

**REPORT ON
GROUND INVESTIGATION
AT
BARLOW MOOR ROAD,
CHORLTON**



REPORT STATUS SHEET

Client:	Liveman Properties Ltd
Report Title:	Report on Ground Investigation at Barlow Moor Road, Chorlton
Report Number:	AG3093-19-AJ73
Report Status:	Validated Issue 1
Date:	February 2020



		Date	Signed for and on behalf of Applied Geology Limited
Report Author	C Sellers MGeol (Hons) FGS MEnvSc Lead Project Geologist	10/02/2020	<i>C. Sellers</i>
Checked	P Gabrielle BSc (Hons) FGS Regional Manager	10/02/2020	<i>P Gabrielle</i>
Authorised	S Day BSc (Hons) MSc CGeol FGS SiLC Director 	10/02/2020	<i>S. Day</i>

CONTENTS

1.0	INTRODUCTION.....	1
1.1	Objectives and Scope of Investigation	1
1.2	Report Layout	1
2.0	SITE DESCRIPTION AND PROPOSALS.....	2
2.1	Site Description.....	2
2.2	Site Proposals.....	2
3.0	SUMMARY OF PREVIOUS REPORT.....	3
3.1	Desk Study Findings.....	3
3.2	Conceptual Site Model	4
4.0	GROUND INVESTIGATION WORKS	5
4.1	Fieldwork	5
4.2	Instrumentation and Monitoring	5
4.3	Laboratory Testing.....	6
5.0	GROUND CONDITIONS.....	7
5.1	Strata Encountered.....	7
5.2	Hard Standing & Made Ground	7
5.3	Alluvium	8
5.4	Glacial Deposits	8
5.5	Wilmslow Sandstone Formation	9
5.6	Groundwater.....	9
5.7	Contamination.....	10
5.8	Soil Gas	10
6.0	GEOENVIRONMENTAL ASSESSMENT.....	10
6.1	Human Health Risk Assessment.....	10
6.2	Controlled Waters Risk Assessment	12
6.3	Disposal of Soil Arisings	12
6.4	Conclusions and Recommendations	12
7.0	GEOTECHNICAL ASSESSMENT	13
7.1	General	13
7.2	Foundation Design	13
7.3	Floor Slab and Gas Protection	14
7.4	Excavations	14
7.5	Pavement Design	15
7.6	Soakaways and Sustainable Drainage Systems (SuDS).....	15
7.7	Buried Concrete and Services.....	15
7.8	Conclusions and Recommendations.....	16

GENERAL NOTES

LIST OF REFERENCES

APPENDICES

APPENDIX A

DRAWINGS & FIGURES

- Site Location Plan, Dwg No AG3093-19-01
- Exploratory Hole Location Plan, Dwg No AG3093-19-02
- Proposed Layout Drawing, DV Architects, Dwg No: PL 0002
- SPT N value v depth

APPENDIX B

EXPLORATORY HOLE LOGS

APPENDIX C

FIELD MONITORING AND IN SITU TEST RESULTS

APPENDIX D

LABORATORY TEST RESULTS & DATA SHEETS

APPENDIX E

STANDARD FIELDWORK AND ASSESSMENT PROCEDURES

1.0 INTRODUCTION

1.1 Objectives and Scope of Investigation

An area of land adjacent to Barlow Moor Road, Chorlton (the site) is being considered for redevelopment by Liveman Properties Ltd (the Client). The proposals for the site comprise the demolition of existing buildings and construction of two new multi-storey residential apartments with associated car parking and communal amenity gardens.

A previous Phase I Geo-Environmental Assessment was carried out for the Client by Jomas Associates Ltd, Report Ref: P1358J1321, dated March 2018, a copy of which was provided by Scott Hughes Design (the Engineer). Applied Geology was appointed by the Client to undertake a Phase II ground investigation in order to:

- Assess the potential for hazardous substances or conditions to exist at the site that might warrant mitigation or remediation appropriate to the intended end use proposed by the Client.
- Establish geological conditions and geotechnical parameters to assist in the safe and economic engineering design of the proposed development.
- Support a future Planning Application.

The terms of reference/brief for the works were mutually developed between Scott Hughes Design (the Engineer) and Applied Geology and are outlined in our proposal (ref: AG19-7005let002) and estimate (ref: AG19-7005-02), dated 14th November 2019.

The scope of works undertaken by Applied Geology comprised:

- Ground investigation together with sampling, monitoring and a programme of laboratory testing.
- Assessment and reporting of the results of the works.

Underground service plans for the site were obtained by Applied Geology between 8th November and 6th December 2019. Service clearance at each exploratory hole location was undertaken by Midland Survey Ltd. A topographic survey drawing was not available.

1.2 Report Layout

This report presents a brief description of the site, a review of the historical desk study data and the factual results of the intrusive investigations carried out. An interpretation of the ground conditions and a discussion/assessment of the findings is presented in the later report text sections. The main text of the report has been produced in a concise format, including the use of data tables to summarise key information where possible. The report should be read in conjunction with the general procedures detailed in Appendix E and General Notes given at the end of the main text, which provide details of investigation techniques, assessment methodology and standards, health & safety and limitations and exceptions of the report. Drawings and factual data including exploratory hole records, and laboratory testing results are presented in the other Appendices.

2.0 SITE DESCRIPTION AND PROPOSALS

2.1 Site Description

The site is located adjacent to Barlow Moor Road, Chorlton, approximately 5.15km southwest of Manchester City centre. The Ordnance Survey grid reference for the centre of the site is 381903 393141 as shown on the Site Location Plan in Appendix A.

The site is irregular in plan shape with dimensions of approximately 50m by 70m, tapering to 40m towards the east. Topographically, the site is relatively flat at approx. 57m AOD. It was noted that the site to the north was topographically lower by approximately 1m.

A site inspection/walkover was undertaken by Applied Geology on 13th November 2019. Access to the site was gained off Barlow Moor Road. At the time of the inspection, the site comprised an active gym and vacant residential property which fronted the site, vacant commercial properties to the central north and south, which were most recently used as a printing shop and CrossFit gym respectively. A basement, which was flooded during the site walkover, was present to the west of the CrossFit gym, and appeared to have been used as a changing room area.

Two active car garages (for service/repair and tyre fitting and maintenance) were present within the western north and south, and an above ground waste oil tank was present within the northwest, utilised by the car service/repair garage for oil changes and, it was noted to be in suitable condition for use with no odours or evidence of leaking. The central portion was left undeveloped as an access road, beneath which was a 2.1m diameter concrete sewer. The ground surface comprised asphalt/soft landscaping externally and concrete hard standing internally. Some minor fly tipping was noted to have taken place within the southwest tip of the site.

The site was bounded to the north by a Shell petrol station, to the west by residential properties, to the south by a mix of commercial and residential buildings, including a new apartment building, and to the east by Barlow Moor Road.

There were semi mature trees located on the southeastern boundary of the site.

2.2 Site Proposals

The proposals for the site comprise demolition of the existing buildings and constructions of two new multi-storey residential apartments (understood contain a combined 46 No apartments, up to five storeys) with associated car parking and communal amenity gardens. The proposals are shown on a proposed site plan (Drawing No: PL 0002), by DV Architects, dated 26th June 2019, a copy of which is presented in Appendix A.

3.0 SUMMARY OF PREVIOUS REPORT

3.1 Desk Study Findings

The pertinent desk study findings below are summarised from the previous Jomas Associates Ltd report dated March 2018, supplemented with information from freely available website sources, including BGS.

Site History	• 1849 – Site and surrounding area are predominantly agricultural fields. A road is shown immediately to the east of the site and a stream (Chorlton Brook) approximately 20m to the north. • 1881 – A well is shown to be present within the southwest corner of the site. A pond is located roughly 150m to the west. • 1922/23 – A large building, labelled 'laundry', is shown within the south of the site and, several smaller unlabelled buildings are present in the north. The pond 150m to the west is no longer present. • 1933/38 – The laundry is now labelled 'Rapid Works', a printing works. A chimney is now present in the southwest corner and the well is no longer shown. Residential development has taken place immediately to the south of the site. • 1955 – Several small buildings are shown on the western boundary. A garage is now present roughly 10m to the south of the site. • 1984 – The west of the site has been redeveloped and now includes two larger rectangular structures. Land immediately north and south have been redeveloped into petrol forecourts. • 2003 - Land immediately to the south has been redeveloped and now comprises a five-storey apartment building. • No further significant changes to present day.
Anticipated Geology and Ground Conditions	• Published BGS Map, sheet 98, indicates site underlain by Superficial Glaciofluvial Sheet Deposits (gravelly sand) and Glacial Till (slightly gravelly sandy clay), overlying bedrock of the Wilmslow Sandstone Formation. Alluvium is also noted to be present within the northwest of the site. A variable thickness of Made Ground relating to historic site activities is also anticipated. • Nearest BGS archive borehole (25m to northeast) indicates Made Ground to 1.37m bgl, overlying silt to 1.83m and sandy gravel to 2.44m bgl. Glacial Till was recorded present from 2.44m to the base of the borehole at 7m bgl. Groundwater was recorded at 2.13m bgl. • Site is not in a radon affected area, with <1% of homes above the Action Level. No radon protection measures are therefore considered necessary for new properties.
Mining/Quarrying	• Site not indicated to be within area of underground coal or other mining. • Site not in area associated with natural cavity formation.
Hydrology	• Nearest surface watercourse is a primary river (Chorlton Brook) 25m to north/northwest of site. • There are no surface water abstractions within 500m of site. • Six licensed discharges with 500m of site, the nearest being 62m to the northeast. • The site is reported to lie within an Environment Agency Zone 2 floodplain, with a Zone 3 floodplain 16m to the northwest (associated with Chorlton Brook).
Hydrogeology	• Wilmslow Sandstone Formation underlying site is a Principal Aquifer. • Glaciofluvial Sheet Deposits and Glacial Till are Secondary 'A' and Secondary (undifferentiated) Aquifers respectively. • Nearest groundwater abstraction license is 1065m S – for spray irrigation. • Site is not within a groundwater Source Protection Zone. • Likely groundwater flow direction is to the north, following the topography towards the Chorlton Brook.
Other	• Seven registered (active/historical) landfills within 1500m of the site, nearest 435m southwest of the site.

Environmental data	- No licensed waste sites within 250m. 17 current industrial land usages within 500m. Of relevance to the site, there are two reported on site; vehicle parts and accessories, and vehicle repair, testing and servicing. - One recorded petrol/fuel site within 250m, which is 20m north. - No environmentally sensitive ecological designations within 500m. - The Liverpool, Manchester, and West Yorkshire Greenbelt is located 439m to the southwest.
---------------------------	--

3.2 Conceptual Site Model

Source-pathway-receptor (SPR) linkages are tabulated below together with the qualitatively assessed risk. The risk to ground workers and construction workers is not included here due to the short-term exposure times that they will be subject to and the assumption that good hygiene practices will be adopted on site and the appropriate use of relevant PPE/RPE will be adhered to when exposed to potentially contaminated soils. Comments regarding contamination issues with respect to ground workers and construction workers are included in the health and safety section of the Standard Procedures included as Appendix E.

Source	Pathway	Receptor	Risk*
Potential contaminants within Made Ground, Alluvium, or resulting from historical site usage.	Inhalation, ingestion, dermal contact.	End users	Low-Medium
	Migration and Leaching	Secondary (undifferentiated), Secondary 'A', and Principal Aquifer.	Low
Soil gas from Made Ground/Alluvium – both on site and off site sources (methane and carbon dioxide)	Migration into buildings and inhalation	End users	Low-Medium
Elevated sulphates in Made Ground or natural soils	Direct contact	Buried concrete	Low
Hydrocarbon contaminants within soils from garages, waste oil tanks etc.	Migration and leaching under the site	Secondary (undifferentiated), Secondary 'A' and Principal Aquifer.	Low
		Water supply pipes	Low-Medium
	Direct contact	End users	Low

*** Definition of Risk Categories**

Negligible - Contaminants that might have unacceptable impact on key receptors, are unlikely to be present, or, no pathway is envisaged.

Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are likely to be minimal.

Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.

High Risk – Contaminants probably or certainly present and pathways are probably also present. Therefore, contaminants are likely to have an unacceptable impact on key receptors and remedial measures are likely to be necessary to reduce the risks to acceptable levels.

4.0 GROUND INVESTIGATION WORKS

4.1 Fieldwork

The following scope of fieldwork was undertaken:

- 4 No 150mm diameter Cable Percussion boreholes (ref. CP1 to CP4) to depths of between 11.87m and 13.5m below ground level (bgl);
- 6 No Driven Continuous Sampling boreholes (ref DCS1 to DCS6) to depths of between 4.45m and 5.45m bgl;
- 3 No TRL DCP tests to nominal depths of 0.8m bgl.

The borehole records are included in Appendix B along with the SPT calibration certificate, and the TRL DCP test results are included in Appendix C.

The locations of the exploratory holes were selected and set out on site by Applied Geology Limited and these were significantly constrained by the available access on site and the presence of underground supply services. CP1A was terminated at 0.7m bgl due to the presence of a service and subsequently relocated as CP1B, while CP3A was relocated to CP3B due to the presence of a concrete obstruction at 0.7m bgl.

The sampling strategy for the exploratory hole locations was to provide best overall coverage given the access constraints. The DCS boreholes were positioned predominantly at internal locations to permit collection of environmental and shallow geotechnical data and to allow for installation of gas and groundwater monitoring in areas of restricted access. The Cable Percussive boreholes were positioned to permit collection of deeper geotechnical data, to confirm depth to bedrock, and to allow for installation of gas and groundwater monitoring points.

The site is located within a UXO moderate risk zone (Zetica rated) and the geo-environmental desk study indicated a high risk, with the recommendation of a UXO risk assessment. A preliminary UXO risk assessment was completed by 1st Line Defence (report ref: EP10173-00, dated November 2019) which recommended a detailed risk assessment or on site UXO support in lieu of the detailed assessment. Therefore, the investigation works were supervised by UXO Specialist Support provided by 1st Line Defence. During drilling, a down-hole magnetometer was used to take readings at 1m intervals to allow safe progression from any UXO.

The positions of the exploratory holes were defined by taping from identifiable features on the site plan (Drawing No: PL 0002) provided by Scott Hughes Design. Surveying and service clearance of each location was undertaken by Midland Survey Ltd. The locations are presented on Drawing No. AG3093-19-02, included in Appendix A.

4.2 Instrumentation and Monitoring

On completion of boring, 50mm diameter standpipes were installed in selected boreholes as follows, with further details included in the relevant borehole logs in Appendix C:

- CP1B, 1.0 to 3.0m bgl, in Made Ground;

- CP2, 1.0 to 3.0m bgl, in Made Ground and Glacial Deposits;
- CP3B, 1.0 to 3.0m bgl in Made Ground and Glacial Deposits; and
- DCS4, 1.0 to 2.5m bgl, in Glacial Deposits.

Washed silica gravel (6-10mm) was used as the filter medium. Each standpipe was fitted with a push-in bung and single gas tap and was finished with flush metal cover concreted in place.

Ground gas and groundwater monitoring visits were undertaken on 6 occasions between 12th December 2019 and 22nd January 2020, including during four periods of low and/or falling atmospheric pressure. Each monitoring well was monitored for concentrations of carbon dioxide, methane, oxygen, flow rates and differential pressures and water level. VOCs were monitored during the first two visits only to confirm the absence of VOCs. The monitoring results are included in Appendix C.

4.3 Laboratory Testing

Geotechnical laboratory testing was undertaken on selected samples and comprised the following:

- 8 No natural moisture content tests;
- 8 No Atterberg limit tests;
- 8 No single undrained triaxial tests; and
- 10 No BRE SD1 suite tests.

Chemical testing was undertaken based upon the desk study, walkover and site observations during the fieldwork. Four samples of Made Ground and three sample of natural strata were analysed for the following suite of contaminants:

- Selected metals suite [arsenic, beryllium, boron, cadmium, chromium (total, trivalent and hexavalent), copper, mercury, nickel, lead, zinc, selenium, vanadium];
- Speciated (16 US EPA) Polycyclic Aromatic Hydrocarbons (PAH);
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG);
- Benzene, Toluene, Ethylbenzene, and Xylene (BTEX);
- Methyl-tertiary-butyl-ether (MTBE);
- Phenols (total);
- pH;
- Soluble sulphate; and
- Organic matter.

In addition, four samples of the Made Ground were submitted for asbestos testing (presence, identification, and quantification, where applicable).

Two samples of Made Ground from the western portion of the site which contained ash and clinker were submitted for leachate testing from the Made Ground in the west of the site, comprising the following suite of contaminants:

- Selected metals suite [arsenic, beryllium, boron, cadmium, total chromium, copper, mercury, nickel, lead, zinc, selenium, vanadium];
- Speciated (16 US EPA) Polycyclic Aromatic Hydrocarbons (PAH);
- Phenols (total);

- pH;
- Sulphate; and
- Total Organic Carbon.

Laboratory test results are included in Appendix D.

5.0 GROUND CONDITIONS

5.1 Strata Encountered

The ground investigation has identified between 0.4m and 3.4m of Made Ground overlying granular and cohesive Glacial Deposits, which in turn overlies the Wilmslow Sandstone Formation, encountered at depths of between 11.2m and 12.2m bgl. Alluvium was only found in the west of the site. Full details of the strata encountered are given on the borehole records presented in Appendix B. A generalised ground profile is presented below to summarise the information.

Stratum	Depth to Top of Strata (m bgl)	Thickness (range) (m)	Comments
Hard Standing	GL	0.13 – 0.2	Present as asphalt where present externally and concrete internally
Made Ground	GL – 0.2	0.15 – 3.4	Thickens to the west
Alluvium	1.7 – 2.4	1.1 – 2.0	Only in DCS1 and DCS2 within the west
Glacial Deposits	0.2 – 4.4	1.05 – 10.0	Encountered at all exploratory hole locations, deepens to the west
Wilmslow Sandstone Formation	11.2 -12.2	0.67 – 1.3	Base not proven

5.2 Hard Standing & Made Ground

Hard standing was encountered across much of the site as asphalt externally and concrete (no evidence of reinforcement) internally from ground level to between 0.13m and 0.2m bgl.

Made Ground was encountered at all locations from between ground level and 0.2m bgl and was proved to depths of between 0.4m and 3.4m bgl, achieving a maximum thickness of 3.4m.

The Made Ground generally comprised very loose brown and black ashy sandy gravel and slightly gravelly sand. The gravel was fine to coarse, angular to subangular mudstone, sandstone, clinker, brick, and quartzite. Although not discussed within the desk study report, it is thought that this material had been used to raise levels across the west/northwest portion of the site to permit the construction of the garages. In CP1A, CP1B, and DCS2 a sub-base type material was encountered, generally comprising grey sandy gravel of fine to coarse angular to subangular limestone.

Cohesive layers of Made Ground were encountered in DCS2 and CP4 from depths of 0.15m and 1.0m bgl to depths of 0.4m and 1.7m bgl, comprising very soft dark brown slightly sandy slightly gravelly clay. The gravel was fine to coarse subangular to subrounded mudstone, sandstone, brick, concrete, and ceramic.

Seven Standard Penetration Tests (SPTs) carried out within the Made Ground recorded 'N' values between N=0 and N=6.

Headspace analysis carried out on samples of the Made Ground recorded VOC concentrations less than the limit of detection (0.1ppm).

5.3 Alluvium

Alluvium was encountered between the Made Ground in the west of the site, in DCS1 and DCS2 only, from depths of 1.7m and 2.4m bgl, proven to depths of between 2.8m and 4.4m bgl, achieving a maximum thickness of 2.0m.

The Alluvium was found to comprise very loose brown silty sand in DCS1 and, very soft dark brown slightly sandy slightly gravelly clay in DCS2. The gravel was fine to coarse subangular to subrounded mudstone and sandstone.

Two SPTs carried out in the Alluvium, at 2.0m and 3.0m bgl, recorded 'N' values of N=1. A further SPT recorded an 'N' value of N=14 at 4.0m bgl, however, this is close to the boundary with underlying granular Glacial Deposits.

5.4 Glacial Deposits

Strata interpreted as interbedded Glacial Deposits were encountered from depths of between 0.4m and 3.4m in all locations below the Made Ground and Alluvium (where boreholes penetrated these strata). The base of the Glacial Deposits were proven to depths of between 11.2m and 12.2m bgl in the cable percussive boreholes, achieving a maximum thickness of 10.0m.

The interbedded Glacial Deposits were generally granular (Glaciofluvial Sheet Deposits) comprising loose or medium dense brown slightly gravelly sand or cohesive (Glacial Till), generally comprising firm to very stiff brown slightly gravelly clay. The gravel was fine to coarse subangular to subrounded quartzite and sandstone.

The results of TRL Dynamic Cone Penetration testing indicated CBR values of between 4% and 6% within the near surface granular Glacial Deposits.

The results of eight Atterberg limits tests carried out on cohesive Glacial Deposits have given plasticity indices of between 12% and 33% (corrected to between 10% and 33%), liquid limits of between 23% and 59%, and plastic limits of between 11% and 26%, indicating the soil to be clay of low to high plasticity and low to medium volume change potential. The results of moisture content tests recorded values of between 11% and 30%.

The results of eight quick undrained triaxial tests carried out in the cohesive Glacial Deposits at depths of between 3.0m and 8.0m bgl recorded shear strengths of between 40kN/m² (medium strength) and 130kN/m² (high strength).

Ten SPTs undertaken within the granular Glacial Deposits recorded 'N' values between N=5 (loose) and N=22 (medium dense).

Thirty-two SPTs carried out in the cohesive Glacial Deposits recorded 'N' values between N=8 and N=34, generally increasing with depth. One SPT at 3.45m bgl in CP1B recorded an 'N' value of N=4, however, this is likely to represent a weathered/softened horizon at the interface of the Made Ground/cohesive Glacial Deposits rather than a true representation of this stratum. A single SPT in CP1B at 11.5m bgl recorded an 'N' value of N=50, however, this may represent larger particles (i.e. cobbles) or be representative of increasing stiffness/strength in proximity to the underlying Wilmslow Sandstone Formation. By applying the empirical relationship of SPT 'N' value, mass shear strength and using an average plasticity of 20% and a corresponding f_1 of 5.5, this correlates to a mass shear strength of between 40kN/m² and 185kN/m² (low to high strength), which generally correlates with the laboratory triaxial testing.

5.5 Wilmslow Sandstone Formation

The Wilmslow Sandstone Formation was encountered underlying the Glacial Deposits in all cable percussive borehole locations (that penetrated the Made Ground) from depths of 11.2m and 12.2m bgl, achieving up to 1.3m of penetration. The base of the stratum was not proven. The Wilmslow Sandstone Formation was generally recovered as reddish-brown silty sand.

SPTs carried out in the Wilmslow Sandstone Formation all refused with penetrations of between 20mm and 200mm for 50 blows, giving extrapolated 'N' values in the range c.50 to 375, suggesting the sandstone is generally extremely weak.

5.6 Groundwater

Groundwater strikes were encountered during the ground investigation as summarised in the table below.

Exploratory Hole	Strata	Depth of Groundwater
CP1B	Made Ground	2.8m rising to 1.8m
	Glacial Deposits	10.3m rising to 9.1m
	Wilmslow Sandstone Formation	12.4m rising to 12.1m
CP2	Made Ground	1.6m rising to 1.3m
	Glacial Deposits	9.8m rising to 9.1m
	Wilmslow Sandstone Formation	11.5m rising to 8.3m
CP3B	Made Ground	2.5m rising to 2.2m
	Glacial Deposits	9.2m rising to 8.1m
	Wilmslow Sandstone Formation	11.5m rising to 11m
CP4	Glacial Deposits	10m rising to 8.1m
DCS2	Made Ground	1.7m – post drilling
DCS4	Glacial Deposits	1.9m – post drilling
DCS5	Glacial Deposits	1.4m – post drilling
DCS6	Glacial Deposits	1.4m – post drilling

Subsequent monitoring of the standpipes between 12th December 2019 and 22nd January 2020 recorded water levels between 0.65m and 2.30m bgl (26.98m mOD and 25.51mOD respectively). Groundwater levels were fairly stable throughout the monitoring period, with the exception of CP2 and CP3B, which initially rose before falling again. This may demonstrate that weather conditions may be affecting

groundwater levels alongside the basement to the southwest of the site. Groundwater flow is inferred to be towards the north/northwest, towards Chorlton Brook.

It should be noted that groundwater levels may vary beyond that observed during the fieldwork period due to seasonal effects throughout the year.

5.7 Contamination

The Made Ground across the site (where present) contained ash, brick, and clinker throughout. The Made Ground to the northwest portion contained ash and clinker which was historically used as a levelling material across the Manchester area. An above ground waste oil tank was present within the west of the site, approximately 10m north of CP1A/B, however, there was no visual or olfactory evidence of any impacted soils or leaking observed.

Other than the above, no other visual or olfactory evidence of significant potential contamination was noted.

5.8 Soil Gas

Alluvium and deep Made Ground were encountered across the west of the site, which included clinker and ash but no significant putrescible or very organic materials were encountered.

Monitoring of the standpipes has recorded methane concentrations of less than detection limit (<0.1%), carbon dioxide concentrations of between 0.3% and 3.8%, and oxygen concentrations of between 9.2% and 21.0% (depleted to atmospheric). Flow readings were taken over a three-minute period and the average result reported rates less than the limit of detection (0.1l/hr). During the first monitoring visit, the flow rate within CP3B fluctuated between 5.8l/hr and 8.1l/hr over 5 minutes, however, this was not replicated during the following monitoring visits.

By applying the maximum methane and carbon dioxide concentrations and an average gas flow rate of 0.1l/hr, Gas Screen Values (GSVs) of 0.0001l/hr for methane and 0.0038l/hr for carbon dioxide have been calculated, in accordance with CIRIA C665.

6.0 GEOENVIRONMENTAL ASSESSMENT

6.1 Human Health Risk Assessment

To determine the presence of source contamination, the results of the chemical testing on soils have been assessed as described in Appendix E, with specific details as follows:

- Proposed end-use – multi-storey residential development with landscaping;
- Screening criteria – residential without plant uptake, assuming 2.5% SOM;
- Assuming a single dataset based on the size of the site, the site's history, current land-use and the proposed redevelopment.

The spreadsheets summarising the laboratory results and relevant screening values for each dataset are presented in Appendix D. For determinands that have been

found to exceed screening values, the following table summarises the individual results, the corresponding screening values and the number of exceedences. In respect of benzo[a]pyrene and other genotoxic PAHs, various PAH ratios have been plotted and compared against data from the Culp et al study and found to be within the same range, therefore use of the surrogate marker approach is justified.

Contaminant	No of samples tested	Concentration Range (mg/kg)	Screening Value (mg/kg)	No. of exceedences
Lead	7	2.6 – 1100	310	2
Benzo[a]pyrene	7	0.05 - 64	5.3	3
Aromatic TPH C21 – C35	7	10 - 2900	1900	1

From this table it can be seen that several of the soil concentrations exceed their corresponding screening values. These relate to the layer of Made Ground in the west of the site (i.e. DCS1, DCS3, and CP1), described as containing ash and clinker.

Measureable concentrations of petroleum hydrocarbon fractions (typically C₁₀ – C₄₄) were identified throughout the Made Ground, with total TPH concentrations of between 190mg/kg and 5,300mg/kg. The highest concentration of 5,300mg/kg was encountered as DCS1 at 0.5m bgl, which also recorded elevated concentrations of PAHs and the highest benzo[a]pyrene concentration, likely due to the presence of ash and clinker. The samples from DCS1, DCS3, and CP1B, containing TPH concentrations of between 900mg/kg to 5,300mg/kg are likely to be associated with the presence of ash and clinker (such as the aromatic C₂₁ – C₃₅ exceedance in DCS1 at 0.5m bgl). An Aliphatic TPH concentration of 850mg/kg was also recorded at DCS1, which may suggest a possible mixed fuel source at this location, although the traces do not match standard product profiles.

No measureable concentrations of BTEX, MTBEs or phenols were recorded in any of the samples. All VOCs measured by PID were all less than the limit of detection.

Chromatogram profiles for both DCS1 and CP1B at 0.5m bgl, both of which contained clinker and ash, showed aromatic product sources, which is consistent with PAHs.

Asbestos screening tests undertaken on four samples of the Made Ground identified asbestos within two samples (DCS1 and CP1B, both at 0.5m bgl). Asbestos quantification testing recorded loose chrysotile fibres at <0.001% mass of the samples which test positive. This can be considered to be at background concentrations and is therefore not considered to be a significant risk to human health.

It is noted, however, that the majority of source-pathway-receptor linkages to potential end-users are effectively broken by hard standing, with only minimal areas of soft landscaping (as communal gardens). Therefore, there is considered to be a low to negligible risk to human health from potential contaminants in the ground.

6.2 Controlled Waters Risk Assessment

No evidence of visual or olfactory evidence of any gross contamination has been identified during the ground investigation.

The results of leachate testing on two samples of Made Ground in DCS1 and CP1B, both at 0.5m bgl, recorded concentrations below their relevant screening values and/or less than detection limit, except lead in DCS1, which was recorded at 16µg/l, a minor exceedance above the UK Drinking Water Standards screening value of 10µg/l. All PAHs recorded values less than the laboratory detection limit (i.e. <0.01µg/l). The spreadsheet summarising the laboratory results and relevant screening values for the data is presented in Appendix D.

Based on the content of the site and the proposed development (which will include limited landscaping or limited permeable paving and will therefore reduce the infiltration and leaching potential), the significant thickness of low permeability of cohesive Glacial Deposits, there is considered to be a low risk to Controlled Waters.

6.3 Disposal of Soil Arisings

The results of the Made Ground encountered on the site generally indicate the material would likely be classified as hazardous waste if sent for disposal at landfill due to elevated PAH/TPH results. Although elevated TPH (>1,000mg/kg) and PAHs were only encountered at DCS1 and CP1B, much of the Made Ground was of similar nature (i.e. ash and clinker throughout) and, therefore, further elevations would be considered likely. Further testing of the Made Ground may enable a re-assessment of the Waste Classification for the Made Ground.

The natural soils are likely to be classified as inert, provided they are appropriately segregated from the Made Ground, but this should be confirmed by the landfill operator. WAC testing would likely be required in any excavated soil if sent to landfill as inert or hazardous waste.

General comments regarding the procedures for the assessment of waste soil for off-site disposal purposes is included in Appendix E.

6.4 Conclusions and Recommendations

The conceptual site model identified potential contaminants within the Made Ground and hydrocarbons from former garages/ waste oil tanks to present a low/ medium risk to end users and the underlying aquifers. Although the ground investigation has confirmed the source, pathway, receptor linkages to exist, the above risk assessments have established a low risk to human health and controlled water receptors. There are elevated concentrations of a number of PAHs (including benzo[a]pyrene), lead, and 'heavy end' aromatic TPHs in the Made Ground, however, the pathway is predominantly broken by the presence of a building or hard standing. Generally, given the limited presence of proposed soft landscaping, it is recommended that the potential risk is mitigated by the placement of an inert cover layer in soft landscaping areas, breaking the potential pathway. Subject to agreement with the Local Authority, a cover layer thickness of 450mm of clean imported topsoil is considered appropriate. This should be validated in accordance with Local Authority requirements, with sufficient thickness to meet proposed planting requirements.

It is noted that permeable paving is proposed within communal garden areas, however, considering the Made Ground within the west/northwest of the site, it is recommended that consideration be given to the use of hard cover to limit the capacity for rainwater to infiltrate and leach determinands from the Made Ground and transport them into the underlying aquifers. Therefore, although some lead may be leachable, there is considered to be a low risk to Controlled Water receptors.

As discussed in Section 6.3 above, elevated concentrations of TPH, lead, and PAH indicate that the Made Ground encountered in the west of the site would likely be classified as hazardous waste if sent for disposal at landfill. As such, there may be implications for the disposal of waste soil arising from the foundation and service trenches.

The existing structures were present for the ground investigation, although access was available at some internal locations, the potential for unidentified contamination still exists at the site. As such, it is recommended that a watching brief is undertaken during groundworks or a discovery strategy is employed, so any evidence of possible unidentified contamination can be dealt with appropriately during the groundworks/basement excavations during redevelopment.

Issues with respect to ground gas and potential effects of contaminants on buried concrete and water supply pipework are included in Section 7.0.

7.0 GEOTECHNICAL ASSESSMENT

7.1 General

The proposals comprise the demolition of the existing buildings and constructions of two new multi-storey residential apartments with associated car parking and communal amenity gardens. The proposed loads were not known at the time of writing this report.

The investigations have identified the ground investigation has identified up to 3.4m of Made Ground (deeper in the west) was encountered overlying Glacial Deposits, which in turn overlies the Wilmslow Sandstone Formation. Alluvium was only found in the west of the site. Monitoring of the standpipe installations recorded groundwater levels 0.65m and 2.30m bgl.

7.2 Foundation Design

Due to the thickness of Made Ground, the presence of Alluvium in the west of the site, likely loads, and the large diameter sewer which crossed the middle of the site, conventional strip/trench fill or pad foundations are not deemed suitable. Therefore, a piled foundation solution is likely to be required, with piles founded within bedrock of the Wilmslow Sandstone Formation and gaining capacity via a combination of skin friction and end bearing. Rotary bored or CFA piles are likely to be necessary to achieve sufficient embedment in rock for the envisaged loadings. An SPT 'N' value versus depth plot is included in Appendix A and should be referred to along with the borehole logs when designing piles.

It should be noted that during the construction of the piles, unless displacement piles are utilised, casing of the Made Ground and natural granular strata is likely to be required to prevent the ground from collapsing. There is also the potential for

encountering obstructions such as brick walls (such as DCS3) and concrete cobbles/boulders (such as CP2A) and other large materials may be present within the Made Ground, all of which may pose a potential problem during the installation of piles. In addition, the basement to the southwest will need to be broken out and infilled with clean granular material to a suitable specification prior to piling. The proximity of the surrounding buildings and infrastructure/services will need to be taken into account when selecting the piling rig and piling methodology.

The advice of specialist and experienced piling contractors should be sought in relation to suitable piling techniques and designs for the ground conditions at the site. An appropriate number of pile tests should be carried out in order to confirm the load capacities and help economical and detailed pile design. The effects of negative skin friction associated with the consolidation of the Made Ground and any loose Alluvium (if present beneath the building footprint) may need to be taken into consideration during pile design.

The piling operations will require the construction of a suitably robust working platform designed appropriately to accommodate the proposed plant and the underlying ground conditions. This could be undertaken in conjunction with the breaking out/removal of subsurface obstructions. Applied Geology can produce such a design if required. The loose and variable Made Ground encountered across the west of the site may impact the design of the required temporary working platform.

If conditions, significantly at variance to those described herein are encountered, specialist geotechnical advice should be sought to make appropriate assessment and recommendations.

7.3 Floor Slab and Gas Protection

Owing to the thickness of Made Ground and anticipated loads, a suspended floor slab is considered necessary.

Although some alluvium and deeper Made Ground was encountered, all methane and carbon dioxide recorded concentrations of <1% and <5% respectively, with no flow rate. The calculated GSVs for the site suggest that the site can be characterised as Situation 1 (CIRIA C665). As such, based on the Conceptual Site Model, the ground conditions and the gas monitoring no gas protection measures are considered necessary. However, this should be agreed with the Local Authority before construction.

7.4 Excavations

Excavations up to c1.5m deep are envisaged for the foundation excavations (such as pile caps), service trenches, and the removal of obstructions (such as the basement). At these depths excavations are expected to be in a combination of Made Ground and Glacial Deposits. These materials may be prone to some short-term instability and spalling and may need to be graded back to a stable angle or trench support should be provided. Trench support or the angle of batter should be designed by an appropriately qualified engineer or competent person to suit the required depth and the ground and groundwater conditions.

Significant groundwater ingress is expected within the Made Ground in the west of the site, as identified during the site investigation and, subsequent groundwater monitoring which has identified groundwater levels between 0.65m and 2.30m bgl and the basement in the southwest was also noted to be flooded. Therefore, dewatering or other temporary works techniques may be required.

7.5 Pavement Design

Based on a review of in situ CBR testing carried out, classification testing, soil type, and reference to IAN 73/06, an equilibrium CBR value of 5% is recommended for the granular glacial strata. Due to the inherent variability of the Made Ground, an equilibrium CBR value of 2% is recommended for this stratum.

The Made Ground should be considered potentially frost susceptible and, as such, should not be present within 450mm of pavement construction.

7.6 Soakaways and Sustainable Drainage Systems (SuDS)

Owing to the presence of high groundwater, variable and, in places, considerable thickness of Made Ground containing some leachable contaminants, soakaways and permeable pavings are not considered suitable across the western portion of the site.

Across the eastern portion of the site, which has proven granular Glacial Deposits at shallow depths and lower groundwater levels, the use of soakaways or SuDS may be suitable. If soakaway drainage or SuDS are proposed across the site, consideration should be given to carrying out soakaway tests in accordance with BRE 365 in order to determine a characteristic infiltration rate.

7.7 Buried Concrete and Services

The results of sulphate testing carried out on samples of the Made Ground indicate characteristic values as following:

- water soluble sulphate: 0.45g/l;
- pH: 7.8.

The results of sulphate testing carried out on samples of the natural strata indicate characteristic values as following:

- water soluble sulphate: 0.07g/l;
- pH: 7.6.

The results of the sulphate tests carried out in the Made Ground and natural strata have identified the Design Sulphate Class to be DS-1 with the Aggressive Chemical Environment for Concrete (ACEC) being AC-1 as defined by the BRE Special Digest 1, Concrete Aggressive Ground, 2005 for a brownfield site and mobile groundwater regime. Further reference should be made to BRE Special Digest 1 for requirements in respect of types of cement and aggregate to be used and variations in type of concrete construction.

Petroleum hydrocarbon fractions (C₁₀ to C₄₄) were detected in samples of the Made Ground between concentrations of 140mg/kg and 5,300mg/kg total TPH, but with

no detectable BTEX, MTBE, phenols, or 'light end' (less than C₁₀) petroleum hydrocarbons detected. This suggests that some restrictions on buried water supply pipe materials may be required, depending on pipe routes, Made Ground removal etc. The chosen pipeline materials should be discussed and agreed with the local Water Authority.

7.8 Conclusions and Recommendations

Based upon the ground conditions at the site, a piled solution is considered necessary, with piles taken through the Made Ground and Glacial Deposits, into competent strata of the Wilmslow Sandstone Formation.

A suspended floor slab is recommended at the site and no gas protection measures are considered necessary.

Due to elevated TPH concentrations recorded locally within the Made Ground, the chosen water supply pipeline materials should be discussed and agreed with the local Water Authority.

No special precautions considered necessary regarding sulphate resisting sulphate.

Applied Geology Limited
First Floor, Lowton Business Park
Newton Road,
Lowton St Mary's,
Warrington,
WA3 2AP

Tel: 01925 738 599

GENERAL NOTES

- A) The assessment made in this report is based on the site terrain and ground conditions revealed by the various field investigations undertaken and also any other relevant data for the site including previous site investigation reports (if available) and desk study data. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available. It must be recognised that many of the Environmental Searches obtained during the course of the desk study are often lengthy. Applied Geology have, where appropriate and in the interests of simplicity, only reproduced the summary of the searches within the report. A full copy of all the search data is held at the Applied Geology office and is available for inspection if required.
- B) The services provided are defined within our proposal and are carried out in line with the terms of appointment between Applied Geology and the Client.
- C) Where any data supplied by the Client or other external source, including that from previous site investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Applied Geology for inaccuracies within this data.
- D) Whilst the report may express an opinion on possible configurations of strata between or beyond the exploratory locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy.
- E) Comments on groundwater (and landfill gas) conditions are based on observations made during the course of the present and past investigations or with reference to published data unless otherwise stated. It should be noted, however, that groundwater (and landfill gas) levels vary due to seasonal (or atmospheric conditions) or other effects.
- F) The copyright of this report and other plans (and documents prepared by Applied Geology) is owned by Applied Geology and no such report, plan or document may be reproduced, published or adapted without the written consent of Applied Geology. Complete copies of the report may, however, be made and distributed by the Client as an expedient in dealing with matters related to its submission.
- G) This report is prepared and written in the context of the proposals stated in the introduction to the report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to Applied Geology for re-assessment and if necessary, re-appraisal.
- H) The survey was conducted and this report was prepared for the sole internal use and reliance of the Client. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology. If an unauthorised third party comes into possession of this report they rely on it at their peril and Applied Geology owes them no duty of care and skill.
- I) Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of this data by the supervising geotechnical or geo-environmental engineers.
- J) Unless specifically stated, the investigation has not taken into account the possible effects of mineral extraction.
- K) The works performed are not a comprehensive site characterisation and should not be construed as being such.
- L) The findings of the geo-environmental risk assessment are based on information obtained from a variety of sources which Applied Geology believe to be correct. Applied Geology cannot and does not guarantee the authenticity or reliability of the information it has relied upon.
- M) The report represents the findings and opinions of experienced geo-environmental consultants. Applied Geology does not provide legal advice and the advice of lawyers may be required.
- N) Conditions at the site are subject to change from the time of the site inspection.
- O) It is possible that researches carried out by Applied Geology, whilst fully appropriate for a phase 1 desk study, failed to indicate the existence of important information sources. Assuming such indicators actually exist, their information could not have been considered in the formulation of Applied Geology findings and opinions.
- P) The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, depends on very many factors in addition to geotechnical considerations and hence its evaluation is outside the scope of this report.
- Q) Applied Geology operates as a Consultancy and does not operate its own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.

LIST OF REFERENCES COMMONLY USED BY APPLIED GEOLOGY IN REPORTS

SECTION/TITLE	AUTHOR/PUBLICATION
LABORATORY TESTING	
BS 1377-1:2016 Method of Test for Soils for Civil Engineering Purposes	BSI
SITE WORK	
Guidelines for Combined Geoenvironmental and Geotechnical Investigations. Issue 2. March 2006.	AGS
BS 5930:2015. Code of Practice for Ground Investigations	BSI
BS 10175:2011 & A1:2013 Code of Practice for the Investigation of Potentially Contaminated Sites	BSI
FOUNDATION DESIGN	
BS EN 1997-1 Eurocode 7 – Geotechnical Design, Part 1. 2004.	BSI
BS EN 1997-2 Eurocode 7 – Geotechnical Design, Part 2. 2007.	BSI
Paper by M. A. Stroud 'The Standard Penetration Test – its Application and Interpretation' within Thomas Telford/ICE book 'Penetration Testing in the UK'. 1989.	Stroud
BRE Special Digest 1: 2005 Third Edition. Concrete in Aggressive Ground	BRE
NHBC Standards, Chapter 4.2: Building Near Trees. 2017.	National House Building Council
Engineering in Chalk (C574). 2002.	CIRIA
Engineering in Mercia Mudstone (C570). 2001.	CIRIA
Engineering in Glacial Till (C504). 1999.	CIRIA
GROUND GAS	
BRE 211 Protecting New Buildings from Radon. 2015.	BRE
BS 8485:2015 Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings.	BSI
Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present. 4 th Ed, 2007	NHBC & RSK Group
Assessing Risks Posed by Hazardous Ground Gases to Buildings. C665. 2007.	CIRIA
Research Bulletin 17. 2012.	CLAIRE
BS 8576:2015 Guidance on Investigations for Ground Gas. Permanent Gases and Volatile Organic Compounds (VOCs)	BSI
Guidance on the Use of Plastic Membranes as VOC Vapour Barriers. C748. 2014.	CIRIA
Remediating and Mitigating Risks from Volatile Organic Compound (VOC) Vapours from Land Affected by Contamination. C716. 2012.	CIRIA
GROUNDWATER	
BRE DG 365: Soakaway Design. 2016.	BRE
BS EN ISO 22282-2:2012 Geotechnical Investigation and Testing – Geohydraulic Testing, Part 2. 2012.	BSI
CONTAMINATION ASPECTS (Soil & Groundwater)	
Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance. 2012.	DEFRA
Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - SP1010. 2014.	DEFRA
HPA Contaminated Land Information Sheet – Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons. Version 3. 2010.	HPA
Cover Systems for Land Regeneration. Thickness of Cover Systems for Contaminated Land. 2004. BR465.	AGS/BRE
Development of Generic Assessment Criteria for Assessing Vapour Risk to Human Health from Volatile Contaminants in Groundwater. Version 1.0. February 2017.	SOBRA
BS 3882:2015 Specification for Topsoil	BSI
The LQM/CIEH S4ULs for Human Health Risk Assessment, 2015. S4UL3159.	Chartered Institute of Environmental Health. Land Quality Management.
Generic Assessment Criteria for Human Health Risk Assessment. 2009.	Chartered Institute of Environmental Health. Land Quality Management.
Model Procedures for the Management of Contaminated Land. Contaminated Land Report. 11 September 2004.	DEFRA / Environment Agency
The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils. February 2005.	Environment Agency
The Environment Agency's Approach to Groundwater Protection, V1. 2017.	Environment Agency
Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination. 2006.	Environment Agency
Guidance for the Safe Development of Housing on Land Affected by Contamination	NHBC
Sampling Strategies for Contaminated Land. Contaminated Land Research Report no.4. 1994.	DoE
NHBC Standards, Chapter 4.1: Land Quality – Managing Ground Conditions. 2017.	National House Building Council
ATRISK ^{soil} Soil Screening Values. 2017.	Atkins
CLEA Software (Version 1.071). 2015.	Environment Agency

The Water Supply (Water Quality) Regulations. 2016.	DWI
Prioritisation & Categorisation Procedure for Sites Which May Be Contaminated (CLR Report No6)	Department of the Environment, Contaminated Land Research Report
Code of Practice for the Investigation & Mitigation of Possible Petroleum-Based Land Contamination. 1993.	The Institute of Petroleum
Piling & Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention. 2001.	Environment Agency
DISPOSAL OF SOIL	
Guidance on the Classification and Assessment of Waste. Technical Guidance WM3. 1 st Ed. 2015.	SEPA, NIEA, Natural Resources Wales & Environment Agency
Waste Sampling and Testing for Disposal to Landfill. 2013.	Environment Agency
BURIED SERVICES	
Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites. (10/WM/03/21). 2011.	UK Water Industries Research
PAVEMENT DESIGN	
Interim Advice Note 73/06 Rev 1, 2009. Design Guidance for Road Pavement Foundations (Draft HD25)	Highways Agency
PLANNING	
DCLG:2012 National Planning Policy Framework and Practice Guidance	Department for Communities and Local Government
HEALTH & SAFETY ASPECTS	
A Guide for Safe Working on Contaminated Sites (Report 132)	CIRIA
Protection of Workers and the General Public During the Development of Contaminated Land (HSG66)	Health & Safety Executive
Construction (Design & Management) Regulations 2015 (CDM)	Health & Safety Executive
Control of Substances Hazardous to Health Regulations 2002	Health & Safety Executive
Workplace Exposure Limits. EH40/2005	Health & Safety Executive
Trenching Practice. Guidance on Groundwater Control (Report 97)	CIRIA
Control of Groundwater for Temporary Works (Report 113)	CIRIA
Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks. C733. 2014.	CIRIA

APPENDIX A



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationery Office, Crown Copyright* LICENCE No: 100055022

APPLIED GEOLOGY

First Floor, Lowton Business Park
Newton Road
Lowton St. Mary's
Warrington
WA3 2AN

Tel: 01925 738599
email: admin@appliedgeology.co.uk

Client:

LIVEMAN PROPERTIES LTD

Project:

BARLOW MOOR ROAD, CHORLTON

Drawn By:

JS

Checked By:

CS

Paper Size:

A4

Scale:

1:50,000

Date:

23.01.2020

NGR:

381903 393141

Title:

SITE LOCATION PLAN

Drawing No:

AG3093-19-01

Revision:

0



KEY:



Cable Percussion Borehole



Driven Continuous Sampling Borehole

Drawing based on DV Architects, drawing No:PL0002 dated 26/06/2019.

APPLIED GEOLOGY

First Floor, Lowton Business Park
Newton Road
Lowton St. Mary's
Warrington
WA3 2AN

Tel: 01925 738599
email:admin@appliedgeology.co.uk

Client:

LIVEMAN PROPERTIES LTD

Project:

BARLOW MOOR ROAD, CHORLTON

Title:

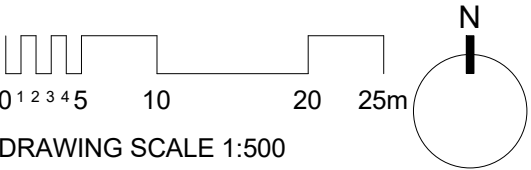
EXPLORATORY HOLE LOCATION PLAN

Drawn By:	JS	Checked By:	CS	Paper Size:	A3
Scale:	NTS			Date:	00.00.2020
Drawing No:	AG3093-19-02			Revision:	0

Key

-  SITE BOUNDARY
-  PROPOSED BUILDING
-  EXISITING BUILDING RETAINED
-  SEWER RUN
-  6m EASEMENT
-  COMMUNAL AMENITY GARDENS
-  ENTRANCES
-  CGI VIEWS

24No Car Park Spaces (incl 3No DDA (61.5%)
39No Covered Cycle Store (100%)



REV.	DATE	COMMENT
☐ CONCEPT	☒ PLANNING	☐ BUILDING CONTROL
☐ COMMENT	☐ TENDER	☐ CONSTRUCTION

UNIT 4
BOTANIC ESTATE
198 EDGE LANE
LIVERPOOL
L7 9PL

T: 0151 228 4666
F: 0151 228 8666
E: admin@dvarchitects.co.uk

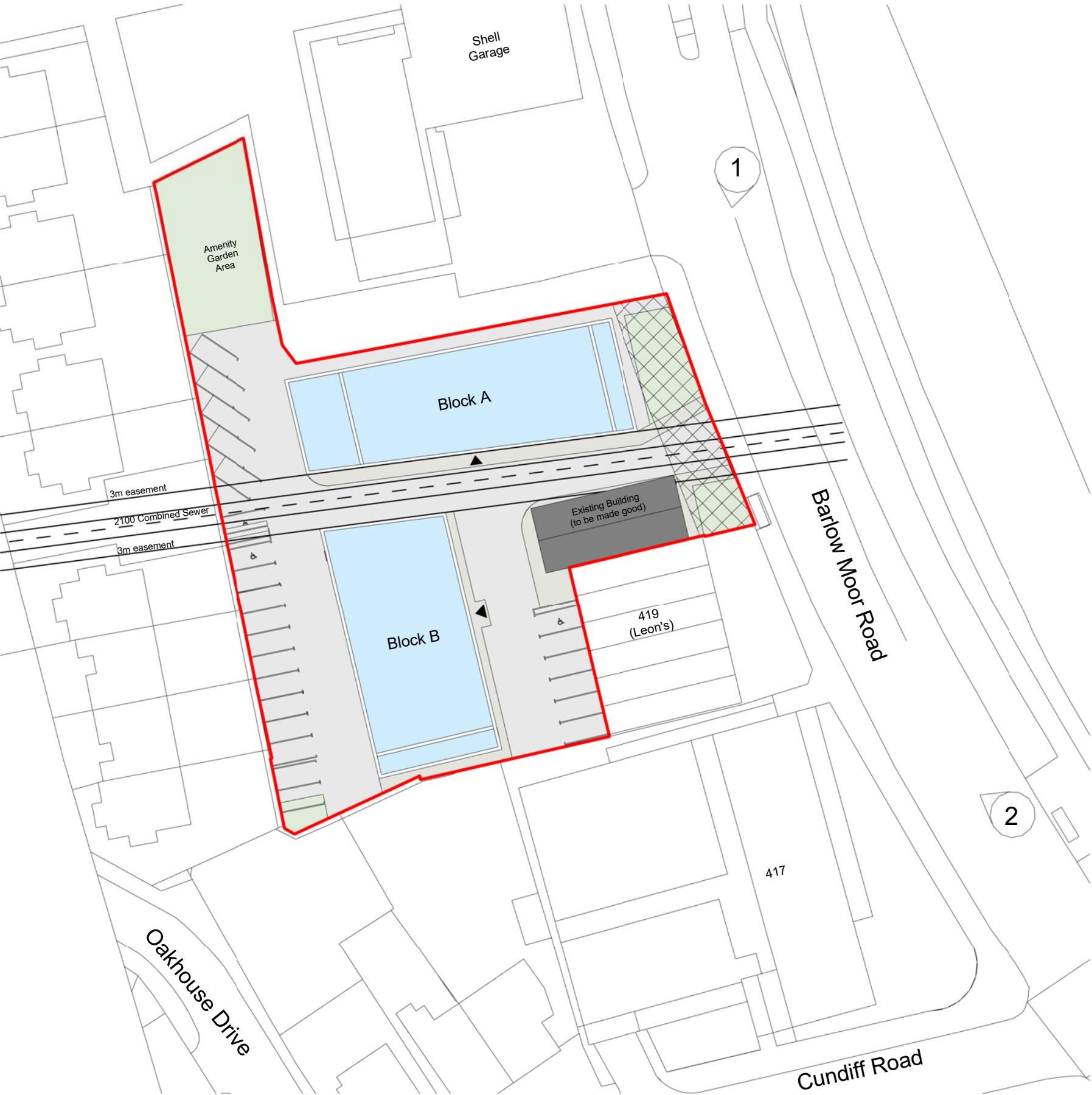


CLIENT:
-

PROJECT:
421 BARLOW MOOR ROAD, M218ER

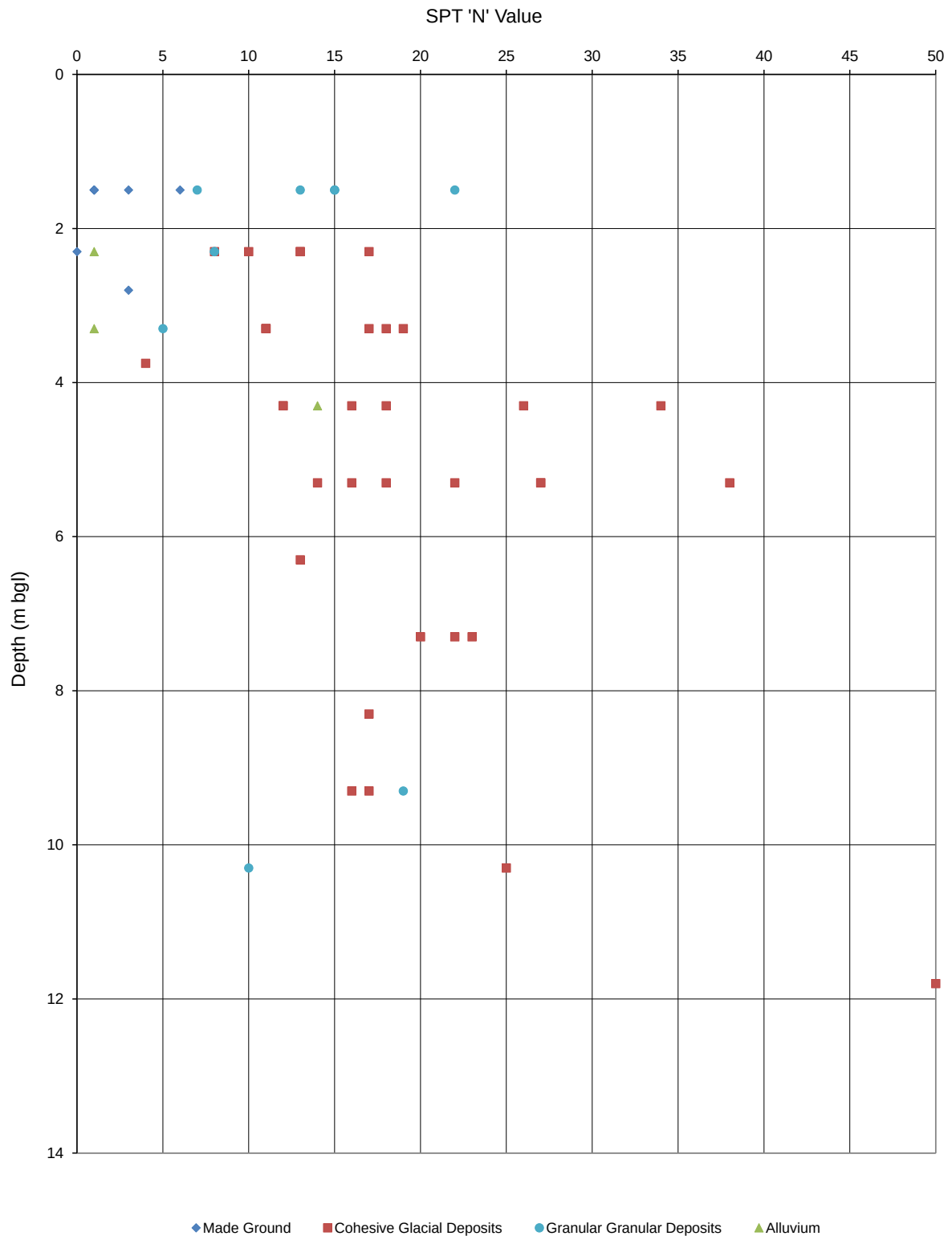
DRAWING:
PROPOSED SITE PLAN

PROJECT N°:	DRAWING N°:	REV:	SCALE: As indicated	DRAWN: JB
1479	PL 0002		SHEET: A3	CHECKED: BH
			DATE: 26.06.19	



1 Site Plan - Proposed
1 : 500

Uncorrected SPT 'N' Value versus depth



Notes: 1. Values >50 omitted for clarity

Client:	Liveman Properties Ltd	APPLIED GEOLOGY
Project:	Barlow Moor Road, Chorlton	
Project No.	AG3093-19	

APPENDIX B

BOREHOLE LOG - CABLE PERCUSSION

CP1A

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

1 of 1

Start 02/12/2019

Coordinates E 381891.53 N 393157.86

Scale

1:50

End 02/12/2019

Ground Level 27.78m AOD

Total Depth

0.70m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				27.58	(0.20)	Asphalt.			
					0.20	(MADE GROUND)			
				27.38	(0.20)	Yellowish brown sandy fine to coarse angular to subangular GRAVEL			
					0.40	of limestone.			
				27.13	(0.25)	(MADE GROUND - SUBBASE)			
					0.65	Reddish brown and black sandy fine to coarse angular to subangular GRAVEL of ash, clinker and brick.			
						(MADE GROUND)			
						At 0.65m bgl: ceramic pipe.			
						End of Borehole at 0.70m			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	

Remarks: Pit terminated at 0.70m bgl due to services encountered. Position moved. Pit backfilled with arisings on completion.

Installation:

Diameter: 150mm to 0.70m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP1B

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

1 of 2

Start 02/12/2019

Coordinates

Scale

1:50

End 03/12/2019

Ground Level 27.78m AOD

Total Depth

13.50m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				27.58	(0.20)	Asphalt.			
				27.38	0.20	(MADE GROUND)			
					(0.20)	Yellowish brown sandy fine to coarse angular to subangular GRAVEL of limestone.			
					0.40	(MADE GROUND - SUBBASE)			
						Very loose reddish brown and black sandy fine to coarse angular to subangular GRAVEL of clinker and ash.			
						(MADE GROUND)			
D	1.20								
S	1.20	N = 1	1.20						
					(3.00)				
D	2.50								
S	2.50	N = 3	1.70						
D	3.00								
S	3.45	N = 4	3.00	24.38	3.40	Stiff to very stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded quartzite.			
U	4.00	(66)				(GLACIAL DEPOSITS)			
						Between 3.40m and 4.00m bgl: soft.			
D	4.50								
D	5.00								
S	5.00	N = 27	4.50						
U	6.00	(71)							
D	6.50								
D	7.00								
S	7.00	N = 22	6.00						
U	8.00	(82)			(8.80)				
D	8.50								
D	9.00								
S	9.00	N = 17	6.00						
U	10.00	(100)							

Continued next sheet

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			2.80	1.80		1.70	3.40	
			10.30	9.10		9.00		
			12.40	12.10		12.00		

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 3.00m bgl.

Diameter: 150mm to 13.50m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP1B

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

2 of 2

Start 02/12/2019

Coordinates

Scale

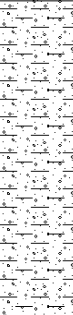
1:50

End 03/12/2019

Ground Level 27.78m AOD

Total Depth

13.50m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	10.50					Stiff to very stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded quartzite. (GLACIAL DEPOSITS)			
D S	11.50 11.50	N = 50	11.50						
				15.58	12.20	Extremely weak red SANDSTONE recovered as sand. (WILMSLOW SANDSTONE FORMATION)			
D S	12.70 12.70	N >50	12.50		(1.30)				
D S	13.40 13.40	N >50	13.40	14.28	13.50	End of Borehole at 13.50m			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			2.80	1.80		1.70	3.40	
			10.30	9.10		9.00		
			12.40	12.10		12.00		

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 3.00m bgl.

Diameter: 150mm to 13.50m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP2

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

1 of 2

Start 05/12/2019

Coordinates E 381889.69 N 393136.66

Scale

1:50

End 05/12/2019

Ground Level 26.88m AOD

Total Depth

12.50m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAOD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	0.20			26.73	(0.15)	Asphalt.			
				26.58	0.15	(MADE GROUND)			
D	0.50				(0.15)	Black ashy sandy fine to coarse angular to subangular GRAVEL of brick and glass.			
					0.30	(MADE GROUND)			
					(1.30)	Brown slightly gravelly very clayey SAND with occasional organic content. Gravel is fine to medium subangular to subrounded quartzite.			
						(MADE GROUND)			
D	1.20								
C	1.20	N = 6	1.20						
B	1.60			25.28	1.60	Brown gravelly SAND. Gravel is fine to coarse subangular to rounded quartzite.			
					(0.60)	(GLACIAL DEPOSITS)			
D	2.00								
C	2.00	N = 10	1.50	24.68	2.20	Stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to rounded quartzite.			
						(GLACIAL DEPOSITS)			
D	2.50								
D	3.00								
S	3.00	N = 11	3.00						
D	4.00								
D	4.50								
D	5.00								
S	5.00	N = 14	4.50						
D	6.00								
D	6.50								
					(9.00)				
D	7.00								
S	7.00	N = 20	7.00						
D	8.00								
D	8.50								
D	9.00								
S	9.00	N = 16							
D	10.00								

Continued next sheet

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			1.60	1.30		1.50	2.50	
			9.80	9.10		9.00		
			11.50	8.30		11.50		

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 3.00m bgl.

Diameter:

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP2

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

2 of 2

Start 05/12/2019

Coordinates E 381889.69 N 393136.66

Scale

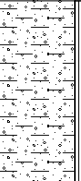
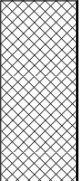
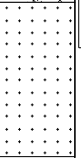
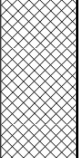
1:50

End 05/12/2019

Ground Level 26.88m AOD

Total Depth

12.50m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
						Stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to rounded quartzite. (GLACIAL DEPOSITS)			
D	11.50			15.68	11.20				
S	11.50	N >50	11.50	(1.02)		Extremely weak reddish brown SANDSTONE recovered as silty sand. (WILMSLOW SANDSTONE FORMATION)			
D	12.20			14.66	12.22				
S	12.20	N >50	12.00			End of Borehole at 12.50m			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			1.60	1.30		1.50	2.50	
			9.80	9.10		9.00		
			11.50	8.30		11.50		

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 3.00m bgl.

Diameter:

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP3A

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

1 of 1

Start 03/12/2019

Coordinates E 381903.81 N 393124.42

Scale

1:50

End 03/12/2019

Ground Level 27.63m AOD

Total Depth

0.70m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				27.48	(0.15)	Asphalt.			
					0.15	(MADE GROUND)			
					(0.55)	Brown fine SAND.			
						(MADE GROUND)			
				26.93	0.70	At 0.70m bgl: concrete.			
						End of Borehole at 0.70m			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	

Remarks: Pit terminated at 0.70m bgl due to concrete obstruction. Position moved. Pit backfilled with arisings on completion.

Installation:

Diameter:

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP3B

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

1 of 2

Start 03/12/2019

Coordinates

Scale

1:50

End 04/12/2019

Ground Level 27.63m AOD

Total Depth

12.50m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				27.48	(0.15)	Asphalt.			
					0.15	(MADE GROUND)			
D	0.50					Dark brown slightly gravelly very clayey SAND with rare organic content. Gravel is fine to medium subangular to subrounded quartzite. (MADE GROUND)			
D	1.20				(2.05)				
S	1.20	N = 3	1.20						
S	2.00	N = 13	1.70						
D	2.50			25.43	2.20	Stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded quartzite. (GLACIAL DEPOSITS)			
D	3.00								
S	3.00	N = 11	3.00						
U	4.00	(49)							
D	4.50								
D	5.00								
S	5.00	N = 21	4.50			From 5.00m bgl: very stiff.			
					(6.80)				
D	6.00	(68)							
D	6.50								
D	7.00								
S	7.00	N = 23	7.00						
U	8.00	(69)							
D	8.50								
D	9.00			18.63	9.00	Medium dense brown slightly gravelly SAND. Gravel is fine subrounded to rounded quartzite. (GLACIAL DEPOSITS)			
S	9.00	N = 19	7.50						
					(1.20)				
D	10.00					Continued next sheet			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			9.20	8.10		9.00		
			11.50	11.00		10.50		
			2.50	2.20		2.00		

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 3.00m bgl.

Diameter:

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP3B

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

2 of 2

Start 03/12/2019

Coordinates

Scale

1:50

End 04/12/2019

Ground Level 27.63m AOD

Total Depth

12.50m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
S	10.00	N = 25	10.00	17.43	10.20	Medium dense brown slightly gravelly SAND. Gravel is fine subrounded to rounded quartzite. (GLACIAL DEPOSITS)			
					(1.00)	Very stiff slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded quartzite. (GLACIAL DEPOSITS)			
D	11.00			16.43	11.20				
D	11.50					Extremely weak reddish brown SANDSTONE recovered as silty sand. (WILMSLOW SANDSTONE FORMATION)			
S	11.50	N >50	11.50		(1.30)				
D	12.20			15.13	12.50				
S	12.20	N >50	12.20						
						End of Borehole at 12.50m			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			9.20	8.10		9.00		
			11.50	11.00		10.50		
			2.50	2.20		2.00		

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 3.00m bgl.

Diameter:

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP4

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

1 of 2

Start 06/12/2019

Coordinates

Scale

1:50

End 06/12/2019

Ground Level

Total Depth

11.87m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	0.30				(0.15)	Asphalt.			
					0.15	(MADE GROUND)			
					(0.25)	Black slightly gravelly sandy SILT. Gravel is fine to coarse angular to subangular brick and concrete.			
					0.40	(MADE GROUND)			
D	1.00				(0.80)	Brown slightly gravelly SAND. Gravel is fine to medium angular to subangular mudstone and sandstone.			
B	1.20				1.20	(MADE GROUND)			
C	1.20	N = 7	1.20			Loose brown slightly gravelly SAND. Gravel is fine to medium subangular to subrounded quartzite and sandstone. (GLACIAL DEPOSITS)			
					(0.90)				
C	2.00	N = 8	1.50		2.10	Firm becoming stiff brown slightly sandy CLAY. Gravel is fine to coarse subangular to subrounded quartzite. (GLACIAL DEPOSITS)			
D	2.50								
U	3.00	(49)							
D	3.50								
D	4.00								
S	4.00	N = 12	4.00						
U	5.00	(59)							
D	5.50								
D	6.00				(7.70)				
S	6.00	N = 13	4.50						
U	7.00	(51)							
D	7.50								
D	8.00								
S	8.00	N = 17	7.50						
U	9.00	(60)							
D	9.50								
D	10.00				9.80	Medium dense brown slightly gravelly SAND. Gravel is fine to medium			
						Continued next sheet			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			10.00	8.10		9.00		Logged: CS
								Checked: PG

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Installation:

Diameter: 150mm to 11.87m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP4

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

2 of 2

Start 06/12/2019

Coordinates

Scale

1:50

End 06/12/2019

Ground Level

Total Depth

11.87m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
S	10.00	N = 19	10.00		(1.40)	Medium dense brown slightly gravelly SAND. Gravel is fine to medium subangular to subrounded quartzite. (GLACIAL DEPOSITS)			
					11.20				
D	11.50				(0.67)	Extremely weak reddish brown SANDSTONE recovered as silty sand. (WILMSLOW SANDSTONE FORMATION)			
S	11.50	N >50	11.50		11.87				
						End of Borehole at 11.87m			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			10.00	8.10		9.00		

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Installation:

Diameter: 150mm to 11.87m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS1

Project

Client

Start

End

Barlow Moor Road, Chorlton

Liveman Properties Ltd

04/12/2019

04/12/2019

Coordinates

Ground Level

27.87m AOD

Project No.

Sheet

Scale

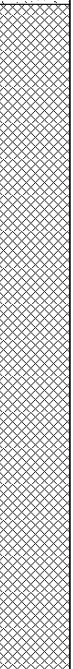
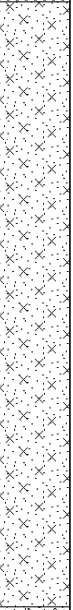
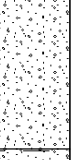
Total Depth

AG3093-19

1 of 2

1:25

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.50 0.50			27.67	(0.20) 0.20	Concrete slab. (MADE GROUND)			
						Very loose black very gravelly SAND. Gravel is angular to subangular brick, clinker and glass. (MADE GROUND)			
S	1.20	N = 1			(2.20)				
D	1.50		101mm /100%						
S	2.00	N = 0							
D	2.50		92mm /100%	25.47	2.40	Very loose brown silty SAND. (ALLUVIUM)			
S	3.00	N = 1							
D	3.50		79mm /100%		(2.00)				
S	4.00	N = 14				Below 4.00m bgl: medium dense.			
D	4.50		70mm /80%	23.47	4.40 (0.50)	Medium dense yellowish brown very gravelly SAND. Gravel is fine rounded quartzite. (GLACIAL DEPOSITS)			
D	5.00			22.97	4.90	Dense reddish brown clayey gravelly SAND. Gravel is medium			
Continued next sheet									

Installation:
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Groundwater Strikes					Drilled: Exploration Ltd
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: CS
					Checked: PG

DCS1

Project No. AG3093-19

Sheet 2 of 2

Scale 1:25

Total Depth 5.45m

[illegible]

Installation:
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Groundwater Strikes					Drilled: Exploration Ltd Logged: CS Checked: PG
Depth Strike	Rose to	Remarks	Cased	Sealed	

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS2

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

1 of 2

Start 04/12/2019

Coordinates

Scale

1:25

End 04/12/2019

Ground Level 28.03m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.40 0.40			27.83	(0.20)	Grey sandy GRAVEL of fine to coarse angular to subangular sandstone, limestone and brick. (MADE GROUND)			
					0.20	Orangish brown gravelly SAND. Gravel is fine to coarse subangular to subrounded limestone and sandstone. (MADE GROUND)			
D ES	0.80 0.80			27.43	(0.40)	Dark brown very clayey gravelly SAND. Gravel is fine to coarse subangular to subrounded limestone, sandstone and brick. (MADE GROUND)			
					0.60				
S	1.20	N = 1		27.03	1.00	Very soft dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded brick, ceramic, mudstone and sandstone. (MADE GROUND)			
D	1.40				(0.70)				
S	2.00	N = 1	101mm /100%	26.33	1.70	Very soft dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone and sandstone. (ALLUVIUM)			
					(1.10)				
D	2.40		92mm /90%	25.23	2.80	Loose dark brown slightly clayey slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. (GLACIAL DEPOSITS)			
B	2.80				(0.70)				
S	3.00	N = 5		24.53	3.50	Stiff brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone. (GLACIAL DEPOSITS)			
D	3.70				(1.95)				
S	4.00	N = 12							
D	4.70								
S	5.00	N = 16							

Continued next sheet

Installation:

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Groundwater Strikes					Drilled: Exploration Ltd Logged: JW Checked: PG
Depth Strike	Rose to	Remarks	Cased	Sealed	
1.70	1.70	Post drilling			

DCS2

Project No. AG3093-19

Sheet 2 of 2

Scale 1:25

Total Depth 5.45m

Installation:
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Exploratory hole logs to be read in conjunction with key sheet

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS3

Project Barlow Moor Road, Chorlton

Project No.

AG3093-19

Client Liveman Properties Ltd

Sheet

1 of 2

Start 04/12/2019

Coordinates

Scale

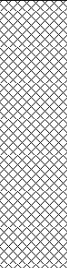
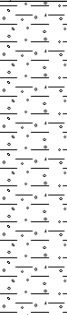
1:25

End 04/12/2019

Ground Level 27.80m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.50 0.50			27.60	(0.20) 0.20	Concrete slab. (MADE GROUND)			
					(0.90)	Brown slightly gravelly SAND. Gravel is fine to coarse angular to subangular brick and clinker. (MADE GROUND) <i>At 0.20m bgl: brick wall in south of pit east to west orientation.</i>			
B S	1.10 1.20	N = 15		26.70	1.10	Medium dense light brown slightly gravelly SAND. Gravel is fine to coarse subrounded to rounded sandstone. (GLACIAL DEPOSITS)			
			101mm /85%		(0.70)				
D S	1.90 2.00	N = 17		26.00	1.80	Stiff brown slightly gravelly CLAY. Gravel is fine to coarse subrounded to rounded sandstone and quartzite. (GLACIAL DEPOSITS)			
			92mm /100%						
D S	2.90 3.00	N = 19							
			79mm /100%		(3.65)				
D S	3.90 4.00	N = 16							
			70mm /100%						
D S	4.90 5.00	N = 18							
Continued next sheet									

Installation:

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Groundwater Strikes					Drilled: Exploration Ltd Logged: JW/CS Checked: PG
Depth Strike	Rose to	Remarks	Cased	Sealed	

DCS3

Project No. AG3093-19

Sheet 2 of 2

Scale 1:25

Total Depth 5.45m

Installation:
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Exploratory hole logs to be read in conjunction with key sheet

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS4

Project

Barlow Moor Road, Chorlton

Client

Liveman Properties Ltd

Start

04/12/2019

End

04/12/2019

Coordinates

Ground Level 27.81m AOD

Project No.

AG3093-19

Sheet

1 of 2

Scale

1:25

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.30 0.30			27.61	(0.20)	Concrete slab. (MADE GROUND)			
					0.20	Orangish brown SAND. (MADE GROUND)			
				27.41	(0.20)	Light brown slightly gravelly SAND. Gravel is fine to coarse subangular to rounded sandstone. (GLACIOFLUVIAL DEPOSITS)			
					0.40				
D ES	0.80 0.80								
S	1.20	N = 22				From 1.20m bgl: medium dense.			
B	1.50		101mm /100%		(1.90)	From 1.70m to 2.30m bgl: gravelly.			
S	2.00	N = 13							
				25.51	2.30	Stiff brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone. (GLACIAL TILL)			
D	2.80		92mm /100%						
S	3.00	N = 18							
			79mm /100%						
D	3.80				(3.15)				
S	4.00	N = 18							
S	5.00	N = 22				Continued next sheet			

Installation: 50mm diameter standpipe installed to 2.50m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: Exploration Ltd Logged: JW Checked: PG
Depth Strike	Rose to	Remarks	Cased	Sealed	
1.90	1.90	Post drilling			

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS4

Project

Client

Start

End

Barlow Moor Road, Chorlton

Liveman Properties Ltd

04/12/2019

04/12/2019

Coordinates

Ground Level

27.81m AOD

Project No.

Sheet

Scale

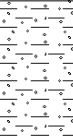
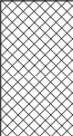
Total Depth

AG3093-19

2 of 2

1:25

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				22.36	5.45	Stiff brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone. (GLACIAL TILL)			
						End of Borehole at 5.45m			

Installation: 50mm diameter standpipe installed to 2.50m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: Exploration Ltd
Depth Strike	Rose to	Remarks	Cased	Sealed	
1.90	1.90	Post drilling			Logged: JW
					Checked: PG

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS5

Project

Barlow Moor Road, Chorlton

Client

Liveman Properties Ltd

Start

05/12/2019

End

05/12/2019

Coordinates

28.01m AOD

Project No.

AG3093-19

Sheet

1 of 1

Scale

1:25

Total Depth

4.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.18			27.85	(0.16)	Concrete slab. (MADE GROUND)			
	0.18			27.81	0.16 (0.04) 0.20	Dark brown slightly gravelly SAND. Gravel is fine to medium angular to subangular brick and slate. (MADE GROUND)			
D ES	0.60					Light brown SAND. (GLACIOFLUVIAL DEPOSITS)			
	0.60								
B S	1.20	N = 13				From 1.20m bgl: medium dense.			
	1.20								
S	2.00	N = 8	101mm /100%		(2.60)	At 2.00m bgl: loose.			
D S	3.00	N = 11	92mm /100%	25.21	2.80	Stiff slightly gravelly sandy CLAY. Gravel is fine subangular to subrounded quartzite. (GLACIAL TILL)			
	3.00								
D S	3.80	N = 26	79mm /20%		(1.65)	From 4.00m bgl: very stiff.			
	4.00								
				23.56	4.45	End of Borehole at 4.45m			

Installation:
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Collapsing at 4.00m bgl to 2.00m bgl. Borehole backfilled with arisings on completion.

Groundwater Strikes					Drilled: Exploration Ltd Logged: CS Checked: PG
Depth Strike	Rose to	Remarks	Cased	Sealed	
1.40	1.40	Post drilling			

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6

Project

Barlow Moor Road, Chorlton

Client

Liveman Properties Ltd

Start

05/12/2019

End

05/12/2019

Coordinates

28.01m AOD

Project No.

AG3093-19

Sheet

1 of 1

Scale

1:25

Total Depth

4.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	0.15			27.88	(0.13)	Concrete slab.			
ES	0.15			27.81	0.13	(MADE GROUND)			
					(0.07)	Dark brown slightly gravelly silty SAND. Gravel is fine to coarse angular to subangular brick.			
					0.20	(MADE GROUND)			
D	0.60					Brown gravelly medium SAND. Gravel is fine to medium subangular to rounded quartzite.			
ES	0.60					(GLACIOFLUVIAL DEPOSITS)			
S	1.20	N = 15				From 1.20m bgl: medium dense.			
D	1.50		101mm /100%		(2.70)				
S	2.00	N = 8				From 2.00m bgl: loose.			
D	2.50		92mm /100%						
D	3.00			25.11	2.90	Stiff brown slightly gravelly sandy CLAY. Gravel is fine subangular to subrounded quartzite.			
S	3.00	N = 17				(GLACIAL TILL)			
			79mm /30%						
					(1.55)				
S	4.00	N = 34				From 4.00m bgl: very stiff.			
				23.56	4.45	End of Borehole at 4.45m			

Installation:
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Borehole backfilled with arisings on completion.

Groundwater Strikes					Drilled: Exploration Ltd
Depth Strike	Rose to	Remarks	Cased	Sealed	
1.40	1.40	Post drilling			Logged: CS
					Checked: PG

SPT SUMMARY SHEET

Project: Barlow Moor Road, Chorlton
Client: Liveman Properties Ltd
Project No: AG3093-19

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive		Test Drive					Test Type	N Value
						Blows	Pen (mm)	Blows		Pen (mm)		Total Pen (mm)		
CP1B	1.20	1.65	1.20	Dry	LSI.T2	1 0	75 75	0 1 0 0	75 75 75 75	300	S	1		
CP1B	2.50	2.95	1.70	Dry	LSI.T2	0 0	75 75	0 1 1 1	75 75 75 75	300	S	3		
CP1B	3.45	3.90	3.00	2.10	LSI.T2	1 0	75 75	0 1 1 2	75 75 75 75	300	S	4		
CP1B	5.00	5.45	4.50	Damp	LSI.T2	3 5	75 75	6 6 7 8	75 75 75 75	300	S	27		
CP1B	7.00	7.45	6.00	Dry	LSI.T2	1 2	75 75	4 5 6 7	75 75 75 75	300	S	22		
CP1B	9.00	9.45	6.00	Dry	LSI.T2	2 3	75 75	4 4 4 5	75 75 75 75	300	S	17		
CP1B	11.50	11.95	11.50	Dry	LSI.T2	2 9	75 75	11 12 12 15	75 75 75 75	300	S	50		
CP1B	12.70	12.90	12.50	12.50	LSI.T2	14 1	75 50	50	70	70	S	>50		
CP1B	13.40	13.55	13.40	13.20	LSI.T2	15 10	75 30	50	40	40	S	>50		
CP2	1.20	1.65	1.20	Dry	LSI.T2	1 2	75 75	1 2 1 2	75 75 75 75	300	C	6		
CP2	2.00	2.45	1.50	1.80	LSI.T2	1 2	75 75	3 2 3 2	75 75 75 75	300	C	10		
CP2	3.00	3.45	3.00	Dry	LSI.T2	2 1	75 75	2 2 3 4	75 75 75 75	300	S	11		
CP2	5.00	5.45	4.50	Dry	LSI.T2	2 2	75 75	2 3 4 5	75 75 75 75	300	S	14		
CP2	7.00	7.45	7.00	Dry	LSI.T2	1 2	75 75	3 4 6 7	75 75 75 75	300	S	20		
CP2	9.00	9.45		Dry	LSI.T2	2 2	75 75	2 4 5 5	75 75 75 75	300	S	16		
CP2	11.50	11.69	11.50	8.50	LSI.T2	7 18	75 25	39 11	75 10	85	S	>50		
CP2	12.20	12.37	12.00	9.00	LSI.T2	11 14	75 20	42 7	75 0	75	S	>50		
CP3B	1.20	1.65	1.20	Damp	LSI.T2	0 0	75 75	0 1 1 1	75 75 75 75	300	S	3		
CP3B	2.00	2.45	1.70	Damp	LSI.T2	1 1	75 75	2 4 3 4	75 75 75 75	300	S	13		
CP3B	3.00	3.45	3.00	2.80	LSI.T2	2 2	75 75	2 2 3 4	75 75 75 75	300	S	11		
CP3B	5.00	5.45	4.50	Dry	LSI.T2	2 3	75 75	4 4 6 7	75 75 75 75	300	S	21		
CP3B	7.00	7.45	7.00	Dry	LSI.T2	2 4	75 75	5 5 5 8	75 75 75 75	300	S	23		
CP3B	9.00	9.45	7.50	Dry	LSI.T2	2 4	75 75	4 4 5 6	75 75 75 75	300	S	19		
CP3B	10.00	10.45	10.00	9.20	LSI.T2	2 3	75 75	5 6 7 7	75 75 75 75	300	S	25		
CP3B	11.50	11.85	11.50	11.10	LSI.T2	10 12	75 75	15 15 20	75 75 50	200	S	>50		
CP3B	12.20	12.40	12.20	12.00	LSI.T2	12 13	75 50	42 8	75 0	75	S	>50		
CP4	1.20	1.65	1.20	Dry	LSI.T2	1 1	75 75	1 2 2 2	75 75 75 75	300	C	7		
CP4	2.00	2.45	1.50	1.40	LSI.T2	1 2	75 75	1 2 3 2	75 75 75 75	300	C	8		
CP4	4.00	4.45	4.00	Dry	LSI.T2	2 2	75 75	2 3 3 4	75 75 75 75	300	S	12		
CP4	6.00	6.45	4.50	Dry	LSI.T2	2 2	75 75	3 3 3 4	75 75 75 75	300	S	13		
CP4	8.00	8.45	7.50	Dry	LSI.T2	2 2	75 75	4 4 4 5	75 75 75 75	300	S	17		
CP4	10.00	10.45	10.00	8.10	LSI.T2	2 2	75 75	2 4 6 7	75 75 75 75	300	S	19		
CP4	11.50	11.82	11.50	8.90	LSI.T2	3 9	75 75	18 18 14	75 75 20	170	S	>50		
DCS1	1.20	1.65			DART425	1 0	75 75	0 0 0 1	75 75 75 75	300	S	1		

Notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.

SPT SUMMARY SHEET

Project: Barlow Moor Road, Chorlton
Client: Liveman Properties Ltd
Project No: AG3093-19

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive		Test Drive					Test Type	N Value
						Blows	Pen (mm)	Blows		Pen (mm)		Total Pen (mm)		
DCS1	2.00	2.45			DART425	1 0	75 75	0 0 0 0	75 75 75 75	300	S	0		
DCS1	3.00	3.45			DART425	1 0	75 75	0 0 1 0	75 75 75 75	300	S	1		
DCS1	4.00	4.45			DART425	2 3	75 75	3 4 5 2	75 75 75 75	300	S	14		
DCS1	5.00	5.45			DART425	5 7	75 75	6 7 9 16	75 75 75 75	300	S	38		
DCS2	1.20	1.65			DART425	0 1	75 75	0 1 0 0	75 75 75 75	300	S	1		
DCS2	2.00	2.45			DART425	0 0	75 75	0 0 0 1	75 75 75 75	300	S	1		
DCS2	3.00	3.45			DART425	0 0	75 75	0 1 2 2	75 75 75 75	300	S	5		
DCS2	4.00	4.45			DART425	2 3	75 75	3 3 2 4	75 75 75 75	300	S	12		
DCS2	5.00	5.45			DART425	2 3	75 75	4 3 4 5	75 75 75 75	300	S	16		
DCS3	1.20	1.65			DART425	3 4	75 75	3 4 4 4	75 75 75 75	300	S	15		
DCS3	2.00	2.45			DART425	2 3	75 75	3 4 6 4	75 75 75 75	300	S	17		
DCS3	3.00	3.45			DART425	2 3	75 75	4 5 5 5	75 75 75 75	300	S	19		
DCS3	4.00	4.45			DART425	2 3	75 75	3 3 5 5	75 75 75 75	300	S	16		
DCS3	5.00	5.45			DART425	3 3	75 75	4 4 4 6	75 75 75 75	300	S	18		
DCS4	1.20	1.65			DART425	5 5	75 75	5 5 5 7	75 75 75 75	300	S	22		
DCS4	2.00	2.45			DART425	2 3	75 75	2 4 3 4	75 75 75 75	300	S	13		
DCS4	3.00	3.45			DART425	4 4	75 75	3 4 5 6	75 75 75 75	300	S	18		
DCS4	4.00	4.45			DART425	4 4	75 75	3 4 5 6	75 75 75 75	300	S	18		
DCS4	5.00	5.45			DART425	4 5	75 75	5 5 5 7	75 75 75 75	300	S	22		
DCS5	1.20	1.65			DART425	2 3	75 75	3 3 3 4	75 75 75 75	300	S	13		
DCS5	2.00	2.45			DART425	1 2	75 75	2 2 2 2	75 75 75 75	300	S	8		
DCS5	3.00	3.45			DART425	2 2	75 75	2 2 3 4	75 75 75 75	300	S	11		
DCS5	4.00	4.45			DART425	4 4	75 75	5 7 7 7	75 75 75 75	300	S	26		
DCS6	1.20	1.65			DART425	3 3	75 75	3 4 4 4	75 75 75 75	300	S	15		
DCS6	2.00	2.45			DART425	2 1	75 75	2 2 2 2	75 75 75 75	300	S	8		
DCS6	3.00	3.45			DART425	3 3	75 75	3 4 5 5	75 75 75 75	300	S	17		
DCS6	4.00	4.45			DART425	3 5	75 75	7 7 10 10	75 75 75 75	300	S	34		

Notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

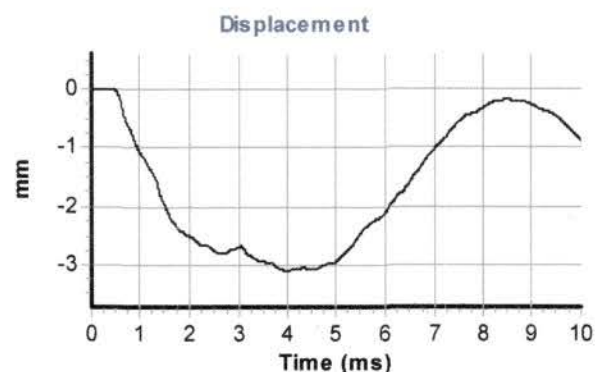
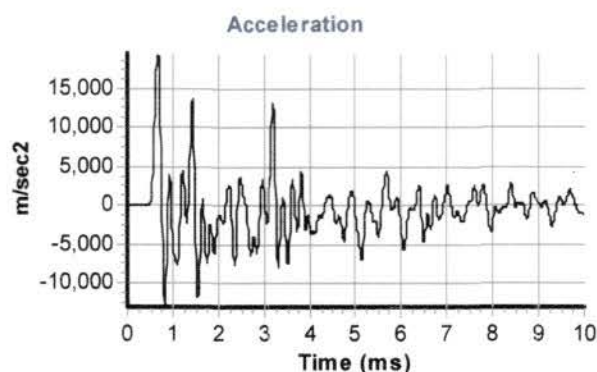
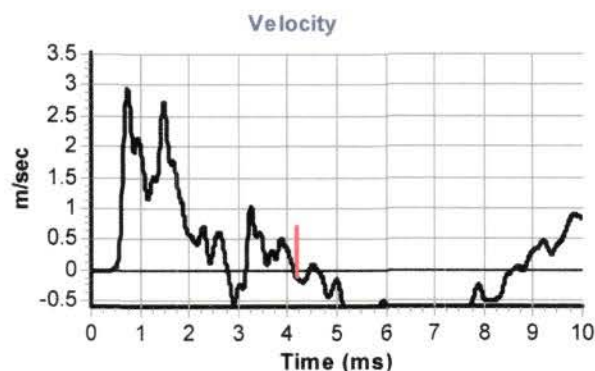
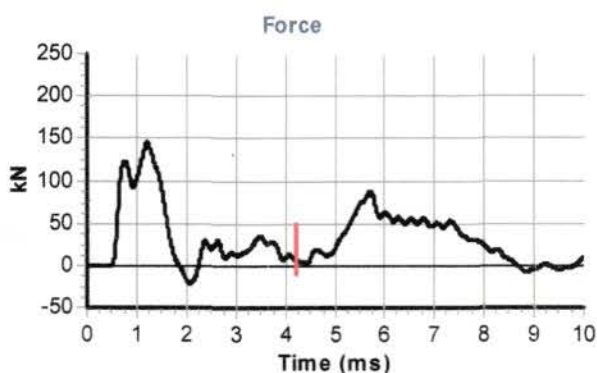
SPT Hammer Ref: LSI.T2
 Test Date: 15/03/2019
 Report Date: 15/03/2019
 File Name: LSI.T2.spt
 Test Operator: KM

Instrumented Rod Data

Diameter d_r (mm): 54
 Wall Thickness t_r (mm): 6.0
 Assumed Modulus E_a (GPa): 208
 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): 13.0

Comments / Location**Calculations**

Area of Rod A (mm²): 905
 Theoretical Energy E_{theor} (J): 473
 Measured Energy E_{meas} (J): 264

Energy Ratio E_r (%): **56**

Signed: S. HOWARTH
 Title: FITTER

The recommended calibration interval is 12 months

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

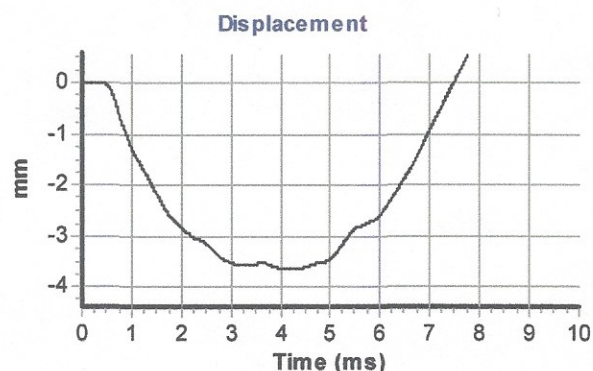
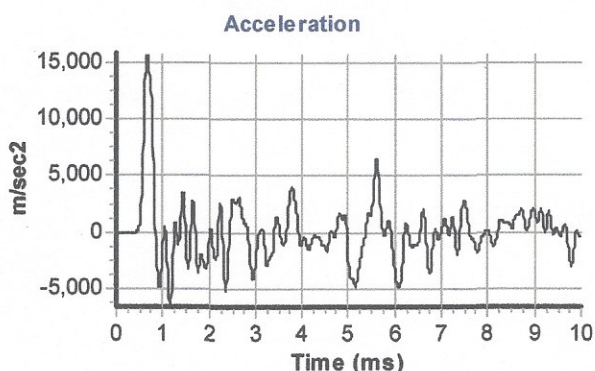
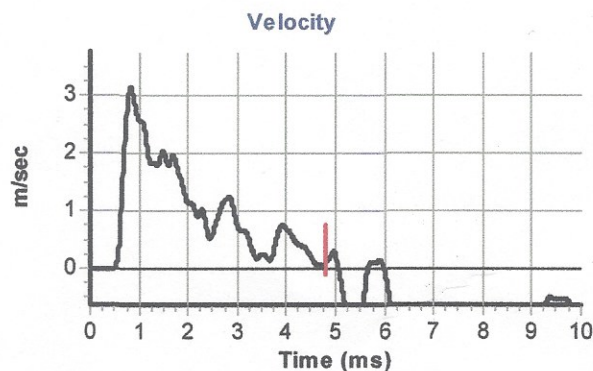
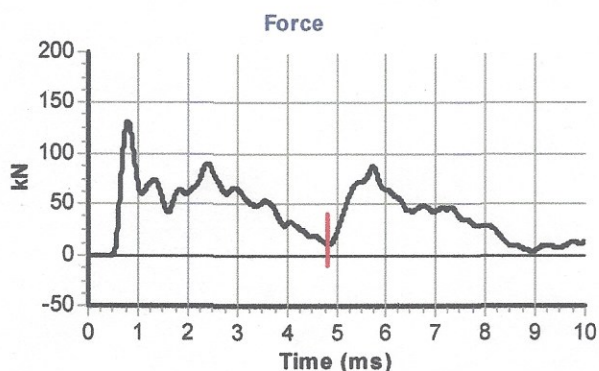
SPT Hammer Ref: DART425
Test Date: 11/02/2019
Report Date: 11/02/2019
File Name: DART425.spt
Test Operator: CM

Instrumented Rod Data

Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 208
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**Calculations**

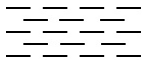
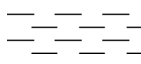
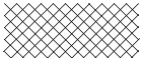
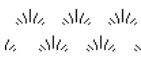
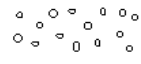
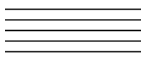
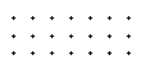
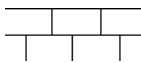
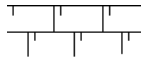
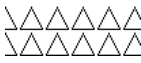
Area of Rod A (mm²): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 319

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

Signed: C.MCCLUSKEY
Title: FITTER

The recommended calibration interval is 12 months

Exploratory Hole Log Key Sheet

Sample Test Notation			Backfill Symbols		Legend Symbols	
D	Small Disturbed sample			Sand		Topsoil
B	Bulk Disturbed sample			Gravel		Made Ground
ES	Environmental sample			Concrete		Concrete
U	Undisturbed U100 sample			Bentonite		Clay
UT	Undisturbed UT100 sample			Arisings		Silt
C	Core sample			Grout		Sand
W	Water sample					Gravel
In Situ Test Notation			Installation Symbols			Peat
S	Standard Penetration Test			Plain Standpipe		Cobbles
S (C)	Standard Penetration Test (cone)			Slotted Standpipe		Boulders
HV	Hand Shear Vane Test			Piezometer		Mudstone
PID	Photoionization Detector Test			Vibrating Wire Piezometer		Siltstone
MEXE	Mexecone Cone Penetrometer Test			Inclinometer		Sandstone
PP	Pocket Penetrometer Test			Extensometer (with magnet locations)		Limestone
K	Permeability Test					Chalk
Results Notation			Groundwater (GW)			Coal
Cu	Shear Strength	kN/m ²				Breccia
N	SPT N Value	-				Conglomerate
PID	VOC Concentration	ppm				Shale
()	U/UT Blow Count	-				Igenous Rock
Rotary Core Notation				Rise		Metamorphic Rock
TCR	Total Core Recovery			Groundwater Strike - with Recorded Rise	NR NR	No Recovery
SCR	Solid Core Recovery			Strike	NR NR	No Recovery
RQD	Rock Quality Designation			Groundwater Strike - No Recorded Rise		
FI	Fracture Index					
If	Fracture Spacing					
NI	Non Intact					
NR	No Recovery					
NA	Not Applicable					
Ease of Dig						
VE	Very Easy					
E	Easy					
M	Moderate					
H	Hard					
VH	Very Hard					
General Notes						
1. Details of the standpipe/piezometer are given on the log. The 'Install' column shows a graphical representation of the installed including depth of instruments including slotted section or piezometer depth, and backfill details. 2. Standard Penetration Test is defined in BS EN ISO 17892. Total N value is shown on the logs, full details of the test increments, equipment references, water and casing levels shown on the SPT Summary Sheet.			Note: Most soils comprise a mixture of particle sizes. The soil type is graphically represented on the log and may be a combination of these symbols.			

TRL DYNAMIC CONE PENETROMETER TEST RESULT

Test Location

Date _____

Operator

Start Depth (mm bgl)

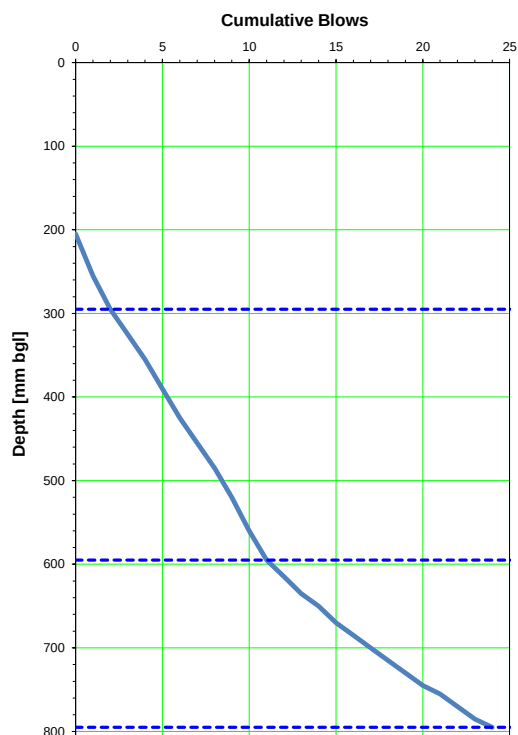
DCS4

04/12/2019

CS

200

Checked by: SD

[illegible]

Notes: TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$ from IAN 73/06 Revision 1 (2009)
Tested in accordance with in house method, based upon TRL Road Note 31 & 8

Surface materials / condition:

Remarks:

Test commenced at base of concrete in DCS4

Client: Liveman Properties Ltd

Project: Barlow Moor Road, Chorlton

Project No.	AG3093-19
--------------------	-----------

APPLIED GEOLOGY

TRL DYNAMIC CONE PENETROMETER TEST RESULT

Date _____

Start Depth (mm bgl)

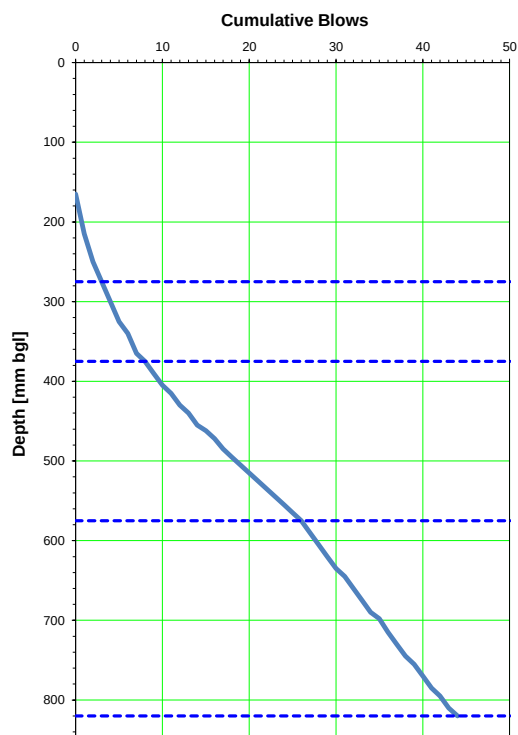
DCS5

04/12/2019

CS

160

Checked by: SD

[illegible]

Notes: TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$ from IAN 73/06 Revision 1 (2009)
Tested in accordance with in house method, based upon TRL Road Note 31 & 8

Surface materials / condition:

Remarks:

Test commenced at base of concrete in DCS5

Client:	Liveman Properties Ltd
Project:	Barlow Moor Road, Chorlton
Project No.	AG3093-19

APPLIED GEOLOGY

TRL DYNAMIC CONE PENETROMETER TEST RESULT

Test Location

Date

Operator

Start Depth (mm bgl)

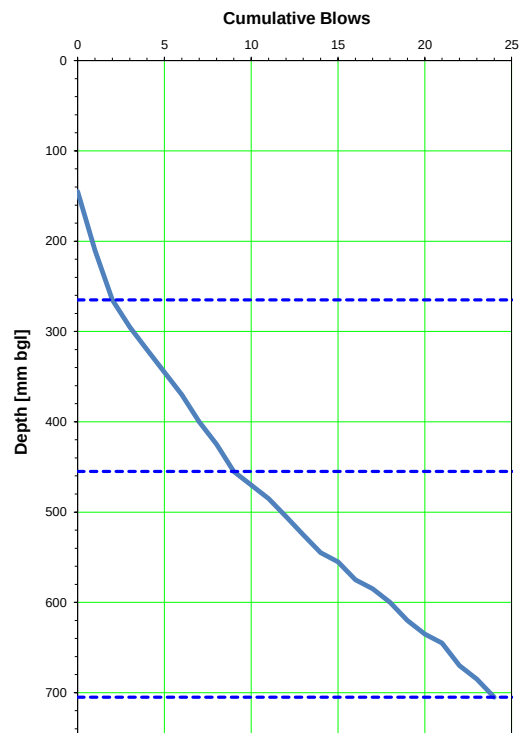
DCS6

04/12/2019

CS

130

Checked by: SD

[illegible]

Notes: TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$ from IAN 73/06 Revision 1 (2009)
Tested in accordance with in house method, based upon TRL Road Note 31 & 8

Surface materials / condition:

Remarks:

Test commenced at base of concrete in DCS6

Client:	Liveman Properties Ltd
Project:	Barlow Moor Road, Chorlton
Project No.	AG3093-19

APPLIED GEOLOGY

APPENDIX C

Ground Gas Monitoring and Flow Results

Project Number: AG3093-19

Project Name: Barlow Moor Road, Chorlton

Date and Time of Monitoring: 12th December 2019 - AM

Phase of Monitoring: 1 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
CP1B	<0.1	<0.1	<0.1	-	<0.1	<0.1	3.8	3.8	18.1	18.1	50	2.20
CP2	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.3	0.3	20.7	20.7	50	1.00
CP3B	8.1	5.8	6.5	-	<0.1	<0.1	0.6	0.6	17.3	17.3	50	1.15
DCS4	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.6	0.6	21.0	21.0	50	2.10

Additional gases (if required)

BH No.	VOCs (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	

Borehole specific comments/observations

Meterological Data

Atmospheric Pressure (mb)	Start: 986
Atmospheric Pressure (mb)	Finish: 986
Pressure Rising or Falling	Falling
Weather Conditions	7/8 clouds
Atmospheric Oxygen (% vol)	21.4
Wind Speed & Direction	9mph SSE
Ambient Air Temperature (°C)	4°C

Site Data

Monitoring Personnel	Carl Sellers
GPS Instrument	
Gasmeter Serial Number	G503948
PID Serial Number	
Ground Conditions (vegetation stress, visual contamination):	

General Notes:

1. Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number: AG3093-19

Project Name: Barlow Moor Road, Chorlton

Date and Time of Monitoring: 19th December 2019 - AM

Phase of Monitoring: 2 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
CP1B	<0.1	<0.1	<0.1	-	<0.1	<0.1	3.5	3.5	17.0	17.0	50	2.25
CP2	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.7	0.7	19.8	19.8	50	0.95
CP3B	<0.1	<0.1	<0.1	-	<0.1	<0.1	1.0	1.0	17.4	17.4	50	0.90
DCS4	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.6	0.6	20.4	20.4	50	2.00

Additional gases (if required)

BH No.	VOCs (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	

Borehole specific comments/observations

Meteorological Data

Atmospheric Pressure (mb)	Start: 992
Atmospheric Pressure (mb)	Finish: 992
Pressure Rising or Falling	Falling
Weather Conditions	5/8 clouds, windy
Atmospheric Oxygen (% vol)	20.7
Wind Speed & Direction	7mph S
Ambient Air Temperature (°C)	10°C

Site Data

Monitoring Personnel	Carl Sellers
GPS Instrument	
Gasmeter Serial Number	G503948
PID Serial Number	
Ground Conditions (vegetation stress, visual contamination):	

General Notes:

1. Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number: AG3093-19

Project Name: Barlow Moor Road, Chorlton

Date and Time of Monitoring: 27th December 2019 - AM

Phase of Monitoring: 3 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
CP1B	<0.1	<0.1	<0.1	-	<0.1	<0.1	3.1	3.1	18.0	18.0	50	2.27
CP2	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.4	0.4	20.4	20.4	50	1.02
CP3B	<0.1	<0.1	<0.1	-	<0.1	<0.1	1.2	1.2	17.5	17.5	50	0.65
DCS4	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.5	0.5	20.7	20.7	50	2.05

Additional gases (if required)

BH No.	VOCs (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	

Borehole specific comments/observations

Meteorological Data

Atmospheric Pressure (mb)	Start: 1026
Atmospheric Pressure (mb)	Finish: 1026
Pressure Rising or Falling	Rising
Weather Conditions	8/8 clouds
Atmospheric Oxygen (% vol)	20.9
Wind Speed & Direction	<5 mph WSW
Ambient Air Temperature (°C)	7°C

Site Data

Monitoring Personnel	Peter Gabrielle
GPS Instrument	
Gasmeter Serial Number	G503948
PID Serial Number	
Ground Conditions (vegetation stress, visual contamination):	

General Notes:

1. Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number: AG3093-19

Project Name: Barlow Moor Road, Chorlton

Date and Time of Monitoring: 9th January 2020 - AM (CHECK)

Phase of Monitoring: 4 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
CP1B	<0.1	<0.1	<0.1	-	<0.1	<0.1	3.1	3.1	18.3	18.3	50	2.30
CP2	-0.4	-0.4	-0.4	-	<0.1	<0.1	0.9	0.9	9.2	9.2	50	1.05
CP3B	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	50	0.70
DCS4	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.6	0.6	20.4	20.4	50	2.10

Additional gases (if required)

BH No.	VOCs (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	

Borehole specific comments/observations
No gas monitoring undertaken on CP3B due to gas tap at 0.65m

Meteorological Data

Atmospheric Pressure (mb)	Start: 1020
Atmospheric Pressure (mb)	Finish: 1020
Pressure Rising or Falling	Rising
Weather Conditions	8/8 clouds
Atmospheric Oxygen (% vol)	20.8
Wind Speed & Direction	15mph SSW
Ambient Air Temperature (°C)	8°C

Site Data

Monitoring Personnel	Carl Sellers
GPS Instrument	
Gasmeter Serial Number	G503948
PID Serial Number	
Ground Conditions (vegetation stress, visual contamination):	

General Notes:

1. Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number: AG3093-19

Project Name: Barlow Moor Road, Chorlton

Date and Time of Monitoring: 16th January 2020 - PM

Phase of Monitoring: 5 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
CP1B	<0.1	<0.1	<0.1	-	<0.1	<0.1	2.9	2.9	18.1	18.1	50	2.30
CP2	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.7	0.7	15.4	15.4	50	1.00
CP3B	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	50	0.90
DCS4	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.6	0.6	20.3	20.3	50	2.05

Additional gases (if required)

BH No.	VOCs (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	

Borehole specific comments/observations
No gas monitoring undertaken on CP3B due to gas tap at 0.65m

Meteorological Data

Atmospheric Pressure (mb)	Start: 999
Atmospheric Pressure (mb)	Finish: 999
Pressure Rising or Falling	Falling
Weather Conditions	7/8 clouds
Atmospheric Oxygen (% vol)	20.6
Wind Speed & Direction	10mph SSE
Ambient Air Temperature (°C)	8°C

Site Data

Monitoring Personnel	Carl Sellers
GPS Instrument	
Gasmeter Serial Number	G503948
PID Serial Number	
Ground Conditions (vegetation stress, visual contamination):	

General Notes:

1. Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number: AG3093-19

Project Name: Barlow Moor Road, Chorlton

Date and Time of Monitoring: 22nd January 2020 - PM

Phase of Monitoring: 6 of 6

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
CP1B	<0.1	<0.1	<0.1	-	<0.1	<0.1	2.8	2.8	17.7	17.7	50	2.30
CP2	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.6	0.2	17.3	20.3	50	1.00
CP3B	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	50	0.95
DCS4	<0.1	<0.1	<0.1	-	<0.1	<0.1	0.5	0.5	20.7	20.7	50	2.10

Additional gases (if required)

BH No.	VOCs (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	

Borehole specific comments/observations
No gas monitoring undertaken on CP3B due to gas tap at 0.65m

Meteorological Data

Atmospheric Pressure (mb)	Start: 1035
Atmospheric Pressure (mb)	Finish: 1035
Pressure Rising or Falling	Falling
Weather Conditions	8/8 clouds
Atmospheric Oxygen (% vol)	21.4
Wind Speed & Direction	<5mph N
Ambient Air Temperature (°C)	9°C

Site Data

Monitoring Personnel	Carl Sellers
GPS Instrument	
Gasmeter Serial Number	G503948
PID Serial Number	
Ground Conditions (vegetation stress, visual contamination):	

General Notes:

1. Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Gas Monitoring Equipment Specification and Accuracy Details

Instrument Specifications

Instrument	Atmospheric Pressure Range	Temperature Range	Flow Range	Flow Resolution	Borehole Pressure Range
GA5000	500-1500 mb +/- 5 mb	-10°C to + 50°C	0-20 lt/hr +/- 0.3 l/hr	0.1l/hr	.+500/-500 mbar +/- 4 mbar
Phocheck Tiger	-	-20 to + 60°C (Certified to -15 to + 45°C)	-	-	-

Instrument Accuracy

Instrument		Methane	Lower Explosive Limit	Carbon Dioxide	Oxygen	Volatile Organic Compounds	Hydrogen Sulphide	Carbon Monoxide
GA5000	Detection Range	0-100%	-	0 -100%	0-25%	NA	0 -50ppm response <30 secs	0 - 1000ppm response <30 Secs
	Detection Accuracy	./- 0.5% @ 0 to 70%, ./-1.5% @ 70 to 100% Response < 10 secs	N/A	./- 0.5% @ 0 to 60%, ./-1.5% @ 60 to 100% Response < 10 secs	./- 1.0% @ 0 to 25%, Response < 20 secs	NA	./- 1.5% FS	./- 2% of FS
Phocheck Tiger	Detection Range	N/A	N/A	N/A	N/A	1 ppb - 10,000 ppm	N/A	N/A
	Detection Accuracy	N/A	N/A	N/A	N/A	+/- 1ppb +/- 5% of actual displayed accuracy +/- One digit Response < 2sec	N/A	N/A

Calibration Frequency

Equipment Serial Numbers

Instruments are calibrated annually. Details of the instrument calibration certificates and service records are available if required.		
	GA5000 (G503948, G505383, G505737)	
	Phocheck Tiger - (T-108308, T-109597, T-109598, T-110423)	

APPENDIX D

SOIL CHEMICAL RESULTS COMPARED AGAINST SCREENING VALUES FOR HUMAN HEALTH

Site: Barlow Moor Road, Chorlton
Job No: AG3093-19

Land Use: Residential without Plant Uptake
Dataset: All results
Soil Organic Matter (%) 2.5 %

Exploratory Hole Reference		DCS1	DCS2	DCS3	DCS4	DCS5	DCS6	CP1B	No. of samples (n)	Residential without Plant Uptake	Source/Justification
Depth (m)		0.50	0.80	0.50	0.80	0.60	0.60	0.5			
Strata		MG	MG	MG	GFD	GFD	GFD	MG			
	Units										
Organic Matter (%)	%	7.3	2.7	2.3	0.1	0.2	0.5	3.9	7		
pH	pH Units	7.8	8.5	7.8	8.5	8.3	7.6	7.9	7		
Arsenic	mg/kg	46	9.2	14	1	1	1	48	7	40	LQM/CIEH S4UL (2015)
Beryllium	mg/kg	2.2	0.53	0.68	0.11	0.09	0.1	2.1	7	1.7	LQM/CIEH S4UL (2015)
Boron - Total	mg/kg	18	4.7	8.4	2.3	2	2	13	7	11000	LQM/CIEH S4UL (2015)
Cadmium	mg/kg	3.3	0.2	0.4	0.2	0.2	0.2	1.7	7	85	LQM/CIEH S4UL (2015)
Chromium (total)	mg/kg	37	15	15	4.9	4.7	3.6	57	7	910	LQM/CIEH S4UL (2015)
Chromium - III	mg/kg	36	15	13	4.4	4.4	3.3	56	7	910	LQM/CIEH S4UL (2015)
Chromium (VI) Screen	mg/kg	4	4	4	4	4	4	4	7	6	LQM/CIEH S4UL (2015)
Copper	mg/kg	300	25	56	2.6	3	2.2	270	7	7100	LQM/CIEH S4UL (2015)
Lead	mg/kg	1100	91	160	2.6	2.8	3.9	590	7	310	C4SL (2014)
Mercury (Total)	mg/kg	1.4	0.3	0.4	0.3	0.3	0.3	0.3	7	56	LQM/CIEH S4UL (2015)
Nickel	mg/kg	48	15	18	7.1	9.7	6.3	45	7	180	LQM/CIEH S4UL (2015)
Selenium	mg/kg	1	1	1	1	1	1	2.4	7	430	LQM/CIEH S4UL (2015)
Vanadium	mg/kg	46	19	21	4.9	5	4	54	7	1200	LQM/CIEH S4UL (2015)
Zinc	mg/kg	760	44	140	15	16	14	490	7	40000	LQM/CIEH S4UL (2015)
Naphthalene	mg/kg	1.1	0.05	0.24	0.05	0.05	0.05	0.2	7	5.6	LQM/CIEH S4UL (2015)
Acenaphthylene	mg/kg	1.3	0.05	0.28	0.05	0.05	0.05	0.55	7	4700	LQM/CIEH S4UL (2015)
Acenaphthene	mg/kg	5.7	0.05	0.39	0.05	0.05	0.05	5.1	7	4600	LQM/CIEH S4UL (2015)
Fluorene	mg/kg	3.1	0.05	0.22	0.05	0.05	0.05	4	7	3800	LQM/CIEH S4UL (2015)
Phenanthrene	mg/kg	37	1.1	4.4	0.05	0.05	0.05	37	7	1500	LQM/CIEH S4UL (2015)
Anthracene	mg/kg	10	0.28	1.1	0.05	0.05	0.05	8.5	7	35000	LQM/CIEH S4UL (2015)
Fluoranthene	mg/kg	100	1.9	20	0.05	0.05	0.05	87	7	1600	LQM/CIEH S4UL (2015)
Pyrene	mg/kg	93	2	21	0.05	0.05	0.05	75	7	3800	LQM/CIEH S4UL (2015)
Benzo[a]anthracene	mg/kg	66	0.93	16	0.05	0.05	0.05	49	7	*	
Chrysene	mg/kg	54	0.84	11	0.05	0.05	0.05	44	7	*	
Benzo[b]fluoranthene	mg/kg	83	0.78	13	0.05	0.05	0.05	56	7	*	
Benzo[k]fluoranthene	mg/kg	30	0.6	6.7	0.05	0.05	0.05	22	7	*	
Benzo[a]pyrene	mg/kg	64	0.85	12	0.05	0.05	0.05	44	7	5.3	C4SL (2014)
Dibenzo[a,h]anthracene	mg/kg	34	0.37	6	0.05	0.05	0.05	24	7	*	
Indeno[1,2,3-cd]pyrene	mg/kg	9.7	0.05	2.3	0.05	0.05	0.05	6.8	7	*	
Benzo[g,h,i]perylene	mg/kg	39	0.43	7.6	0.05	0.05	0.05	25	7	*	
Total of 16 PAHs	mg/kg	633	10	122	0.8	0.8	0.8	490	7		
Phenols (Total)	mg/kg	1	1	1	1	1	1	1	7	690	LQM/CIEH S4UL (2015)
Benzene	mg/kg	1	1	1	1	1	1	1	7	0.7	LQM/CIEH S4UL (2015)
Toluene	mg/kg	1	1	1	1	1	1	1	7	1900	LQM/CIEH S4UL (2015)
Ethylbenzene	mg/kg	1	1	1	1	1	1	1	7	190	LQM/CIEH S4UL (2015)
m&p Xylene	mg/kg	1	1	1	1	1	1	1	7	180	LQM/CIEH S4UL (2015)
o-Xylene	mg/kg	1	1	1	1	1	1	1	7	210	LQM/CIEH S4UL (2015)
Aliphatic TPH >C5-C6	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	7	78	LQM/CIEH S4UL (2015)
Aliphatic TPH >C6-C8	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	7	230	LQM/CIEH S4UL (2015)
Aliphatic TPH >C8-C10	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	7	65	LQM/CIEH S4UL (2015)
Aliphatic TPH >C10-C12	mg/kg	7.7	4.8	2.3	1	1	1	1	7	330	LQM/CIEH S4UL (2015)
Aliphatic TPH >C12-C16	mg/kg	47	9.5	7.3	2	2	2	9	7	2400	LQM/CIEH S4UL (2015)
Aliphatic TPH >C16-C21	mg/kg	110	13	22	8	8	8	24	7	-	
Aliphatic TPH >C21-C35	mg/kg	580	22	54	8	8	8	110	7	92000	LQM/CIEH S4UL (2015)
Aliphatic TPH >C35-C44	mg/kg	100	8.4	8.4	8.4	8.4	8.4	30	7	92000	LQM/CIEH S4UL (2015)
Total Aliphatic Hydrocarbons	mg/kg	850	49	85	10	10	10	170	7		
Aromatic TPH >C5-C7	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	7	690	LQM/CIEH S4UL (2015)
Aromatic TPH >C7-C8	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	7	1800	16
Aromatic TPH >C8-C10	mg/kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	7	110	LQM/CIEH S4UL (2015)
Aromatic TPH >C10-C12	mg/kg	6.2	1.6	4	1	1	1	3.9	7	590	LQM/CIEH S4UL (2015)
Aromatic TPH >C12-C16	mg/kg	83	8.8	19	2	2	2	48	7	2300	LQM/CIEH S4UL (2015)
Aromatic TPH >C16-C21	mg/kg	1200	51	180	10	10	10	600	7	1900	LQM/CIEH S4UL (2015)
Aromatic TPH >C21-C35	mg/kg	2900	78	560	10	10	10	120	7	1900	LQM/CIEH S4UL (2015)
Aromatic TPH >C35-C44	mg/kg	330	8.4	53	8.4	8.4	8.4	180	7	1900	LQM/CIEH S4UL (2015)
Total Aromatic Hydrocarbons	mg/kg	4500	140	820	10	10	10	2000	7		
Total Petroleum Hydrocarbons	mg/kg	5300	190	900	10	10	10	2200	7		
TPH Interpretation	Description	PAHs	-	-	-	-	-	PAHs			
Asbestos ID	Detection	Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	Detected	7		Detection Limit
Asbestos ID	Description	Chrysotile	-	-	-	-	-	Chrysotile			Detection Limit
Asbestos Quantity	%	0.001	-	-	-	-	-	0.001	2		Detection Limit

Key -
Value within sample set exceeds screening value
Statistical value exceeds screening value

LQM/CIEH S4UL Reference No. S4UL3159 (2015)
Values in **bold** are reported at the laboratory limit of detection
Benzo(a)pyrene has been used as a 'surrogate marker for genotoxic PAH' as discussed in Appendix E of CL:AIRE SP1010 'Development of C4SL for Assessment of Land Affected by Contamination', December 2013.
This allows assessment of the combined carcinogenic risk associated with genotoxic PAH using only b(a)p. Genotoxic PAHs include Benz(a)pyrene, Benzo(a)anthracene,

SUMMARY OF LEACHATE TEST RESULTS

Site Barlow Moor Road, Manchester
Job Number AG3093-19
Type of Water Leachate

Determinand	Limit of Detection	Hazardous or Non-Hazardous^	Sample Identity Depth Sampled Date	DCS1 0.5 04/12/2019	CP1B 0.5 04/12/2019	No. of samples (n)	Waters Screening Value	Source & Justification
pH		-	-	7.8	7.7	2	-	-
TOC		-	mg l ⁻¹	6.97	4.07	2	-	-
Arsenic	1.1	Haz	µg l ⁻¹	1.1	1.4	2	10	UK Drinking Water Standards (2010)
Cadmium	0.08	Non Haz	µg l ⁻¹	0.08	0.08	2	5	UK Drinking Water Standards (2010)
Chromium (Total)	0.4	Non Haz	µg l ⁻¹	7.5	4.8	2	50	UK Drinking Water Standards (2010)
Chromium (III)	1	Non Haz	µg l ⁻¹	7.5	1	2	50	UK Drinking Water Standards (2010)
Chromium (VI)	5	Haz	µg l ⁻¹	5	5	2	50	UK Drinking Water Standards (2010)
Copper	0.7	Non Haz	µg l ⁻¹	17	8.3	2	2000	UK Drinking Water Standards (2010)
Lead	1	Haz	µg l ⁻¹	16	4.3	2	10	UK Drinking Water Standards (2010)
Mercury	0.5	Haz	µg l ⁻¹	0.5	0.5	2	1	UK Drinking Water Standards (2010)
Nickel	0.3	Non Haz	µg l ⁻¹	1.4	0.3	2	20	UK Drinking Water Standards (2010)
Selenium	4	Non Haz	µg l ⁻¹	4	4	2	10	UK Drinking Water Standards (2010)
Zinc	0.4	Non Haz	µg l ⁻¹	25	15	2	5000	UK Drinking Water Standards (2010)
Boron	10	Non Haz	µg l ⁻¹	63	10	2	1000	UK Drinking Water Standards (2010)
Beryllium	0.2	Non Haz	µg l ⁻¹	0.2	0.2	2	12	UK Drinking Water Standards (2010)
Vanadium	1.7	Non Haz	µg l ⁻¹	1.7	1.7	2	60	UK Drinking Water Standards (2010)
Sulphate	0.1	Non Haz	mg l ⁻¹	30.8	5.7	2	250	UK Drinking Water Standards (2010)
Phenol	1	Non Haz	µg l ⁻¹	1	1	2	7.7	WFD Environmental Standard, 2010
Naphthalene	0.01	Non Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Acenaphthylene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Acenaphthene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Fluorene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Phenanthrene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Anthracene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Fluoranthene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Pyrene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[a]anthracene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Chrysene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[b]fluoranthene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[k]fluoranthene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[a]pyrene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Dibenz(a,h)Anthracene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Indeno(1,2,3-c,d)Pyrene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit
Benzo[g,h,i]perylene	0.01	Haz	µg l ⁻¹	0.01	0.01	2	0.01	Detection limit

Key-

Result exceeds test Detection Limit (for Haz determinands)

Result exceeds Screening Value (for Non Haz determinands)

Values in bold at the limit of detection

^ Note:

Hazardous and non-hazardous substances determined by JAGDAG (Jan 2017) and published at <http://www.wfduk.org/sites/default/files/Media/170116%20Substance%20Determinationsfinal.pdf>. These are marked in bold.

For substances not assessed by JAGDAG, Applied Geology has assumed a determinanation based on our understanding of the behaviour of the chemical. These determinations are highlighted in yellow.

**Carl Sellers**

Applied Geology Ltd
Lowton Business Park
Newton Road
Lowton
Warrington
WA3 2AN

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

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: carl.sellers@appliedgeology.co.uk

Analytical Report Number : 19-76927

Replaces Analytical Report Number : 19-76927, issue no. 1

Project / Site name:	Barlow Moor Road, Chorlton	Samples received on:	10/12/2019
Your job number:	AG3093-19	Samples instructed on:	11/12/2019
Your order number:	15216	Analysis completed by:	18/12/2019
Report Issue Number:	2	Report issued on:	20/01/2020
Samples Analysed:	2 leachate samples - 7 soil samples		

Signed: 

Zina Abdul Razzak
Senior Quality Specialist

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 19-76927

Project / Site name: Barlow Moor Road, Chorlton

Your Order No: 15216

Lab Sample Number	1389121	1389122	1389123	1389124	1389125
Sample Reference	DCS1	DCS2	DCS3	DCS4	DCS5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.80	0.50	0.80	0.60
Date Sampled	04/12/2019	04/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	15	8.9
Total mass of sample received	kg	0.001	NONE	0.59	0.97

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected	-	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	< 0.001	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	< 0.001	-	-	-	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	8.5	7.8	8.5	8.3
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	320	25	1500	41	29
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.16	0.012	0.74	0.020	0.015
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	162	12.4	744	20.3	14.7
Organic Matter	%	0.1	MCERTS	7.3	2.7	2.3	0.1	0.2

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	1.1	< 0.05	0.24	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	1.3	< 0.05	0.28	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	5.7	< 0.05	0.39	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	3.1	< 0.05	0.22	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	37	1.1	4.4	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	10	0.28	1.1	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	100	1.9	20	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	93	2.0	21	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	66	0.93	16	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	54	0.84	11	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	83	0.78	13	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	30	0.60	6.7	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	64	0.85	12	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	34	0.37	6.0	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	9.7	< 0.05	2.3	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	39	0.43	7.6	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	633	10.0	122	< 0.80	< 0.80
-----------------------------	-------	-----	--------	-----	------	-----	--------	--------

Analytical Report Number: 19-76927

Project / Site name: Barlow Moor Road, Chorlton

Your Order No: 15216

Lab Sample Number	1389121	1389122	1389123	1389124	1389125
Sample Reference	DCS1	DCS2	DCS3	DCS4	DCS5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.80	0.50	0.80	0.60
Date Sampled	04/12/2019	04/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	46	9.2	14	< 1.0	< 1.0
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	2.2	0.53	0.68	0.11	0.09
Boron (total)	mg/kg	1	MCERTS	18	4.7	8.4	2.3	2.0
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	3.3	< 0.2	0.4	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (III)	mg/kg	1	NONE	36	15	13	4.4	4.4
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	37	15	15	4.9	4.7
Copper (aqua regia extractable)	mg/kg	1	MCERTS	300	25	56	2.6	3.0
Lead (aqua regia extractable)	mg/kg	1	MCERTS	1100	91	160	2.6	2.8
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.4	< 0.3	0.4	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	48	15	18	7.1	9.7
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	46	19	21	4.9	5.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	760	44	140	15	16

Magnesium (water soluble)	mg/kg	5	NONE	15	6.0	66	< 5.0	< 5.0
---------------------------	-------	---	------	----	-----	----	-------	-------

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	7.7	4.8	2.3	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	47	9.5	7.3	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	110	13	22	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	580	22	54	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	100	< 8.4	< 8.4	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	740	49	85	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44)	mg/kg	10	NONE	850	49	85	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	6.2	1.6	4.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	83	8.8	19	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	1200	51	180	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	2900	78	560	< 10	< 10
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	330	< 8.4	53	< 8.4	< 8.4
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	4100	140	770	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC44)	mg/kg	10	NONE	4500	140	820	< 10	< 10

TPHCWG - Total C5 - C44 Aliphatic & Aromatic	mg/kg	10	NONE	5300	190	900	< 10	< 10
--	-------	----	------	------	-----	-----	------	------



Analytical Report Number: 19-76927

Project / Site name: Barlow Moor Road, Chorlton

Your Order No: 15216

Lab Sample Number				1389121	1389122	1389123	1389124	1389125
Sample Reference				DCS1	DCS2	DCS3	DCS4	DCS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.80	0.50	0.80	0.60
Date Sampled				04/12/2019	04/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Miscellaneous Organics

Product ID		N/A	NONE	See Appendix	-	-	-	-
------------	--	-----	------	--------------	---	---	---	---

Analytical Report Number: 19-76927

Project / Site name: Barlow Moor Road, Chorlton

Your Order No: 15216

Lab Sample Number				1389126	1389127			
Sample Reference				DCS6	CP1			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.60	0.50			
Date Sampled				04/12/2019	04/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	5.8	15			
Total mass of sample received	kg	0.001	NONE	1.2	0.82			

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Chrysotile			
Asbestos in Soil	Type	N/A	ISO 17025	-	Detected			
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	< 0.001			
Asbestos Quantification Total	%	0.001	ISO 17025	-	< 0.001			

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.6	7.9			
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	42	66			
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.021	0.033			
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	21.0	32.9			
Organic Matter	%	0.1	MCERTS	0.5	3.9			

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.20			
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.55			
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	5.1			
Fluorene	mg/kg	0.05	MCERTS	< 0.05	4.0			
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	37			
Anthracene	mg/kg	0.05	MCERTS	< 0.05	8.5			
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	87			
Pyrene	mg/kg	0.05	MCERTS	< 0.05	75			
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	49			
Chrysene	mg/kg	0.05	MCERTS	< 0.05	44			
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	56			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	22			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	44			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	24			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	6.8			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	25			

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	490			
-----------------------------	-------	-----	--------	--------	-----	--	--	--

Analytical Report Number: 19-76927

Project / Site name: Barlow Moor Road, Chorlton

Your Order No: 15216

Lab Sample Number				1389126	1389127			
Sample Reference				DCS6	CP1			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.60	0.50			
Date Sampled				04/12/2019	04/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	48			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.10	2.1			
Boron (total)	mg/kg	1	MCERTS	2.0	13			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	1.7			
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0			
Chromium (III)	mg/kg	1	NONE	3.3	56			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	3.6	57			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	2.2	270			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	3.9	590			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	6.3	45			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	2.4			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	4.0	54			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	14	490			
Magnesium (water soluble)	mg/kg	5	NONE	7.1	7.9			

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0			
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0			
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0			
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0			
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0			

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001			
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001			
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001			
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0			
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	9.0			
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	24			
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	110			
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	30			
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	140			
TPH-CWG - Aliphatic (EC5 - EC44)	mg/kg	10	NONE	< 10	170			
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001			
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001			
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001			
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	3.9			
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	48			
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	600			
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	1200			
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	180			
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	1800			
TPH-CWG - Aromatic (EC5 - EC44)	mg/kg	10	NONE	< 10	2000			
TPHCWG - Total C5 - C44 Aliphatic & Aromatic	mg/kg	10	NONE	< 10	2200			

Analytical Report Number: 19-76927

Project / Site name: Barlow Moor Road, Chorlton

Your Order No: 15216

Lab Sample Number				1389126	1389127			
Sample Reference				DCS6	CP1			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.60	0.50			
Date Sampled				04/12/2019	04/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Miscellaneous Organics

Product ID		N/A	NONE	-	See Appendix			
------------	--	-----	------	---	--------------	--	--	--



Analytical Report Number: **19-76927**
Project / Site name: **Barlow Moor Road, Chorlton**
Your Order No: **15216**

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

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

Quantitative Analysis

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

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

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

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
1389121	DCS1	0.50	123	Loose Fibres	Chrysotile	< 0.001	< 0.001
1389127	CP1	0.50	118	Loose Fibres	Chrysotile	< 0.001	< 0.001

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



Analytical Report Number: 19-76927
Project / Site name: Barlow Moor Road, Chorlton

Your Order No: 15216

Lab Sample Number				1389128	1389129			
Sample Reference				DCS1	CP1			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.50	0.50			
Date Sampled				04/12/2019	04/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	7.8	7.7			
Sulphate as SO ₄	mg/l	0.1	ISO 17025	30.8	5.7			
Total Organic Carbon (TOC)	mg/l	0.1	NONE	6.97	4.07			

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	< 1.0	< 1.0			
----------------------------	------	---	-----------	-------	-------	--	--	--

Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01			
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01			
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01			

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2			
-------------------	------	-----	------	-------	-------	--	--	--

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1	1.4			
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2			
Boron (dissolved)	µg/l	10	ISO 17025	63	< 10			
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08			
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0			
Chromium (III)	µg/l	1	NONE	7.5	< 1.0			
Chromium (dissolved)	µg/l	0.4	ISO 17025	7.5	4.8			
Copper (dissolved)	µg/l	0.7	ISO 17025	17	8.3			
Lead (dissolved)	µg/l	1	ISO 17025	16	4.3			
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5			
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.4	< 0.3			
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0			
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7	< 1.7			
Zinc (dissolved)	µg/l	0.4	ISO 17025	25	15			
Magnesium (dissolved)	mg/l	0.005	ISO 17025	1.5	0.40			

Analytical Report Number : 19-76927

Project / Site name: Barlow Moor Road, Chorlton

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1389121	DCS1	None Supplied	0.50	Brown loam and clay with gravel and vegetation.
1389122	DCS2	None Supplied	0.80	Brown loam and clay with gravel and vegetation.
1389123	DCS3	None Supplied	0.50	Brown sand.
1389124	DCS4	None Supplied	0.80	Beige sand.
1389125	DCS5	None Supplied	0.60	Beige sand.
1389126	DCS6	None Supplied	0.60	Light brown sand.
1389127	CP1	None Supplied	0.50	Brown clay and sand with gravel.

Analytical Report Number : 19-76927

Project / Site name: Barlow Moor Road, Chorlton

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025

Iss No 19-76927-2 Barlow Moor Road, Chorlton AG3093-19

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

The results included within the report are representative of the samples submitted for analysis.

Page 11 of 14

Analytical Report Number : 19-76927

Project / Site name: Barlow Moor Road, Chorlton

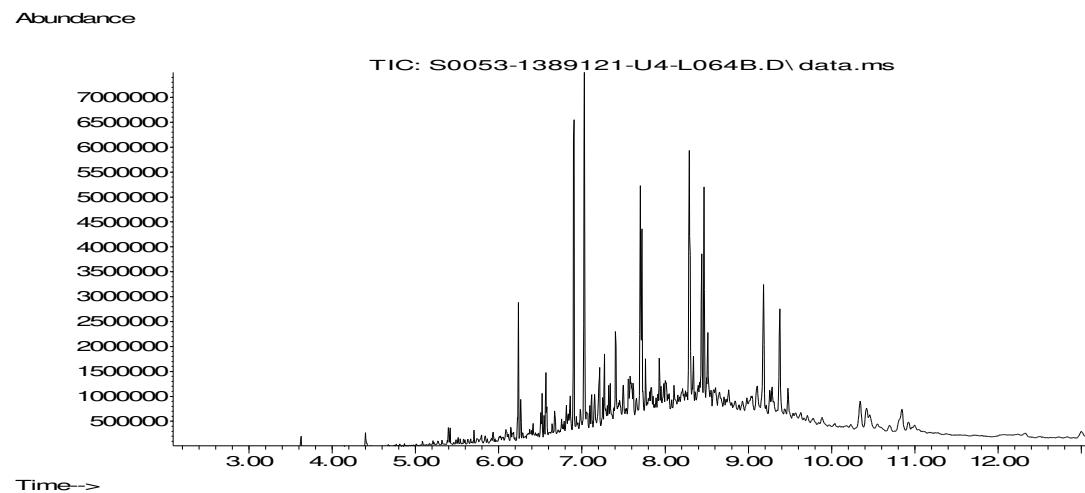
Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Product ID in soil	Determination of product ID by interpretation against standard chromatograms - Soil.	In-house method	L064-PL/UK	W	NONE
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil ¹⁰⁰	L039-PL	W	ISO 17025
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total organic carbon in leachate	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/cleanup.	L088/76-PL	W	MCERTS

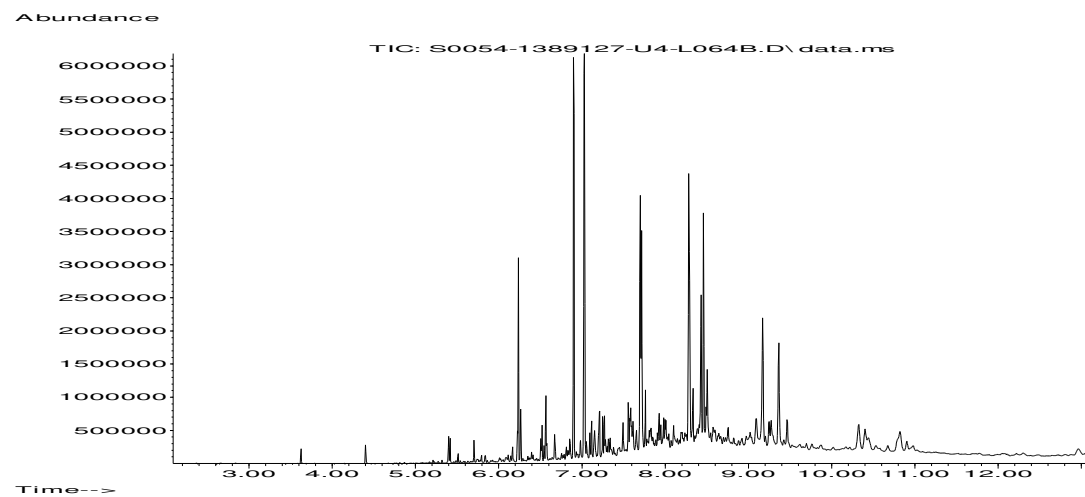
For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.



The total ion count (TIC trace) shows a carbon range from C10 to C44.
The sample TIC trace is complex, showing predominantly aromatic product sources.
The chromatographic profile is consistent with substituted poly aromatic hydrocarbons.



The total ion count (TIC trace) shows a carbon range from C10 to C44.
Sample does not match with fuel profile, but is consistent of PAH's.

**Carl Sellers**

Applied Geology Ltd
Lowton Business Park
Newton Road
Lowton
Warrington
WA3 2AN

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

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: carl.sellers@appliedgeology.co.uk

Analytical Report Number : 19-78119

Project / Site name: Barlow Moor Road, Chorlton

Samples received on:

Your job number: AG3093-19

Samples instructed on: 17/12/2019

Your order number: 15235

Analysis completed by: 06/01/2020

Report Issue Number: 1

Report issued on: 06/01/2020

Samples Analysed: 4 soil samples

Signed:

Zina Abdul Razzak
Senior Quality Specialist

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 19-78119

Project / Site name: Barlow Moor Road, Chorlton

Your Order No: 15235

Lab Sample Number	1395717	1395718	1395719	1395720	
Sample Reference	CP18	CP2	CP38	CP4	
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)	8.00	8.00	4.00	3.00	
Date Sampled	02/12/2019	02/12/2019	02/12/2019	02/12/2019	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	21	19
Total mass of sample received	kg	0.001	NONE	0.40	0.40

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.3	8.3	8.1	8.0	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.074	0.067	0.042	0.047	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	73.6	67.2	42.3	46.8	

Analytical Report Number : 19-78119

Project / Site name: Barlow Moor Road, Chorlton

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1395717	CP18	None Supplied	8.00	Brown clay and sand.
1395718	CP2	None Supplied	8.00	Brown clay and sand.
1395719	CP38	None Supplied	4.00	Brown clay and sand.
1395720	CP4	None Supplied	3.00	Brown clay and sand.

Analytical Report Number : 19-78119

Project / Site name: Barlow Moor Road, Chorlton

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19
Job Number: 19-78107
Date Sampled: 02/12/2019
Date Received: 16/12/2019
Date Tested: 02/01/2020
Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

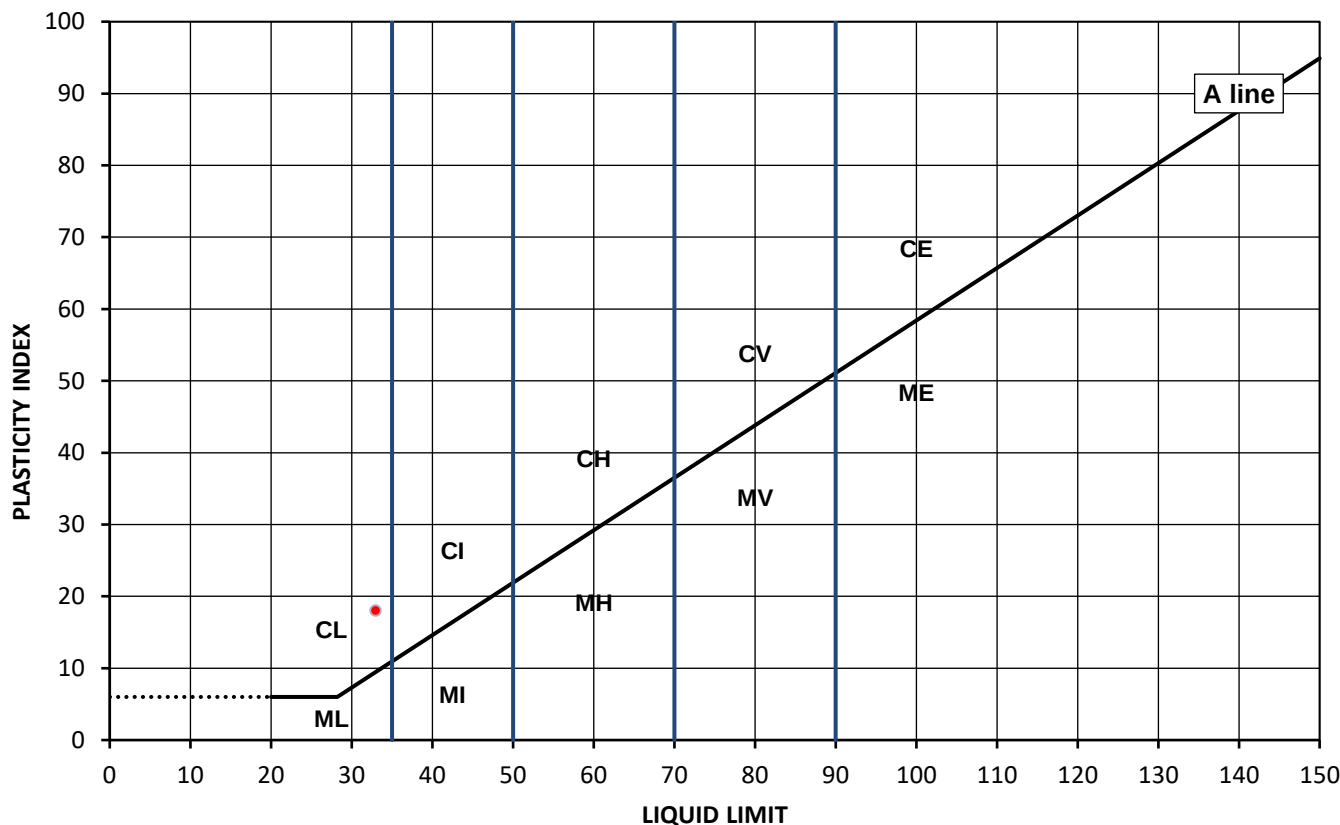
Test Results:

Laboratory Reference: 1395660
Hole No.: CP1B
Sample Reference: Not Given
Soil Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 4.00
Depth Base [m]: Not Given
Sample Type: U

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
16	33	15	18	83



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O		append to classification for organic material (eg CHO)		

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Piotrowski

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19

Job Number: 19-78107

Date Sampled: 02/12/2019

Date Received: 16/12/2019

Date Tested: 02/01/2020

Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

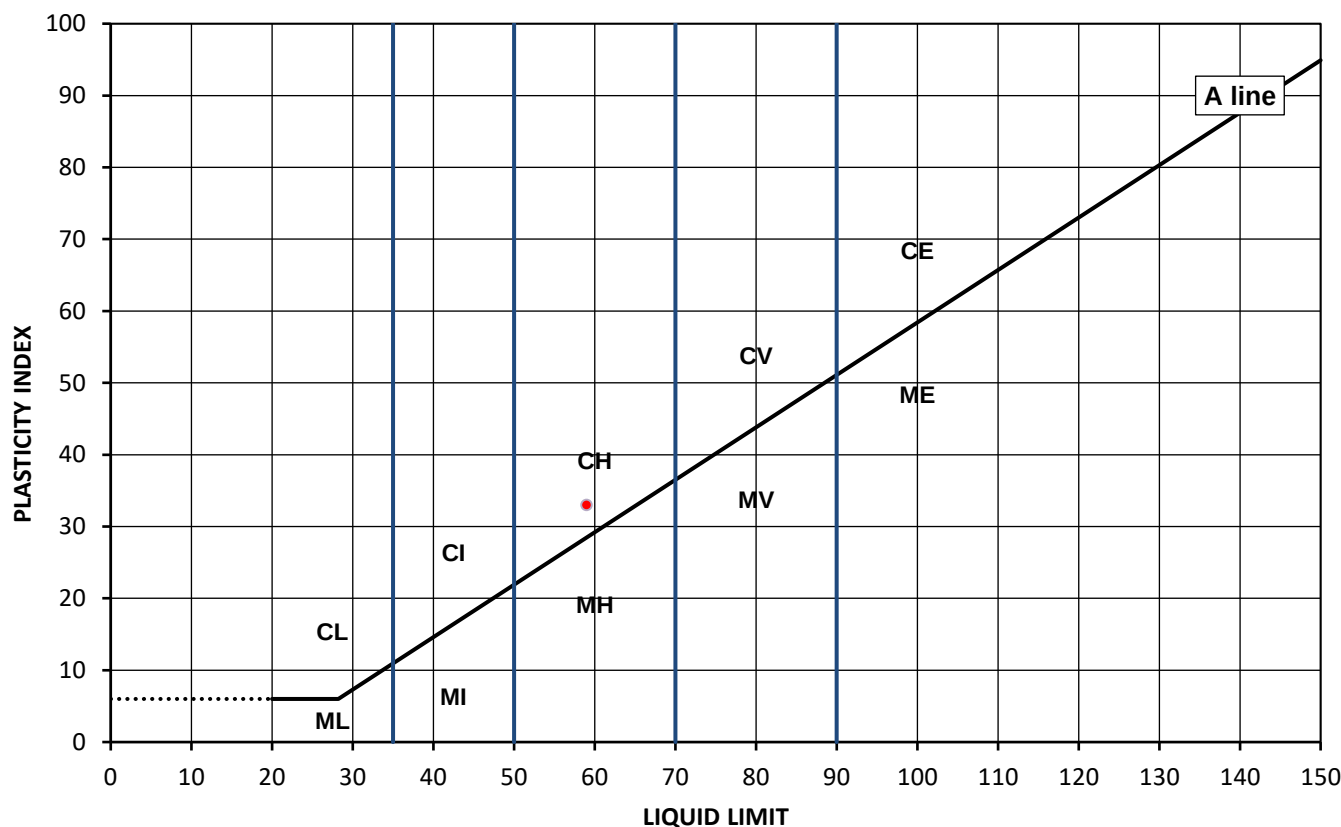
Test Results:

Laboratory Reference: 1395661
Hole No.: CP1B
Sample Reference: Not Given
Soil Description: Brown slightly sandy CLAY

Depth Top [m]: 8.00
Depth Base [m]: Not Given
Sample Type: U

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
30	59	26	33	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic		O	append to classification for organic material (eg CHO)		

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on test results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Piotrowski

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19

Job Number: 19-78107

Date Sampled: 02/12/2019

Date Received: 16/12/2019

Date Tested: 02/01/2020

Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 1395662

Hole No.: CP2

Sample Reference: Not Given

Soil Description: Brown slightly gravelly slightly sandy CLAY

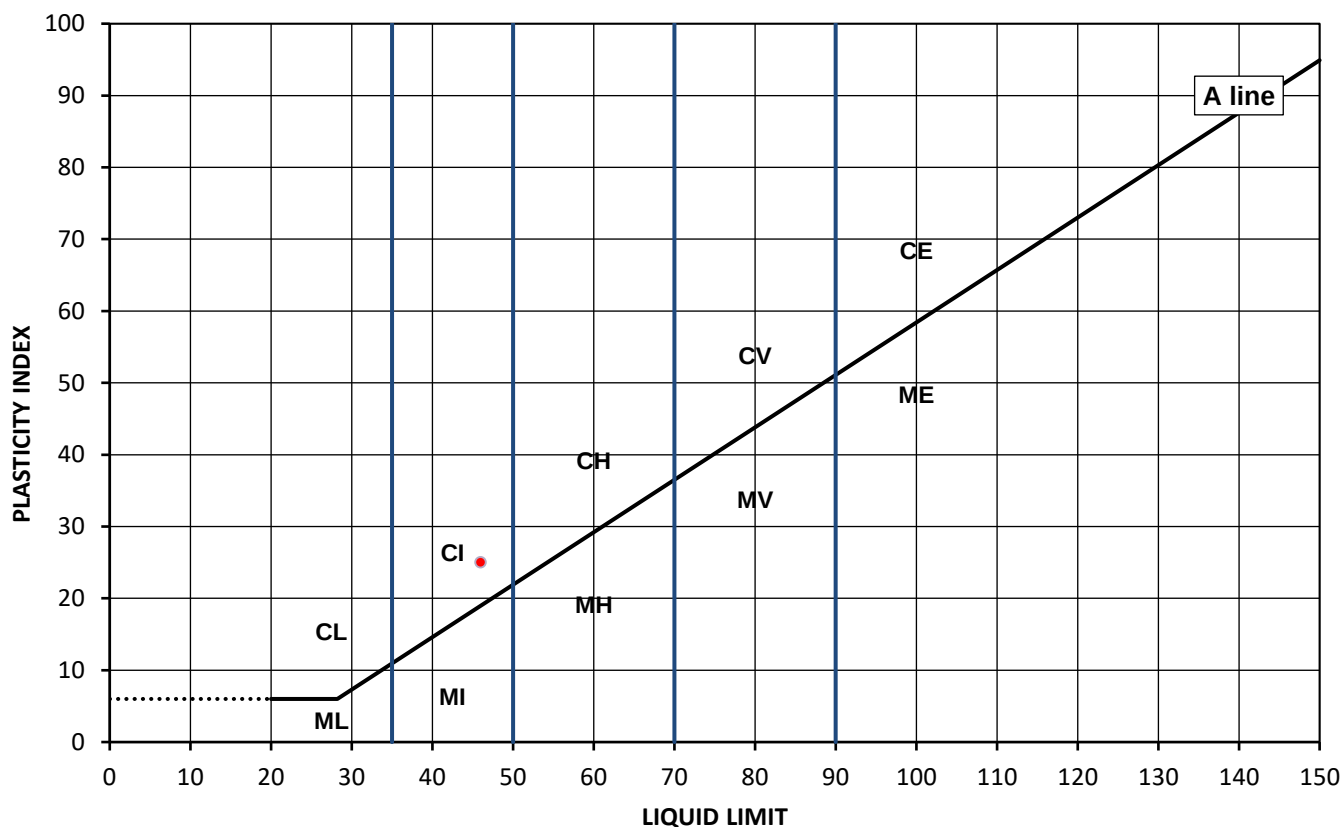
Depth Top [m]: 6.00

Depth Base [m]: Not Given

Sample Type: U

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	46	21	25	99



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O		append to classification for organic material (eg CHO)		

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Piotrowski

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19

Job Number: 19-78107

Date Sampled: 02/12/2019

Date Received: 16/12/2019

Date Tested: 02/01/2020

Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

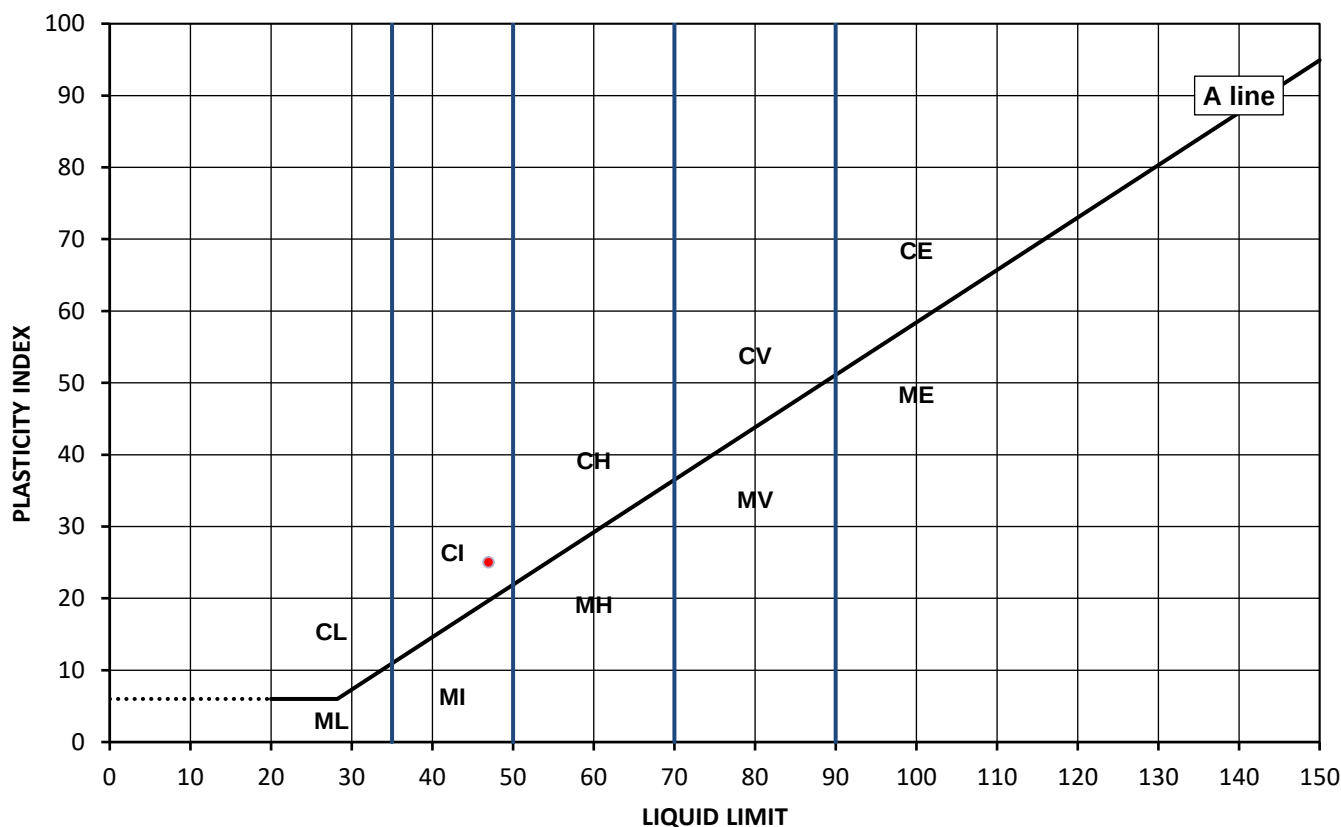
Test Results:

Laboratory Reference: 1395663
Hole No.: CP2
Sample Reference: Not Given
Soil Description: Brown slightly sandy CLAY

Depth Top [m]: 8.00
Depth Base [m]: Not Given
Sample Type: U

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	47	22	25	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O		append to classification for organic material (eg CHO)		

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on test results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Piotrowski

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19

Job Number: 19-78107

Date Sampled: 02/12/2019

Date Received: 16/12/2019

Date Tested: 02/01/2020

Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

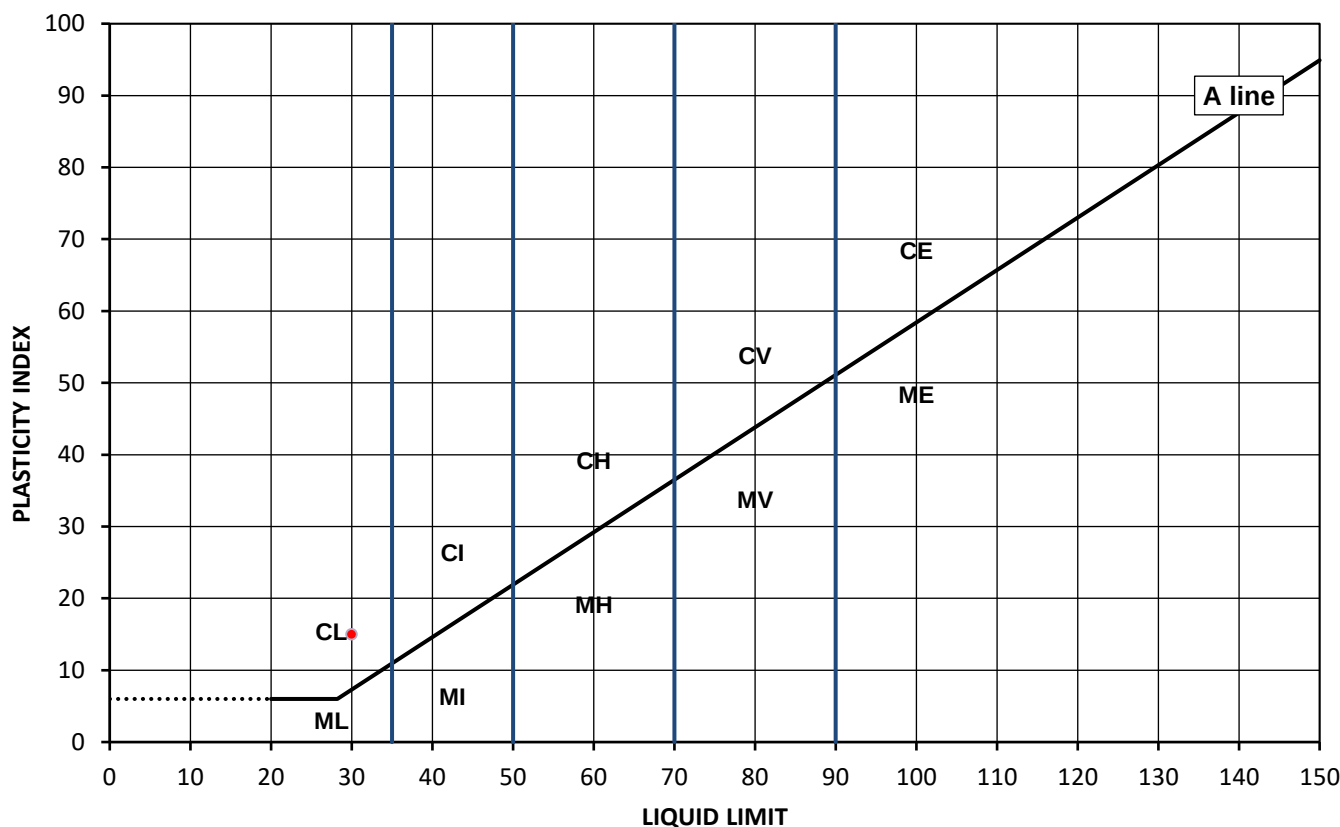
Test Results:

Laboratory Reference: 1395664
Hole No.: CP3B
Sample Reference: Not Given
Soil Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 4.00
Depth Base [m]: Not Given
Sample Type: U

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
16	30	15	15	96



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O		append to classification for organic material (eg CHO)		

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on test results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Piotrowski

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19

Job Number: 19-78107

Date Sampled: 02/12/2019

Date Received: 16/12/2019

Date Tested: 02/01/2020

Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 1395665

Hole No.: CP3B

Sample Reference: Not Given

Soil Description: Brown sandy CLAY

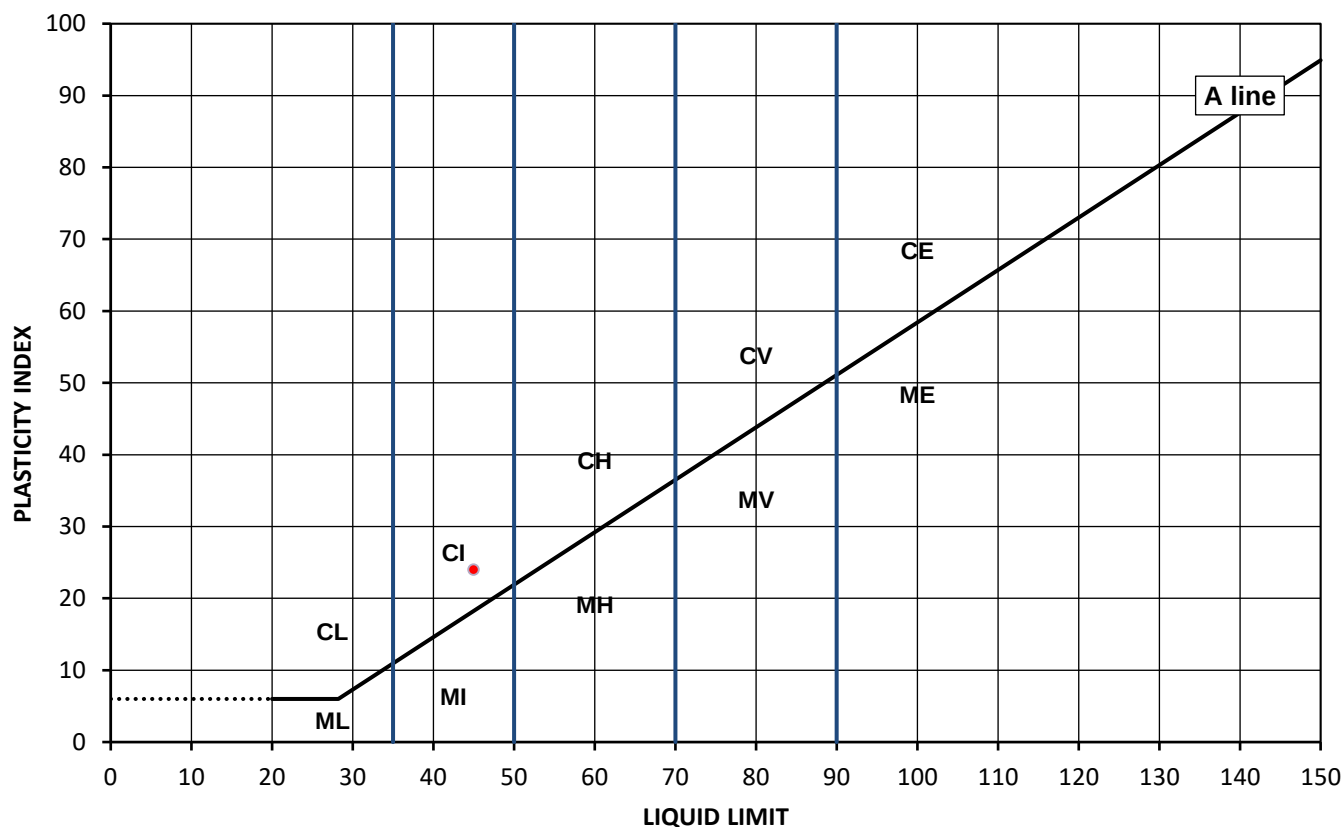
Depth Top [m]: 8.00

Depth Base [m]: Not Given

Sample Type: U

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
25	45	21	24	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O		append to classification for organic material (eg CHO)		

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take in to account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Piotrowski

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19
Job Number: 19-78107
Date Sampled: 02/12/2019
Date Received: 16/12/2019
Date Tested: 02/01/2020
Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

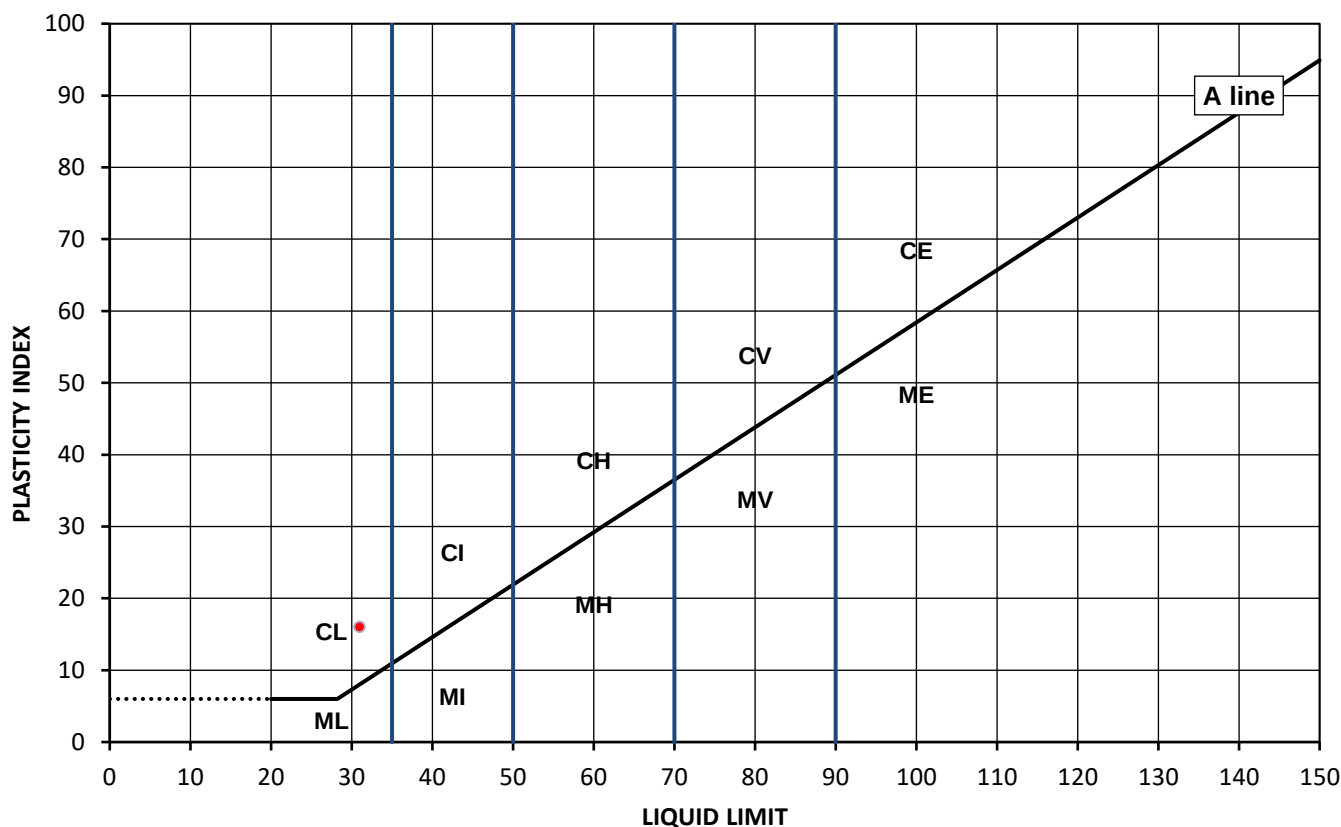
Test Results:

Laboratory Reference: 1395666
Hole No.: CP4
Sample Reference: Not Given
Soil Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 3.00
Depth Base [m]: Not Given
Sample Type: U

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
15	31	15	16	89



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O		append to classification for organic material (eg CHO)		

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Piotrowski

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19

Job Number: 19-78107

Date Sampled: 02/12/2019

Date Received: 16/12/2019

Date Tested: 02/01/2020

Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 1395667

Hole No.: CP4

Sample Reference: Not Given

Soil Description: Brown gravelly clayey dense SAND

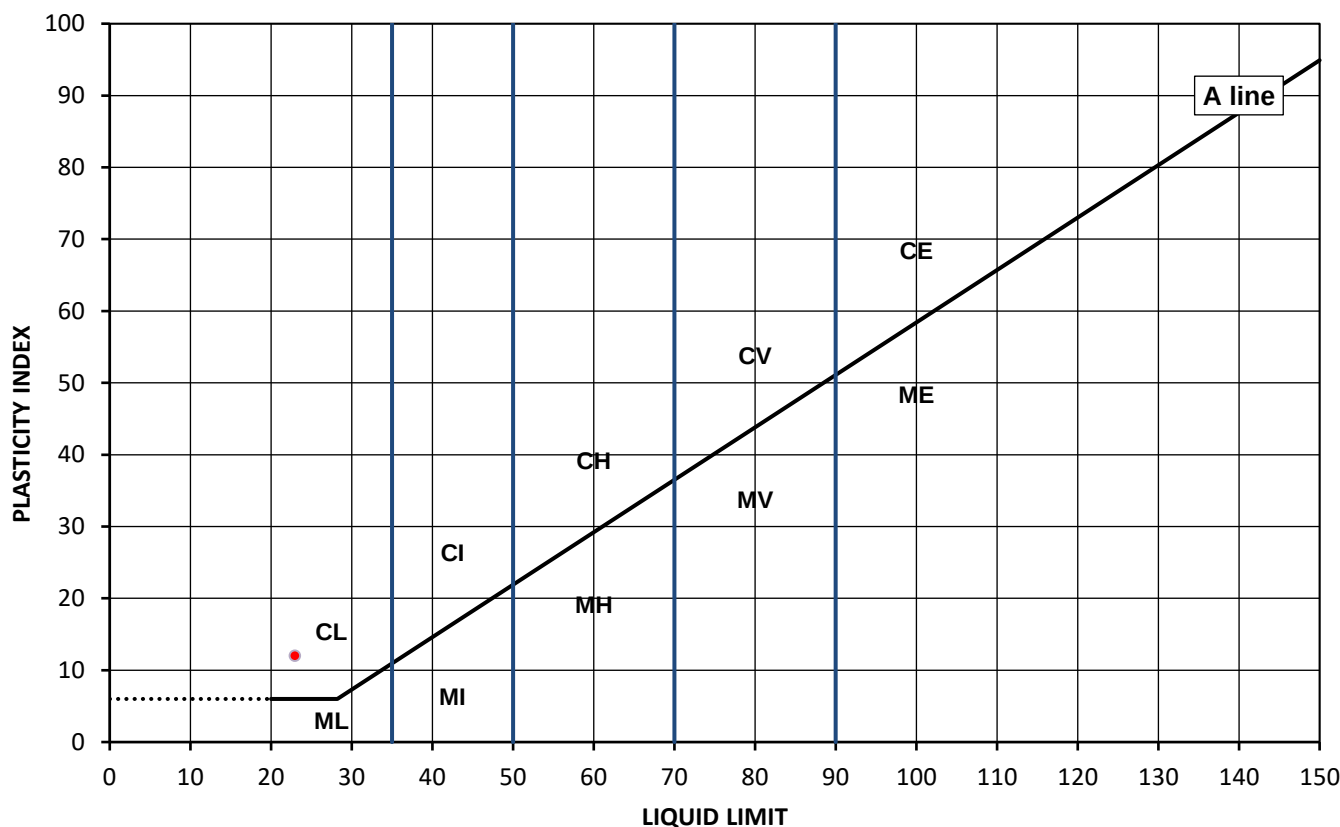
Depth Top [m]: 7.00

Depth Base [m]: Not Given

Sample Type: U

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
11	23	11	12	85



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	L	Low	Liquid Limit	below 35
M	Silt		I	Medium		35 to 50
			H	High		50 to 70
			V	Very high		70 to 90
			E	Extremely high		exceeding 90
	Organic	O		append to classification for organic material (eg CHO)		

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take in to account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Piotrowski

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



SUMMARY REPORT

Summary of Classification Test Results

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with:

MC by BS 1377-2: 1990: Clause 3.2; WC by BS EN 17892-1: 2014; Atterberg
by BS 1377-2: 1990: Clause 4.3, Clause 4.4 and 5; PD by BS 1377-2: 1990:
Clause 8.2

Client Reference: AG3093-19

Job Number: 19-78107

Date Sampled: 02/12/2019

Date Received: 16/12/2019

Date Tested: 02/01/2020

Sampled By: CS

Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN

Contact: Carl Sellers
Site Address: Barlow Moor Road, Chorlton

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	MC	WC	Atterberg				Density			Total Porosity#		
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um	LL	PL	PI	bulk Mg/m3	dry Mg/m3	PD Mg/m3			
1395660	CP1B	Not Given	4.00	Not Given	U	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	16		83	33	15	18						
1395661	CP1B	Not Given	8.00	Not Given	U	Brown slightly sandy CLAY	Atterberg 1 Point	30		100	59	26	33						
1395662	CP2	Not Given	6.00	Not Given	U	Brown slightly gravelly slightly sandy CLAY	Atterberg 1 Point	22		99	46	21	25						
1395663	CP2	Not Given	8.00	Not Given	U	Brown slightly sandy CLAY	Atterberg 1 Point	26		100	47	22	25						
1395664	CP3B	Not Given	4.00	Not Given	U	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	16		96	30	15	15						
1395665	CP3B	Not Given	8.00	Not Given	U	Brown sandy CLAY	Atterberg 1 Point	25		100	45	21	24						
1395666	CP4	Not Given	3.00	Not Given	U	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	15		89	31	15	16						
1395667	CP4	Not Given	7.00	Not Given	U	Brown gravelly clayey dense SAND	Atterberg 1 Point	11		85	23	11	12						

Note: # Non accredited; NP - Non plastic

Comments: Re-issue 1: Hole No. amended

Signed:

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based tical results in a report take in to account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."



4041

TEST CERTIFICATE
Unconsolidated Undrained**Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

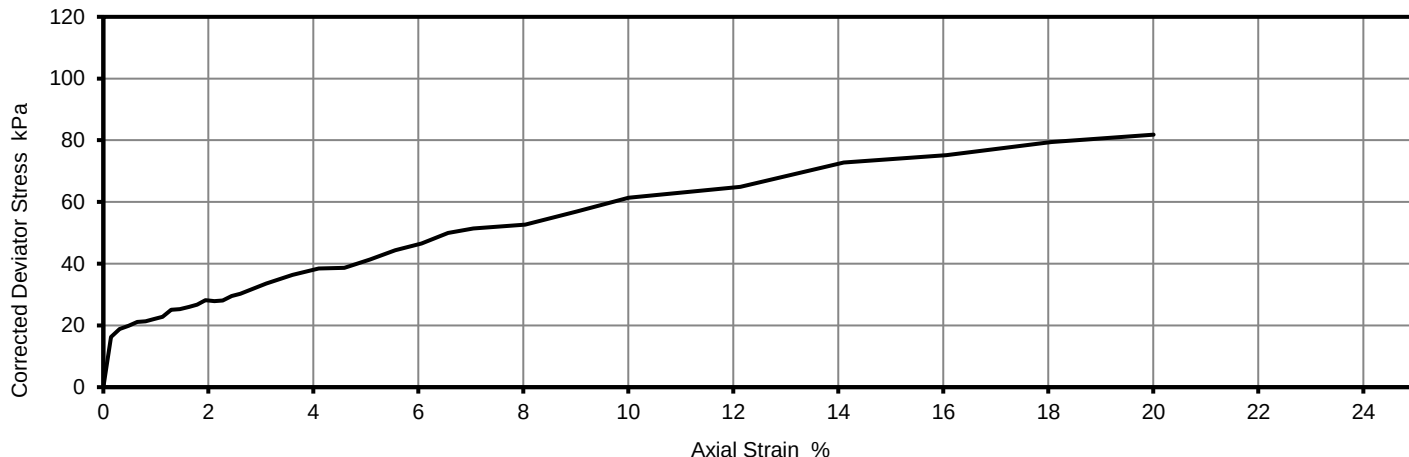
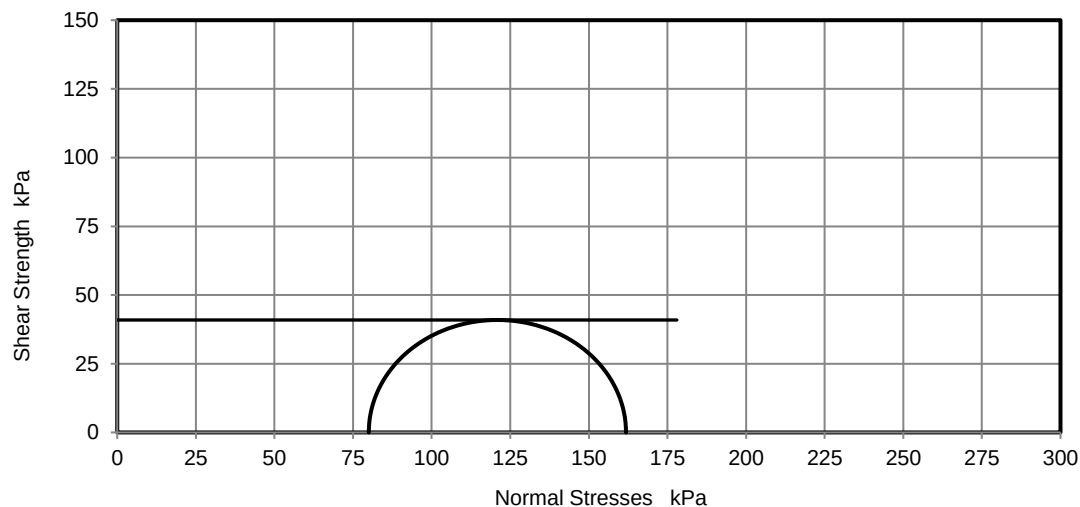
Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN
Contact: Carl Sellers
Site Address: Barlow Moor Road, ChorltonClient Reference: AG3093-19
Job Number: 19-78107
Date Sampled: 02/12/2019
Date Received: 16/12/2019
Date Tested: 02/01/2020
Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

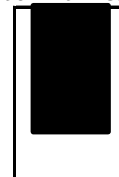
Test Results:Laboratory Reference: 1395660
Hole No.: CP1B
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAYDepth Top [m]: 4.00
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	141.52 mm
Diameter	69.56 mm
Bulk Density	2.25 Mg/m ³
Moisture Content	16 %
Dry Density	1.93 Mg/m ³
Membrane Correction	1.55 kPa

Rate of Strain	2.00 %/min
Cell Pressure	80 kPa
Axial Strain at failure	20.0 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	82 kPa
Undrained Shear Strength, c_u	41 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.28 mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample

Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



4041

TEST CERTIFICATE
Unconsolidated Undrained**Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

Client: Applied Geology Ltd
 Client Address: Lowton Business Park, Newton Road,
 Lowton, Warrington,
 WA3 2AN
 Contact: Carl Sellers
 Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19
 Job Number: 19-78107
 Date Sampled: 02/12/2019
 Date Received: 16/12/2019
 Date Tested: 02/01/2020
 Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

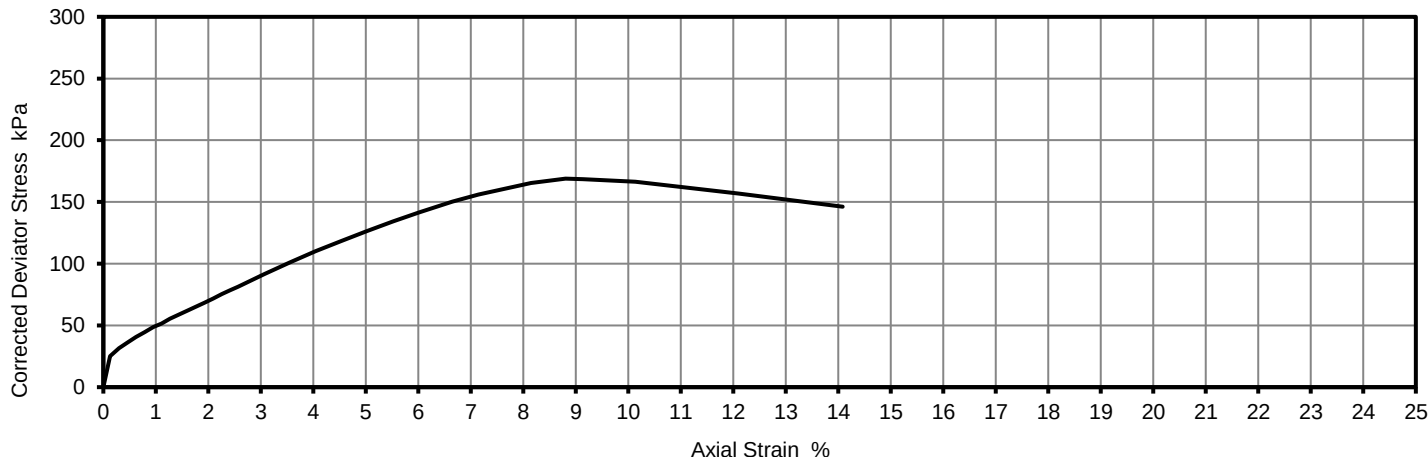
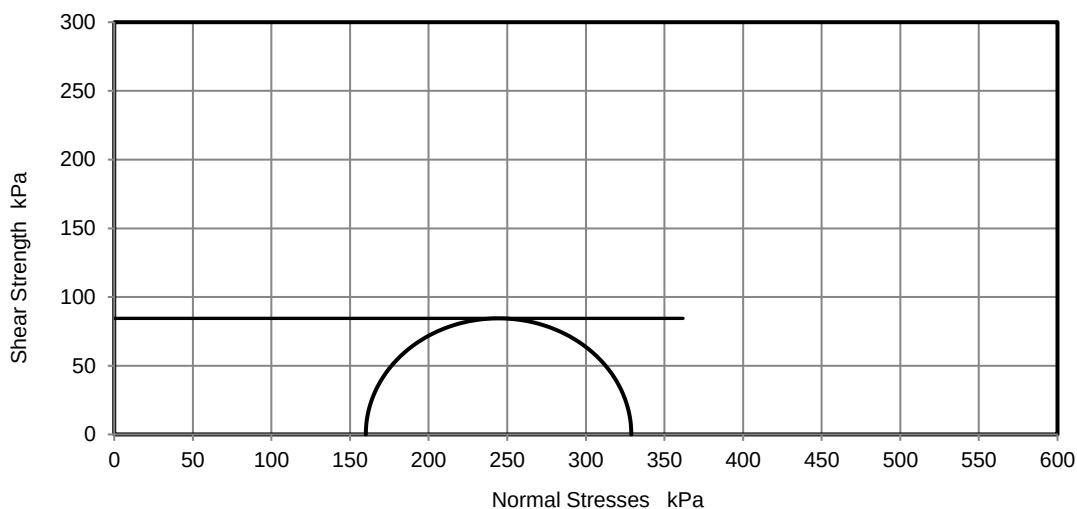
Laboratory Reference: 1395661
 Hole No.: CP1B
 Sample Reference: Not Given
 Sample Description: Brown slightly sandy CLAY

Depth Top [m]: 8.00
 Depth Base [m]: Not Given
 Sample Type: U

Test Number	1
Length	191.30 mm
Diameter	103.62 mm
Bulk Density	1.95 Mg/m ³
Moisture Content	30 %
Dry Density	1.50 Mg/m ³
Membrane Correction	0.55 kPa

Rate of Strain
 Cell Pressure
 Axial Strain at failure
 Deviator Stress, ($\sigma_1 - \sigma_3$)_f
 Undrained Shear Strength, c_u
 Mode of Failure
 Membrane thickness

2.00	%/min
160	kPa
8.8	%
169	kPa
84	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Compound	
0.28	mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Dariusz Piotrowski
 PL Geotechnical Laboratory Manager
 for and on behalf of i2 Analytical Ltd



4041

TEST CERTIFICATE
Unconsolidated Undrained**Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

Client: Applied Geology Ltd
 Client Address: Lowton Business Park, Newton Road,
 Lowton, Warrington,
 WA3 2AN
 Contact: Carl Sellers
 Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19
 Job Number: 19-78107
 Date Sampled: 02/12/2019
 Date Received: 16/12/2019
 Date Tested: 02/01/2020
 Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

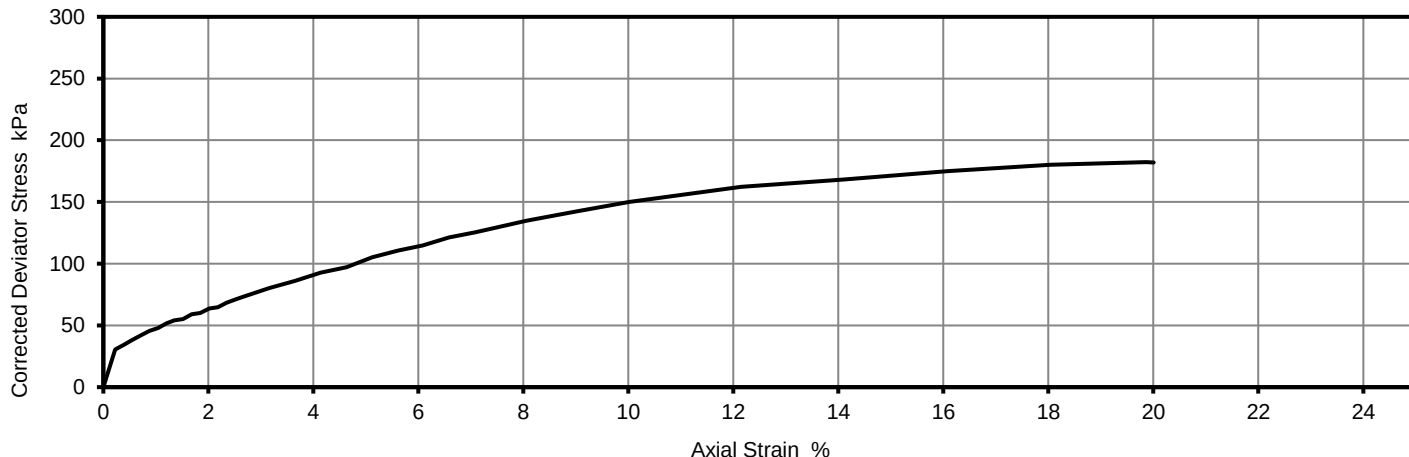
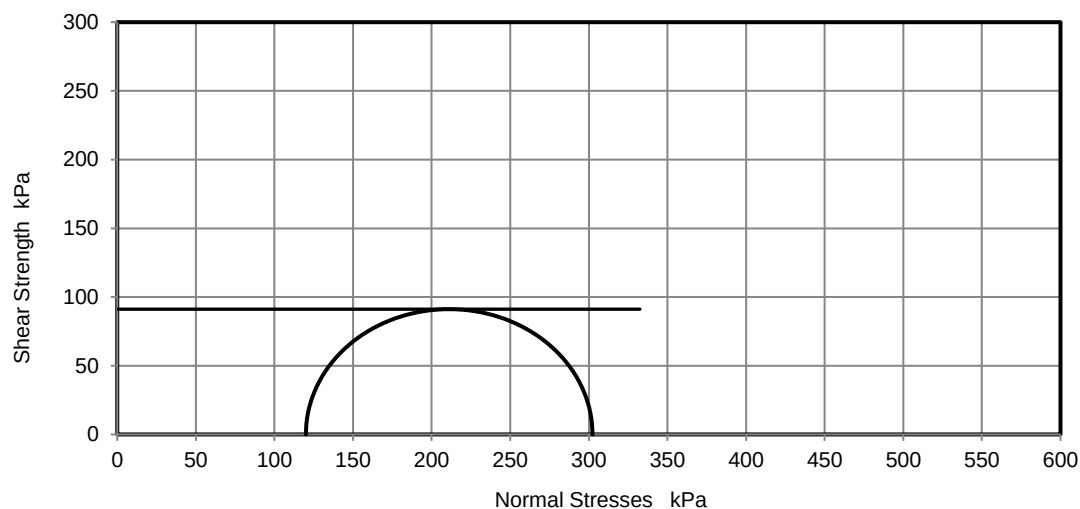
Test Results:

Laboratory Reference: 1395662
 Hole No.: CP2
 Sample Reference: Not Given
 Sample Description: Brown slightly gravelly slightly sandy CLAY

Depth Top [m]: 6.00
 Depth Base [m]: Not Given
 Sample Type: U

Test Number	1
Length	200.04 mm
Diameter	99.78 mm
Bulk Density	2.09 Mg/m ³
Moisture Content	22 %
Dry Density	1.71 Mg/m ³
Membrane Correction	1.15 kPa

Rate of Strain	2.00 %/min
Cell Pressure	120 kPa
Axial Strain at failure	19.9 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	182 kPa
Undrained Shear Strength, c_u	91 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.30 mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Dariusz Piotrowski
 PL Geotechnical Laboratory Manager
 for and on behalf of i2 Analytical Ltd



4041

TEST CERTIFICATE
Unconsolidated Undrained**Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

Client: Applied Geology Ltd
 Client Address: Lowton Business Park, Newton Road,
 Lowton, Warrington,
 WA3 2AN
 Contact: Carl Sellers
 Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19
 Job Number: 19-78107
 Date Sampled: 02/12/2019
 Date Received: 16/12/2019
 Date Tested: 02/01/2020
 Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

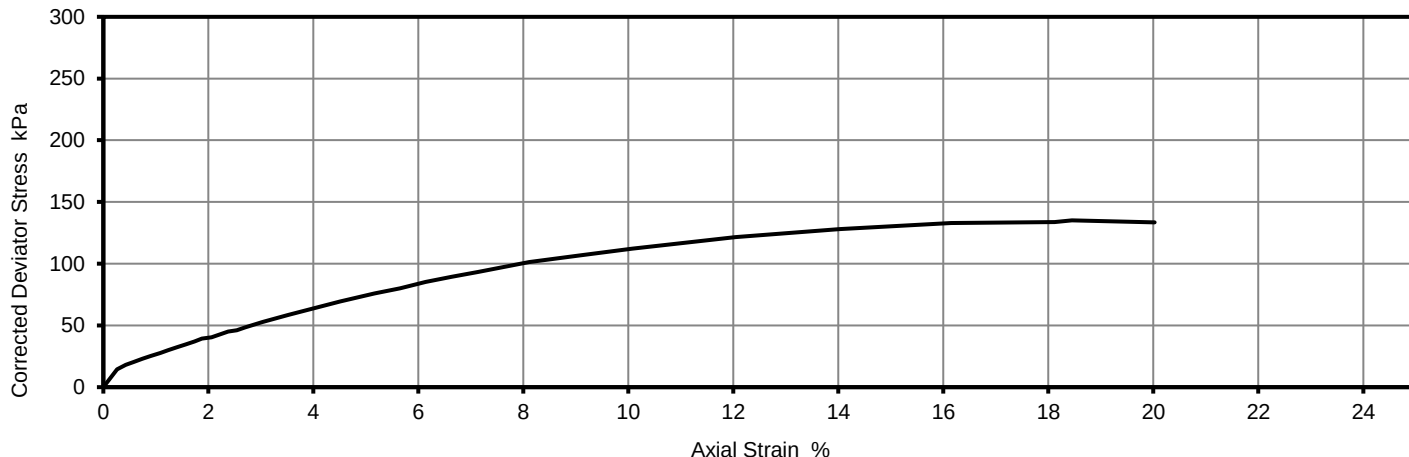
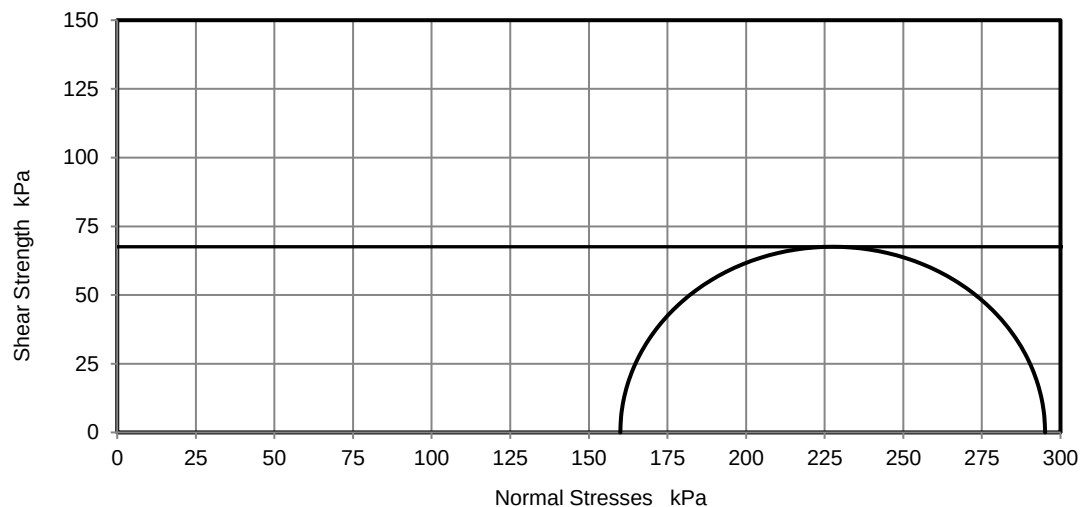
Test Results:

Laboratory Reference: 1395663
 Hole No.: CP2
 Sample Reference: Not Given
 Sample Description: Brown slightly sandy CLAY

Depth Top [m]: 8.00
 Depth Base [m]: Not Given
 Sample Type: U

Test Number	1
Length	195.86 mm
Diameter	102.25 mm
Bulk Density	1.99 Mg/m ³
Moisture Content	26 %
Dry Density	1.59 Mg/m ³
Membrane Correction	0.95 kPa

Rate of Strain	2.00 %/min
Cell Pressure	160 kPa
Axial Strain at failure	18.5 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	135 kPa
Undrained Shear Strength, c_u	68 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.27 mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Dariusz Piotrowski
 PL Geotechnical Laboratory Manager
 for and on behalf of i2 Analytical Ltd



4041

TEST CERTIFICATE
Unconsolidated Undrained**Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

Client: Applied Geology Ltd
 Client Address: Lowton Business Park, Newton Road,
 Lowton, Warrington,
 WA3 2AN
 Contact: Carl Sellers
 Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19
 Job Number: 19-78107
 Date Sampled: 02/12/2019
 Date Received: 16/12/2019
 Date Tested: 02/01/2020
 Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

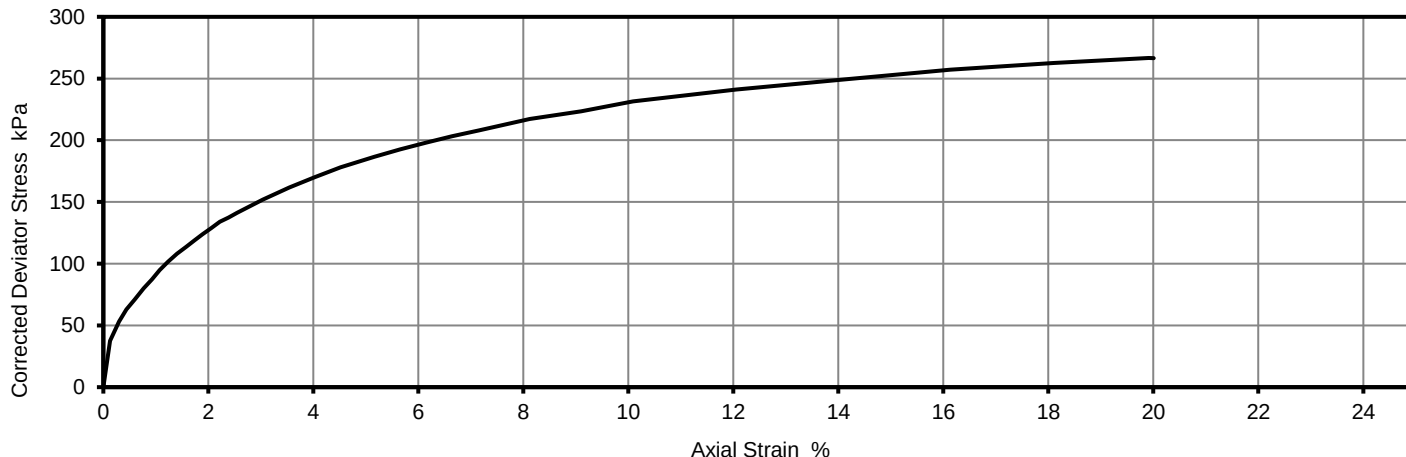
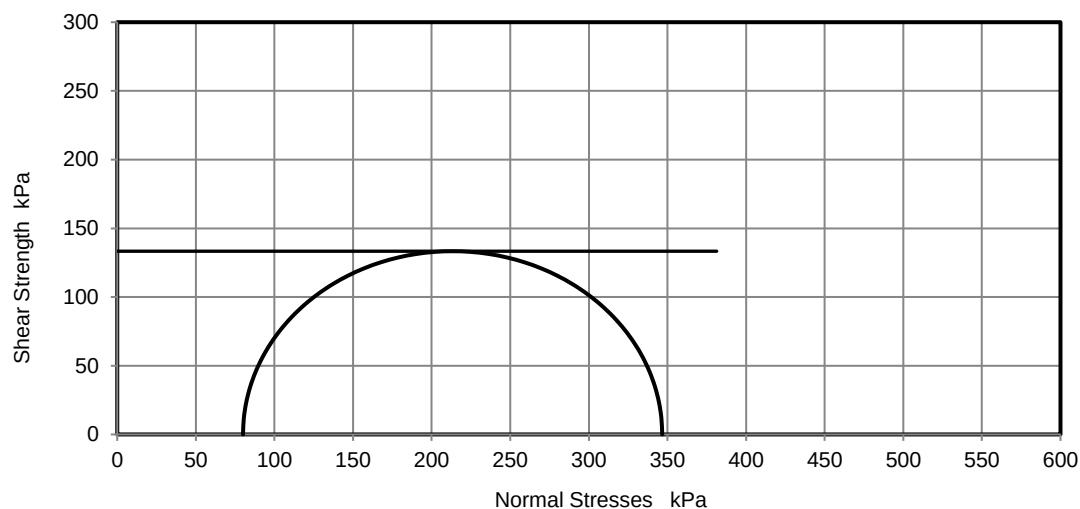
Test Results:

Laboratory Reference: 1395664
 Hole No.: CP3B
 Sample Reference: Not Given
 Sample Description: Brown slightly gravelly very sandy CLAY

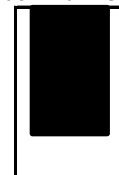
Depth Top [m]: 4.00
 Depth Base [m]: Not Given
 Sample Type: U

Test Number	1
Length	140.65 mm
Diameter	68.54 mm
Bulk Density	2.22 Mg/m ³
Moisture Content	16 %
Dry Density	1.92 Mg/m ³
Membrane Correction	1.40 kPa

Rate of Strain	2.00 %/min
Cell Pressure	80 kPa
Axial Strain at failure	19.9 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	267 kPa
Undrained Shear Strength, c_u	133 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.25 mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Dariusz Piotrowski
 PL Geotechnical Laboratory Manager
 for and on behalf of i2 Analytical Ltd



4041

TEST CERTIFICATE
Unconsolidated Undrained**Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

Client: Applied Geology Ltd
 Client Address: Lowton Business Park, Newton Road,
 Lowton, Warrington,
 WA3 2AN
 Contact: Carl Sellers
 Site Address: Barlow Moor Road, Chorlton

Client Reference: AG3093-19
 Job Number: 19-78107
 Date Sampled: 02/12/2019
 Date Received: 16/12/2019
 Date Tested: 02/01/2020
 Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

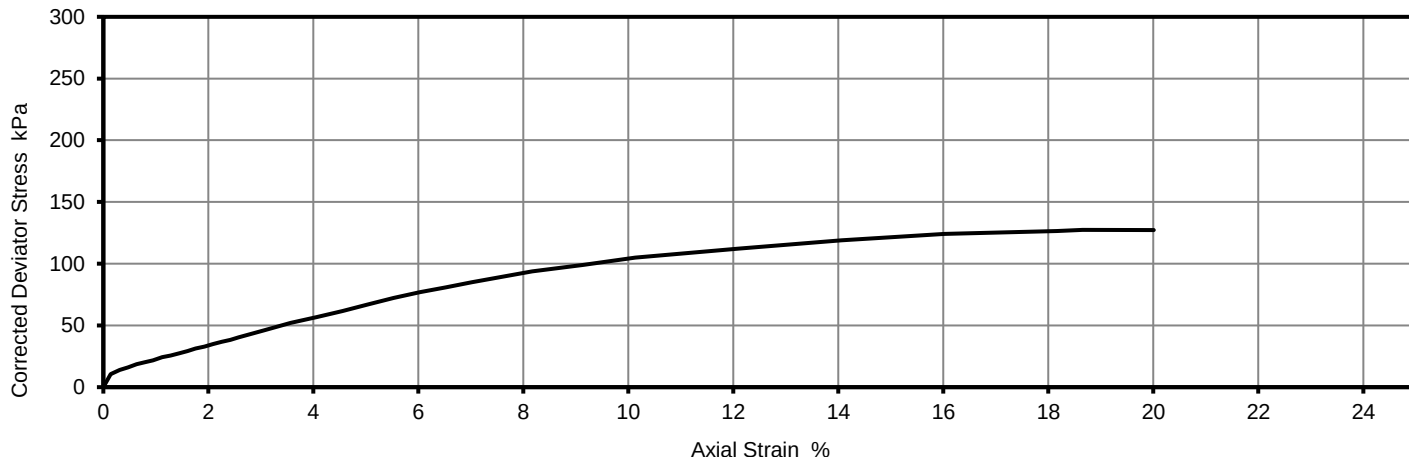
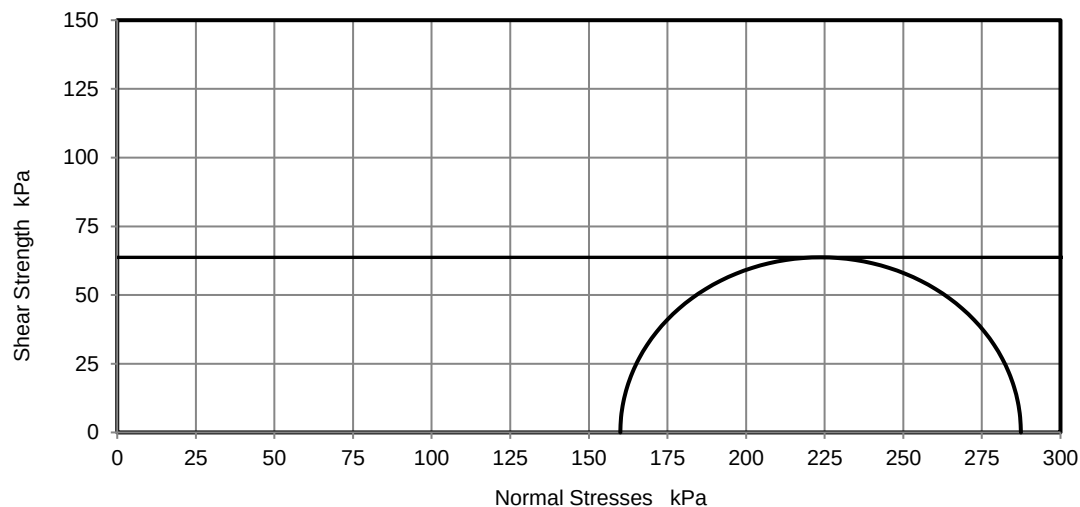
Test Results:

Laboratory Reference: 1395665
 Hole No.: CP3B
 Sample Reference: Not Given
 Sample Description: Brown sandy CLAY

Depth Top [m]: 8.00
 Depth Base [m]: Not Given
 Sample Type: U

Test Number	1
Length	198.12 mm
Diameter	100.81 mm
Bulk Density	2.00 Mg/m ³
Moisture Content	25 %
Dry Density	1.60 Mg/m ³
Membrane Correction	1.12 kPa

Rate of Strain	2.00 %/min
Cell Pressure	160 kPa
Axial Strain at failure	18.7 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	127 kPa
Undrained Shear Strength, c_u	64 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.31 mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Dariusz Piotrowski
 PL Geotechnical Laboratory Manager
 for and on behalf of i2 Analytical Ltd



4041

TEST CERTIFICATE
Unconsolidated Undrained**Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

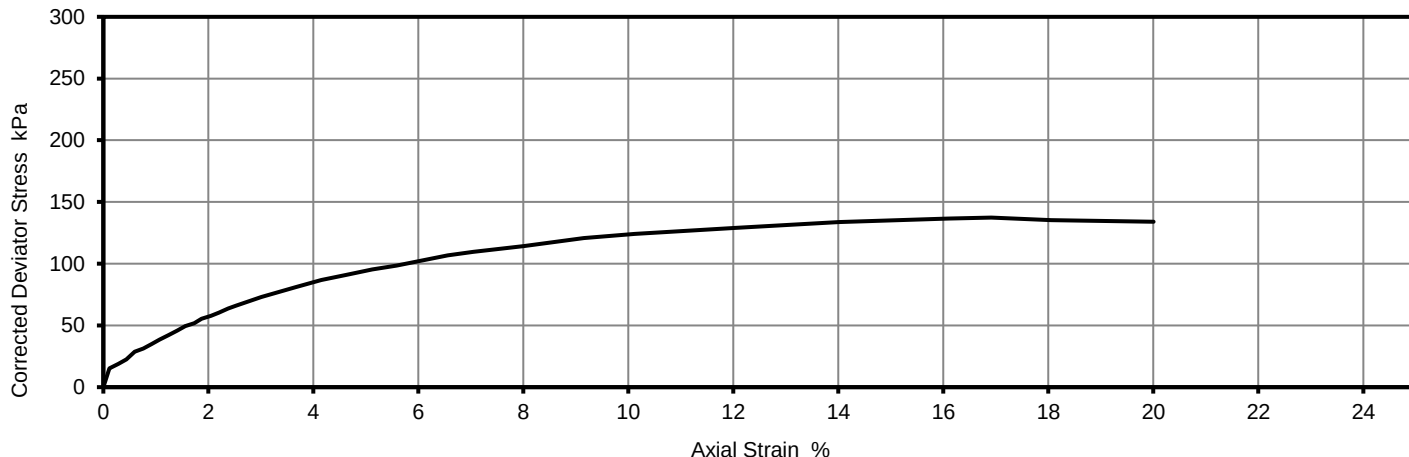
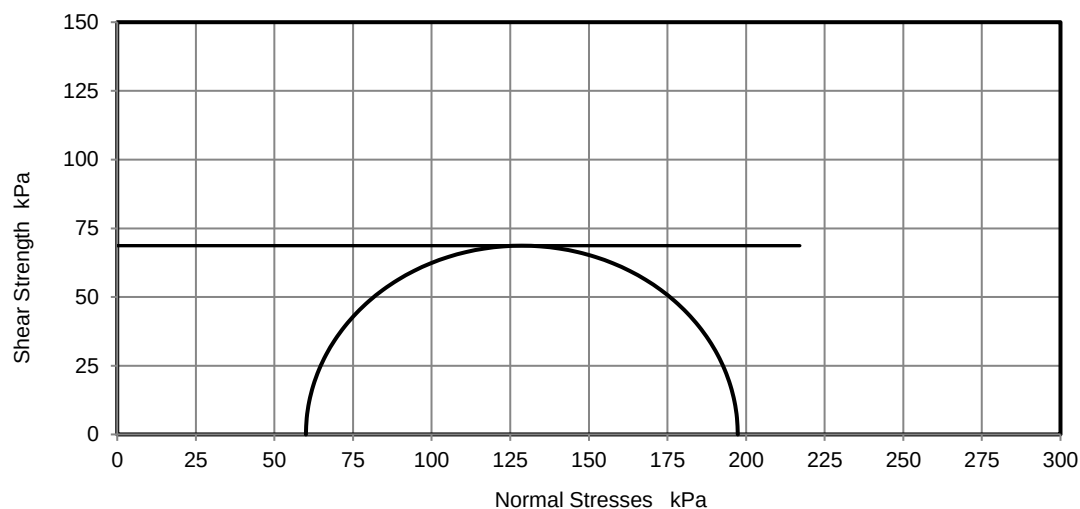
Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN
Contact: Carl Sellers
Site Address: Barlow Moor Road, ChorltonClient Reference: AG3093-19
Job Number: 19-78107
Date Sampled: 02/12/2019
Date Received: 16/12/2019
Date Tested: 02/01/2020
Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:Laboratory Reference: 1395666
Hole No.: CP4
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAYDepth Top [m]: 3.00
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	202.80 mm
Diameter	100.51 mm
Bulk Density	2.25 Mg/m ³
Moisture Content	15 %
Dry Density	1.96 Mg/m ³
Membrane Correction	0.87 kPa

Rate of Strain	1.97 %/min
Cell Pressure	60 kPa
Axial Strain at failure	16.9 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	137 kPa
Undrained Shear Strength, c_u	69 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.26 mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample

Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



4041

TEST CERTIFICATE
Unconsolidated Undrained**Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

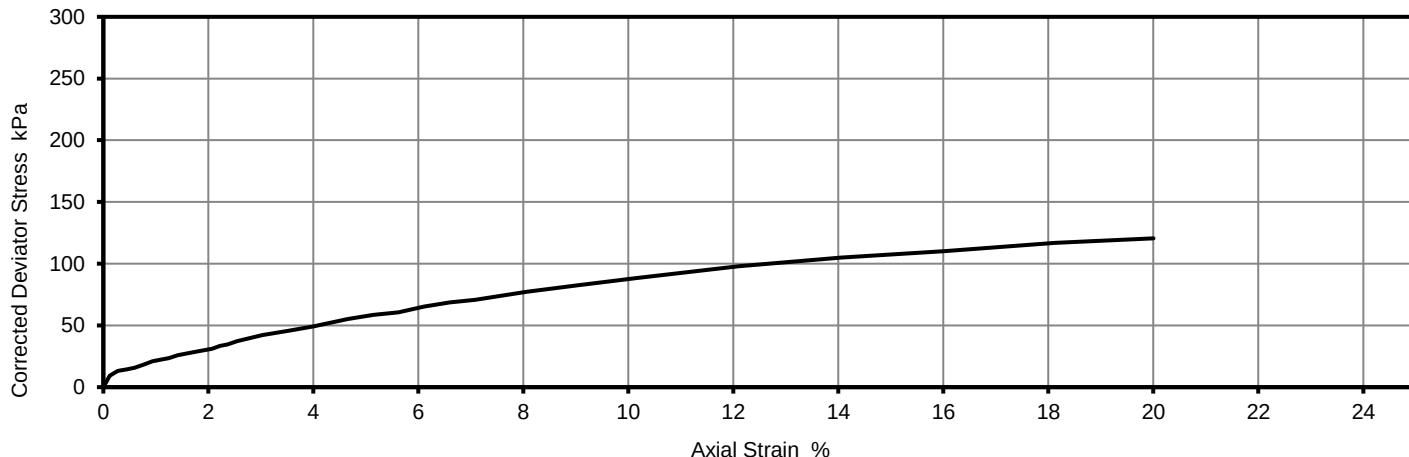
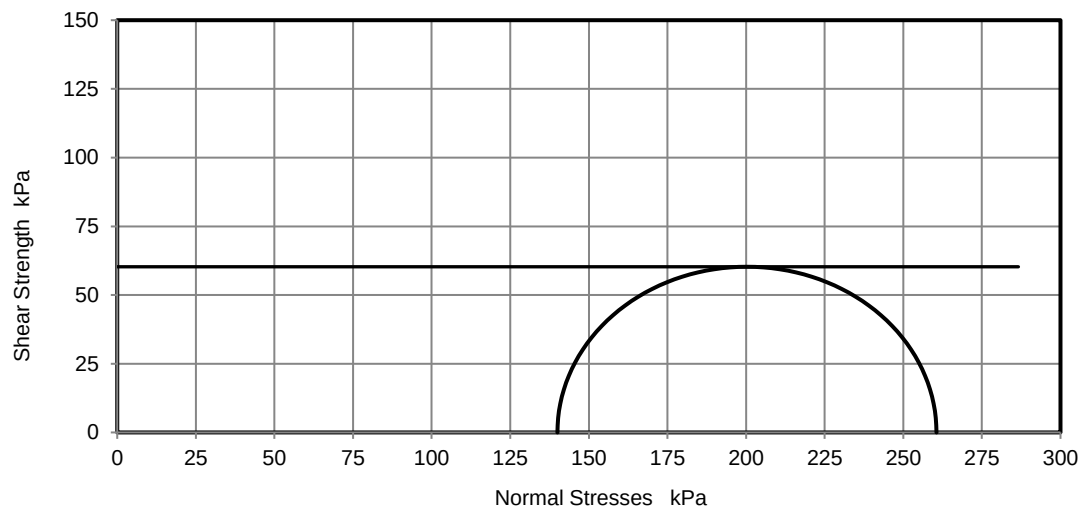
Client: Applied Geology Ltd
Client Address: Lowton Business Park, Newton Road,
Lowton, Warrington,
WA3 2AN
Contact: Carl Sellers
Site Address: Barlow Moor Road, ChorltonClient Reference: AG3093-19
Job Number: 19-78107
Date Sampled: 02/12/2019
Date Received: 16/12/2019
Date Tested: 02/01/2020
Sampled By: CS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:Laboratory Reference: 1395667
Hole No.: CP4
Sample Reference: Not Given
Sample Description: Brown gravelly clayey dense SANDDepth Top [m]: 7.00
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	202.17 mm
Diameter	98.09 mm
Bulk Density	2.41 Mg/m ³
Moisture Content	11 %
Dry Density	2.16 Mg/m ³
Membrane Correction	1.18 kPa

Rate of Strain	1.98 %/min
Cell Pressure	140 kPa
Axial Strain at failure	20.0 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	121 kPa
Undrained Shear Strength, c_u	60 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.30 mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample

Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks: Re-issue 1: Hole No. amended

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report are representative of the samples submitted for analysis. Any assessment of compliance with specifications based on results in a report take into account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

Signed:

Dariusz Piotrowski
PL Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

APPENDIX E

APPENDIX E

STANDARD FIELDWORK AND ASSESSMENT PROCEDURES

Scope of Work

The scope of work undertaken is defined in Section 1 of the Report. It should be noted that Applied Geology Limited does not provide arboricultural surveys, specialist surveys for the detection of invasive plant species (such as Japanese Knotweed) or protected species of wildlife. Information from environmental and ecological datasets is included from a review of the MAGIC (Multi-Agency Geographic Information for the Countryside) website, however, if a full assessment of Environmental or Ecological aspects is required, it is recommended that other specialists are consulted. Similarly, information on flood risk is included; obtained from the Environment Agency Web site and the GroundSure report; but this is not intended to be a full hydrological study and, if a flood risk assessment is needed, additional analysis by others is recommended to confirm this aspect of the development. Also, whilst our field staff have undergone asbestos awareness training, Applied Geology does not undertake asbestos surveys or provide specific advice relating to asbestos-containing materials. Any suspected asbestos-containing materials observed by our field staff will be mentioned in the report but further assessment by others may be required.

Fieldwork

Fieldwork is generally carried out in accordance with BS5930 (2015) "Code of Practice for Site Investigations" and BS10175 (2011) Investigation of Potentially Contaminated Sites, unless otherwise stated.

Prior to commencement on site, statutory services plans are generally obtained and verbal enquiries are also made regarding the positions of private or statutory services on site. Prior to excavation or drilling, locations are scanned with a cable avoidance tool (CAT) and service pits are generally excavated at borehole positions, where possible.

Descriptions and depths of the various strata recovered are presented on the exploratory hole records, reproduced in the report appendices, together with sample depths, the results of in-situ testing, comments on groundwater inflows, and any other pertinent information. The strata descriptions are in general accordance with BS5930:2015. Disturbed plastic pot and glass amber jar samples are recovered from the various strata and stored and transported in cool boxes, where relevant, for possible future laboratory testing.

Light cable percussion boreholes are generally drilled using a Pilcon Wayfarer or Dando rig and are advanced using equipment to bore 200/150mm diameter boreholes. Disturbed plastic pot samples are recovered from all deposits encountered to allow examination and laboratory testing. Certain strata are cased off due to their tendency to collapse, particularly in the presence of groundwater inflows and/or to reduce the risk of cross contamination. In situ Standard Penetration Tests, using Split Spoon (SPT) and Cone (CPT) are undertaken in the boreholes to provide a measure of the relative density of the granular (coarse grained) deposits or shear strength of the clay/chalk/ weathered rock deposits using industry recognised correlation guidelines of shear strength against SPT "N" value results. Within the fine grained (cohesive) deposits, "undisturbed" 100mm driven open tube samples were recovered from the various deposits to provide samples for examination and laboratory testing. On encountering groundwater, boring is usually suspended for 20 minutes while any rise in water level is recorded. Full details of the groundwater observations and monitoring results during boring operations are included on the borehole records. All boreholes without monitoring wells installed are usually backfilled with arisings upon completion, unless otherwise stated on the individual logs.

Unless otherwise stated on the relevant logs, trial pits are excavated using a wheeled backhoe excavator, usually with a 0.6m wide bucket. The excavations are logged from the ground surface by an Engineering Geologist / Geo-environmental Engineer and relevant field testing, appropriate to the soils encountered, is carried out on samples brought to the surface. Representative disturbed soil samples are collected from selected horizons for subsequent laboratory testing. The trial pits are

usually unshored and where reasonable, left open for a period of time to allow observations of pit stability and depth and inflow rate of any groundwater ingress. The excavations are backfilled with arisings prior to moving on to the next position. Any trial pits carried out as part of this or previous investigations may represent soft spots and conduits/sumps for groundwater or surface water. In excavations, such materials may also be loose and unstable.

Driven Continuous Sampling (DCS) boreholes are drilled using a track mounted Global mini-rig or similar using sampling tubes of varying diameter (decreasing with depth). Samples of the deposits encountered are recovered in 1m long clear plastic liners, which are logged and sub-sampled on site by an Engineering Geologist. Generally for geotechnical investigations, during the drilling process in-situ Standard Penetration Tests (SPTs) are undertaken at selected depths to provide a measure of the relative density of the granular (coarse grained) deposits or shear strength of the clay/chalk/ weathered rock deposits using industry recognised correlation guidelines of shear strength against SPT "N" value results. Groundwater seepages are noted during drilling if encountered. All boreholes without monitoring wells installed are usually backfilled with arisings upon completion.

Unless specifically stated in the report, exploratory hole locations should be regarded as approximate. Consideration should be given to accurate location of the exploratory holes where it is considered they may impact on proposed development.

It should be noted that groundwater levels at any particular site may fluctuate due to rainfall, seasonal variations etc and, therefore, levels may be different to those measured during the course of the fieldwork and monitoring period.

Laboratory Testing

The geotechnical testing was carried out in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes and was undertaken by a UKAS accredited specialist laboratory. Chemical testing was undertaken by a UKAS accredited specialist chemical testing laboratory and MCERTS accredited methods, in accordance with Environment Agency recommendations, were specified where available.

Contamination Assessment – Human Health

Applied Geology Limited has followed the guidance given in the CLR 11 publication and other available guidance to assess the contaminant concentrations. Details of the methodology followed are briefly outlined below.

The available chemical data is sorted into appropriate datasets depending on sampling regime and ground conditions. An initial generic quantitative risk assessment is undertaken on this data using statistical tests, where appropriate, and relevant screening values. Risk to human health has been initially assessed by comparing soil results against various published screening criteria. These have been sourced from the following, in order of preference:

- DEFRA. Category 4 Screening Levels (C4SL), March 2014;
- LQM/CIEH S4UL for Human Health Risk Assessment (S4UL), 2015*;
- Environment Agency/DEFRA, Soil Guideline Values (SGV) published in 2009;
- EIC/AGS/CL:AIRE Soil Generic Assessment Criteria (GAC), 2010.

*- © Land Quality Management Limited reproduced with permission; Publication Number S4UL3159. All rights reserved

Except for lead and benzo(a)pyrene, the assessments will be carried out by comparing results against the LQM/CIEH S4UL in the first instance, where these values are exceeded, then reference will be made to the C4SLs where such exist. Lead will only be compared to the C4SL because no S4UL exists for lead. For Benzo(a)pyrene, Applied Geology has chosen to adopt the approach presented by the C4SL committee rather than the approach proposed by LQM/CIEH. Further discussion on this is presented below.

It is our view, and the view of others in the industry, that the C4SL were derived for use in both the Part IIA system and through the planning system, as they allow identification of those sites that fall within Category 4 (not contaminated) and are therefore able to be developed with no further remedial action. The C4SLs are considered to represent a contamination level that is 'low' from a toxicological view point, which we therefore consider to be 'acceptable' under planning.

Historically, the level of contamination has been assessed with reference to SGV values which were derived to represent a 'minimal' level of contamination. The SGVs are still valid and can be used alongside C4SL, however both screening values are only intended to provide guidance as to the level of contamination and, where concentrations fall below these screening values, the site is not contaminated (and is within Category 4). Exceedance of a SGV/S4UL/C4SL does not automatically indicate that an 'unacceptable' risk exists at a site; simply that further consideration of that particular contaminant is required.

At this time, there are two toxicological methodologies that can be used in the derivation of screening criteria for PAHs; Relative Potency Factor (RPFs) or the Surrogate Marker approach. Applied Geology has chosen (based on the latest guidance from the Health Protection Agency (HPA) to use the surrogate marker approach proposed in the C4SL methodology, whereby benzo(a)pyrene can be used as a surrogate marker for all 'genotoxic' (gene damaging) PAHs. The surrogate marker approach estimates the toxicity of a mixture of PAHs in an environmental matrix by using data from toxicity studies in which a PAH mixture of known composition was tested. Exposure to the surrogate marker benzo(a)pyrene is assumed to represent exposure to all the PAHs in the environmental matrix. Thus, the level of toxicity ascribed to the surrogate represents the toxicity of the PAH mixture. This allows an assessment of the combined carcinogenic risk associated with genotoxic PAHs using only benzo(a)pyrene. In order to confirm that the mixture of genotoxic PAH in the soil is similar to the coal tar mixture used in the toxicological study, various PAH ratios are plotted and checked to see that they fall within the limits set in HPA, 2010.

Contamination Assessment – Water Quality

Risks to water quality has been assessed by following the Environment Agency guidance on groundwater protection (previously known as GP3), updated on their website in March 2017, see <https://www.gov.uk/government/policies/water-quality> and 'The Environment Agency's approach to groundwater protection' (March 2017 Version 1.0).

For hazardous substances, which should be prevented from entering groundwater, the screening criteria are initially set as the limit of detection, however, if groundwater has already been impacted, an appropriate environmental standard will then be used. For hazardous substances, background quality may also be taken into account.

For non-hazardous compounds, their release should not result in any pollution or significant risk of pollution in the future, as such comparison with UK DWS or EQS standards will allow determination of whether pollution could occur. Typically screening criteria will be sourced from the following:

- Environmental Standards (ES), which are defined in European legislation such as the Water Framework Directive (WFD) (2000/60/EC) and the Priority Substances Directive (PSD) (2008/105/EC) a daughter directive of the WFD.
- The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Direction, 2010.
- UK Water Supply (Water Quality) Regulations, 2010.
- UK quality standards for water to be used for direct abstraction to potable supply e.g. Surface Water (Abstraction for Drinking Water) (Classification) Regulations, 1996.
- World Health Organisation (WHO) Guidelines for Drinking Water Quality.

Re-use of Soils and Waste Soil Disposal

It is noted that if any excavated material is to be reused on site, a Waste Management Plan (WMP) and / or a Materials Management Plan (MMP) will probably be required. Any such materials must be suitable for re-use without further treatment, and only the quantity necessary for the specified works should be used. Any materials not within these definitions may need to be considered as waste whereby a Waste Management Licence Exemption may also be required.

A specific categorisation and assessment of potential waste soils arising from the proposed development has not been undertaken as part of the investigation, unless otherwise detailed in the report text. However, generic comments and advice are made below for the reader.

All waste soils should be sorted to prevent mixtures of waste types. Where possible, any waste soil should be recycled and the volume of soil to be disposed of should be minimised. Any excavated soil material and excess spoil disposed of off-site should be treated as Waste and classified as Inert, Non-hazardous or Hazardous, prior to removal from site, as required by the "Duty of Care" (Environmental Protection Act, 1990) legislation together with Annex II of Directive 1999/31/EC ("Landfill Directive"). Initially, Basic Characterisation of the waste is required whereby the material should be described and its source of origin recorded (a site plan, exploratory hole records and the certificates of chemical analysis in this report should be included). This should also include data on its composition and leaching behaviour, its European Waste Catalogue (EWC) code, and where relevant any hazardous properties according to Annex III of Directive 91/689/EEC. This information should be provided to the licensed waste contractor.

Soils excavated on many sites would generally fall under the EWC description "Soil and Stones", EWC code 17 05 04. Waste Acceptance Criteria (WAC) testing is required for many Inert wastes and generally for all Hazardous Waste but not for non-hazardous waste. There are certain restrictions for inert wastes regarding topsoil and peat. Any asbestos must be disposed of by suitably licensed contractors to a suitably licensed facility.

Health & Safety Aspects

As outlined within the HSE publication 'Successful Health and Safety Management - HSG65', this report should inform your development of safe systems of work and information as an input into the safety management system.

When developing risk control systems we suggest making reference to the CIRIA report 132 "A guide for safe working on contaminated sites" and the HSE document "Protection of workers and the general public during the development of contaminated land – HSG66". All risk control measures should be in accordance with the guidelines laid down within the Management of Health and Safety at Work Regulations 1999.

The contents of this report may be used to supplement the contents of the Health and Safety File as required under the Construction Design and Management (CDM) Regulations.

Where excavations are undertaken on site, trench support or the angle of batter should be designed by an appropriately qualified engineer or competent person to suit the required depth and the ground and groundwater conditions. Care should be taken when digging excavations to prevent undermining or causing loss of support to the foundations of the nearby adjoining structures. Surcharging such as from spoil or vehicle movements close to excavation sides should be avoided. Practical guidance on trench excavation is given in CIRIA Report 97 Trenching Practice. Guidance on groundwater control is given in CIRIA Report 113 Control of groundwater for temporary works. Temporary works should be designed by a suitably qualified engineer or a competent person particularly where personnel access is necessary, in accordance with the requirements of the Construction (Design and Management) (CDM) Regulations.