value has been adopted due to the withdrawal of the SGV, as it was not considered to be sufficiently health protective.
- 6.1.1.3 6no. Made Ground samples were analysed for Total Organic Carbon (TOC) contents. Soil organic matter (SOM) contents were calculated from the TOC results. SOM contents ranged from 5.3% to 17.6% with an average of 11.9%. In undertaking the human health GQRA for the Made Ground, we have assumed a conservative SOM of 6% for the Made Ground.
- 6.1.1.4 The Made Ground PAH congener results were analysed using the LQM PAH profiling tool to determine whether using benzo(a)pyrene (BaP) as a surrogate marker for PAH contamination derived from coal tar was appropriate. The graph below presents the results of this assessment. As all of the results plot within $\pm 2.5x$ the mean of the Culp PAH data, the use of BaP as a surrogate marker for PAH contamination was considered to be justified. It should be noted that non-detect concentrations were treated as being equal to the laboratory detection limit.

³ Environment Agency/Department for Environment, Food and Rural Affairs, 2004, Model Procedures for the Management of Land Contamination, CLR11

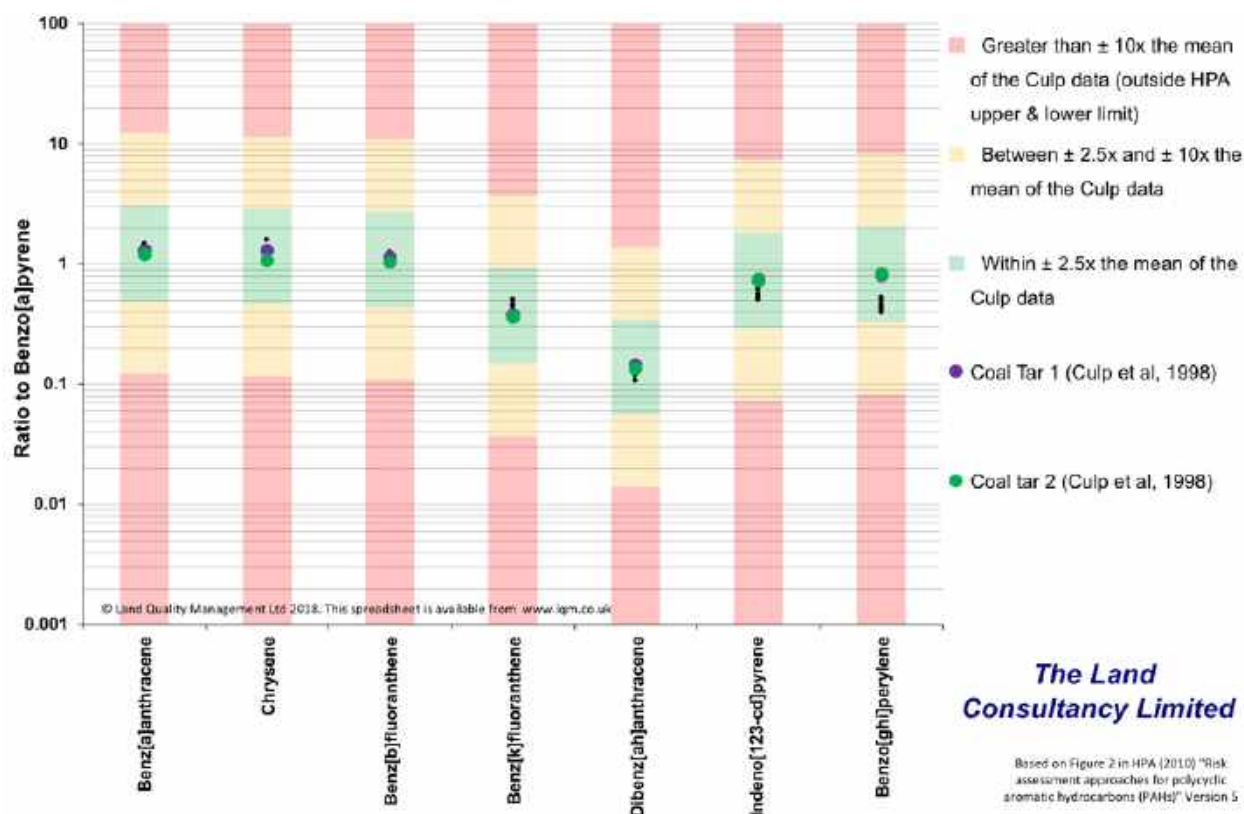
⁴ <https://www.gov.uk/government/publications/contaminated-land-exposure-assessment-clea-tool>

⁵ Environment Agency, 2009, Human health toxicological assessment of contaminants in soil (SR2) & Updated technical background to the CLEA model (SR3)

⁶ Nathanail, C.P., McCaffrey, C., Gillet, A.G, Ogden, R.C. and Nathanail, J.F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

⁷ The EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment. December 2009.

⁸ Defra (2014a & b). SP1010 – Development of Category 4 Screening Levels for assessment of land affected by contamination.



6.1.1.5 The property is intended to be developed out with residential properties which will incorporate small garden areas. A proposed development plan is displayed on Drawing No. TLC985/03 in Appendix A. The chemical testing results obtained have therefore been compared to screening concentrations derived for the residential with plant uptake scenario.

6.1.1.6 The summary table in Appendix C present the results of the human health GQRA. The GQRA has identified two (CoC) beneath the property. The Made Ground samples equaling or exceeding GAC concentrations are listed in the table below.

Contaminant of Concern (CoC)	GAC (mg/kg)	Measured Concentration (mg/kg)	Location & Depth (bgl)	Notes
Lead	200 (C4SL)	270	WS2 @ 0.85m	General Made Ground
		218	WS4 @ 1.00m	Ashy Made Ground
		261	WS5 @ 0.30m	Topsoil Made Ground
Benzo(a)Pyrene (BaP)	5.0 (C4SL)	5.14	WS1 @ 0.50m	General Made Ground
		24.5	WS2 @ 0.85m	General Made Ground
		6.65	WS3 @ 0.15m	Ashy Made Ground
		25.6	WS4 @ 1.00m	Ashy Made Ground
		14.5	WS5 @ 0.30m	Topsoil Made Ground

6.1.1.7 Made Ground TPH (C10-40) concentrations ranged from 56mg/kg to 2,060mg/kg. Speciated TPH analysis of the samples which recorded the three highest TPH (C10-40) concentrations (WS2 @ 0.85m – 2,060mg/kg, WS4 @ 0.20m – 1,440mg/kg and WS5 @ 0.30m – 1,340mg/kg) were carried out, to determine whether any elevated aromatic

or aliphatic fraction concentrations were present. No elevated concentrations were recorded.

6.1.1.8 The WS2 @ 0.85m – 2,060mg/kg, WS4 @ 0.20m – 1,440mg/kg and WS5 @ 0.30m – 1,340mg/kg Made Ground samples were also analysed for BTEX compounds and MTBE. No elevated BTEX or MTBE concentrations were detected.

6.1.1.9 5no. Made Ground samples were analysed for asbestos fibres. Loose asbestos fibres (chrysotile) were detected within one sample (WS4 @ 0.20m), and this sample was subsequently subjected to an asbestos in soil quantification analysis. The concentration of asbestos fibres within the sample analysed was 0.002% w/w. ICRC Guidance Note 64/85 'Asbestos on Contaminated Site' dated 1990, provides guidance for asbestos concentrations in soil, and suggests that fibre concentrations should be <0.001% w/w. Therefore, the asbestos recorded within the WS4 sample could pose a risk to human health.

6.2 Human Health Results Discussion

6.2.1 As the BaP concentrations recorded were generally well above the C4SL screening concentration of 5.0mg/kg, statistical analysis of the BaP data was not carried out as this exercise would not have changed the conclusion that the Made Ground beneath this site is generally heavily contaminated with BaP (and other PAH compounds).

6.2.2 The Made Ground also often contains slightly elevated concentrations of lead with respect to the 200mg/kg screening concentration of 200mg/kg.

6.2.3 The Made Ground is also locally contaminated with chrysotile asbestos fibres with respect to human health.

6.2.4 Remedial works will be required to reduce the risk that the above contaminants pose to end users of the site.

6.3 Phytotoxic Risk

6.3.1 A potentially phytotoxic concentration of boron (3.2mg/kg) was recorded from the sample of WS1 @ 0.50m Made Ground. The screening concentration for boron is 3mg/kg.

6.3.2 No elevated concentrations copper, zinc or nickel were recorded from the Made Ground.

6.3.3 Screening concentrations (and their source) are presented in Appendix C.

6.4 Groundwater

6.4.1 The sample of groundwater recovered from WS2 was analysed for pH value and sulphate content only.

6.4.2 The sample recorded a pH value of 8.2 and a sulphate concentration of 198mg/kg. This concentration is below the UK Environmental Quality Standard and UK Drinking Water Standard values of 400mg/kg and 250mg/kg respectively.

6.5 Buried Concrete

6.5.1 Risks to buried concrete are considered in sections 8.3 and 9.2.

6.6 Ground Gas

- 6.6.1 The risk posed to end users from ground gases has been assessed in line with CL:AIRE research bulletin RB17⁹. The gas risk assessment approach outlined in this document is compatible with the ground gas guidance presented within CIRIA Report C665¹⁰ and British Standard BS8485:2007¹¹, and is suitable for sites which are at low risk of being affected by ground gases. The extent to which gas measures should be incorporated into proposed developments is based off the encountered Made Ground thickness, the Made Ground total organic carbon (TOC) content and the age of the Made Ground.
- 6.6.2 The need to undertake gas monitoring to assess the ground gas regime beneath the site by carrying out a period of ground gas monitoring, was not considered necessary as:
- Earth Environmental & Geotechnical's February 2014 desk study did not indicate the presence of any credible potentially significant sources of ground gas within at least 250m of the site boundary.
 - The desk study indicated that there was unlikely to be any shallow coal workings beneath the site.
 - The Made Ground encountered at the site ranged from 1.00m (WS3) to 2.40m thick with an average thickness of 1.74m.
 - With the exception of occasional timber fragments, no biodegradable materials (e.g. paper, wood, cloth etc.) or gross amounts of organic contamination were observed within the Made Ground.
 - No horizons of natural organic rich soil were recorded beneath the site.
- 6.6.3 6no. Made Ground samples were analysed for Total Organic Carbon (TOC) content. TOC contents for 6no. of the samples ranged from 3.05% to 10.20% with an average TOC content of 6.92%.
- 6.6.4 The samples of ash and cinder rich Made Ground recovered from WS3 @ 0.15m, WS4 @ 0.20m and WS4 @ 1.00m recorded TOC contents of 6.12%, 7.40% and 9.68% respectively. It is noted that ash and clinker (and cinders) can give high TOC results that do not represent the risk of gas emissions from such material (it is generally not degradable and so cannot produce methane or carbon dioxide). A sample of topsoil analysed from WS5 @ 0.30m depth recorded a TOC content of 10.20%; this topsoil was encountered between g.l. to 0.50m depth and is restricted in aerial extent (≈9% of the total site area).
- 6.6.5 Given the above and based off the Made Ground descriptions given on the borehole logs, the TOC contents recorded from the WS1 @ 0.50m and WS2 @ 0.85m samples of 3.05% and 5.06% respectively, are considered by TLC to be most representative of the TOC content of the Made Ground across the site.
- 6.6.6 The age of the vast majority of the Made Ground beneath this site is likely to be >20 years old.
- 6.6.7 In accordance with the following table, which is reproduced (without footnotes) from the CL:AIRE RB17 research bulletin, in terms of defining the gas protection measures which

⁹ CL:AIRE research bulletin RB17, dated November 2012 and entitled 'A Pragmatic Approach to Ground Gas Risk Assessment'.

¹⁰ CIRIA Report C665, dated 2007 and entitled 'Assessing risk posed by hazardous ground gases to buildings'.

¹¹ BSI 2007, dated 2007 and entitled Code of practice for the characterization and remediation from ground gas in affected developments'.

will need to be incorporated into the proposed development, the 'Characteristic Situation' of the site is CS3.

Characteristic situation (BS8485 & CIRIA C665)	Thickness of Made Ground (m)	Maximum total organic carbon content of Made Ground (TOC (%))		Comments
		Made Ground	Made Ground in place for >20years	
CS1	Maximum 5m Average <3m	≤1.0	≤1.0	Limiting values based on reported soil organic matter (SOM) content of natural soils up to about 1%
CS2	Maximum 5m Average <3m	≤1.5	≤3	Limiting values based on gas generation modelling assuming slow degradation Equilibrium methane concentration in building above <0.01%
CS3	Maximum 5m Average <3m	≤4	≤6	Limiting values based on gas generation modelling assuming slow degradation Equilibrium methane concentration in building above <0.01%

6.7 Risk Assessment

6.7.1 Risks to the potential receptors identified for site derived contamination (see the following table) have been classified with reference to CIRIA guidance C552¹² using the following risk classifications:

- High Risk – There is a high probability that severe harm could arise or is occurring to the designated receptor from an identified hazard.
- Moderate Risk – It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
- Low Risk – It is possible that harm could arise to a designated receptor from an identified hazard, but it is unlikely that this harm, if realised, would at worst be normally mild.

6.8.2 Where the pollutant linkage is considered to not be viable, then a negligible risk rating has been adopted. As such the conceptual site model from the desk study has been updated to take into account the generic screening and risk assessment and is tabulated overleaf.

¹² CIRIA, 2001, Contaminated Land Risk Assessment – A Guide to Good Practice, C552

Source	Pathway	Receptor	Comment	Risk	Mitigation Measures	Residual Risk
Made Ground Lead and Benzo(a)Pyrene (BaP) contamination.	– Dermal contact. – Inhalation of contaminated soil and dust. – Consumption of home grown produce.	– Future site residents	6no. samples were analysed for a comprehensive suite of determinands. 3no. samples recorded lead concentrations (218-270mg/kg) which are above the 200mg/kg GAC level. 5no. samples recorded BaP concentrations (5.14-25.6mg/kg) which are above the 5.0mg/kg GAC level.	Very High (principally from BaP)	In garden areas/any soft landscaping areas, cap the Made Ground with imported clean soil. Thickness of the capping layer must be at least 600mm.	Very low.
Made Ground Lead and BaP contamination.	– Dermal contact. – Inhalation of contaminated soil and dust.	– Construction and future site maintenance workers	These receptors will be coming into direct contact with the Made Ground.	Very High (principally from BaP)	Wear appropriate PPE, eating/smoking prohibited away from designated areas, wash hands before eating/smoking.	Low
Made Ground Lead and BaP contamination.	– Inhalation of contaminated soil and dust during the construction period.	– Neighbouring residents	Excavations and surface soil stripping during the construction period could generate contaminated dust – this could be blown off site. Contaminated soil could also be tracked off site on works vehicles.	Low	Keep exposed soils damp in dry/windy weather. Use a wheel wash if necessary.	Very low.
Made Ground	– Leaching with offsite migration	– Off-site residents	It is considered unlikely that off-site residents will come into contact with any contaminated leachate generated from the Made Ground beneath this site. Site is approximately level. The groundwater table was recorded at 2.15-2.544m bgl across the site. However, groundwater seepages were recorded ≥ 0.60m bgl. No volatile contamination has been recorded.	Very low	None required.	Negligible
Made Ground Asbestos fibres.	– Inhalation.	– Future site residents – Construction and future site maintenance workers – Neighbouring residents	5no. samples were screened for asbestos fibres. Loose chrysotile asbestos fibres were recorded in the Made Ground recovered from WS4 @ 0.20m. Fibres were not detected within the other samples. The concentration of fibres within the soil was 0.002% w/w. This is above the guideline level of 0.001%.	Low Low Very Low	Keep exposed soils damp in dry/windy weather.	Negligible

Source	Pathway	Receptor	Comment	Risk	Mitigation Measures	Residual Risk
Made Ground	– Leaching with vertical migration	– Principal Aquifer	Laboratory leachate analysis of the Made Ground and detailed groundwater analysis has not carried out. However, the site is underlain by 2.60m+ to 3.65m of typically stiff low permeability clay Glacial Till. This will serve to protect the Collyhurst Sandstone aquifer by reducing the potential for any contaminated leachate generated from the Made Ground to migrate down and affect it. Completely weathered sandstone may have been encountered within the base of 4no. out of 5no. of the boreholes sunk across the site. Very little perched ground water is present within the Made Ground. Post development ≈40-45% of the total site area will be covered with buildings or external hardstandings. This will limit the amount of potentially contaminated leachate that could be generated through rainwater percolating down through the Made Ground. It is advised by TLC that the properties to be positioned adjacent to Culcheth Lane are supported on piled foundations, whereas the properties located towards the rear of the site are advised to be supported on spread foundations (see section 9.2). The use of piles will potentially provide a potential pathway through the Glacial Till for any contaminated groundwater to migrate vertically down into the sandstone aquifer. There are no groundwater abstractions or groundwater source protection zones located within influencing distance of the site.	Low to medium	No specific mitigation measures considered necessary. Risk should reduce following completion of the building works. Remedial works in garden areas should also reduce the risk – as it is likely that contaminated soils will have to be removed from the site to allow for construction of the capping layer to protect end users.	Low
Made Ground	– Leaching with lateral migration	– Surface Waters	No potential surface water receptors for site borne contamination have been identified within 375m of the site.	Negligible	None required.	Negligible

Source	Pathway	Receptor	Comment	Risk	Mitigation Measures	Residual Risk
Carbon dioxide (and possibly methane) derived from: - On site Made Ground Deposits, and/or - Deposits of Made Ground located close to the site boundary.	- Inhalation of hazardous gas concentrations. - Migration through permeable strata. - Seepage into properties and build-up in confined areas.	- End users - Residents within adjacent property - Construction and Future maintenance workers.	TOC contents of 3.05% and 5.06% have been take at representative of the Made Ground. No organic rich natural soil horizons have been identified. The vast majority of the Made Ground present is likely to be >20 years old. The average thickness of the Made Ground is 1.74m. No landfills are present within influencing distance of the site. According to CL:AIRE research bulletin RB17, the site falls within Characteristic Situation 3 (CS3).	High (End users) Very low (Residents in adjacent property) Medium (Construction and future maintenance workers)	Install gas protection measures to a level commensurate with CS3. None required. (The gas pressures present within the Made Ground beneath the site are unlikely to be high enough to force the gas off site). Take appropriate precautions in deep excavations.	Negligible Very low Very Low
Soil/Groundwater	Reaction	Buried concrete	Low pH and high sulphate concentrations can cause buried concrete to severely degrade and weaken. The groundwater table is likely to be below the depth at which foundations will be emplaced.	Medium	Use a specification of concrete appropriate to the ground conditions. See sections 8.3 and 9.2.	Negligible
Made Ground/Groundwater	- Ingestion of tainted water supply. - Degradation of plastic water supply pipes and seals.	- Future site residents - Pipe work	Organic contamination has been identified within the Made Ground.	High	A United Utilities pipeline risk assessment for potable waters will need to be undertaken to determine the appropriate specification of pipework to be used.	Negligible
Made Ground Boron	Root uptake of phytotoxic contaminants.	Flora	The boron concentration recorded was only very slightly elevated. The Made Ground materials encountered on this are physically not suitable to be used as topsoil.	Low	None required following the importation of suitable topsoil in garden areas.	Negligible

7.0 CONTAMINATION AND GROUND GASES – CONCLUSIONS AND RECOMMENDATIONS

7.1 Contamination

- 7.1.1 Made Ground was encountered within all of the boreholes (WS1-WS5) sunk across the site, to depths of between 1.00m (WS3) to 2.40m (WS1). The Made Ground was generally comprised of multiple layers of both cohesive and granular material. Ash and cinder rich deposits were described in WS3 and WS4; some of the Made Ground recovered from WS5 contained occasional cinder gravel and may also have been ashy. Glacial Till (sandy gravelly clay) was recorded beneath the Made Ground and was penetrated within WS2-WS5 at depths of between 4.80-5.30m. Sand of uncertain provenance (may be Glacial origin or may represent completely weathered Collyhurst Sandstone) was encountered below the Glacial Till and was proven to a maximum depth of 6.45m.
- 7.1.2 Groundwater seepages/minor ingresses were often recorded within the Made Ground $\geq 0.60\text{m}$ bgl, and minor ingresses were noted from occasional thin ($\leq 10\text{mm}$) sand bands contained within the Glacial Till. Subsequent groundwater level monitoring of the boreholes recorded groundwater levels at depths of between 2.15-2.54m.
- 7.1.3 The Made Ground is heavily contaminated with benzo(a)pyrene (BaP). 5no. out of 6no. samples analysed recorded BaP concentrations (5.14-25.6mg/kg) which are above the screening level for the protection of human health (5.0mg/kg). Several samples also recorded slightly elevated lead concentrations (218-270mg/kg) when compared to the 200mg/kg screening level for lead.
- 7.1.4 5no. samples of Made Ground were analysed for asbestos fibres. Loose chrysotile asbestos fibres were detected in one sample; subsequent quantification of the amount of asbestos within the sample recorded an asbestos concentration of 0.002% w/w. This is slightly above the 0.001% guideline concentration for asbestos in soil. Asbestos fibres within the Made Ground may therefore also pose a risk to human health.
- 7.1.5 To protect end users from the arsenic, lead and benzo(a)pyrene contamination, it is advised that the Made Ground located within proposed garden areas should be covered with a 600mm thick capping layer. This capping layer should comprise of an initial no dig layer (MOT type 1 material, 20-30mm, minimal fines) or a bright orange woven geotextile; the remaining portion of the capping layer could comprise of clean inert fill and sufficient topsoil for use as a growing medium. Although the existing and proposed finished site levels have not been made available to TLC, it is considered likely, given the topography of the site and surrounding land, that at least some of the Made Ground present beneath the site will have to be removed in order to accommodate the capping layer.
- 7.1.6 Although leachate analyses of the Made Ground and the analysis of samples of groundwater samples has not been carried out, the Collyhurst Sandstone principal aquifer beneath the site is not considered to be at significant risk from site borne contamination. There are no licensed groundwater abstractions taking place within influencing distance of the site and the property does not lie within an Environment Agency defined groundwater source protection zone.
- 7.1.7 The Made Ground is unlikely to pose a significant risk to flora. Despite this, the Made Ground is physically not suitable for use as topsoil with the proposed garden areas.
- 7.1.8 Due to the presence of organic contamination within the Made Ground soils across the site, a United Utilities pipeline risk assessment for potable water supply will need to be completed.

7.1.9 It is advised that a design sulphate class of DS-3 is adopted for buried concrete; the ACEC classification of site is AC-3. (see section 9.2).

7.1.10 Risks to construction workers are considered to be managed through health and safety procedures including the CDM regulations. Standard health and safety precautions (as per HSE guidance¹³) should be adopted by all workers involved with site enabling and construction works, and future maintenance works. These should include as a minimum:

- Ensuring wind blow is minimised by dampening down exposed surfaces.
- Ensuring that all vehicles leaving the site are clean and if necessary have used a wheel wash.
- Wearing appropriate PPE.
- Limiting unauthorised access to the site to prevent exposure to contaminated materials.
- The provision and use of washing facilities for site staff, requirement for high standards of personal hygiene to be adopted by all site staff, particularly before and during meals.
- Restrict smoking to designated areas.

7.2 Ground Gas

7.2.1 A gas risk assessment has been carried out in accordance with CL:AIRE research bulletin RB17 dated 2012.

7.2.2 Based on the most likely TOC content of the Made Ground soil, the thickness of the Made Ground (average 1.74m thick) and the likely age of the vast majority of the Made Ground (>20years old), the site falls within Characteristic Situation 3 (CS3) as presented within CIRIA report C665.

7.2.3 Using the guidance within BS 8485:2015¹⁴, for CS3 and the proposed development a gas protection score of 4.5 is given. A score of 4.5 can be achieved by:

- A reinforced cast in-situ suspended floor with minimal penetrations – will give 1 points worth of protection;

or,

- a cast in-situ ground-bearing floorslab (with only nominal mesh reinforcement) – will give 0.5 points worth of protection;

incorporating both a

- subfloor gas dispersal layer – will give 1.5 to 2.5 points worth of protection;

and a

- gas resistant membrane – will give a further 2 points worth of protection.

¹³ HSE (1991). 'Protection of workers and the general public during the development of contaminated land'. London HMSO.

¹⁴ BS 8485:2015 *Incorporating corrigendum No.1*. 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

- 7.2.4 Any gas protection measures should be approved by the building control and contaminated land sections of the Local Authority prior to installation. Documentary evidence that the gas protection measures have been adequately installed will need to be reviewed and approved by the Local Authority; a gas membrane fitting inspection/validation service is offered by TLC.
- 7.2.5 Construction workers should be made aware that elevated concentrations of ground gas (especially carbon dioxide on this site) could be present in any deep excavations. Risks to construction workers are considered to be managed through health and safety procedures including the CDM regulations.
- 7.2.6 Risks to residents residing within developments located within property adjacent/close to the site, from site derived gases are considered to be very low.

7.3 Remedial Strategy Report

- 7.3.1 This will be required by Manchester City Council prior to any remedial related works being undertaken at this site.

7.4 Remediation, Verification and Site Completion Report

- 7.4.1 It is recommended that all remediation related works which are carried out on site are validated by a third party, and suitable documentary evidence is subsequently provided in a Site Completion Report; documentary evidence could comprise of photographs, consignment documents and analytical results. The Site Completion Report should include as a minimum:
- Validation of the installed gas protection measures.
 - Details of the areas of the site from where Made Ground has been removed.
 - Verification of all imported soils to be placed in garden and soft landscaped areas. The sampling suite and regime should follow Council guidance. A typical sampling regime would be 1no. sample analysed per 250m³ for subsoil and 1no. sample per 50m³ of topsoil (or a minimum of 3no. samples per source). Samples would be tested for a comprehensive suite of determinands comprising as a minimum: metals, speciated PAHs, petroleum hydrocarbons and an asbestos screen.
 - Information on the installation of protective pipes and /or sterile trenches.
- 7.4.2 The Site Completion Report will assist the Council in the discharge of the contaminated land planning condition, and will be of use to solicitors acting on behalf of any prospective conveyancer who may have concerns over the site. The NHBC would also require sight of the Site Completion Report prior to providing warranties for the properties.

8.0 GEOTECHNICAL LABORATORY TESTING – RESULTS AND ASSESSMENT

8.1 Geotechnical Testing

- 8.1.1 A programme of laboratory and in-situ testing was undertaken in accordance with BS:1377 (1990) 'Methods of Test for Soils for Civil Engineering Purposes'. The following tests being carried out:

BS Test No.	Description
Part 2:3	Moisture Content
Part 2:4, 5	Determination of Atterberg Limits
Part 3:5, 9	Sulphate Content, pH value
Additional Tests as per BRE Special Digest 1:2005	Sulphur content

- 8.1.2 The Atterberg limits and moisture content testing results are presented in Appendix D. The pH, sulphate and sulphur testing results are presented in Appendix C.

8.2 Atterberg Limits and Moisture Content Determinations

- 8.2.1 3no. samples (2no. Glacial Till and 1no. Made Ground) were analysed for natural Moisture Content and Atterberg limits. The results of this testing are summarised in the table below:

Description	%
Moisture Content	14 to 34
Plastic Limit	21 to 27
Liquid Limit	43 & 44
Plasticity Index*	13.7 to 20.4

* - Corrected in accordance with NHBC Chapter 4.2

- 8.2.2 The samples tested are of low plasticity and should be regarded as being of low to medium volume change potential, and of intermediate plasticity.

8.3 Buried Concrete

- 8.3.1 5no. samples (4no. Made Ground and 1no. Glacial Till) were analysed for total sulphur, total sulphate and pH value.

- 8.3.2 The chemical testing results obtained are summarised in the tables below:

MADE GROUND			
Determinand	No of Results	Results	Characteristic Value
pH (units)	5	7.14 to 8.05	7.16
Water Soluble Sulphate (mg/l)	4	25 to 127	-
Total Sulphate (%)	5	0.04 to 1.3	0.71
Total Sulphur (%)	4	0.04 to 0.14	
Total Potential Sulphate (%)*	-	0.15 to 0.42	-
Potential Amount of Oxidisable Sulphide (%)*	-	0.10 to 0.35	-

* - Calculated according to BRE Digest SD-1: 2005¹⁵

¹⁵ 'Concrete in aggressive ground', BRE Special Digest 1:2005 third edition.

GLACIAL TILL			
Determinand	No of Results	Results	Characteristic Value
pH (units)	1	8.01	-
Water Soluble Sulphate (mg/l)	1	37	-
Total Sulphate (%)	1	0.03	-
Total Sulphur (%)	1	0.02	-
Total Potential Sulphate (%)*	-	0.06	-
Potential Amount of Oxidisable Sulphide (%)*	-	0.03	-

* - Calculated according to BRE Digest SD-1: 2005

- 8.3.3 One Made Ground oxidisable sulphide concentration surpassed the 0.3% threshold specified in BRE Special Digest 1, whereby if exceeded, pyrite may be present.
- 8.3.4 The sample of groundwater analysed from WS2 recorded a pH value of 8.2, and a sulphate concentration of 198mg/kg.

9.0 GEOTECHNICAL ASSESSMENT

9.1 Geotechnical Model

9.1.1 Based on the site investigation data, the following ground model has been adopted for the geotechnical assessment:

Stratum	Depth to Base (bgl)	Notes/Consistency/Strength Parameters
Made Ground	1.00 to 2.40m	Made Ground deposits were recorded at all locations. Comprised of layers of both cohesive and granular soils materials. Cobbles and boulders were often encountered in to ≈ 1m bgl. SPT N values obtained within the Made Ground of 0, 1, 1 and 4 were recorded implying that this material is of very low strength. A plasticity index* of 13.8% was recorded from a sample of clay Made Ground recovered from WS2 at 2.00m depth. The clay tested was of low volume change potential and of intermediate plasticity.
Devensian Glacial Till	4.80 to 5.30m (not penetrated in WS1 – proven to 5.00m only)	Comprised of extremely closely to very closely fissured dark brown mottled grey sandy gravelly CLAY. Fissuring and mottling were absent below 3.00-4.00m bgl. Thin (≤ 10mm) sand horizons were occasionally recorded within the Till. Clay consistency was typically firm to stiff or stiff. However, weathered soft and soft to firm clay was recorded in WS5 (1.30-1.65m); firm clays were then described to 1.95m bgl. SPT N values (uncorrected) are summarised below: 1.20-1.65m – N = 5 & 8 2.00-2.45m – N = 16 to 21 3.00-3.45m – N = 22 to 30 4.00-4.45m – N = 25 to 33 In-situ Cu values obtained using a hand-held shear vane are summarised below: 1.00-2.00m – Cu = 54 to >125kPa 2.00-5.00m – Cu = 80 to >125kPa (results were typically >100kPa) Plasticity Index* results for the clay of 19.2 and 20.5% were recorded, indicating low to medium shrinkage potential. The clay tested was of intermediate plasticity.
Sand	5.45m+ to 6.45m+ (not penetrated)	Brown fine and medium grained SAND was encountered below the Glacial Till. The provenance of the sand is uncertain (may be of Glacial origin or represent completely weathered Collyhurst Sandstone). SPT N values (uncorrected) from the sand ranged from 35 to 56.

* - Corrected in accordance with NHBC Guidance – Chapter 4.2 'Building near trees'

9.1.2 Groundwater seepages/minor ingresses were often recorded within the Made Ground at depths of ≥ 0.60 m. Minor groundwater ingresses were associated with the thin sand bands which were occasionally noted within the Glacial Till. Standing groundwater levels recorded across the site following completion of the site works ranged from 2.15m to 2.54m bgl.

9.1.3 The development proposal for the site is to construct 2no. detached, and 4no. semi-detached three storey residential dwellings on the site. A proposed development plan is displayed on Drawing No. TLC985/03 in Appendix A.

9.2 Foundations, Floorslabs and Buried Concrete

9.2.1 The Made Ground and soft to soft to firm Glacial Till (encountered in WS5 between 1.30-1.65m depth) are not considered suitable as a founding stratum due to the risk of excessive total and differential settlement occurring.

- 9.2.2 It is advised that the 3no. houses proposed to be situated towards the rear of the site, are supported on strip foundations, which have been extended by trench fill emplaced into the firm or stiffer Glacial Till encountered at depths of at least 1.00m bgl; the founding depth is likely to vary between $\approx 1.00\text{--}2.00\text{m}$ bgl. Foundations can be designed on an allowable bearing pressure of 125kN/m^2 .
- 9.2.3 Foundations may need to be deepened if tree planting is proposed, in accordance with NHBC Chapter 4.2 entitled 'Building near trees'.
- 9.2.4 It is advised that the houses to be located adjacent to Culcheth Lane are supported on piled foundations, as the depth of Made Ground in this area of the site (up to 2.4m) would make the use of spread foundations uneconomic.
- 9.2.5 The design of the piles should be undertaken by a specialist contractor, and the design verified on site by carrying out pile load tests.
- 9.2.6 Pile design would need to take into account noise and vibration issues, nearby structures and services, as well as the potential for obstructions within the Made Ground (e.g. cobbles, boulders, relic foundations etc).
- 9.2.7 Suspended floorslabs are advised to be adopted on this site owing to the thickness and low strength of the Made Ground.
- 9.2.8 It is advised that a design sulphate class of DS-3 is adopted for buried concrete; the ACEC classification of site is AC-3¹⁶.

9.4 General

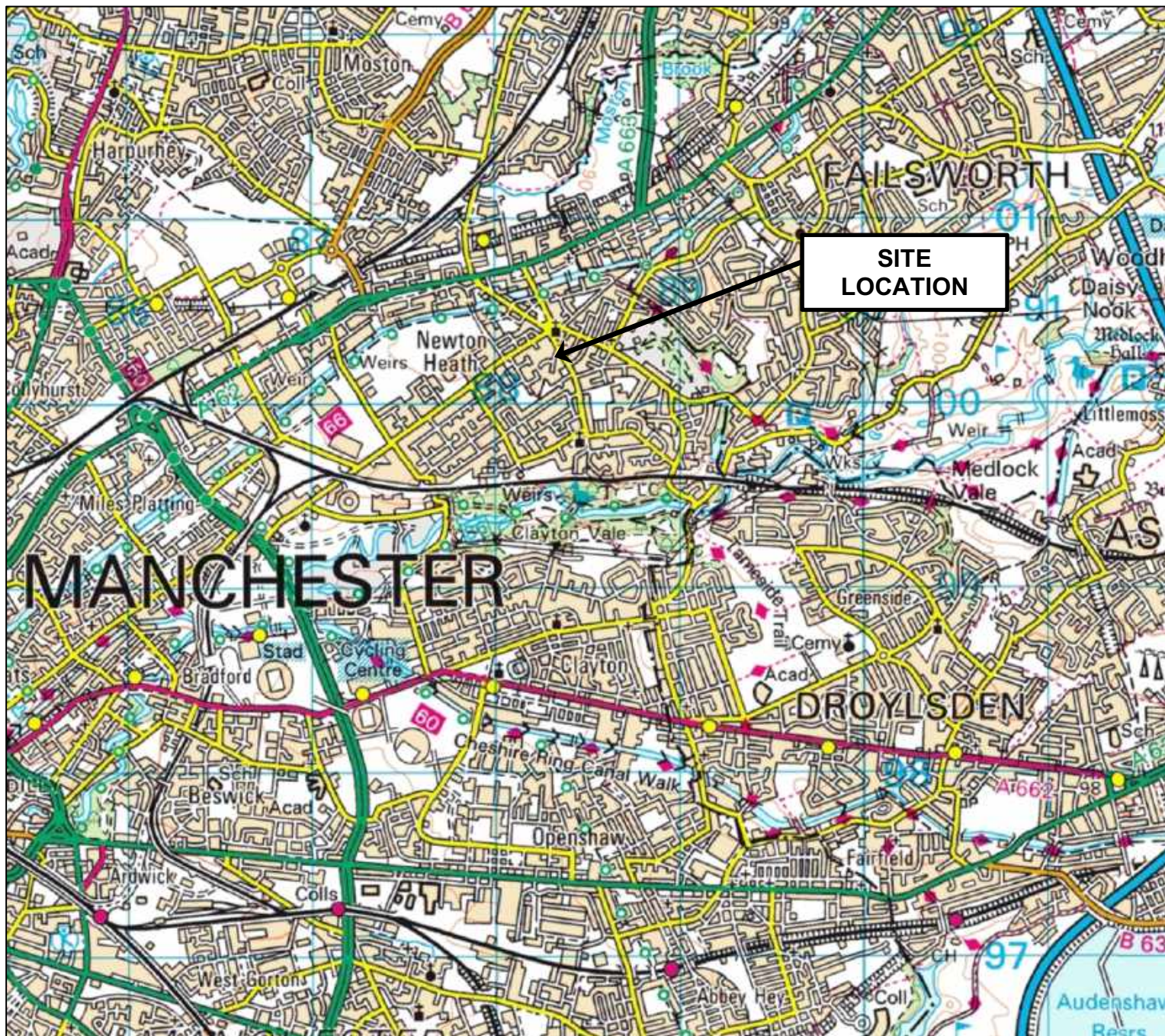
- 9.4.1 Excavations through the Made Ground would not be expected to stand unsupported, even in the short term and temporary support would be required; alternatively, if sufficient space is available, excavations could be battered back to a suitable angle of repose.
- 9.4.2 Excavation advice is provided within CIRIA Report 97: Trenching Practice.
- 9.4.3 Foundation excavations taken down below $\approx 0.60\text{m}$ depth may encounter minor groundwater ingresses, which should be controllable using simple sump pumping techniques. If required, advice on de-watering is given in CIRIA Report No C750, dated 2016 and entitled 'Groundwater control: design and practice'.

¹⁶ Concrete design guidance has been taken from BRE Special Digest 1:2005 'Concrete in Aggressive Ground'

APPENDICES

APPENDIX A

DRAWINGS



**SITE
LOCATION**



THE LAND CONSULTANCY LIMITED

Fairweather House, 4 Parker Lane, Whitestake, Preston PR4 4JX
Tel: 01772 610609; M: 07771 800859
email: sfknot@thelandconsultancy.co.uk; www.thelandconsultancy.co.uk

Project:

Land Bounded by Culcheth Lane and Tandlewood Mews, Newton Heath, Manchester M40 1LU

Title:

Site Location Plan

Scale:

NTS

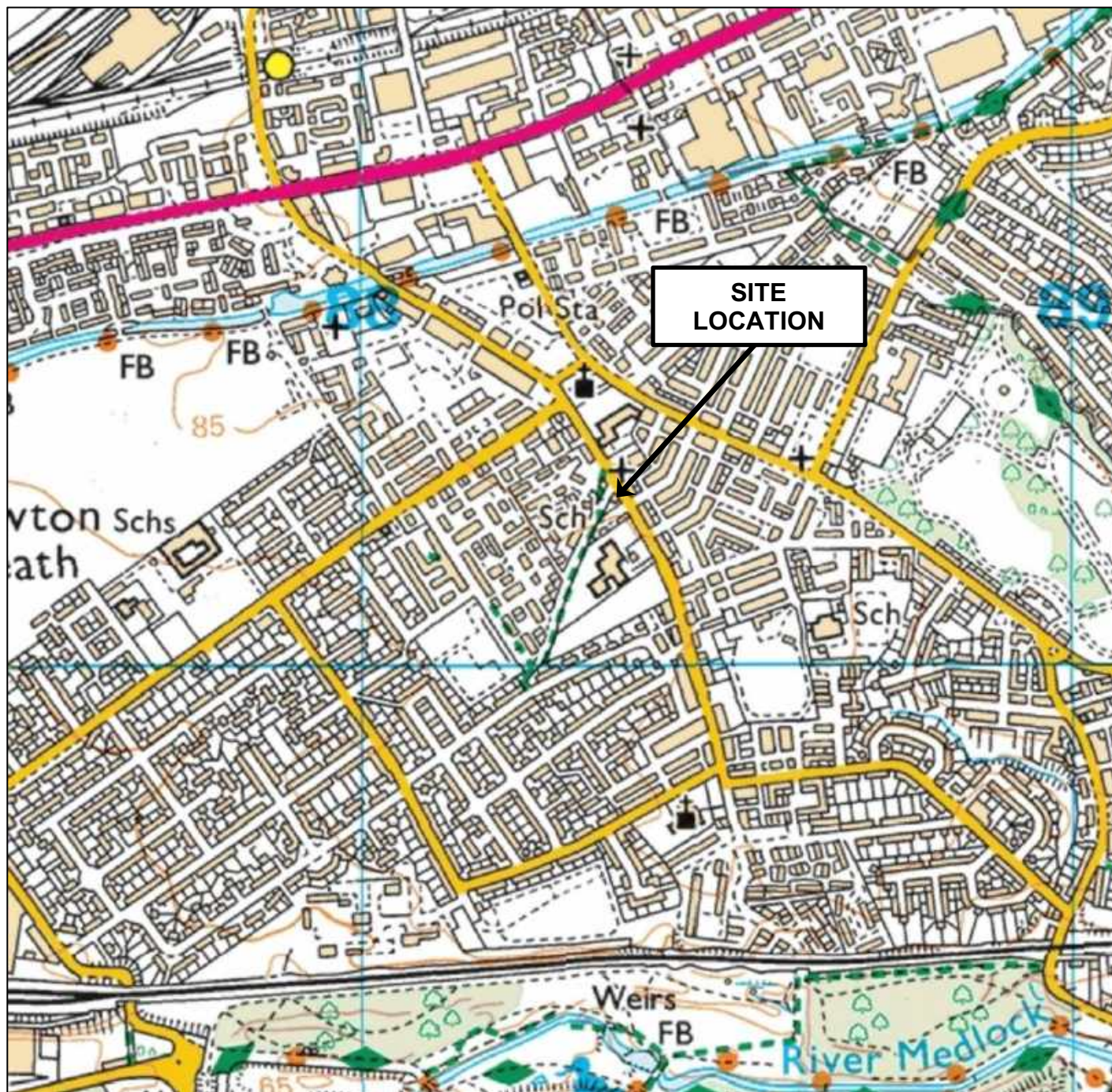
Drawn by:

SFK

Date:

10/04/2018

Drawing No.: TLC985/01a



THE LAND CONSULTANCY LIMITED

Fairweather House, 4 Parker Lane, Whitestake, Preston PR4 4JX
 Tel: 01772 610609; M: 07771 800859
 email: sfknot@thelandconsultancy.co.uk; www.thelandconsultancy.co.uk

Project:

Land Bounded by Culcheth Lane and Tandlewood Mews, Newton Heath, Manchester M40 1LU

Title:

Site Location Plan

Scale:

NTS

Drawn by:

SFK

Date:

10/04/2018

Drawing No.: TLC985/01b



**SITE
BOUNDARY**



Borehole location. WS2 & WS4 were installed.

THE LAND CONSULTANCY LIMITED

Fairweather House, 4 Parker Lane, Whitestake, Preston PR4 4JX
Tel: 01772 610609; M: 07771 800859

email: sfknot@thelandconsultancy.co.uk; www.thelandconsultancy.co.uk

Project:

Land Bounded by Culcheth Lane and Tandlewood Mews, Newton Heath, Manchester M40 1LU

Title:

Site Boundary & Exploratory Hole Plan – Shows Position of former Public House.

Scale:

As Shown

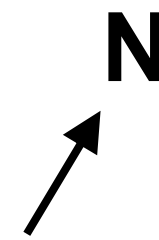
Drawn by:

SFK

Date:

15/05/2018

Drawing No.: TLC985/02



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Project:

Land Bounded by Culcheth Lane and Tandlewood Mews, Newton Heath, Manchester M40 1LU

Title:

Proposed Site Layout Plan

Scale:

NTS

Drawn by:

SFK

Date:

15/05/2018

Drawing No.: TLC985/03

APPENDIX B

**WINDOWLESS SAMPLING BOREHOLE LOGS &
SPT CALIBRATION CERTIFICATE**

The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk	Contract Name: Culcheth Lane		Client: Style Builders Ltd			Borehole ID: WS1							
	Contract Number: TLC985	Date Started: 17/04/2018	Logged By: S.F.Knott	Start Date: 17/04/2018	End Date: 17/04/2018	Sheet 1 of 1							
	Easting:	Northing:	Ground Level (mAOD):	Hole Type: Windowless Sampling Borehole			Scale: 1:50						
Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans and Mick Wilkinson		Method / Plant Used Archway Competitor Dart Rig			Weather / Ground Conditions Weather: Dry, cloudy, windy then rain, T=11-13C / Ground = damp.								
Samples & In Situ Testing				Strata Details				Groundwater					
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation					
0.50	D1	SPT(C) 1.20m, N=0 (1,1/0,0,0,0)		(2.40)		Soft and soft to firm dark brownish grey and dark grey sandy gravelly CLAY with medium to high cobble and boulder content. Gravel is fine to coarse angular of brick, concrete, slate, pottery, breeze block, glass, sandstone and occasional coal and quartzite. Cobbles and boulders are of brick, sandstone and concrete. Occasional rootlets and timber fragments noted. Deposit is generally slightly organic rich. (MADE GROUND) ... 1.00 to 2.00m - Only 20% recovery. ... 1.50 to 2.40m - Very soft to soft.	1						
1.80 - 2.00	D2	SPT(C) 2.00m, N=4 (1,1/0,0,1,3)					2						
2.20 - 2.40	D3												
2.60 - 2.75	D4	HV 2.50m, Cu = 125 kPa HV 2.70m, Cu = 125 kPa HV 2.90m, Cu = 125 kPa SPT(C) 3.00m, N=30 (5,5/6,7,8,9) HV 3.60m, Cu = 101 kPa HV 3.85m, Cu = 104 kPa SPT(S) 4.00m, N=26 (3,3/6,6,6,8) HV 4.50m, Cu = 80 kPa HV 4.80m, Cu = 107 kPa	2.40		Stiff extremely closely to very closely fissured dark brown mottled grey sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded of sandstone, siltstone and mudstone. Grey mottling is gleying. (Glacial Till) ... 3.00 to 5.00m - Fissuring not noted. Gleying absent.	3							
				(2.60)			4						
				5.00		End of Borehole at 5.00m	5						
							6						
							7						
							8						
							9						
							10						
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)					
					1.20	300			Hand pit excavated to 1.20m depth to clear services.				
					2.00	87			No casing used.				
					3.00	77			Borehole partially collapsed following completion of the borehole.				
					4.00	67			Backfilling detail: g.l. to 3.00m = bentonite; 3.00 to 5.00m = borehole collapse material.				
					5.00	57			Recovered soils were logged in accordance with BS5930: 2015.				
Chiselling			Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks
								2.00			0		Minor ingress.

The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk		Contract Name: Culcheth Lane			Client: Style Builders Ltd			Borehole ID: WS2														
		Contract Number: TLC985	Date Started: 17/04/2018	Logged By: S.F.Knott	Start Date: 17/04/2018	End Date: 17/04/2018																
Easting:		Northing:		Ground Level (mAOD):		Hole Type: Windowless Sampling Borehole			Sheet 1 of 1 Scale: 1:50													
Drilling Contractor / Drillers LOT Geotechnics / Keith Evans and Mick Worthington				Method / Plant Used Archway Competitor Dart Rig			Weather / Ground Conditions Weather: Dry, cloudy, windy then rain, T=11-13C / Ground = damp															
Samples & In Situ Testing				Strata Details						Groundwater												
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description				Water Strike	Backfill/ Installation											
0.10	D1	SPT(C) 1.20m, N=1 (2,1/1,0,0,0)		0.20		Dark grey and dark brownish grey sandy very gravelly CLAY with high cobble and boulder content. Gravel is fine to coarse angular of brick, concrete, pottery, sandstone and glass. Cobbles and boulders are of brick, concrete and sandstone. Occasional plastic, timber and scrap metal fragments noted. Deposits is generally slightly organic rich. (MADE GROUND) TARMAC. (MADE GROUND)																
0.50	D2			0.35																		
0.85	D3			(0.40)																		
1.10	D4			0.75																		
2.00 - 2.10	D5	SPT(C) 2.00m, N=12 (1,2/2,3,3,4)		1.00		Compact beige clayey silty sandy GRAVEL. Gravel is fine to coarse angular of limestone. (MADE GROUND) Brick COBBLES with some dark grey clayey gravelly sand matrix. Gravel is fine to coarse angular of concrete, brick, sandstone and occasional glass. (MADE GROUND) Soft to firm dark grey/black sandy gravelly CLAY. Organic rich. Gravel is fine to coarse angular of coal, sandstone and brick. (MADE GROUND - Burnt odour) Brownish grey very clayey very gravelly SAND with medium to high cobble content. Slightly organic rich. Gravel is fine to coarse angular of brick, concrete with occasional pottery, sandstone, coal and mortar. Cobbles are of brick and concrete. (MADE GROUND)				1												
	2.75	D6		HV 2.40m, Cu = 125 kPa HV 2.60m, Cu = 125 kPa									(1.35)									
		D7		HV 2.90m, Cu = 125 kPa SPT(S) 3.00m, N=22 (4,4/4,5,6,7)									2.35									
3.70	D7	HV 3.60m, Cu = 125 kPa HV 3.75m, Cu = 115 kPa HV 3.90m, Cu = 105 kPa SPT(S) 4.00m, N=26 (5,4/5,6,7,8)		(2.85)		Stiff extremely closely to very closely fissured darbrown mottled grey sandy gravelly CLAY. Gravel is fine to coarse subrounded to subangular of mudstone, siltstone, sandstone and occasional coal. Grey mottling is gleying. (Glacial Till)				2												
													SPT(S) 5.00m, N=56 (8,8/19,12,12,13)	5.20	3	4	5	6	7	8	9	10
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:														
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Hand pit excavated to 1.20m depth to clear services. Installation detail: 50mm ID HDPE pipe installed - g.l. to 0.80m = plain and 0.80 to 3.80m = slotted; geosock, end caps and protective cover fitted. Backfilling detail: g.l. to 0.10m = concrete; 0.10 to 0.80m = betonite pellets; 0.80 to 3.80m = 10mm washed pea gravel; 3.80 to 5.45m = benetonite. Recovered soils were logged in accordance with BS5930: 2015.													
					1.20	300	2.00	110														
					2.00	87																
					3.00	77																
					4.00	67																
					5.00	57																
Chiselling				Installation				Water Strikes														
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks									
				0.00	0.80	PLAIN	50	0.60		1.00	0		Seepages. Minor ingress.									
				0.80	3.80	SLOTTED	50	2.80	2.00		0											

The Land Consultancy Limited	Contract Name: Culcheth Lane				Client: Style Builders Ltd				Borehole ID:					
	Contract Number: TLC985		Date Started: 17/04/2018	Logged By: S.F.Knott		Start Date: 17/04/2018	End Date: 17/04/2018	WS3						
	Easting:	Northing:	Ground Level (mAOD):		Hole Type: Windowless Sampling Borehole			Sheet 1 of 1						
								Scale: 1:50						
	Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans & Mick Worthington		Method / Plant Used Archway Competitor Dart Rig				Weather / Ground Conditions Weather: Dry, cloudy, windy then rain, T=11-13C / Ground = Damp.							
Samples & In Situ Testing				Strata Details				Groundwater						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description		Water Strike	Backfill/ Installation					
0.15	D1			0.10	[Pattern]	Soft dark grey sandy very gravelly CLAY. Gravel is fine to coarse of tarmac. (MADE GROUND)								
				0.20	[Pattern]	Black sandy GRAVEL. Sand is ash rich. Gravel is fine to coarse angular of cinders. (MADE GROUND)								
0.90	D2	SPT(C) 1.20m, N=8 (1,1/2,2,2,2)		(0.80)	[Pattern]	Soft brown, grey and yellowish brown sandy gravelly CLAY with low cobble content. Gravel is fine to coarse angular to subrounded of sandstone, siltstone, mudstone, brick and occasional coal. Cobbles are of brick. (MADE GROUND - Reworked Glacial Till)		1						
1.50	D3	HV 1.35m, Cu = 92 kPa HV 1.60m, Cu = 107 kPa HV 1.80m, Cu = 125 kPa SPT(S) 2.00m, N=21 (2,3/4,5,6,6) HV 2.25m, Cu = 97 kPa HV 2.60m, Cu = 108 kPa HV 2.90m, Cu = 125 kPa SPT(S) 3.00m, N=29 (3,4/6,7,7,9) HV 3.60m, Cu = 125 kPa HV 3.85m, Cu = 125 kPa SPT(S) 4.00m, N=27 (4,4/5,7,7,8) HV 4.50m, Cu = 108 kPa HV 4.75m, Cu = 103 kPa SPT(S) 5.00m, N=45 (6,8/10,11,11,13)				Firm to stiff extremely closely to very closely fissured dark brown mottled grey sandy gravelly CLAY. Gravel is fine to coarse subrounded to subangular of sandstone, mudstone, siltstone and occasional coal. Grey mottling is gleying. (Glacial Till) ... 1.50 to 4.80m - Stiff.	2							
				(3.80)	[Pattern]			3						
						...>3.50m - Fissuring and gleying are absent.								
						... 3.90m - 10mm thick clayey silty sand band. Saturated.		4						
						... 4.25m - 2mm thick brown silty sand band.								
				4.80	[Pattern]	Dense brown fine and medium grained SAND.		5						
				(0.65)										
				5.45		End of Borehole at 5.45m								
								6						
								7						
								8						
								9						
								10						
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
					1.20	300			Hand pit excavated to 1.20m depth to clear services.					
					2.00	87			No casing used.					
					3.00	77			Backfilling detail: g.l. to 1.00m - Bored arisings; and, 1.00 to 5.45m = bentonite.					
					4.00	67			Recovered soils were logged in accordance with BS5930: 2015.					
					5.00	57								
Chiselling				Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks
									3.90			0		Minor ingress

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Chiselling <table><thead><tr><th>From (m)</th><th>To (m)</th><th>Duration</th><th>Remarks</th><th>Top (m)</th><th>Base (m)</th><th>Type</th><th>Dia (mm)</th><th>Depth Strike</th><th>Depth Casing</th><th>Depth Sealed</th><th>Time (mins)</th><th>Rose To (m)</th><th>Remarks</th></tr></thead><tbody><tr><td></td><td></td><td></td><td></td><td>0.00</td><td>0.85</td><td>PLAIN</td><td>50</td><td>1.20</td><td></td><td>1.65</td><td>0</td><td></td><td rowspan="2">Minor ingress</td></tr><tr><td></td><td></td><td></td><td></td><td>0.85</td><td>3.85</td><td>SLOTTED</td><td>50</td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table>									From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks					0.00	0.85	PLAIN	50	1.20		1.65	0		Minor ingress					0.85	3.85	SLOTTED	50																																																															
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The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk	Contract Name: Culcheth Lane		Client: Style Builders Ltd			Borehole ID:							
	Contract Number: TLC985		Date Started: 17/04/2018	Logged By: S.F.Knott	Start Date: 17/04/2018	End Date: 17/04/2018	WS5						
	Easting:	Northing:	Ground Level (mAOD):	Hole Type: Windowless Sampling Borehole			Sheet 1 of 1						
	Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans & Mick Worthington		Method / Plant Used Archway Competitor Dart Rig		Weather / Ground Conditions Weather: Dry, cloudy, windy then rain, T=11-13C / Ground = Damp		Scale: 1:50						
	Samples & In Situ Testing		Strata Details				Groundwater						
	Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation				
0.30	D1	SPT(C) 1.20m, N=5 (0,0/1,1,2,1)		(0.50)	[Pattern]	Weeds over soft black sandy gravelly CLAY with rootlets. Organic rich. Gravel is fine to coarse angular of pottery, concrete and occasional brick and glass. (MADE GROUND) ... 0.10-0.20m - Deposit contains a high concrete cobble and boulder content.	1						
0.80	D2			(0.80)	[Pattern]	Dark grey very clayey gravelly SAND. Sand is probably slightly ashy. Gravel is fine to coarse angular of rotten concrete, mortar, brick and occasional pottery and cinders. Occasional fragments of plastic noted. (MADE GROUND)							
1.80 - 1.90	D3			HV 1.75m, Cu = 54 kPa HV 1.95m, Cu = 72 kPa SPT(S) 2.00m, N=20 (2,2/4,5,5,6) HV 2.30m, Cu = 101 kPa HV 2.55m, Cu = 125 kPa	1.30 (0.35) 1.65	[Pattern]				Soft and soft to firm yellowish brown, grey and orangish brown sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone and siltstone. (Glacial Till - Weathered) Firm extremely closely to very closely fissured dark brown mottled grey sandy gravelly CLAY. Gravel is fine to coarse subrounded to subangular of sandstone, mudstone, siltstone and occasional coal. Grey mottling is gleying. (Glacial Till) ... 1.95 to 2.20m - Firm to stiff ... 2.20 to 5.30m - Stiff			
2.50	D4	HV 2.85m, Cu = 125 kPa SPT(S) 3.00m, N=28 (4,4/6,7,7,8) HV 3.60m, Cu = 101 kPa HV 3.85m, Cu = 112 kPa SPT(S) 4.00m, N=33 (5,5/6,9,9,9) HV 4.25m, Cu = 108 kPa HV 4.60m, Cu = 125 kPa HV 4.90m, Cu = 120 kPa SPT(S) 5.00m, N=36 (5,5/7,10,9,10)	(3.65)	[Pattern]	[Pattern]	2	2						
										3	3		
										4	4		
						5	5						
				5.30 5.45		Brown fine and medium grained SAND. End of Borehole at 5.45m	6						
							7						
							8						
							9						
							10						
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)					
					1.20	300	2.00	110	Hand pit excavated to 1.20m depth to clear services.				
					2.00	87			Backfilling detail: g.l. to 2.00m - bored arisings; and 2.00 to 5.45m = bentonite.				
					3.00	77			Recovered soils were logged in accordance with BS5930: 2015.				
					4.00	67							
					5.00	57							
Chiselling			Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks
								1.15		2.00	0		Minor ingress

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: DART358
Test Date: 01/12/2017
Report Date: 01/12/2017
File Name: DART358.spt
Test Operator: SH

Instrumented Rod Data

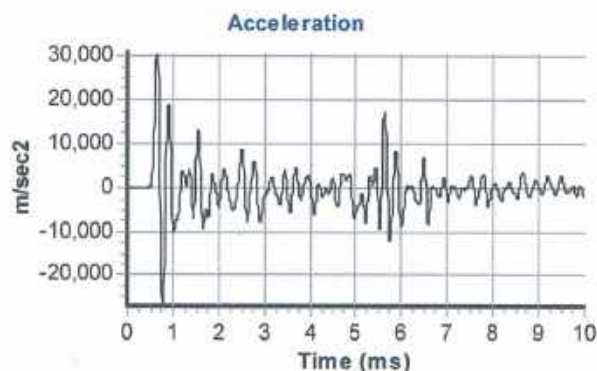
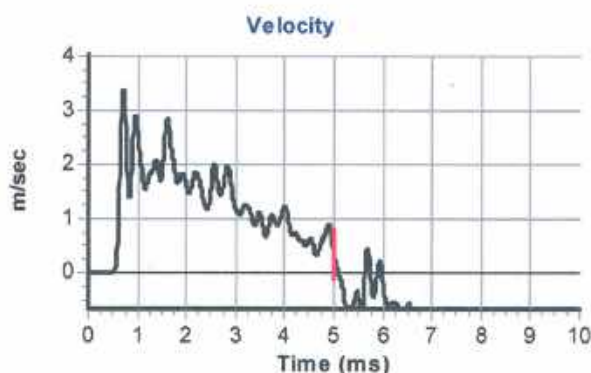
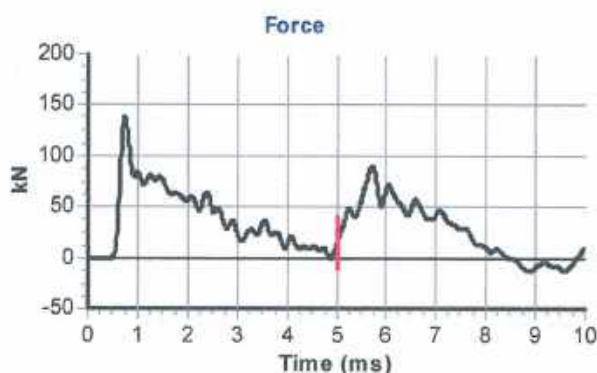
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 200
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

Comments / Location

CALIBRATION



Calculations

Area of Rod A (mm^2): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 316

Energy Ratio E_r (%): **67**

M. Gardner

Signed: M.GARDNER

Title: FITTER

The recommended calibration interval is 12 months

APPENDIX C
CHEMICAL TESTING RESULTS AND SCREENING VALUES

Screening values of 6.0% SOM have been used for Made Ground (Conservative - SOM range was 5.3% to 17.6%, average = 11.9%)

Proposed End Usage: Residential with Plant Uptake

GT = Glacial Till

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Hole ID		Screening Value (1% SOM)	Screening Value (2.5% SOM)	Screening Value (6% SOM)	Source of Screening Value	WS1 0.50m MG	WS2 0.50m MG	WS2 0.85m MG	WS3 0.15m MG (ashy)	WS4 0.20m MG (ashy)	WS4 1.00m MG (ashy)	WS5 0.30m (MG (topsoil)	WS1 2.60-2.75m GT	WS2 1.75-1.90m MG			MG Pass/Fail/?
Depth Soil Type																	
pH	pH	NV	NV	NV	-	7.19	-	7.45	7.14	7.75	7.46	7.32	8.01	8.05			-
Sulphate (acid soluble)	mg/kg	NV	NV	NV	-	13000	-	700	710	640	390	670	-	-			-
Sulphate (water soluble)	mg/l	NV	NV	NV	-	-	-	51	127	-	25	-	37	44			-
Sulphur (acid soluble)	mg/kg	NV	NV	NV	-	-	-	0.14	0.06	-	0.05	-	0.02	0.07			-
Cyanide (total)	mg/kg	NV	NV	NV	-	<1	-	<1	<1	<1	<1	<1	-	-			-
Phenols - Total by HPLC	mg/kg	120	200	380	a	<0.2	-	<0.2	<0.2	<0.2	<0.2	<0.2	-	-			PASS
Total Organic Carbon	% w/w	NV	NV	NV	-	3.05	-	5.06	6.12	7.4	9.68	10.2	-	-			-
Arsenic	mg/kg	37	37	37	a	12	-	17	16	8	20	29	-	-			PASS
Boron (water soluble)	mg/kg	290	290	290	a	3.2	-	2.6	2.4	1.7	1.4	2.1	-	-			PASS
Cadmium	mg/kg	11	11	11	a	1.3	-	1.6	1.5	1.9	1.9	1.8	-	-			PASS
Chromium	mg/kg	NV	NV	NV	-	21	-	25	16	16	19	23	-	-			-
Chromium (hexavalent)	mg/kg	6	6	6	a	<1	-	<1	<1	<1	<1	<1	-	-			PASS
Copper	mg/kg	2400	2400	2400	a	93	-	73	92	41	65	91	-	-			PASS
Lead	mg/kg	200	200	200	b	182	-	270	161	140	218	261	-	-			FAIL
Mercury	mg/kg	40	40	40	a	0.41	-	1.52	0.78	0.71	0.29	0.71	-	-			PASS
Nickel	mg/kg	130	130	130	a	20	-	24	25	20	32	28	-	-			PASS
Selenium	mg/kg	250	250	250	a	<1	-	<1	<1	1	<1	<1	-	-			PASS
Zinc	mg/kg	3700	3700	3700	a	754	-	160	125	97	85	151	-	-			PASS
EPH total (>C10-C40)	mg/kg	NV	NV	NV	-	240	-	2060	468	1440	56	1340	-	-			-
VPH total (>C5-C10)	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-			-
Asbestos in Soil (inc. matrix)																	
Asbestos in soil		-	-	-	-	NAD	NAD	-	NAD	Chrysotile	-	NAD	-	-			-
Asbestos matrix (microscope)		-	-	-	-	-	-	-	-	Loose fibres	-	-	-	-			-
Asbestos in Soil Quantification % (Hand Picking & Weighing)																	
Asbestos in soil % composition	% w/w	-	-	-	-	-	-	-	-	0.002	-	-	-	-			-
PAH 16																	
Acenaphthene	mg/kg	210	510	1100	a	0.75	-	15.1	1.8	12.6	0.23	3.68	-	-			PASS
Acenaphthylene	mg/kg	170	420	920	a	0.39	-	<0.10	0.05	0.34	0.03	<0.10	-	-			PASS
Anthracene	mg/kg	2400	5400	11000	a	2.43	-	22.4	3.41	20.4	0.47	5.51	-	-			PASS
Benzo(a)anthracene	mg/kg	7.2	11	13	a	6.16	-	36.4	7.47	34	1	16.5	-	-			FAIL
Benzo(a)pyrene	mg/kg	2.2	2.7	3.0	a	5.14	-	24.5	6.65	25.6	0.91	14.5	-	-			FAIL
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	a	6.03	-	30.7	7.95	30.5	1.09	18	-	-			FAIL
Benzo(ghi)perylene	mg/kg	320	340	350	a	2.06	-	10.8	2.81	11.9	0.48	7.38	-	-			PASS
Benzo(k)fluoranthene	mg/kg	77	93	100	a	2.34	-	11.4	2.76	13	0.41	6.55	-	-			PASS
Chrysene	mg/kg	15	22	27	a	5.92	-	39.4	7.67	35.4	1.1	20.4	-	-			FAIL
Dibenz(ah)anthracene	mg/kg	0.24	0.28	0.30	a	0.55	-	2.88	0.71	3.2	0.12	1.85	-	-			FAIL
Fluoranthene	mg/kg	280	560	890	a	14.7	-	80.3	19.6	68.4	2.24	33.2	-	-			PASS
Fluorene	mg/kg	170	400	860	a	0.94	-	12	1.57	12.3	0.2	2.2	-	-			PASS
Indeno(123-cd)pyrene	mg/kg	27	36	41	a	2.63	-	13.1	3.37	15.6	0.51	8.08	-	-			PASS
Naphthalene	mg/kg	2.3	5.6	13	a	0.15	-	1	0.17	0.61	0.11	<0.30	-	-			PASS
Phenanthrene	mg/kg	95	220	440	a	9.53	-	82.3	13.1	88.8	2.03	23.7	-	-			PASS
Pyrene	mg/kg	620	1200	2000	a	12.7	-	71	17.4	56.7	2.06	32	-	-			PASS
PAH (Total 16)	mg/kg	NV	NV	NV	-	72.4	-	454	96.5	430	13	194	-	-			-
Coal Tar (BaP used as surrogate marker)	mg/kg	0.79	0.98	1.1	a	5.14	-	24.5	6.65	25.6	0.91	14.5	-	-			FAIL
Coal Tar (BaP used as surrogate marker)	mg/kg	-	-	5.0	b	5.14	-	24.5	6.65	25.6	0.91	14.5	-	-			FAIL
TPH CWG																	
Alii >C5-C6	mg/kg	42	78	160	a	-	-	<0.01	-	<0.01	-	<0.01	-	-			PASS
Alii >C6-C8	mg/kg	100	230	530	a	-	-	<0.01	-	<0.01	-	<0.01	-	-			PASS
Alii >C8-C10	mg/kg	27	65	150	a	-	-	<0.01	-	<0.01	-	<0.01	-	-			PASS
Alii >C10-C12	mg/kg	130	330	770	a	-	-	<0.1	-	<0.1	-	<0.1	-	-			PASS
Alii >C12-C16	mg/kg	1100	2400	4300	a	-	-	<0.1	-	9	-	<0.1	-	-			PASS
Alii >C16-C21	mg/kg	65000	92000	110000	a	-	-	<0.2	-	72.6	-	17.5	-	-			PASS
Alii >C21-C35	mg/kg				-	-	-	-	-	-	-	-	-	-	-	-	
Alii >C35-C44	mg/kg	65000	92000	110000	a	-	-	-	-	-	-	-	-	-			-
Total Aliphatics	mg/kg	NV	NV	NV	-	-	-	<0.1	-	81.5	-	17.4	-	-			PASS
Aro >C5-C7	mg/kg	70	140	300	a	-	-	<0.01	-	<0.01	-	<0.01	-	-			PASS
Aro >C7-C8	mg/kg	130	290	660	a	-	-	<0.01	-	<0.01	-	<0.01	-	-			PASS
Aro >C8-C9	mg/kg	3400	83	190	a	-	-	<0.02	-	<0.02	-	<0.02	-	-			PASS
Aro >C9-C10	mg/kg				-	-	-	-	-	-	-	-	-	-	-	-	
Aro >C10-C12	mg/kg	74	180	380	a	-	-	2.9	-	1.2	-	1.9	-	-			PASS
Aro >C12-C16	mg/kg	140	330	660	a	-	-	31.2	-	59.3	-	16	-	-			PASS
Aro >C16-C21	mg/kg	1100	1500	1700	a	-	-	110	-	429	-	83.8	-	-			PASS
Aro >C21-C35	mg/kg	1100	1500	1700	a	-	-	92.1	-	424	-	138	-	-			PASS
Aro >C35-C44	mg/kg	1100	1500	1700	a	-	-	-	-	-	-	-	-	-			-
Total Aromatics	mg/kg	NV	NV	NV	-	-	-	236	-	913	-	239	-	-			PASS
TPH (Alii & Aro)	mg/kg	NV	NV	NV	-	-	-	236	-	995	-	257	-	-			PASS
TPH (C5-C10)	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-			-

Screening values of 6.0% SOM have been used for Made Ground (Conservative - SOM range was 5.3% to 17.6%, average = 11.9%)

Proposed End Usage: Residential with Plant Uptake

GT = Glacial Till

NAD = No Asbestos Detected

Hole ID		Screening Value (1% SOM)	Screening Value (2.5% SOM)	Screening Value (6% SOM)	Source of Screening Value	WS1 0.50m MG	WS2 0.50m MG	WS2 0.85m MG	WS3 0.15m MG (ashy)	WS4 0.20m MG (ashy)	WS4 1.00m MG (ashy)	WS5 0.30m (MG (topsoil))	WS1 2.60-2.75m GT	WS2 1.75-1.90m MG			MG Pass/Fail/?
TPH (C10-C40)	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-			
BTEx Compounds & MTBE																	
Benzene	mg/kg	0.087	0.17	0.37	a	-	-	<0.01	-	<0.01	-	<0.01	-	-	-	-	PASS
Toluene	mg/kg	130	290	660	a	-	-	<0.01	-	<0.01	-	<0.01	-	-	-	-	PASS
Ethyl Benzene	mg/kg	47	110	260	a	-	-	<0.01	-	<0.01	-	<0.01	-	-	-	-	PASS
o Xylene	mg/kg	60	140	330	a	-	-	<0.01	-	<0.01	-	<0.01	-	-	-	-	PASS
m Xylene	mg/kg	59	140	320	a	-	-	<0.01	-	<0.01	-	<0.01	-	-	-	-	PASS
p Xylene	mg/kg	56	140	310	a	-	-	<0.01	-	<0.01	-	<0.01	-	-	-	-	PASS
Xylene (mixed isomers)	mg/kg	56	140	310	a	-	-	-	-	-	-	-	-	-	-	-	-
MTBE	mg/kg	49	84	160	c	-	-	<0.01	-	<0.01	-	<0.01	-	-	-	-	PASS
SVOC																	
Hexachlorobenzene	mg/kg	1.8	3.3	5	a	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	mg/kg	120	260	570	c	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	mg/kg	1400	3300	7200	c	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	280	610	1100	c	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cresols (2-, 3-, & 4-Methylphenol)	mg/kg	80	180	400	c	-	-	-	-	-	-	-	-	-	-	-	-
4-Bromophenylphenyl ether	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenylphenylether	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitrophenol	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	mg/kg	0.87	2.0	4.5	a	-	-	-	-	-	-	-	-	-	-	-	-
2-Methyl-4,6-dinitrophenol	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.78	1.7	3.9	c	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	1.5	3.2	7.2	c	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	19	43	97	c	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.87	2.0	4.5	a	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.87	2.0	4.5	a	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.87	2.0	4.5	a	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	mg/kg	3.7	9.2	22	c	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrophenol	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4,6-Dinitro-2-methylphenol	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	mg/kg	120	200	380	a	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	mg/kg	0.22	0.52	1.2	a	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloroaniline	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitroaniline	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Nitroaniline	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroaniline	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitrosodimethylamine	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitroso-n-dipropylamine	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Dioctylphthalate	mg/kg	2300	2800	3100	c	-	-	-	-	-	-	-	-	-	-	-	-
n-Dibutylphthalate	mg/kg	130	31	67	c	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Azobenzene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Isophorone	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	mg/kg	0.20	0.48	1.1	c	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Perylene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
VOC																	
Dichlorodifluoromethane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	mg/kg	0.0083	0.0098	0.013	c	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	mg/kg	0.00064	0.00087	0.0014	a	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	mg/kg	8.3	11	18	c	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	mg/kg	0.23	0.40	0.82	c	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Disulfide	mg/kg	0.14	0.29	0.62	a	-	-	-	-	-	-	-	-	-	-	-	-

TLC985 - Land off Culheth Lane, Newton Heath - End Users Human Health GAC Screen

Values is **red** exceed the GAC screening concentration.

MG = Made Ground

Proposed End Usage: Residential with Plant Uptake

GT = Glacial Till

Screening values of 6.0% SOM have been used for Made Ground (Conservative - SOM range was 5.3% to 17.6%, average = 11.9%)

NAD = No Asbestos Detected

Hole ID Depth Soil Type		Screening Value (1% SOM)	Screening Value (2.5% SOM)	Screening Value (6% SOM)	Source of Screening Value	WS1 0.50m MG	WS2 0.50m MG	WS2 0.85m MG	WS3 0.15m MG (ashy)	WS4 0.20m MG (ashy)	WS4 1.00m MG (ashy)	WS5 0.30m (MG (topsoil)	WS1 2.60-2.75m GT	WS2 1.75-1.90m MG			MG Pass/Fail/?
Dichloromethane	mg/kg	0.58	0.98	1.7	c	-	-	-	-	-	-	-	-	-	-	-	-
trans 1,2-Dichloroethene	mg/kg	0.19	0.34	0.70	c	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	mg/kg	2.4	3.9	7.4	c	-	-	-	-	-	-	-	-	-	-	-	-
cis 1,2-Dichloroethene	mg/kg	0.11	0.19	0.37	c	-	-	-	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	mg/kg	NV	NV	NV	c	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	mg/kg	0.91	1.7	3.4	a	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	mg/kg	8.8	18	39	a	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	mg/kg	0.026	0.056	0.13	a	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	mg/kg	0.0071	0.0110	0.019	a	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	mg/kg	0.016	0.034	0.075	a	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	mg/kg	0.024	0.042	0.084	c	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	mg/kg	0.016	0.030	0.061	c	-	-	-	-	-	-	-	-	-	-	-	-
cis 1,3-Dichloropropene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
trans 1,3-Dichloropropene	mg/kg	0.6	1.2	2.7	c	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	mg/kg	0.18	0.39	0.90	a	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	mg/kg	0.46	1.0	2.4	a	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg	1.2	2.8	6.4	a	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	mg/kg	8.1	19	43	c	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform (Tribromomethane)	mg/kg	2.8	5.9	13	c	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	mg/kg	11	27	64	c	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg	1.6	3.4	7.5	a	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	mg/kg	0.87	2.0	4.7	c	-	-	-	-	-	-	-	-	-	-	-	-
n-Propylbenzene	mg/kg	34	82	190	c	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg	0.35	0.85	2.0	c	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.40	1.0	2.3	a	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	61	150	350	a	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	23	55	130	a	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	2.6	6.4	15	a	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	mg/kg	0.29	0.7	1.6	c	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg	1.5	3.6	8.6	a	-	-	-	-	-	-	-	-	-	-	-	-

Source References

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- Defra, 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (SP1010): Final Project Report', March 2014; & Defra, 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (SP1010): Policy Companion Document', March 2014.
- CLAIRe / AGS / EIC (December 2009), 'The Soil Generic Assessment Criteria for Human Health Risk Assessment'.

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/02957

Issue Number: 1

Date: 08 May, 2018

Client: The Land Consultancy Ltd
4 Parker Lane
Preston
PR4 4JX

Project Manager: Stephen Knott
Project Name: Culcheth Lane, Manchester
Project Ref: TLC985
Order No: N/A
Date Samples Received: 19/04/18
Date Instructions Received: 20/04/18
Date Analysis Completed: 08/05/18

Prepared by:



Holly Neary-King
Administrative Assistant

Approved by:



Georgia King
Admin & Client Services Supervisor

Envirolab Job Number: 18/02957

Client Project Name: Culcheth Lane, Manchester

Client Project Ref: TLC985

Lab Sample ID	18/02957/1	18/02957/2	18/02957/3	18/02957/4	18/02957/5	18/02957/6	18/02957/7	18/02957/8	Units	Method ref
Client Sample No										
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS4	WS5	WS1		
Depth to Top	0.50	0.50	0.85	0.15	0.20	1.00	0.30	2.60		
Depth To Bottom								2.75		
Date Sampled	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6A	4AB	6	6A	4AB	6A	4E	6		
% Stones >10mm _A	9.0	-	<0.1	8.5	<0.1	22.9	<0.1	<0.1	% w/w	A-T-044
pH _D ^{M#}	7.19	-	7.45	7.14	7.75	7.46	7.32	-	pH	A-T-031s
pH BRE _D ^{M#}	-	-	7.45	7.14	-	7.46	-	8.01	pH	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{M#}	-	-	51	127	-	25	-	37	mg/l	A-T-026s
Sulphate (acid soluble) _D ^{M#}	13000	-	700	710	640	390	670	-	mg/kg	A-T-028s
Sulphate BRE (acid sol) _D ^{M#}	-	-	0.07	0.07	-	0.04	-	0.03	% w/w	A-T-028s
Sulphur BRE (total) _D	-	-	0.14	0.06	-	0.05	-	0.02	% w/w	A-T-024s
Cyanide (total) _A ^{M#}	<1	-	<1	<1	<1	<1	<1	-	mg/kg	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	-	<0.2	<0.2	<0.2	<0.2	<0.2	-	mg/kg	A-T-050s
Total Organic Carbon _D ^{M#}	3.05	-	5.06	6.12	7.40	9.68	10.2	-	% w/w	A-T-032s
Arsenic _D ^{M#}	12	-	17	16	8	20	29	-	mg/kg	A-T-024s
Boron (water soluble) _D ^{M#}	3.2	-	2.6	2.4	1.7	1.4	2.1	-	mg/kg	A-T-027s
Cadmium _D ^{M#}	1.3	-	1.6	1.5	1.9	1.9	1.8	-	mg/kg	A-T-024s
Copper _D ^{M#}	93	-	73	92	41	65	91	-	mg/kg	A-T-024s
Chromium _D ^{M#}	21	-	25	16	16	19	23	-	mg/kg	A-T-024s
Chromium (hexavalent) _D	<1	-	<1	<1	<1	<1	<1	-	mg/kg	A-T-040s
Lead _D ^{M#}	182	-	270	161	140	218	261	-	mg/kg	A-T-024s
Mercury _D	0.41	-	1.52	0.78	0.71	0.29	0.71	-	mg/kg	A-T-024s
Nickel _D ^{M#}	20	-	24	25	20	32	28	-	mg/kg	A-T-024s
Selenium _D ^{M#}	<1	-	<1	<1	1	<1	<1	-	mg/kg	A-T-024s
Zinc _D ^{M#}	754	-	160	125	97	85	151	-	mg/kg	A-T-024s
EPH Total (>C10-C40) _A [#]	240	-	2060	468	1440	56	1340	-	mg/kg	A-T-007s

Envirolab Job Number: 18/02957

Client Project Name: Culcheth Lane, Manchester

Client Project Ref: TLC985

Lab Sample ID	18/02957/1	18/02957/2	18/02957/3	18/02957/4	18/02957/5	18/02957/6	18/02957/7	18/02957/8	Units	Method ref
Client Sample No										
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS4	WS5	WS1		
Depth to Top	0.50	0.50	0.85	0.15	0.20	1.00	0.30	2.60		
Depth To Bottom								2.75		
Date Sampled	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6A	4AB	6	6A	4AB	6A	4E	6		
Asbestos in Soil (inc. matrix)										
Asbestos in soil _A [#]	NAD	NAD	-	NAD	Chrysotile	-	NAD	-		A-T-045
Asbestos Matrix (microscope) _A	-	-	-	-	Loose fibres	-	-	-		A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	-	N/A	N/A	-	N/A	-		
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) ₀	-	-	-	-	0.002	-	-	-	% w/w	A-T-054

Envirolab Job Number: 18/02957

Client Project Name: Culcheth Lane, Manchester

Client Project Ref: TLC985

Lab Sample ID	18/02957/1	18/02957/2	18/02957/3	18/02957/4	18/02957/5	18/02957/6	18/02957/7	18/02957/8	Units	Method ref
Client Sample No										
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS4	WS5	WS1		
Depth to Top	0.50	0.50	0.85	0.15	0.20	1.00	0.30	2.60		
Depth To Bottom								2.75		
Date Sampled	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6A	4AB	6	6A	4AB	6A	4E	6		
PAH-16MS										
Acenaphthene _A ^{M#}	0.75	-	15.1	1.80	12.6	0.23	3.68	-	mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	0.39	-	<0.10	0.05	0.34	0.03	<0.10	-	mg/kg	A-T-019s
Anthracene _A ^{M#}	2.43	-	22.4	3.41	20.4	0.47	5.51	-	mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	6.16	-	36.4	7.47	34	1.00	16.5	-	mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	5.14	-	24.5	6.65	25.6	0.91	14.5	-	mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	6.03	-	30.7	7.95	30.5	1.09	18	-	mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	2.06	-	10.8	2.81	11.9	0.48	7.38	-	mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	2.34	-	11.4	2.76	13	0.41	6.55	-	mg/kg	A-T-019s
Chrysene _A ^{M#}	5.92	-	39.4	7.67	35.4	1.10	20.4	-	mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.55	-	2.88	0.71	3.20	0.12	1.85	-	mg/kg	A-T-019s
Fluoranthene _A ^{M#}	14.7	-	80.3	19.6	68.4	2.24	33.2	-	mg/kg	A-T-019s
Fluorene _A ^{M#}	0.94	-	12	1.57	12.3	0.20	2.20	-	mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	2.63	-	13.1	3.37	15.6	0.51	8.08	-	mg/kg	A-T-019s
Naphthalene _A ^{M#}	0.15	-	1.00	0.17	0.61	0.11	<0.30	-	mg/kg	A-T-019s
Phenanthrene _A ^{M#}	9.53	-	82.3	13.1	88.8	2.03	23.7	-	mg/kg	A-T-019s
Pyrene _A ^{M#}	12.7	-	71	17.4	56.7	2.06	32	-	mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	72.4	-	454	96.5	430	13	194	-	mg/kg	A-T-019s

Envirolab Job Number: 18/02957

Client Project Name: Culcheth Lane, Manchester

Client Project Ref: TLC985

Lab Sample ID	18/02957/1	18/02957/2	18/02957/3	18/02957/4	18/02957/5	18/02957/6	18/02957/7	18/02957/8	Units	Method ref
Client Sample No										
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS4	WS5	WS1		
Depth to Top	0.50	0.50	0.85	0.15	0.20	1.00	0.30	2.60		
Depth To Bottom								2.75		
Date Sampled	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6A	4AB	6	6A	4AB	6A	4E	6		
TPH CWG										
Ali >C5-C6 _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
Ali >C6-C8 _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
Ali >C8-C10 _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
Ali >C10-C12 _A [#]	-	-	<0.1	-	<0.1	-	<0.1	-	mg/kg	A-T-023s
Ali >C12-C16 _A [#]	-	-	<0.1	-	9.0	-	<0.1	-	mg/kg	A-T-023s
Ali >C16-C21 _A [#]	-	-	<0.1	-	20.8	-	0.7	-	mg/kg	A-T-023s
Ali >C21-C35 _A [#]	-	-	<0.1	-	51.8	-	16.8	-	mg/kg	A-T-023s
Total Aliphatics _A	-	-	<0.1	-	81.5	-	17.4	-	mg/kg	A-T-023s
Aro >C5-C7 _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
Aro >C7-C8 _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
Aro >C8-C9 _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
Aro >C9-C10 _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
Aro >C10-C12 _A [#]	-	-	2.9	-	1.2	-	1.9	-	mg/kg	A-T-023s
Aro >C12-C16 _A [#]	-	-	31.2	-	59.3	-	16.0	-	mg/kg	A-T-023s
Aro >C16-C21 _A [#]	-	-	110	-	429	-	83.8	-	mg/kg	A-T-023s
Aro >C21-C35 _A [#]	-	-	92.1	-	424	-	138	-	mg/kg	A-T-023s
Total Aromatics _A	-	-	236	-	913	-	239	-	mg/kg	A-T-023s
TPH (Ali & Aro) _A	-	-	236	-	995	-	257	-	mg/kg	A-T-023s
BTEX - Benzene _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
BTEX - Toluene _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
BTEX - o Xylene _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s
MTBE _A [#]	-	-	<0.01	-	<0.01	-	<0.01	-	mg/kg	A-T-022s

Envirolab Job Number: 18/02957

Client Project Name: Culcheth Lane, Manchester

Client Project Ref: TLC985

Lab Sample ID	18/02957/9								Units	Method ref
Client Sample No										
Client Sample ID	WS2									
Depth to Top	1.75									
Depth To Bottom	1.90									
Date Sampled	17-Apr-18									
Sample Type	Soil									
Sample Matrix Code	6A									
% Stones >10mm _A	6.2								% w/w	A-T-044
pH BRE _D ^{M#}	8.05								pH	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{M#}	44								mg/l	A-T-026s
Sulphate BRE (acid sol) _D ^{M#}	0.11								% w/w	A-T-028s
Sulphur BRE (total) _D	0.07								% w/w	A-T-024s

REPORT NOTES

General:

This report shall not be reproduced, except in full, without written approval from Envirolab.

All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure and there is insufficient sample to repeat the analysis. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: The Land Consultancy Ltd, 4 Parker Lane, Preston, PR4 4JX

Project No: 18/02957

Project: Culcheth Lane, Manchester

Date Instructions Received: 20/04/2018 (am)

Clients Project No: TLC985

Cool Box Temperatures (°C): 11.0, 12.0

Lab Sample ID	18/02957/3	18/02957/5	18/02957/7
Client Sample No			
Client Sample ID/Depth	WS2 0.85m	WS4 0.20m	WS5 0.30m
Date Sampled	17/04/18	17/04/18	17/04/18
Deviation Code			
F	✓	✓	✓

Key

F Maximum holding time exceeded between sampling date and analysis for analytes listed below

HOLDING TIME EXCEEDANCES

Lab Sample ID	18/02957/3	18/02957/5	18/02957/7
Client Sample No			
Client Sample ID/Depth	WS2 0.85m	WS4 0.20m	WS5 0.30m
Date Sampled	17/04/18	17/04/18	17/04/18
VPH CWG	✓	✓	✓

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

General Assessment Criteria (GAC) Screening Values for the Protection of Human Health

Screening Values shown are for a Sandy Loam soil with a pH of 7.0

With respect to elemental mercury, hydrocarbons and other organic contamination, it is assumed that free phase contamination is not present.

		All Concentrations are in mg/kg DW																		Source			
		Residential with Plant Uptake			Residential without Plant Uptake			Allotments			Commercial			Public Open Space (in a Residential Area)			Public Open Space (Park)						
		SOM (%)			SOM (%)			SOM (%)			SOM (%)			SOM (%)			SOM (%)						
12.56			12.56			12.56			12.56			12.56			12.56			12.56			12.56		
METALS and SEMI-METALS																							
	Antimony	ND			550			ND			7500			ND			ND			c			
	Arsenic	37			40			43			640			79			170			a (SAUL)			
	Arsenic	37			40			49			640			79			170			b (CASL)			
	Barium	ND			1300			ND			22000			ND			ND			c			
	Beryllium	1.7			35			35			410			220			63			a (SAUL)			
	Boron	290			11000			12			240000			21000			46000			a (SAUL)			
	Cadmium	11			85			1.9			190			120			532			a (SAUL)			
	Cadmium	26			149			4.9			410			220			880			b (CASL)			
	Chromium (III)	910			18000			18000			8600			1500			33000			a (SAUL)			
	Chromium (VI)	6			6			6			33			7.7			220			a (SAUL)			
	Chromium (VI)	21			21			170			49			23			250			b (CASL)			
	Copper	2400			7100			520			68000			12000			44000			b (CASL)			
	Lead	200			310			80			2330			630			1300			b (CASL)			
	Mercury (elemental)	1.2			1.2			21			58 (25.8)			16			30 (25.8)			a (SAUL)			
	Mercury (inorganic)	40			56			19			1100			120			240			a (SAUL)			
	Mercury (Methyl)	11			15			6			320			40			68			a (SAUL)			
	Molybdenum	ND			670			ND			17000			ND			ND			c			
	Nickel	130			180			53			980			230			800			a (SAUL)			
	Selenium	250			430			88			12000			1100			1800			a (SAUL)			
	Vanadium	410			1200			91			9000			2000			5000			a (SAUL)			
	Zinc	3700			40000			620			730000			81000			170000			a (SAUL)			
PETROLEUM HYDROCARBONS																							
	Aliphatic EC 5-8	42	78	160	42	78	160	730	1700	3900	3200 (304)	5900 (558)	12000 (1150)	570000 (304)	590000	600000	95000 (304)	130000 (558)	180000 (1150)	a (SAUL)			
	Aliphatic EC >8-10	100	230	530	100	230	530	2300	5600	13000	7800 (144)	17000 (322)	40000 (736)	60000	610000	620000	150000 (144)	220000 (322)	320000 (736)	a (SAUL)			
	Aliphatic EC >8-10	27	65	150	27	65	150	320	770	1700	2000 (78)	4800 (190)	11000 (451)	13000	13000	13000	14000 (78)	18000 (190)	21000 (451)	a (SAUL)			
	Aliphatic EC >10-12	130 (48)	330 (118)	760 (283)	130 (48)	330 (118)	760 (283)	2200	4400	7300	9700 (48)	23000 (118)	47000 (283)	13000	13000	13000	21000 (48)	23000 (118)	24000 (283)	a (SAUL)			
	Aliphatic EC >12-16	1100 (24)	2400 (59)	4300 (142)	1100 (24)	2400 (59)	4400 (142)	11000	13000	13000	59000 (24)	82000 (59)	90000 (142)	13000	13000	13000	23000 (24)	25000 (59)	26000 (142)	a (SAUL)			
	Aliphatic EC >16-35	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	a (SAUL)			
	Aliphatic EC >35-44	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	a (SAUL)			
	Aromatic EC 5-7 (benzene)	70	140	300	370	680	1400	13	27	57	26000 (1220)	46000 (2260)	86000 (4710)	56000	56000	56000	76000 (120)	84000 (2260)	92000 (4710)	a (SAUL)			
	Aromatic EC >7-8 (toluene)	130	220	360	180	380	380	22	51	120	56000 (89)	110000 (1920)	180000 (4360)	56000	56000	56000	87000 (89)	95000 (1920)	100000 (4360)	a (SAUL)			
	Aromatic EC >8-10	34	83	190	47	10	270	8.6	21	51	3500 (613)	8100 (1500)	17000 (3580)	5000	5000	5000	7200 (613)	8500 (1500)	9300 (3580)	a (SAUL)			
	Aromatic EC >10-12	74	180	380	250	590	1200	13	31	74	16000 (364)	28000 (899)	34000 (2150)	5000	5000	5000	9200 (364)	9700 (899)	10000	a (SAUL)			
	Aromatic EC >12-16	140	330	660	180	410	2500	23	57	130	36000 (169)	37000	38000	5100	5100	5000	10000	10000	10000	a (SAUL)			
	Aromatic EC >16-21	260	640	930	1900	1900	46	110	260	3800	28000	28000	28000	3800	3800	3800	7600	7700	7800	a (SAUL)			
	Aromatic EC >21-35	1100	1500	1900	1900	1900	370	820	1600	2800	28000	28000	28000	3800	3800	3800	7800	7800	7900	a (SAUL)			
	Aromatic EC >35-44	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	a (SAUL)			
	Aliphatic + Aromatic EC >44-70	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	a (SAUL)			
POLYNUCLEAR AROMATIC HYDROCARBONS																							
	Acenaphthene	210	510	1100	3000 (57.0)	4700 (141)	6000 (336)	34	85	200	84000 (57)	97000 (141)	100000	15000	15000	15000	29000	30000	30000	a (SAUL)			
	Acenaphthylene	170	420	920	2900 (86.1)	4600 (212)	6000 (506)	28	69	160	83000 (86.1)	97000 (212)	100000	15000	15000	15000	29000	30000	30000	a (SAUL)			
	Anthracene	2400	5400	11000	31000 (1.17)	35000	37000	380	950	2200	520000	540000	540000	74000	74000	74000	150000	150000	150000	a (SAUL)			
	Benzo(a)anthracene	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	a (SAUL)			
	Benzo(b)fluoranthene	2.2	2.7	3.0	3.2	3.2	3.2	0.97	2.0	3.5	35	35	36	5.7	5.7	5.7	11	12	13	a (SAUL)			
	Benzo(k)fluoranthene	2.6	3.3	3.7	3.3	4.0	4.0	0.96	2.1	3.8	44	44	45	7.1	7.2	7.2	13	15	16	a (SAUL)			
	Benzo(g,h,i)perylene	320	340	350	360	390	400	290	470	500	3900	4000	4000	640	640	640	1400	1500	1600	a (SAUL)			
	Benzo(k)fluoranthene	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	a (SAUL)			
	Chrysene	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	a (SAUL)			
	Dibenz(a,h)anthracene	0.24	0.28	0.30	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	a (SAUL)			
	Fluoranthene	280	560	890	1500	1600	160	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	a (SAUL)			
	Fluorene	170	400	860	2800 (30.9)	3800 (76.5)	4500 (183)	27	67	160	68000 (30.9)	68000	71000	9900	9900	9900	20000	20000	20000	a (SAUL)			
	Indeno(1,2,3-cd)pyrene	27	36	41	45	46 (212)	46	9.5	21	39	500	510	510	82	82	82	150	160	180	a (SAUL)			
	Naphthalene	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190 (76.4)	460 (183)	1100 (432)	4900	4900	4900	1200 (76.4)	1900 (183)	3000	a (SAUL)			
	Phenanthrene	95	220	440	1300 (36.0)	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	a (SAUL)			
	Pyrene	620	1200	2000	3700	3800 (76.5)	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	a (SAUL)			
	Coal Tar (BaP used as a surrogate marker)	-	-	5.0	-	-	5.3	-	-	5.7	-	-	77	-	-	10	-	-	21	b (CASL)			
	Coal Tar (BaP used as a surrogate marker)	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	a (SAUL)			
BTX COMPOUNDS																							
	Benzene	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	a (SAUL)			
	Benzene	-	-	0.87	-	-	3.3	-	-	0.18	-	-	98	-	-	140	-	-	230	b (CASL)			
	Toluene	130	290	660	880 (869)	1900	3900	22	51	120	56000 (869)	110000 (1920)	180000 (4360)	56000	56000	56000	87000 (869)	95000 (1920)	100000 (4360)	a (SAUL)			
	Ethylbenzene	47	110	260	83	190	440	16	39	91	5700 (518)	13000 (1220)	27000 (2940)	24000	24000	24000	17000 (518)	22000 (1220)	27000 (2940)	a (SAUL)			
	Xylene, o-	60	140	330	88	210	480	28	67	160	6600 (478)	15000 (1120)	33000 (2620)	41000	41000	41000	17000 (478)	24000 (1120)	33000 (2620)	a (SAUL)			
	Xylene, m-	59	140	320	82	190	450	31	74	170	6200 (625)	14000 (1470)	31000 (3460)	42000	42000	42000	17000 (625)	24000 (1470)	32000 (3460)	a (SAUL)			
	Xylene, p-	56	140	310	79	180	430	29	69	160	5900 (576)	14000 (1350)	30000 (3170)	43000	43000	43000	17000 (576)	23000 (1350)	31000 (3170)	a (SAUL)			
	Xylenes (mixed isomers)	66	140	310	79	180	430	28	67	160	5900 (576)	14000 (1350)	30000 (3170)	43000	43000	43000	17000	23000 (1350)	31000 (3170)	a (SAUL)			
* Based on lowest of the 3 xylene congener results returned																							
PHENOL, CHLOROPHENOLS & OTHER PHENOL COMPOUNDS																							
	Phenol	120	200	380	440	690	1200	23	42	83	440												

General Assessment Criteria (GAC) Screening Values for the Protection of Human Health

Screening Values shown are for a Sandy Loam soil with a pH of 7.0

With respect to elemental mercury, hydrocarbons and other organic contamination, it is assumed that free phase contamination is not present.

	All Concentrations are in mg/kg DW																		Source		
	Residential with Plant Uptake			Residential without Plant Uptake			Allotments			Commercial			Public Open Space (in a Residential Area)			Public Open Space (Park)					
	SOM (%)			SOM (%)			SOM (%)			SOM (%)			SOM (%)			SOM (%)					
	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6
Tetrachloroethene (PCE)	0.18	0.39	0.90	0.18	0.40	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	810 (424)	1100 (951)	1500	a (S4UL)		
Tetrachloromethane (Carbon Tetrachloride)	0.026	0.056	0.13	0.026	0.056	0.130	0.45	1.0	2.4	2.9	6.3	14	890	920	950	190	270	400	a (S4UL)		
Trans 1,2 Dichloroethene	0.19	0.34	0.70	0.19	0.35	0.71	0.93	1.9	4.0	22.0	40	81	ND	ND	ND	ND	ND	ND	c		
Trichloroethene (TCE)	0.016	0.034	0.075	0.017	0.036	0.080	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	a (S4UL)		
Trichloromethane (Chloroform)	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	a (S4UL)		
Tribromomethane (Bromoform)	2.8	5.9	13	5.2	11	23	0.95	2.1	4.6	760	1500	3100	ND	ND	ND	ND	ND	ND	c		
Vinyl Chloride (Chloroethene)	0.00064	0.00087	0.0014	0.00077	0.0010	0.0015	0.00055	0.0010	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5.0	5.4	a (S4UL)		
CHLOROBENZENES (+ other BENZENE RELATED COMPOUNDS)																					
Bromobenzene	0.87	2.0	4.7	0.91	2.1	4.9	3.2	7.6	18	97	220	520	ND	ND	ND	ND	ND	ND	c		
Chlorobenzene	0.46	1.0	2.4	0.46	1.0	2.4	5.9	14	32	56	30	290	11000	13000	14000	1300 (675)	2000 (1520)	2900	a (S4UL)		
1,2-Dichlorobenzene	23	55	130	24	57	130	94	230	540	2000 (571)	4800 (1370)	11000 (3240)	90000	95000	98000	24000 (571)	36000 (1370)	51000 (3240)	a (S4UL)		
1,3-Dichlorobenzene	0.40	1.0	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	a (S4UL)		
1,4-Dichlorobenzene	61	150	350	61	150	350	15	37	88	4400 (224)	10000 (540)	25000 (1280)	17000	17000	17000	36000 (224)	36000 (540)	36000 (1280)	a (S4UL)		
Hexachlorobenzene	1.8 (0.20)	3.3 (0.50)	4.9	4.1 (0.20)	5.7 (0.50)	6.7 (1.2)	0.47	1.1	2.5	110 (0.20)	120	120	16	16	16	30	30	30	a (S4UL)		
Isopropylbenzene	11	27	64	12	28	67	32	79	190	1400 (390)	3300 (950)	7700 (2250)	ND	ND	ND	ND	ND	ND	c		
Pentachlorobenzene	5.8	12	22	19	30	38	1.2	3.1	7.0	640 (43.0)	770 (107)	830	100	100	100	190	190	190	a (S4UL)		
Propylbenzene	34	82	190	40	97	230	34	83	200.0	4100 (402)	9700 (981)	21000 (2330)	ND	ND	ND	ND	ND	ND	c		
1,2,3-Trichlorobenzene	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	26	102	250	590	1800	1800	1800	770 (134)	1100 (330)	1600 (789)	a (S4UL)		
1,2,4-Trichlorobenzene	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	18000	1700 (318)	2600 (786)	4000 (1880)	a (S4UL)		
1,3,5-Trichlorobenzene	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380 (36.7)	580 (90.8)	860 (217)	a (S4UL)		
1,2,3,4-Tetrachlorobenzene	15	36	78	24	56	120	4.4	11	26	1700 (122)	3080 (304)	4400 (728)	830	830	830	1500 (122)	1600	1600	a (S4UL)		
1,2,3,5-Tetrachlorobenzene	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.90	2.2	49 (39.4)	120 (98.1)	240 (235)	78	78	79	110 (39)	120	130	a (S4UL)		
1,2,4,5-Tetrachlorobenzene	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42 (19.7)	72 (49.1)	96	13	13	13	25	26	26	a (S4UL)		
1,2,4-Trimethylbenzene	0.35	0.85	2.0	0.41	0.99	2.3	0.38	0.93	2.2	42	99	220	ND	ND	ND	ND	ND	ND	c		
PESTICIDES																					
Aldrin	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	a (S4UL)		
Dieldrin	0.97	2.0	3.5	7.0	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	31	31	a (S4UL)		
Atrazine	3.3	7.60	17.4	610	620	620	0.50	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	a (S4UL)		
Dichlorvos	0.032	0.066	0.14	6.4	6.5	6.5	0.0049	0.010	0.022	140	140	140	16	16	16	26	26	27	a (S4UL)		
Alpha-Endosulfan	7.4	18	41	160 (0.003)	280 (0.007)	410 (0.016)	1.2	2.9	6.9	5600 (0.003)	7400 (0.007)	8400 (0.016)	1200	1200	1200	2400	2400	2400	a (S4UL)		
Beta-Endosulfan	7.0	17	39	190 (0.00007)	320 (0.0002)	440 (0.0004)	1.1	2.7	6.4	6300 (0.00007)	7800 (0.0002)	8700	1200	1200	1200	2400	2400	2500	a (S4UL)		
Alpha-Hexachlorocyclohexane (inc. Lindane)	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	a (S4UL)		
Beta-Hexachlorocyclohexane (inc. Lindane)	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	a (S4UL)		
Gamma-Hexachlorocyclohexane (inc. Lindane)	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	a (S4UL)		
PHTHALATES																					
Bis (2-Ethylhexyl) Phthalate	280 (8.68)	610 (21.6)	1100 (51.7)	2700 (8.68)	2800 (21.6)	2800 (51.7)	47 (8.68)	120 (21.6)	280 (51.7)	85000 (8.68)	86000 (21.6)	86000 (51.7)	ND	ND	ND	ND	ND	ND	c		
Butyl Benzy Phthalate	1400 (26.3)	3300 (64.7)	7200 (154)	42000 (26.3)	44000 (64.7)	7200 (154)	220 (26.3)	550 (64.7)	1300 (154)	940000 (26.3)	940000 (64.7)	950000 (154)	ND	ND	ND	ND	ND	ND	c		
Diethyl Phthalate	120 (13.7)	260 (29.1)	570 (65)	1900 (13.7)	3500 (29.1)	6300 (65)	19 (13.7)	41 (29.1)	94 (65)	150000 (13.7)	220000 (29.1)	290000 (65)	ND	ND	ND	ND	ND	ND	c		
Di-n-Butyl Phthalate	13 (4.65)	31 (11.4)	67 (27.3)	450 (4.65)	450 (11.4)	450 (27.3)	2.0	5.0	12	15000 (4.65)	15000 (11.4)	15000 (27.3)	ND	ND	ND	ND	ND	ND	c		
Di-n-Octyl Phthalate	2300 (32.6)	2800 (81.5)	3100 (196)	3400 (32.6)	3400 (81.5)	3400 (196)	940 (32.6)	2100 (81.5)	3900 (196)	89000 (32.6)	89000 (81.5)	89000 (196)	ND	ND	ND	ND	ND	ND	c		
TOLUENE COMPOUNDS & EXPLOSIVES																					
2,4,6-Trinitrotoluene (TNT)	1.6	3.7	8.1	65	66	66	0.24	0.58	1.40	1000	1000	1000	130	130	130	260	270	270	a (S4UL)		
2,4-Dinitrotoluene	1.5	3.2	7.2	170 (141)	170	170	0.22	0.49	1.10	3700 (141)	3700 (299)	3800 (669)	ND	ND	ND	ND	ND	ND	c		
2,6-Dinitrotoluene	0.78	1.7	3.9	78	84	87	0.12	0.27	0.61	1900 (287)	1900 (622)	1900 (1400)	ND	ND	ND	ND	ND	ND	c		
RDX	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000 (18.7)	51000	53000	a (S4UL)		
HMX	5.7	13	28	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000 (0.35)	23000 (0.39)	24000 (0.48)	a (S4UL)		
OTHER COMPOUNDS																					
Carbon Disulphide	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	a (S4UL)		
2-Chloronaphthalene	3.7	9.2	22	3.80	9.3	22	40	98	230	390	960	2200 (669)	ND	ND	ND	ND	ND	ND	c		
Bisphenyl	66 (34.4)	160	360	220 (34.4)	500 (84.3)	980 (201)	14	35	83	33000 (84.3)	83	48000 (201)	ND	ND	ND	ND	ND	ND	c		
Styrene	8.1	19	43	35	78	170	1.6	3.7	8.7	3300 (626)	6500 (1440)	11000 (3350)	ND	ND	ND	ND	ND	ND	c		
Methyl Tert-Butyl Ether (MTBE)	49	84	160	73	120	220	23	44	90	7900	13000	24000	ND	ND	ND	ND	ND	ND	c		
Tributyl Tin Oxide	0.25	0.59	1.3	1.4	3.1	5.7	0.042	0.10	4.0	130 (41.3)	180 (101)	200 (241)	ND	ND	ND	ND	ND	ND	c		
Hexachloro-1,3-Butadiene	0.29	0.70	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	a (S4UL)		

■ The GAC presented exceeds the solubility saturation limit, which is presented in brackets. Soil concentrations above soil saturation may indicate that NAPL is present. Risks from NAPL need to be considered separately.

■ The GAC presented exceeds the vapour saturation limit, which is presented in brackets.

Source References

a Nathanael, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanael, J.F., 'The LQM/CI/CH S4ULs for Human Health Risk Assessment', Dated 2015 and published by Land Quality Press, Nottingham.

b Defra, 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (SP1010): Final Project Report', March 2014; & Defra, 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (SP1010): Policy Companion Document', March 2014. Values are advised to be used by the NHBC - see Issue 15 of their 'Technical Extra' document dated October 2014.

c CL:AIRE / AGS / EIC (December 2009), 'The Soil Generic Assessment Criteria for Human Health Risk Assessment'.

ICRCL 59/83 Guideline Levels for Assessing Phytotoxicity

	Trigger Value (mg/kg)
Boron	3
Copper	130
Nickel	70
Zinc	300

Note: The phytotoxic effects of copper, nickel and zinc may be additive.
The trigger values given here are for pH=6.5 (which is the approximate acidity of pure rainwater). In neutral or alkaline soils, phytotoxic effects are unlikely at the above concentrations.

ICRCL 59/83 'The Assessment and Redevelopment of Contaminated Land', published by DEFRA, 1987

APPENDIX D

GEOTECHNICAL TESTING RESULTS



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 38954

Client Ref: **TLC 985**

Report Date: **03-05-2018**

Client PO:

Client **The Land Consultancy**
4 Parker Lane
Whitestake
Preston
PR4 4JX

Contract Title: **Culcheth Lane, Manchester**
For the attention of: **Dr. Stephen Knott**

Date Received: **20-04-2018**
Date Commenced: **20-04-2018**
Date Completed: **03-05-2018**

Test Description	Qty
Moisture Content BS 1377 : Part 2 : 3.2 - * UKAS	3
4 Point Liquid & Plastic Limit (LL/PL) BS 1377 Part 2 : 4.3 & 5.3 - * UKAS	3
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)

Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative/Quality Assistant)

Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



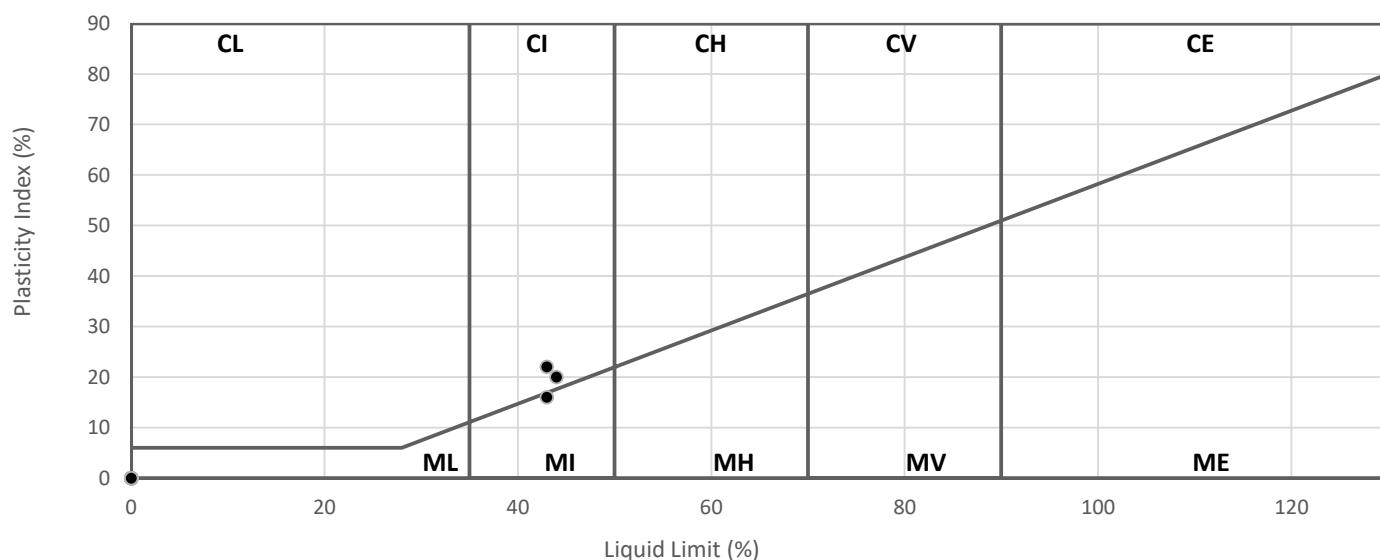
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)

Contract Number	38954	
Site Name	Culcheth Lane, Manchester	

[illegible]

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION



Operators	Checked	02/05/2018	Wayne Honey	
DB	Approved	03/05/2018	Ben Sharp	