

A1816-2
Geo-Environmental Report

**Land Adj to Chestnut Terrace,
Sutton Bridge, Lincolnshire.**



For

Lincoln Jack Ltd

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1. INTRODUCTION

AGS Ground Solutions (AGS) was commissioned by Alan Brown Development Services Ltd (The Planning Consultant) on behalf of Lincoln Jack Ltd (The Client) to undertake a geo-environmental site investigation on a site known as Land Adj to Chestnut Terrace, Sutton Bridge.

It is understood that the development will comprise the erection of 18 no. detached residential dwellings, on disused farmland.

The purpose of the ground investigation was to carry out a due diligence study on the entire site, prior to purchase, and also to determine the near-surface ground profile and to provide information for the design of foundations for new structure on the areas of the site where houses are planned. In addition, the risks posed by ground contamination were also examined.

For the purposes of this investigation, the site was divided into three areas; Area A, a square plot at the northern end of Withington Street, where 9 detached houses are planned; Area B, an L-shaped plot to the north and east of Chestnut Terrace, where 9 detached houses are planned; Area C, a rectangular plot to the north of plots A and B, where no development is currently planned.

A Phase 1 Geo-Environmental Report was published by AGS Ground Solutions on 24th September 2018 – Report number A1816-1. This report should be read in conjunction with the Phase 1 Report.

Our general Terms and Conditions are applicable to this report.

2. SITE LOCATION AND LAYOUT

A site walkover survey was presented in the Phase 1 Report.

No changes were noted on the site between the site walkover survey and the intrusive site investigation.

3. ENVIRONMENTAL SETTING

3.1 GEOLOGY

Reference to the British Geological Survey 1:50,000 scale geological map of the area shows the site as being underlain by Superficial deposits, identified as Tidal Flat Deposits – Clay and Silt (TFD). This is shown to be underlain by The Ampthill Clay Formation - Mudstone (AMC).

The British Geological survey provides the following geological descriptions. Contains British Geological Survey materials © NERC 2018:

Tidal Flat Deposits – Clay and Silt (TFD)

Description: Tidal Flat Deposits - Clay And Silt. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by shorelines (U).

Setting: shorelines (U). These sedimentary deposits are shallow-marine in origin. They are detrital, generally coarse-grained forming beaches and bars in a coastal setting.

Ampthill Clay Formation – Mudstone (AMC)

Description: Ampthill Clay Formation - Mudstone. Sedimentary Bedrock formed approximately 157 to 164 million years ago in the Jurassic Period. Local environment previously dominated by shallow seas.

Setting: shallow seas. These sedimentary rocks are shallow-marine in origin. They are detrital, ranging from coarse- to fine-grained (locally with some carbonate content) forming interbedded sequences.

4. INTRUSIVE INVESTIGATION

4.1 FIELDWORK

The site works were carried out between the 26th September and 27th September 2016 and comprised the following:

- Excavation of 8 no. Window Sample Holes to depths of 5.45 m.
- Performance of 2 no. Dynamic Probe Soundings to depths of between 15.80 m and 15.90 m.
- Excavation of 8 no. Trial Pits to depths of between 1.50 m and 3.00 m.
- Percolation tests within 2 no. of the Trial Pits.

The positions of the above works on the site are indicated on Figure 2, Exploratory Hole Location Plan.

The intrusive investigation was concentrated in areas A and B, where buildings were planned, with only limited investigation in Area C.

Window Sample Holes

Eight Window Sample Holes were excavated on the site between the 26th and 27th September 2018.

Window sample holes WS1 to WS8 were excavated on the site using an Archway Competitor Dart window sample rig.

The window sample holes were excavated to examine the ground, and to establish the thickness of each of the soil horizons. The resulting cores were examined by an engineer.

Standard Penetration Tests (SPTs) were performed every 1.0 m intervals in all of the window sample holes.

A hand-held pocket penetrometer was used to gather information on mass shear strength within the window sample arisings.

Samples were recovered for laboratory analysis.

Pocket Penetrometer results are shown on Figure 3.

Window Sample Hole Logs are presented in Appendix 2.

Dynamic Probe Soundings

Two Dynamic Probe Soundings were completed on the site on 27th September 2018.

Dynamic Probe Soundings DP1 to DP2 were performed using an Archway Competitor Dart Window Sample Rig.

The test comprised recording the number of blows to drive a steel cone in increments of 100 mm into the ground. This was recorded as the DPN100 value.

The purpose of the dynamic probe soundings was to establish the likely depth to the Amphill Clay Formation on the site.

A combined dynamic probe plot is presented in Figure 4.

The dynamic probe results are presented in Appendix 3.

Trial Pits

Eight trial pits were excavated using a backhoe excavator on the 27th September 2018.

Trial pits TP1 to TP8 were excavated to supplement the data gathered from the windowless sampling, to allow an in-situ observation of the soils on the site to be made and to enable percolation testing to be carried out.

Percolation testing was carried out in trial pits TP1 and TP2. It was planned to carry out the percolation tests in accordance with BRE special digest 365, with three flings in each pit. However, owing to a very slow percolation rate, this was not possible.

It was also planned to carry out percolation testing in at least one other location, however, access onto the site for the water tanker did not permit this.

Photographs of trial pits are presented in Appendix 1.

Trial Pit logs are presented in Appendix 4.

Percolation test results are presented in Appendix 5.

4.2 GROUNDWATER

Groundwater was encountered across the site. Details are presented in the table below.

Location	Depth Struck	Rising To	After	Note
	(m BGL)	(m)	(mins)	
WS1	2.40	2.40	20	During excavation
WS2	2.45	2.45	20	During excavation
WS3	2.30	2.30	20	During excavation
	-	2.73	-	End of day
WS4	2.40	2.40	20	During excavation

	-	2.58	-	End of day
WS5	2.40	2.40	20	During excavation
WS6	2.80	2.80	20	During excavation
	-	2.45	-	End of day
WS7	2.80	2.80	20	During excavation
WS8	2.60	2.60	20	During excavation
	-	1.47	-	Immediately after installation (end of day)
TP1	DRY	DRY	20	Percolation test
TP2	DRY	DRY	20	Percolation test
TP3	2.30	2.30	20	Soils noted as saturated
TP4	2.50	2.50	20	Soils noted as saturated
TP5	DRY	DRY	20	
TP6	DRY	DRY	20	
TP7	DRY	DRY	20	
TP8	DRY	DRY	20	

It should be noted that the absence of groundwater is not necessarily indicative of the absence of a groundwater table in view of the short period the trial excavations remained open. Groundwater levels may vary due to seasonal fluctuations in rainfall, but in the shorter term can be affected by antecedent weather conditions or other causes.

5. LABORATORY TESTING

5.1 GEOTECHNICAL TESTING

The following range of laboratory tests was scheduled:

Moisture Content of soil	16 no.
Liquid and Plastic Limits of soil	8 no.
Particle Size Distribution (Wet Sieve)	8 no.
Bulk & Dry Density	3 no.
Oedometer Consolidation	3 no.
Quick Undrained Triaxial Compression	7 no.

The results of geotechnical testing are presented in Appendix 5.

5.2 ANALYTICAL TESTING

Chemical analysis of the samples was undertaken by i2 Analytical, Watford (UKAS & MCERTS accredited). A selection of soil samples were analysed for contaminants considered appropriate to the history of the site:

Toxic Metals	Phytotoxic Metals	Inorganic Compounds	Organic Compounds
Arsenic Cadmium Chromium Copper Lead Mercury Nickel Selenium Zinc	Copper Nickel Zinc	Sulphate (water soluble) pH value	Total Petroleum Hydrocarbons (TPH) Polycyclic Aromatic Hydrocarbons (PAH) Soil Organic Matter Mineral Oil

The results of the analytical testing are presented in Appendix 6.

6. EVALUATION OF GROUND CONDITIONS AND ENGINEERING PROPERTIES

6.1 SOIL PROFILE

During the site investigation, two main soil / rock layers were identified on the site. An upper layer of Made Ground (MGR) was encountered which was found to overlay Tidal Flat Deposits (TFD).

Made Ground (MGR)

Made Ground (MGR) was the uppermost layer encountered on the site. The material was described generally as a dark brown or black organic rich topsoil.

In the two areas closet to the end of Chestnut Terrace and Withington Street, it was noted that the made ground also contained a small quantity of fly-tipped waste.

The Made Ground (MGR) was encountered in all excavations and was found to vary in thickness from 0.10 m in window sample hole WS1 to 0.75 m in trial pit TP6.

Tidal Flat Deposits (TFD)

The Tidal Flat Deposits comprised a fine sand with varying proportions of silt and clay.

The material was layered horizontally, suggesting that it had been laid relatively recently in geological terms. The material was noted to be very soft where wet.

The thickness of the Tidal Flat Deposits was not observed on site, however, can be intimated from the dynamic probe soundings as being around 14.50 m in both locations.

Amphill Clay Formation (AMC)

The Amphill Clay Formation was not observed on site, but was intimated to have been encountered in dynamic probe sounds DP1 and DP2 below a depth of 15.0 m.

A summary of the strata, as discussed above, is presented in the table below.

Stratum	Depth to top of Layer (m BGL)	Thickness (m)	Depth to base of Layer (m BGL)
Made Ground (MGR)	0.00	0.10 – 0.75	0.10 – 0.75
Tidal Flat Deposits (TFD)	0.10 – 0.75	14.50	15.00
Amphill Clay Formation (AMC)	15.00	Not proven	Not Encountered

6.2 ENGINEERING PROPERTIES

The engineering properties of the principal strata, as tabulated above, can be assessed based upon a combination of the in-situ observations and test results. A summary of the engineering properties is given below:

Made Ground (MGR)

Given the thickness and composition of the Made Ground (MGR), it is not considered to be a suitable founding stratum and no engineering properties have been presented.

Tidal Flat Deposits (TFD)

The Tidal Flat Deposits (TFD) was described as being a clayey or silty sand.

The results of laboratory testing show that the proportion of fines varied from 7.50 % to 71.90 %. The proportion of sand varied from 28.10 % to 92.50 %. No coarse material was encountered on the site.

Laboratory testing shows that the plasticity indices range from 11 % to 19 %, with two of the samples tested being reported as 'non-plastic' (i.e. < 10 %).

It is therefore likely that the material will behave in a cohesive fashion, however, the cohesion is likely to be low.

Bulk densities ranged from 1.55 Mg/m³ to 1.94 Mg/m³, with dry densities ranging between 1.40 Mg/m³ to 1.56 Mg/m³.

Undrained triaxial shear strength testing was carried out on a number of samples; the results are indicated in the table below:

Depth (m)	Test Location	Undrained Shear Strength (kN/m ²)	Note
0.75	TP3	28	Soft
0.80	TP5	24	Soft
0.90	TP6	40	Firm
0.90	TP8	18	Very soft
1.40	TP2	43	Firm
1.50	TP4	68	Firm

A number of Standard Penetration Tests (SPTs) were carried out within the Tidal Flat Deposits (TFD). The results show that 'N' values of between 0 and 29 can be expected.

SPT 'N' values can be related to mass shear strength by means of a conversion factor. For a soil with a plasticity of 19 %, the factor (f_1) would be 5.0.

In addition, two dynamic probe sounds were carried out within the Tidal Flat Deposits. DPN 100 values can be broadly compared with SPT 'N' values by adding three successive DPN 100 values.

Depth (m)	Test Location	DPN 100 Value	Equivalent SPT 'N' Value	SPT 'N' value	Conversion Factor	Mass Shear Strength (kN/m ²)	Note
1.0	WS1	-	-	7	5.0	35	Soft
	WS2	-	-	5	5.0	25	Soft
	WS3	-	-	7	5.0	35	Soft
	WS4	-	-	4	5.0	20	Soft
	WS5	-	-	11	5.0	55	Firm
	WS6	-	-	15	5.0	75	Stiff
	WS7	-	-	10	5.0	50	Firm
	WS8	-	-	13	5.0	65	Firm
	DP1	3, 3, 3	9	-	5.0	45	Firm
	DP2	4, 5, 5	14	-	5.0	70	Firm
2.0	WS1	-	-	6	5.0	30	Firm
	WS2	-	-	0	5.0	0	Very soft
	WS3	-	-	3	5.0	15	Very soft
	WS4	-	-	8	5.0	40	Firm
	WS5	-	-	15	5.0	75	Stiff
	WS6	-	-	15	5.0	75	Stiff
	WS7	-	-	14	5.0	70	Firm
	WS8	-	-	14	5.0	70	Firm
	DP1	1, 1, 1	3	-	5.0	15	Very soft
	DP2	4, 5, 5	14	-	5.0	70	Firm
3.0	WS1	-	-	5	5.0	25	Soft
	WS2	-	-	1	5.0	5	Very soft
	WS3	-	-	4	5.0	20	Soft
	WS4	-	-	4	5.0	20	Soft
	WS5	-	-	25	5.0	125	Stiff
	WS6	-	-	25	5.0	125	Stiff

	WS7	-	-	17	5.0	85	Stiff
	WS8	-	-	21	5.0	105	Stiff
	DP1	3, 4, 4	11	-	5.0	55	Firm
	DP2	12, 8, 9	29	-	5.0	145	Stiff
4.0	WS1	-	-	12	5.0	60	Firm
	WS2	-	-	13	5.0	65	Firm
	WS3	-	-	7	5.0	35	Soft
	WS4	-	-	12	5.0	60	Firm
	WS5	-	-	12	5.0	60	Firm
	WS6	-	-	17	5.0	85	Stiff
	WS7	-	-	10	5.0	50	Medium dense
	WS8	-	-	13	5.0	65	Medium dense
	DP1	3, 2, 4	9	-	5.0	45	Loose
	DP2	10, 7, 8	25	-	5.0	125	Medium dense
5.0	WS1	-	-	16	5.0	80	Medium dense
	WS2	-	-	12	5.0	60	Medium dense
	WS3	-	-	11	5.0	55	Medium dense
	WS4	-	-	12	5.0	60	Medium dense
	WS5	-	-	13	5.0	65	Medium dense
	WS6	-	-	13	5.0	65	Medium dense
	WS7	-	-	11	5.0	55	Medium dense
	WS8	-	-	11	5.0	55	Medium dense
	DP1	4, 4, 5	13	-	5.0	65	Medium dense
	DP2	11, 7, 6	24	-	5.0	120	Medium dense

The results of pocket penetrometer testing show that the ground is particularly stiff in the upper metre, suggesting that the ground is desiccated, perhaps due to the action of tree roots.

Below the upper meter, the ground is shown as soft, increasing to firm below 4.0 m.

Three oedometer consolidation tests were carried out on the site, which show that the maximum coefficient of compressibility (M_v) ranges between 0.32 m²/MN and 0.81 m²/MN

The coefficient of compressibility can also be calculated from the SPT 'N' value, by way of a conversion factor. For a soil with a plasticity index of 19 %, this factor (f_2) would be 0.55, using the equation ($M_v = \frac{1}{f_2 N}$)

The laboratory results and SPT calculated results for the upper 2.0 m of ground are presented in the table below.

Depth (m)	Test Location	DPN 100 Value	Equivalent SPT 'N' Value	SPT 'N' value	Conversion Factor	Coefficient of compressibility (M_v)	Compressibility
0.7	TP2	-	-	-	-	0.32	High
1.0	WS1	-	-	7	0.55	0.26	Medium
	WS2	-	-	5	0.55	0.36	High
	WS3	-	-	7	0.55	0.26	Medium
	WS4	-	-	4	0.55	0.45	High
	WS5	-	-	11	0.55	0.17	Medium
	WS6	-	-	15	0.55	0.12	Medium
	WS7	-	-	10	0.55	0.18	Medium
	WS8	-	-	13	0.55	0.14	Medium
	DP1	3, 3, 3	9	-	0.55	0.21	Medium
	DP2	4, 5, 5	14	-	0.55	0.13	Medium
1.1	TP7	-	-	-	-	0.81	High
1.3	TP3	-	-	-	-	0.46	High
2.0	WS1	-	-	6	0.55	0.30	High
	WS2	-	-	0	0.55	>1.5	Very high
	WS3	-	-	3	0.55	0.61	High
	WS4	-	-	8	0.55	0.23	Medium
	WS5	-	-	15	0.55	0.12	Medium
	WS6	-	-	15	0.55	0.12	Medium
	WS7	-	-	14	0.55	0.13	Medium
	WS8	-	-	14	0.55	0.13	Medium
	DP1	1, 1, 1	3	-	0.55	0.61	High
	DP2	4, 5, 5	14	-	0.55	0.13	Medium

For engineering design purposes, the following values may be used:

At 1.0 m:

Bulk Unit Mass	-	1.60 Mg/m ³ (assumed)
Mass Shear Strength	-	25 kN/m ² (soft)
Coefficient of Compressibility (m_v)	-	0.35 m ² /MN (high)

Amphill Clay Formation (AMC)

No observations of the Amphill Clay Formation were made, so it is not possible to derive any engineering properties at this stage.

7. ENGINEERING DESIGN

7.1 PRELIMINARY FOUNDATION DESIGN

At the time of reporting, a foundation design was not available, however, it is understood that the structures planned include traditional timber framed houses. It is therefore likely that line loads would be in the region of 80 kN/m² – 120 kN/m².

It is assumed that the Made Ground (MGR) will be removed prior to construction.

Consideration has therefore been given to a shallow foundation design. In deliberation of suitable foundation options consideration was given to the geotechnical hazards and risks as presented below.

Geotechnical Hazard	Qualitative Risk & Consequences	Possible Risk Reduction Measures
Variations in stiffness of ground below foundation depth that could give rise to unacceptable total and differential settlement.	High Buildings particularly sensitive to differential settlement would result in cracking of superstructure if conventional brickwork or brick cladding.	Calculate likely magnitude of settlement and determine if within acceptable tolerances. Make foundations act as reinforced beams. Include movement joints where necessary.
Shrinkage/swelling of foundation soils due to the action of tree roots.	Medium Foundation movement and superstructure.	Calculate magnitude of shrinkage / swelling. Use piled foundations if required. Ground floors should be suspended.
Existing underground structures such as, service runs and old footings.	Low Implication for foundation depth and economic feasibility of shallow foundations.	New foundations to be constructed in undisturbed ground or alternatively disturbed ground to be removed and replaced with suitable engineering fill.
Potential for solution feature or subsurface voids	Low Buildings particularly sensitive to differential settlement would result in cracking of superstructure if conventional brickwork or brick cladding.	Carry out visual inspection of ground prior to constructing foundations. Consider probe drilling beneath particularly sensitive structures such as tanks. Make foundations act as reinforced beams. Include movement joints where necessary.
Potential for buoyancy due to high groundwater levels.	High Groundwater pressure may cause buildings or structures with a low ground bearing pressure, such as tanks or rafts, to become buoyant, causing movement of the structure which may result in cracking or rotation of the structure.	Place buildings / structures above the highest groundwater level wherever possible. If not possible, calculate the magnitude of buoyancy and consider reinforcement of foundations to resist groundwater pressure. Ground anchors may also be constructed to prevent movement of structures.

Given the variations in thickness and composition of the Made Ground (MGR), this layer was considered to be unsuitable as a founding stratum.

Consideration was therefore given to a traditional strip foundation placed at 1.0 m within The Tidal Flat Deposits (TFD).

7.1 STRIP FOUNDATIONS

Consideration has been given to a pad foundation placed at a depth of 1.0 m in the Tidal Flat Deposits (TFD).

Indications are that a foundation, 0.5 m wide, placed at a depth of 1.0 m within the Tidal Flat Deposits would have a maximum allowable bearing pressure of 55 kN/m².

This would result in a maximum line load of 27.5 kN/m run.

This foundation is unlikely to be capable of supporting the proposed buildings with a line load in the region of 80 kN – 120 kN / m run being required.

7.2 RAFT FOUNDATIONS

Consideration has been given to a raft foundation placed at a depth of 0.75 m, within the Tidal Flat Deposits (TFD).

Indications are that a reinforced raft foundation, 8 m long by 8 m wide placed at 0.75 m depth would be capable of supporting a maximum spread load of 40 kN/m².

A raft foundation, placed at a depth of 0.75 m, with a maximum spread load of 40 kN/m² would be expected to experience around 45 mm of total settlement, with around 20 % being immediate settlement, and the remaining 80 % being long term, consolidation settlement.

Whilst the settlement may be high, by creating a reinforced raft, the structure should remain rigid throughout the settlement process, meaning that differential settlement will not occur.

Raft foundation may make it difficult to construct adjoining structures (such as garages or future extensions), and consideration will need to be given to different rates of settlement on different rafts, with movement joints where structures connect.

Whilst no tidal groundwater was observed beneath the site, it is likely that the groundwater will rise and fall with the seasons (the site works having been carried out during drought conditions). Should groundwater come into contact with the base of the raft at any time during the season, consideration would need to be given to buoyancy.

7.3 PILE FOUNDATIONS

Boreholes excavated during the site investigation did not penetrate the rock sufficiently to allow determination of the rock properties along the full length of a

pile, however, indications from the dynamic probing would indicate that a piled foundation solution would be possible on the site.

Based upon the information gathered to date, it is likely that piles would need to be around 20 – 25 m long to provide sufficient bearing capacity for the proposed buildings.

Additional work will be required to allow the design of piles on the site.

7.4 TEMPORARY WORKS

Excavations in excess of 1.2 m depth are likely to be required in connection with the proposed development on this site. If there is a requirement for personnel to enter into excavations, then the need for trench side support should be considered for any depth of excavation, and therefore appropriate equipment should be available on site prior to excavation proceeding. A site-specific risk assessment should be carried out where man entry into excavations is required.

The base of foundation excavations should be inspected and any soft loose, organic or otherwise deleterious material at foundation level removed and replaced with lean mix concrete. The soils encountered will be liable to softening/loosening when exposed to surface water infiltration. To avoid deterioration of the prepared formation the base of foundations should be blinded with concrete as soon as practical after excavation and particularly if there is delay before placing foundation concrete.

Foundations would be required to be deepened locally where ground disturbance occurs due to removal of any buried obstructions.

In addition, where any significant or unexpected made, soft or loose ground, or sudden colour changes are encountered within excavations, an inspection (footings inspection) should be carried out to ensure that there are no unrecorded mine workings, solution features or other unstable ground, and to determine the nature of the infill.

7.5 GROUND FLOORS

The NHBC Guidance advises that for new residential developments where the plasticity of near surface soils exceeds 10% and where the depth of made ground exceeds 600 mm within self-contained areas, the ground floor slab should be suspended.

The plasticity of near-surface soils varied from < 10% to 19 %. The thickness of made ground varied between 100 mm and 750 mm. Given this, suspended ground floor slabs are recommended for any new buildings on the site.

7.6 CHEMICAL ATTACK ON BURIED CONCRETE

The results of the chemical testing on soils indicated concentrations of water-soluble sulphate of between 0.008 g/l and 0.087 g/l as SO₄, pH values were in the range of 7.5 to 8.7 pH units.

In accordance with BRE Special Digest 1 (SD1:2005 Third Edition) entitled 'Concrete in Aggressive Ground', a design sulphate class for the site of DS-1 is recommended. Using SD1 an ACEC (Aggressive Chemical Environment for Concrete) class of AC-1 is recommended.

7.7 SOAKAWAYS

Infiltration rate tests were carried out in two trial pits on the site, within the Tidal Flat Deposits (TFD).

It was planned to carry out the infiltration testing in accordance with BRE special digest 365, however this was not possible within either trial pit, because of poor soakage, and only one of the three fillings were partially completed.

Upon completion of subsequent trial excavations on the site.

The results of the testing are presented in Appendix 5.

The results of infiltration rate testing are presented in the table below.

	Trial Pit TP1	Trial Pit TP2
	0.90 – 1.50	0.83 – 1.50
Filling 1	2.23×10^{-7}	2.71×10^{-7}
Filling 2	-	-
Filling 3	-	-

Given the clayey soil, the potentially high groundwater table and the poor infiltration rates, it is unlikely that conventional soakaways will be a practical solution for the disposal of stormwater on the site.

Consideration should therefore be given to an alternative solution, such as:

- Construction of attenuation tanks, with subsequent disposal to a stormwater or combined sewer.
- Discharge to a nearby watercourse.
- Use of permeable pavements and surface infiltration wherever possible to minimise infiltration rates.

8. GROUND CONTAMINATION ASSESSMENT

8.1 RISKS TO HUMAN HEALTH

The UK's primary contaminated land guidance is contained within the Contaminated Land Exposure Assessment (CLEA) framework. Within this framework a number of Soil Guideline Values (SGVs) have been published for key contaminants along with toxicological guideline values relating to intake thresholds. The soil guideline values provided by the CLEA model represent intervention values for end users based upon potential human exposure and soil concentrations of a contaminant above these values might represent an unacceptable risk to the health of the site users.

The Land Quality Management (LQM) and Chartered Institute of Environmental Health (CIEH) have used the intake thresholds provided by the Environment Agency to provide Suitable For Use Values (S4Us) for a range of proposed end uses. The proposed end uses presented include:

- Residential (With plant uptake)
- Residential (Without plant uptake)
- Allotment
- Commercial / Industrial
- Public Open Space (Residential)
- Public Open Space (Park)

Based upon the proposals for Proposed Ascent Building, the proposed end use is Residential (with plant uptake).

The four tables presented on the proceeding pages show the S4U values for:

Table 1: Toxic Metals

Table 2: Organic Compounds & Inorganic Compounds

Table 3: Total Petroleum Hydrocarbons (TPH)

Table 4: Polycyclic Aromatic Hydrocarbons (PAH)

The S4Us are presented alongside the laboratory results, recorded on site. The assessment criteria appropriate for the site are highlighted in **yellow**. Elevated contaminant levels are highlighted in **red**, with safe contaminant levels highlighted in **green**.

Organic and inorganic compounds can represent a complex situation, with concentrations that can change over time. Organic and Inorganic compound S4Us are dependent on the amount of Soil Organic Matter (SOM) and three values are presented, based upon 1% SOM, 2.5 % SOM and 6% SOM. Where SOM is less than 1% SOM, the S4U may not provide sufficient protection for the site and a site-specific risk assessment should be undertaken.

Table 1: Assessment Criteria & Soil Results for Metals														
	Metal													
	Arsenic	Beryllium	Cadmium	Chromium (III)	Chromium (IV)	Copper	Lead	Mercury	Inorganic Mercury	Methylmercury	Nickel	Selenium	Vanadium	Zinc
Assessment Criteria														
Source	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	GAC	S4UL	S4UL	S4UL	SGV	S4UL	S4UL	
Units	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg
Residential (with plant uptake)	37	1.7	11	910	6	2400	290	1.2	40	11	180	350	410	3700
Residential (without plant uptake)	40	1.7	85	910	6	7100	340	1.2	56	15	180	350	1200	40000
Allotment	43	35	1.9	18000	1.8	520	250	21	19	6	230	120	91	620
Commercial Industrial	640	12	190	8600	33	68000	n/a	58	1100	320	980	1300	9000	730000
POS (residential)	79	2.2	120	1500	7.7	12000	n/a	16	120	40	230	n/a	2000	81000
POS (park)	170	63	532	33000	220	44000	n/a	30	240	68	3400	n/a	5000	130000
Soil Results														
TP1 1.4	5.4	-	<0.2	19	<4.0	8.1	7.9	<0.3	-	-	15	<1.0	-	35
TP4 2.4	5.7	-	<0.2	7.9	<4.0	5.6	4.5	<0.3	-	-	6.0	<1.0	-	16
WS1 0.3	10	-	<0.2	27	<4.0	15	19	<0.3	-	-	22	<1.0	-	60
WS1 0.7	7.4	-	<0.2	27	<4.0	15	19	<0.3	-	-	22	<1.0	-	60
WS2 0.2	11	-	<0.2	22	<4.0	16	20	<0.3	-	-	17	<1.0	-	55
WS4 0.1	10	-	<0.2	19	<4.0	21	24	<0.3	-	-	15	<1.0	-	60
WS4 0.5	8.5	-	<0.2	14	<4.0	7.9	8.5	<0.3	-	-	11	<1.0	-	29
WS5 0.1	12	-	<0.2	22	<4.0	24	19	<0.3	-	-	18	<1.0	-	57
WS5 0.5	12	-	<0.2	26	<4.0	17	14	<0.3	-	-	20	<1.0	-	50
WS8 0.4	9.7	-	<0.2	17	<4.0	14	16	<0.3	-	-	16	<1.0	-	44
WS8 1.4	2.9	-	<0.2	3.2	<4.0	2.5	3.6	<0.3	-	-	3.1	<1.0	-	9.4
Interpretation														
Arithmetic Mean	8.6	-	0.2	18.6	4.0	13.3	14.1	0.3	-	-	15	1.0	-	43.2
True Mean	10.2	-	0.2	22.8	4.0	16.9	17.9	0.3	-	-	18.4	1.0	-	53.3
Outliers?	No	-	No	No	No	No	No	No	-	-	No	No	-	No
Exceeds GAC?	No	-	No	No	No	No	No	No	-	-	No	No	-	No

Table 2: Assessment Criteria & Soil Results for Organic & Inorganic Compounds (except TPH & PAH)											
		Compound									
	SOM	Benzene	Toluene	Ethylbenzene	Xylene	Phenol		Chlorophenols	Pentachlorophenol	Carbon Disulphide	Hexachlorobutadiene
Source		S4UL	S4UL	S4UL	S4UL	S4UL		GAC	S4UL	S4UL	S4UL
Units	%	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg		Mg/kg	Mg/kg	Mg/kg	Mg/kg
Residential (with plant uptake)	1 2.5 6	0.087 0.17 0.37	130 290 660	47 110 260	56 130 310	280 550 1100		0.87 2.0 4.5	0.22 0.52 1.2	0.14 0.29 0.62	0.29 0.7 1.6
Residential (without plant uptake)	1 2.5 6	0.038 0.7 1.4	880 1900 3900	83 190 440	79 180 430	750 1300 2300		94 150 210	27 29 31	0.14 0.29 0.62	0.32 0.78 1.8
Allotment	1 2.5 6	0.017 0.034 0.075	22 51 120	16 39 91	28 67 160	66 140 280		0.13 0.3 0.7	0.03 0.08 0.19	4.8 10 23	0.25 0.61 1.4
Commercial Industrial	1 2.5 6	27 47 90	56000 110000 180000	5700 13000 27000	5900 14000 30000	760 1500 3200		3200 4000 4300	400 400 400	11 22 47	31 66 120
POS (residential)	1 2.5 6	72 72 73	56000 56000 56000	24000 24000 25000	41000 42000 43000	760 1500 3200		620 620 620	60 60 60	11000 11000 12000	25 25 25
POS (park)	1 2.5 6	90 100 110	87000 95000 100000	17000 22000 27000	17000 23000 31000	760 1500 3200		1100 1100 1100	110 120 120	1300 1900 2700	48 50 51
Soil Results											
TP1 1.4	0.9	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
TP4 2.4	0.3	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS1 0.3	2.1	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS1 0.7	1.1	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS2 0.2	5.5	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS4 0.1	5.0	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS4 0.5	1.2	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS5 0.1	8.5	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS5 0.5	1.7	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS8 0.4	2.0	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
WS8 1.4	0.2	<1.0	<1.0	<1.0	<1.0	<1.0		-	-	-	-
Interpretation											
Arithmetic Mean		1.0	1.0	1.0	1.0	1.0		-	-	-	-
True Mean		1.0	1.0	1.0	1.0	1.0		-	-	-	-
Outliers?		No	No	No	No	No		-	-	-	-
Exceeds GAC?		No	No	No	No	No		-	-	-	-

Table 3: Assessment Criteria & Soil Results for Total Petroleum Hydrocarbons (TPH)																	
		Compound															
		Aliphatic								Aromatic							
	SOM	C5 – C6	> C6 – C8	> C8 – C10	> C10 – C12	> C12 – C16	> C16 – C35	> C35 – C44	C5 – C7	> C7 – C8	> C8 – C10	> C10 – C12	> C12 – C16	> C16 – C21	> C21 – C35	> C35 – C44	> C44 – C70
Source		S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL
Units	%	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg
Residential ↓ (with plant uptake)	1 2.5 6	42 78 160	100 230 530	27 65 150	130 330 760	1100 2400 4300	65000 92000 110000	65000 92000 110000	70 140 300	130 290 660	34 83 190	74 180 30	140 330 660	260 540 930	1100 1500 1700	1100 1500 1700	1600 1800 1900
Residential ↓ (without plant uptake)	1 2.5 6	42 78 160	100 230 530	27 65 150	130 330 770	1100 2400 4400	65000 92000 110000	65000 92000 110000	370 690 1400	860 1800 3900	47 110 270	250 590 1200	1800 2300 2500	1900 1900 1900	1900 1900 1900	1900 1900 1900	1900 1900 1900
Allotment	1 2.5 6	730 1700 3900	2300 5600 13000	320 770 1700	2200 4400 7300	1100 1300 1300 0	260000 270000 270000	260000 270000 270000	13 27 57	22 51 120	8.6 21 51	13 31 74	23 57 130	46 110 260	370 820 1600	370 820 1600	370 820 1600
Commercial Industrial	1 2.5 6	3200 5900 12000	7800 17000 40000	2000 4800 11000	9700 2300 4700 0	5900 8200 9000 0	160000 170000 180000 0	160000 170000 180000 0	26000 46000 86000 0	56000 11000 0 17000	3500 8100 18000 0	1600 2800 3400 0	3600 3700 3800 0	2800 2800 2800 0	2800 2800 2800 0	2800 2800 2800 0	2800 2800 2800 0
POS (residential)	1 2.5 6	57000 59000 60000 0	60000 61000 62000 0	13000 13000 13000 0	1300 1300 1300 0	1300 1300 1300 0	250000 250000 250000 0	250000 250000 250000 0	56000 56000 56000 0	56000 56000 56000 0	5000 5000 5000 0	5000 5000 5000 0	5100 5100 5000 0	3800 3800 3800 0	3800 3800 3800 0	3800 3800 3800 0	3800 3800 3800 0
POS (park)	1 2.5 6	95000 13000 18000 0	15000 22000 32000 0	14000 18000 21000 0	2100 2300 2400 0	2500 2500 2600 0	450000 480000 490000 0	450000 480000 490000 0	75000 84000 92000 0	87000 95000 10000 0	7200 8500 9300 0	9200 9700 1000 0	1000 1000 1000 0	7600 7700 7800 0	7800 7800 7900 0	7800 7800 7900 0	7800 7800 7900 0
Soil Results																	
TP1 1.4	0.9	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
TP4 2.4	0.3	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS1 0.3	2.1	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS1 0.7	1.1	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS2 0.2	5.5	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS4 0.1	5.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS4 0.5	1.2	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS5 0.1	8.5	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS5 0.5	1.7	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS8 0.4	2.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
WS8 1.4	0.2	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<8.0	<8.0	<0.00 1	<0.00 1	<0.00 1	<1.0	<2.0	<10	<10	-	-
Interpretation																	
Arithmetic Mean		0.001	0.001	0.001	1.0	2.0	8.0	8.0	0.001	0.001	0.001	1.0	2.0	10	10	-	-
True Mean		0.001	0.001	0.001	1.0	2.0	8.0	8.0	0.001	0.001	0.001	1.0	2.0	10	10	-	-
Outliers?		No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-
Exceeds GAC?		No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-

Table 4: Assessment Criteria & Soil Results for Polycyclic Aromatic Hydrocarbons (PAH)																	
		Compound															
	SOM	Napthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz[a]anthracene	Chrysene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Indeno[123-cd]pyrene	Dibenz[ah]anthracene	Coal Tar
Source		S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL
Units	%	Mg/k g	Mg/kg	Mg/kg	Mg/k g	Mg/k g	Mg/kg	Mg/k g	Mg/k g	Mg/k g	Mg/k g	Mg/k g	Mg/k g	Mg/k g	Mg/k g	Mg/k g	Mg/k g
Residential (with plant uptake)	1 2.5 6	2.3 5.6 13	170 420 920	210 510 1100	170 400 860	95 220 440	2400 5400 11000	280 560 890	620 1200 2000	7.2 11 13	15 22 27	2.6 3.3 3.7	77 93 100	2.2 2.7 3.0	27 36 41	0.24 0.28 0.3	0.79 0.98 1.1
Residential (without plant uptake)	1 2.5 6	2.3 5.6 13	2900 4600 6000	3000 4700 6000	3800 3800 4500	1300 1500 1300	31000 35000 37000	1500 1600 1600	3700 3800 3800	11 15 15	30 31 32	3.9 4.0 4.0	110 110 110	3.2 3.2 3.2	45 46 46	0.31 0.32 0.32	1.2 1.2 1.2
Allotment	1 2.5 6	4.1 10 24	28 69 160	34 85 200	27 67 160	15 38 90	380 950 2200	52 130 290	110 270 620	2.9 6.5 13	4.1 9.4 19	0.99 2.1 3.9	37 75 130	0.97 2.0 3.5	9.5 21 39	0.14 0.27 0.43	0.32 0.67 1.2
Commercial Industrial	1 2.5 6	190 460 1100	83000 97000 100000	84000 97000 100000	63000 68000 71000	22000 22000 23000	52000 54000 54000	23000 23000 23000	54000 54000 54000	170 170 180	350 350 350	44 44 45	1200 1200 1200	35 35 36	500 510 510	3.5 3.6 3.6	15 15 15
POS (residential)	1 2.5 6	4900 4900 4900	15000 15000 15000	15000 15000 15000	9900 9900 9900	3100 3100 3100	74000 74000 74000	3100 3100 3100	7400 7400 7400	29 29 29	57 57 57	7.1 7.2 7.2	190 190 190	5.7 5.7 5.7	82 82 82	0.57 0.57 0.58	2.2 2.2 2.2
POS (park)	1 2.5 6	1200 1900 3000	29000 30000 30000	29000 30000 30000	20000 20000 20000	6200 6200 6300	15000 15000 15000	6300 6300 6400	15000 15000 15000	49 56 62	93 110 120	13 15 16	370 410 440	11 12 13	150 170 180	1.1 1.3 1.4	4.4 4.7 4.8
Soil Results																	
TP1 1.4	0.9	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	-
TP4 2.4	0.3	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	-
WS1 0.3	2.1	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
WS1 0.7	1.1	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
WS2 0.2	5.5	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
WS4 0.1	5.0	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
WS4 0.5	1.2	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
WS5 0.1	8.5	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
WS5 0.5	1.7	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
WS8 0.4	2.0	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
WS8 1.4	0.2	<0.0 5	<0.05	<0.05	<0.0 5	<0.0 5	<0.05	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	<0.0 5	--
Interpretation																	
Arithmetic Mean		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	-
True Mean		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	-
Outliers?		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-
Exceeds GAC?		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-

8.2 RISKS TO GROUNDWATER

The CLEA framework does not provide a method for the assessment of groundwater quality. However, the Environment Agency does publish tables of dangerous substances, which may represent a risk to the quality of groundwater.

Every listed dangerous substance has a concentration limit called an Environmental Quality Standard (EQS). EQSs must not be exceeded in any controlled watercourse in England and Wales.

The EQS values were developed in line with the EC Dangerous Substance Directive (76/464/EEC). These limits relate to the potential risk to Controlled Waters and not human health for which CLEA is the overriding risk assessment model.

8.3 RISKS TO PLANTS

The CLEA framework does not provide a method for the assessment of phototoxic risks to plants. However, maximum permissible concentrations have been published in the Sludge (Use in Agriculture) Regulations 1989 (SI 1989, No. 1263). This legislation enforces the provisions of the EC Directive 86/278/EEC for potentially toxic elements (PTEs) on soils for agricultural use where sewage sludge has been applied (see table below). These limits relate to the potential risk to plants and not human health for which CLEA is the overriding risk assessment model.

Table 5 shows the soil results for phytotoxic metals

Table 5: Assessment Criteria & Soil Results for Phytotoxic Metals				
		Metal		
	pH	Zinc	Copper	Nickel
Source		SI 1989 1263	SI 1989 1263	SI 1989 1263
Units	pH Units	Mg/kg	Mg/kg	Mg/kg
All uses	5.0 – 5.5	200	80	50
	> 5.5 – 6.0	200	100	60
	> 6.0 – 7.0	200	135	75
	> 7.0	300	200	110
Results				
TP1 1.4	7.6	35	8.1	15
TP4 2.4	8.2	16	5.6	6.0
WS1 0.3	8.1	60	15	22
WS1 0.7	8.5	42	12	16
WS2 0.2	7.8	55	16	17
WS4 0.1	7.7	60	21	15
WS4 0.5	8.3	29	7.9	11
WS5 0.1	7.5	57	24	18

WS5 0.5	8.2	50	17	20
WS8 0.4	8.2	44	14	16
WS8 1.4	8.7	9.4	2.5	3.1
Interpretation				
Arithmetic Mean		43.2	13.3	15
True Mean		53.3	16.9	18.4
Outliers?		No	No	No
Exceeds GAC?		No	No	No

8.4 RISKS TO BURIED STRUCTURES AND PLANT

The potential risks to buried concrete can be assessed by reference to the BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground'. This document provides a methodology for the specification of concrete based on the ground conditions encountered and is based upon chemical analysis and associated factors (e.g. groundwater). The guidance provides a Design Sulphate Class (DS) based upon the ground conditions and it is considered that a low concentration of sulphate and pH (i.e. DS – 1 and DS – 2) is considered to represent a low risk to buildings.

In addition, where water is supplied in plastic pipes, which could come into contact with contaminated ground then this can lead to premature failures, resulting in leakage and loss of water quality. The Water Regulations Advisory Scheme (WRAS) has published an Information and Guidance Note (The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land (No 9-04-03)) which provides a table of threshold values. If these threshold values are exceeded, then consideration should be given to the selection of pipe material. The WRAS threshold values are presented in the table below for a range of potential hazards.

Table 6: Assessment Criteria & Soil Results for Water Supply Pipes										
	Organic Contaminants						Corrosion			
	Coal Tar	CEM	Phenol	PAH	TEM	Petroleum Hydrocarbons	Sulphate	Sulphur	Sulphide	pH
Source	WRAS 9-04-03	WRAS 9-04-03	WRAS 9-04-03	WRAS 9-04-03	WRAS 9-04-03	WRAS 9-04-03	WRAS 9-04-03	WRAS 9-04-03	WRAS 9-04-03	WRAS 9-04-03
Units	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	Mg/kg	pH units
Minimum (all uses)	-	-	-	-	-	-	-	-	-	5.0
Maximum (all uses)	50	50	5.0	50	510	50	2000	5000	250	8.0
Results										
TP1 1.4	-	-	<1.0	<0.8	-	<10	24	-	-	7.6
TP4 2.4	-	-	<1.0	<0.8	-	<10	138	-	-	8.2
WS1 0.3	-	-	<1.0	<0.8	-	<10	23	-	-	8.1
WS1 0.7	-	-	<1.0	<0.8	-	<10	21	-	-	8.5
WS1 3.7	-	-	-	-	-	-	152	-	-	8.5
WS2 0.2	-	-	<1.0	<0.8	-	<10	34	-	-	7.8
WS3 4.7 - 4.8	-	-	-	-	-	-	174	-	-	8.3
WS4 0.1	-	-	<1.0	<0.8	-	<10	31	-	-	7.7
WS4 0.5	-	-	<1.0	<0.8	-	<10	17	-	-	8.3
WS5 0.1	-	-	<1.0	<0.8	-	<10	38	-	-	7.5
WS5 0.5	-	-	<1.0	<0.8	-	<10	17	-	-	8.2
WS5 4.9 – 5.0	-	-	-	-	-	-	116	-	-	8.5
WS6 4.0 – 4.2	-	-	-	-	-	-	72	-	-	8.6
WS8 0.4	-	-	<1.0	<0.8	-	<10	25	-	-	8.2
WS8 1.4	-	-	<1.0	<0.8	-	<10	18	-	-	8.7
Interpretation										
Arithmetic Mean	-	-	1.0	0.8	-	10	60	-	-	8.2
True Mean	-	-	1.0	0.8	-	10	85.4	-	-	8.3
Outliers?	-	-	No	No	-	No	No	-	-	No
Exceeds GAC?	-	-	No	No	-	No	No	-	-	YES

9. CONTAMINATION RISK ASSESSMENT

This risk assessment has been undertaken with due regard to the advice relating to groundwater as provided in the Environment Agency's "Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources", the advice provided in the Contaminated Land (England) Regulations 2000, and the associated statutory guidance. The guidance defines contaminated land as any land that is in such a condition that by reason of substances in, on or under the land:

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- pollution of controlled water is being, or is likely to be caused.

This definition is based on the principles of risk assessment defined as a combination of the probability (or frequency) of occurrence of a defined hazard and the magnitude (including the seriousness) of the consequences. Central to the risk assessment process is the concept of pollutant linkage, which is a linkage between a contaminant and a receptor by means of a pathway.

Statutory definitions relating to pollution linkage.	
Contaminant	"a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of controlled waters."
Receptor	"a living organism, a group of living organisms, and ecological system or a piece of property" which meets given criteria. "controlled waters which are, or could be, polluted by a contaminant".
Pathway	"one or more routes or means by, or through, which a receptor: • is being exposed to, or affected by, a contaminant, or • could be so exposed or affected".

The relationship between these components is discussed below to identify the existence of any source-pathway-receptor linkage on the site, and hence the potential risks associated with any contamination. This risk assessment is based on the proposed redevelopment of the site as a commercial / industrial development.

Potential receptors/targets at the site and in the area in which the site is located include:

- future occupants and the general public
- construction/maintenance workers
- groundwater resources
- underground services in and around the site

9.1 CONTAMINANT SOURCES

The following potential contaminant sources were identified on site:

- The site is understood to contain some fly-tipped waste.

Elevated concentrations of pH were encountered on the site. These are likely to be due to the presence of chalk which is naturally alkaline.

9.2 RISK TO HUMAN HEALTH

All potentially toxic metals, inorganic compounds and organic compounds were found to be within their appropriate SGV / screening values.

On balance, of the toxicological risks posed by the ground contamination encountered, as part of the intrusive investigations undertaken by AGS Ground Solutions Ltd, it is considered that the potential risks to site workers and future occupants could be adequately controlled as follows:

Site Workers

- Provision of appropriate personal protective equipment and hygiene facilities.
- Provision of appropriate dust suppression, to minimise the generation of potentially contaminated suspended particulates during site works.

Future Occupants

The risks to future occupants are considered to be low.

9.3 RISKS TO WATER RESOURCES

The site is not situated within a groundwater source protection zone.

A single groundwater sample was analysed for a general suite of contaminants.

The levels of potential mobile contaminants are low, so the risks posed by the works are therefore considered to be low.

9.4 RISKS TO PLANTS

Levels of potential phototoxic metals were considered to be low.

Therefore, the risks to plants were considered to be low.

9.5 RISKS TO BUILDINGS & SERVICES

Elevated levels of pH were encountered on the site.

High alkalinity may have the effect of corroding certain types of water pipe. It is therefore recommended that alkali-resistant water supply pipes are used for any potable water supplies.

Concentrations of other corrosive and inorganic compounds were low.

The residual risks to buried services are therefore considered to be low.

Advice on concrete was provided in chapter 7.5.

9.6 WASTE DISPOSAL

Should an excess volume of soil be required to be disposed of off-site then a waste classification may be required.

For a waste classification to be undertaken, materials may need to be subjected to leachate testing which would give an indication to the soluble component of contaminants and, therefore those most toxic to the environment in the waste. The classification will then allow the appropriate disposal pathway to a suitably licensed disposal facility to be determined.

Based upon the information obtained to date, waste obtained from the site is likely to be classified as inert.

10. DUE DILIGENCE ASSESSMENT

We understand that the Client is yet to purchase the site.

The following discussion outlines the key liabilities which the Client is likely to assume responsibility for in the event that they choose to purchase the land.

The list is not exhaustive, but designed to give an overview of liabilities.

Foundations

The geology of the site is such that traditional foundations will not be viable for the proposed dwellings.

Specialist foundations will therefore be required. This may take the form of reinforced rafts, but is more likely to take the form of piles.

Should the raft foundation be chosen, there will be a long-term liability with a potentially high settlement of up to 45 mm, which may affect service connections etc.

Should the piled foundation be chosen, further ground investigation will be required in order to establish the actual pile depth and design, however, based upon the investigation, it is likely that piles in excess of 20 m will be required on the site.

Specialist foundations will take longer and will cost more to design and construct.

Groundwater

The groundwater table on the site was recorded at between 1.47 m and 2.58 m, during drought conditions.

A high groundwater table will create a number of liabilities, including buoyancy effects on buried tanks / foundations, such as attenuation tanks, inspection chambers etc.

In addition, the high groundwater combined with the geology of the site will create conditions where running sands are possible, making deep excavations difficult on the site. This was observed in the trial pitting exercise. Specialist excavation techniques, including temporary piling and dewatering are likely to be required for any deep excavations on the site. This will result in a longer construction time and significant additional expense.

The groundwater pressure may restrict the type of piling rig which may be used on the site, resulting in a longer drilling time / additional costs for piling.

Temporary Works

It is likely, given the strength of the ground, that trench support will be required for any excavation where man-entry is required. This is likely to result in significant extra expense.

Depending on the time of year, temporary roadways may be required on the site, to permit vehicular movement, as the upper soil horizon is likely to soften significantly during periods of wet weather.

Ground Floor Slabs

Suspended ground floor slabs will be required on the site. These are likely to result in additional construction costs.

Surface Water Drainage

The results of percolation testing carried out on the site indicate that soakaways will not be viable.

We understand that others have carried out a single test on the site, however, the test was not carried out at a depth where a soakaway could be practicably installed, and the tests were not carried out in accordance with BRE Special Digest 365, so the results are not considered representative.

We would recommend that an alternative to soakaways be found for stormwater drainage. This may include connection to a nearby stormwater / combined sewer, perhaps with an attenuation tank to regulate flow. Alternatively, it may be possible to discharge to a local watercourse, if one can be found.

The disposal of surface water is a significant liability as it requires the cooperation of third parties, including landowners and local / national authorities. Obtaining the relevant permissions is likely to be time consuming and expensive, and there is a possibility that a solution may not be reached.

Contamination

The soils on the site are alkaline, with elevated pH values being recorded across the site. This may create a corrosive environment, and specially coated water supply pipes will be required for all new potable water supplies on the site. This is likely to involve additional expense.

Summary

The site investigation has established that there are significant liabilities relating to both building foundations and surface water drainage on the site, which will result in significant additional expenditure, in addition to a number of smaller liabilities.

We would recommend that you employ an estimator to help quantify any additional costs associated with these liabilities.

11. CONCLUSIONS AND RECOMMENDATIONS

Based on the intrusive investigation and subsequent laboratory testing, the following conclusions and recommendations have been drawn up in respect to Land Adj. to Chestnut Terrace, Sutton Bridge.

- The ground investigation identified an upper layer of Made Ground to be underlain by Tidal Flat Deposits (TFD).
- Groundwater was encountered on the site at relatively shallow depths.
- Traditional shallow foundations are unlikely to be able to support the proposed building foundations.
- It is likely that a raft foundation, 8 m by 8 m, placed at a depth of 0.75 m within the Tidal Flat Deposits could support a maximum spread load of 40 kN/m².
- Based upon the likely maximum load of 40 kN/m² placed upon the foundation at 0.75 m, initial calculations show that settlement is likely to be in the region of 45 mm.
- Indications are that piles would be viable on the site; however, further investigation will be required in order to establish a suitable pile design.
- The effects of buoyancy should be considered when designing and structures which may extend below the water table on the site.
- Suspended ground floors should be considered for the new dwellings on the site.
- The results of permeability tests show that soakaways are unlikely to be viable on the site.
- With regards to attack on buried concrete, a design sulphate class of DS-1 is recommended, with an ACEC class of AC-1.
- A contamination risk assessment identified the risks to human health, to be low.
- A risk to buried water supply pipes was identified from elevated pH levels.
- It is recommended that all water supply pipes be coated with an alkali-resistant material.
- The risks posed to all other types of buried services were considered to be low.
- Risks to plants were considered to be low.
- Risks to groundwater were considered to be low.
- Should an excess volume of soil be required to be disposed of off-site then a waste classification may be required. Based upon the information recovered on site, the waste would be considered to be 'Inert'.

FIGURES:

1. Site Location Plan
2. Exploratory Hole Location Plan
3. Pocket Penetrometer vs Depth Plot
4. Dynamic Probe Combined Plot.

APPENDICES:

1. Site Photographs
2. Window Sample Hole Logs
3. Dynamic Probe Soundings
4. Trial Pit Logs
5. Percolation Test Results
6. Geotechnical Laboratory Test Results
7. Analytical Laboratory Test Results

Figure 1
Site Location Plan



Project Sutton Bridge

Project Number A1816

Location Spalding, Lincolnshire

Client Lincoln Jack Ltd / Alan Brown Development Services Ltd

Drawing Title Site Location Plan

Drawing Number	Revision	Date	Approximate Scale
A1816-01	1	03/10/2018	1:10000 @ A4

Key

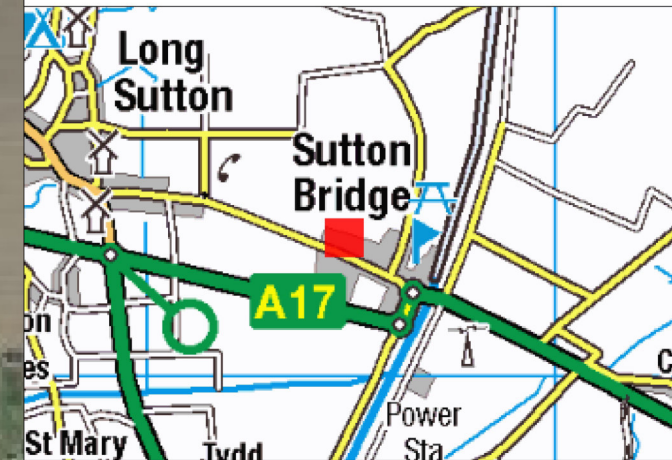
 Site Boundary

0 100 200 300 400 500 m



Figure 2

Exploratory Hole Location Plan



Project			Sutton Bridge
Project Number			A1816
Location			Spalding, Lincolnshire
Client			Lincoln Jack Ltd / Alan Brown Development
Drawing Title			Exploratory Hole Location Plan
Drawing Number	Revision	Date	Approximate Scale
A1816-02	1	03/10/2018	1:2500 @ A4

Key

-  Site Boundary
-  Approximate Borehole Locations
-  Approximate Trial Pit Locations

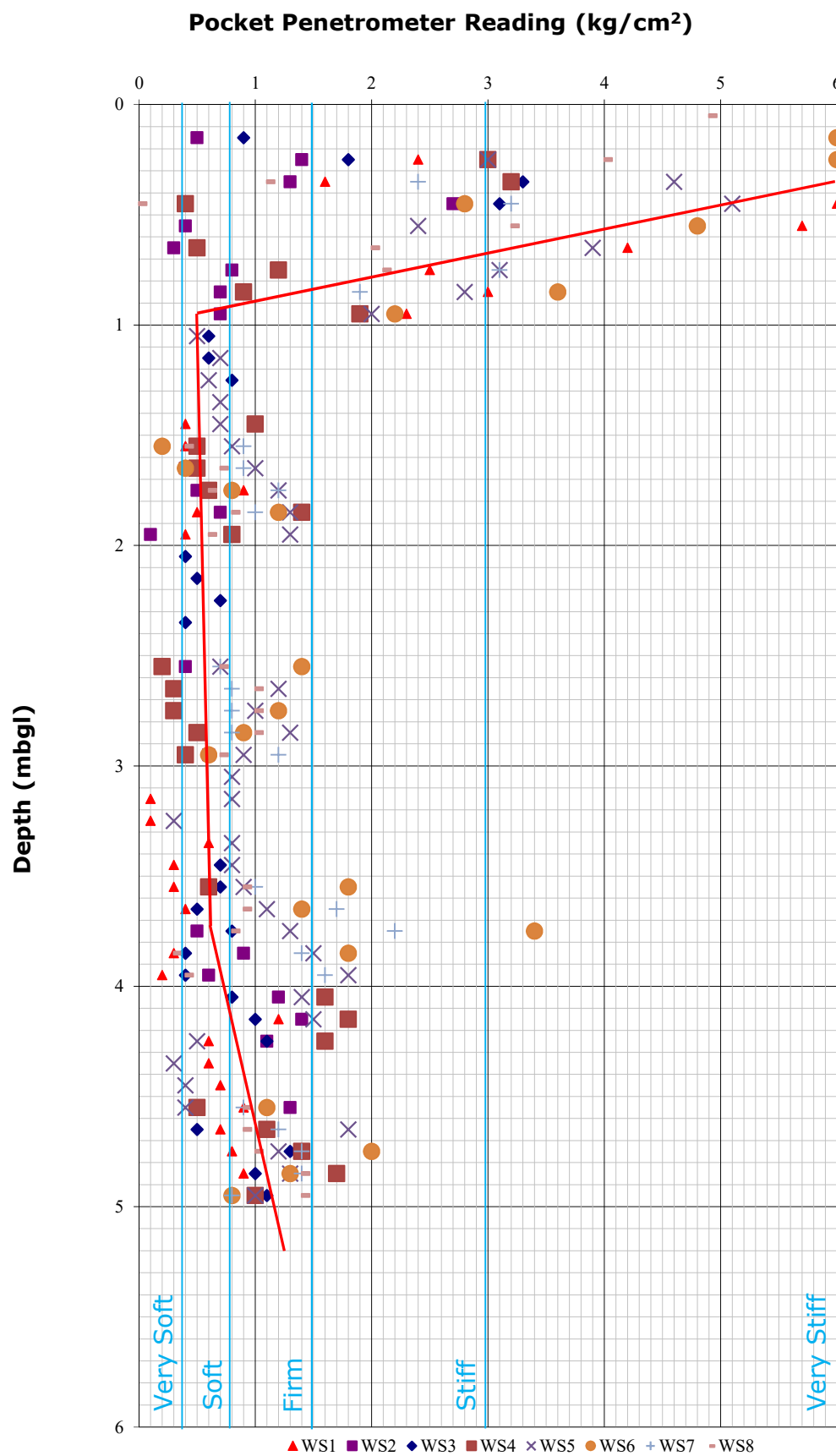
0 20 40 60 80 100 m



Figure 3

Pocket Penetrometer vs. Depth Plot

Figure 3. Pocket Penetrometer Reading-Depth Profile



Compiled:
CS

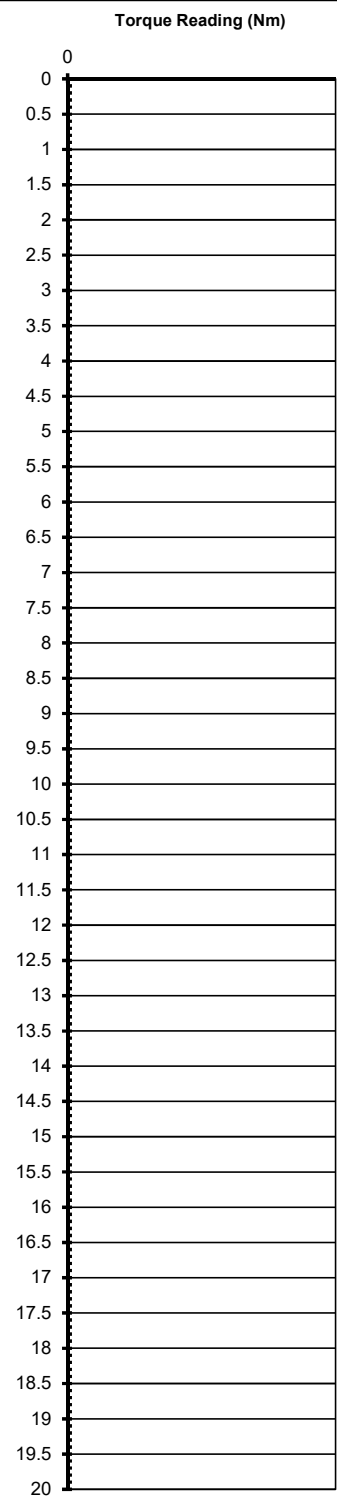
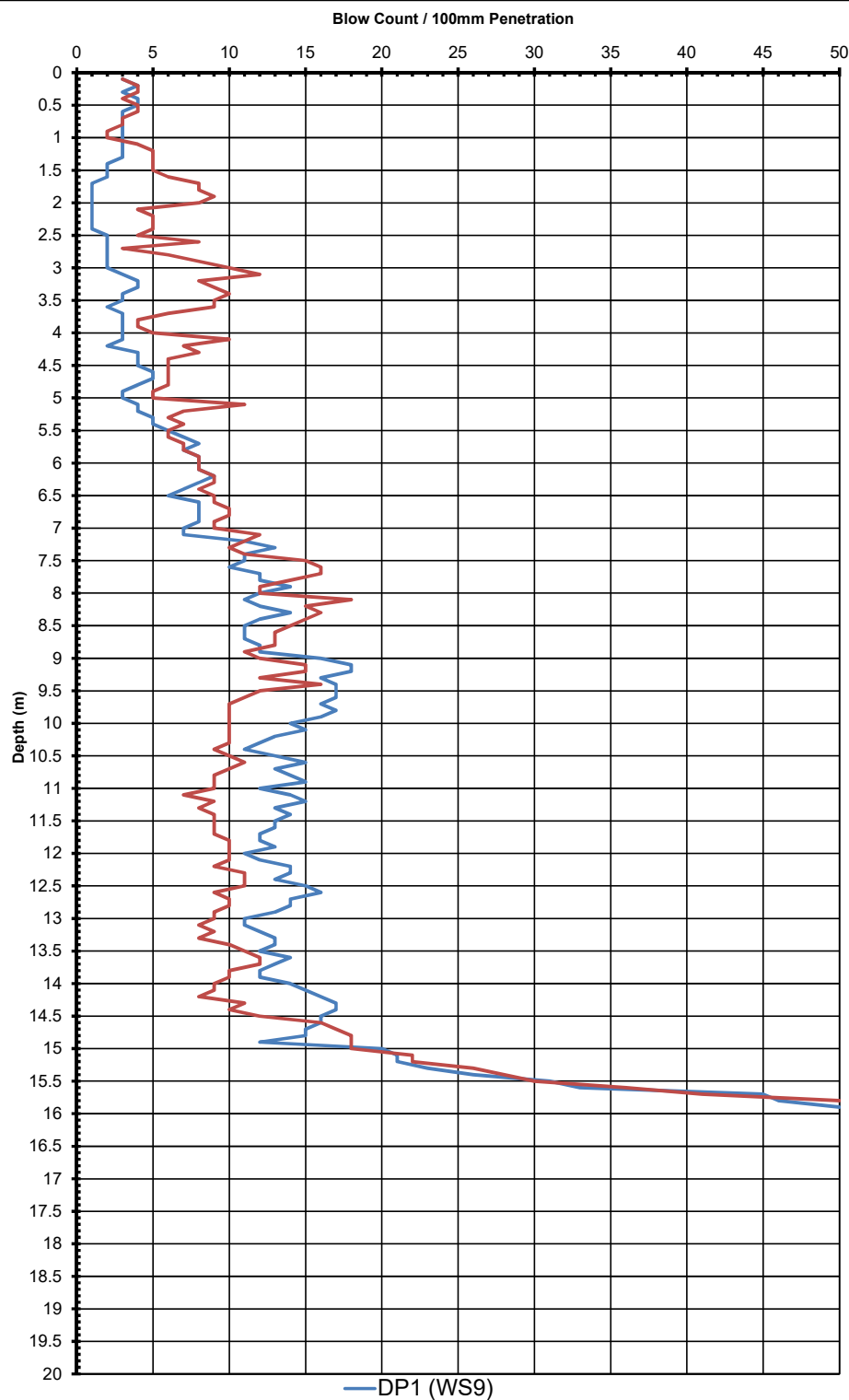
Checked:
PF

Approved:
PF

Figure 4

Combined Dynamic Probe Plot

DYNAMIC PROBE TEST RESULTS						Probe No:	Combined
Project Name:	Sutton Bridge					Lab. Order No:	n/a
Client Name:	Lincoln Jack Ltd / Alan Brown Development Services Ltd					Project No:	A1816
Hammer Weight:	63.5 kg	Cone Diameter:	43.7 mm			Date:	03/10/2018
Hammer Drop:	500 mm	Rod Diameter:	35 mm			Ground Level (m)	-



AGS Ground Solutions www.app-geo.co.uk		
Tested By: C-JD	Approved By: PF	
Checked By: IP		

Appendix 1

Site Photographs



Photograph 1: General view of site, facing west, showing the northern end of Area A, and the western end of Area C. The drill rig is set up on window sample hole WS1.



Photograph 2: Location of window sample hole WS5, facing north west. The white van is parked at the western end of Area C. The drill rig is positioned within Area B.



Photograph 3: View from Area B, looking east, showing the eastern end of Area C. The vehicles parked denote the end of Area C.



Photograph 4: Trial pit TP1 immediately prior to filling.



Photograph 5: Trial pit TP2, immediately prior to filling.



Photograph 6: Trial pit TP3, showing collapsing of saturated soil.



Photograph 7: Trial Pit TP4, showing the collapsing of trial pit sides due to saturated soil.



Photograph 8: Trial Pit TP5.



Photograph 9: Trial Pit TP6.



Photograph 10: Trial pit TP7



Photograph 11: Trial pit TP8

Appendix 2

Window Sample Hole Logs

Project Name: Sutton Bridge
Project Location: Spalding, Lincolnshire
Client: Lincoln Jack Ltd / Alan Brown Development Services Ltd

Job No:
A1816

Ground Level (m):

Date Started:26/09/2018
Date Completed:26/09/2018

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.25 ~~0.35~~ 0.35 ~~0.45~~ 0.45 ~~0.55~~ 0.55 ~~0.65~~ 0.65 0.75 0.85 ~~0.95~~ 1.00- 1.45 1.45 ~~1.55~~ 1.55 1.65 1.75 1.85 1.95 2.00- 2.45 3.00- 3.45 3.45 3.55 ~~3.65~~ 3.65 3.75 3.85 3.95 4.00- 4.45 ~~4.45~~ 4.45 ~~4.55~~ 4.55 4.65 4.75 4.85 5.00- 5.45	WS1 WS1 WS1 WS1 <							

Job No:
A1816

Date Started:26/09/2018
Date Completed:26/09/2018

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)		
Depth (m)	No.	Type	Result							
0.15 ~~0.20~~ 0.25 ~~0.30~~ 0.35 0.40 ~~0.45~~ 0.50 ~~0.55~~ 0.60 ~~0.65~~ 0.70 ~~0.75~~ 0.80 ~~0.85~~ 0.90 ~~0.95~~ 1.00 ~~1.05~~ 1.10 ~~1.15~~ 1.20 ~~1.25~~ 1.30 ~~1.35~~ 1.40 ~~1.45~~ 1.50 ~~1.55~~ 1.60 ~~1.65~~ 1.70 ~~1.75~~ 1.80 ~~1.85~~ 1.90 ~~1.95~~ 2.00 ~~2.05~~ 2.10 ~~2.15~~ 2.20 ~~2.25~~ 2.30 ~~2.35~~ 2.40 ~~2.45~~ 2.50 ~~2.55~~ 2.60 ~~2.65~~ 2.70 ~~2.75~~ 2.80 ~~2.85~~ 2.90 ~~2.95~~ 3.00 ~~3.05~~ 3.10 ~~3.15~~ 3.20 ~~3.25~~ 3.30 ~~3.35~~ 3.40 ~~3.45~~ 3.50 ~~3.55~~ 3.60 ~~3.65~~ 3.70 ~~3.75~~ 3.80 ~~3.85~~ 3.90 ~~3.95~~ 4.00 ~~4.05~~ 4.10 ~~4.15~~ 4.20 ~~4.25~~ 4.30 ~~4.35~~ 4.40 ~~4.45~~ 4.50 ~~4.55~~ 4.60 ~~4.65~~ 4.70 ~~4.75~~ 4.80 ~~4.85~~ 4.90 ~~4.95~~ 5.00 ~~5.05~~ 5.10 ~~5.15~~ 5.20 ~~5.25~~ 5.30 ~~5.35~~ 5.40 ~~5.45~~ 5.50 ~~5.55~~ 5.60 ~~5.65~~ 5.70 ~~5.75~~ 5.80 ~~5.85~~ 5.90 ~~5.95~~ 6.00	WS2	J	PP=25.0	1,2/1,1,1,2	MADE GROUND: Turf over topsoil (Made Ground)	-0.15		0.15		
0.25	WS2	TUB	PP=69.0		Fine, sandy brown, coarse SILT (Tidal Flat Deposits)	-0.55		0.25		
0.35	WS2	D	PP=64.0					0.35		
0.45	WS2	J	PP=132.0		Fine to medium yellow brown SAND with minor coarse silt (Tidal Flat Deposits)	-0.55		0.45		
0.55			PP=20.0					0.55		
0.65			PP=15.0					0.65		
0.75			PP=39.0					0.75		
0.85	WS2	TUB	PP=34.0		1,1/-,-,-,-	...from 1.60 Increases in wetness		-5.45	0.85	
0.95	WS2	D	PP=34.0						0.95	
1.40	WS2	D	PP=34.0						1.40	
1.55	WS2	D	PP=25.0	...from 2.40 Waterlogged sample			-5.45		1.55	
1.65			PP=20.0						1.65	
1.75			PP=25.0						1.75	
1.85			PP=34.0						1.85	
1.95	WS2	D	PP=5.0	...from 2.40 Waterlogged sample			-5.45		1.95	
2.40			SN=0						2.40	
2.55			WS2						D	PP=20.0
2.65					PP=15.0	2.65				
2.75	PP=15.0	2.75								
2.85	PP=25.0	2.85								
2.95	WS2	D	PP=29.0	...from 2.40 Waterlogged sample	-5.45	2.95				
3.75			SN=1			3.75				
3.85			WS2			D	PP=25.0	...from 2.40 Waterlogged sample	-5.45	3.85
3.95							PP=44.0			3.95
4.55	PP=29.0	4.55								
4.90	SN=13	4.90								
4.55	WS2	D	PP=64.0	...from 2.40 Waterlogged sample	-5.45	4.55				
4.90			WS2			D	SN=12	...from 2.40 Waterlogged sample	-5.45	4.90
5.45							2,2/3,3,3,4			5.45
5.45							2,3/2,3,3,4			5.45

Remarks:

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Logged By: CS

Scale: 1:50

FIG No.

Checked By:

Approved By:

Fig 2

AGS Ground Solutions Ltd 4 Bond Street, Redruth, Cornwall TR15 2QB 01209 202 409 agsgroundssolutions.com Window Sampler Log No. WS3 Sheet: 1 of 1												
Equipment & Methods. PM Sampling Ltd Support Used: None			Project Name: Sutton Bridge Project Location: Spalding, Lincolnshire Client: Lincoln Jack Ltd / Alan Brown Development Services Ltd		Job No: A1816							
Co-ordinates: E: N:			Ground Level (m):		Date Started: 26/09/2018 Date Completed: 26/09/2018							
Samples and In situ Testing			Field Records		DESCRIPTION		Reduced Level (m)	Legend	Depth (Thick) (m)			
Depth (m)	No.	Type								Result		
0.15 0.20 0.35 0.45 0.70	WS3 WS3 WS3	J TUB D	PP=44.0 PP=88.0 PP=162.0 PP=152.0	1,2/2,2,1,2	MADE GROUND: Turf over brown topsoil (Made Ground)		-0.30		(0.30) 0.30			
					Fine to medium SAND with minor coarse silt (Tidal Flat Deposits)							
1.20 1.00- 1.45	WS3 WS3	D SPTLS	SN=7		Fine sandy dark brown / grey coarse SILT (Tidal Flat Deposits)					-2.00		(1.70) 2.00
2.20 2.00- 2.45	WS3 WS3	D SPTLS	SN=3									
2.70	WS3	D		Fine to medium dark brown / grey SAND with coarse silt (Tidal Flat Deposits)		-3.00		(0.70) 3.00				
3.00- 3.45 3.45 3.55 ~~3.60~~ 3.75 3.85 3.95 4.00- 4.45	WS3 WS3 WS3 WS3 WS3 WS3 WS3	SPTLS D SPTLS D SPTLS	SN=4 PP=34.0 PP=34.0 PP=25.0 PP=39.0 PP=20.0 PP=20.0 SN=7	2,2/1,1,1,1 1,1/1,1,2,3	End of W/S 5.45 m (Thickness of basal layer not proven)				-5.45		(2.45) 5.45	
4.65 ~~4.70~~ 4.75 4.85 4.95 5.00- 5.45	WS3 WS3 WS3 WS3 WS3	D SPTLS SPTLS SPTLS SPTLS	PP=25.0 PP=64.0 PP=49.0 PP=54.0 SN=11				2,3/3,3,2,3					
Remarks:					Logged By: CS			Checked By:				
Notes: For explanation of symbols and abbreviations, see Key Sheet.					Scale: 1:50		Approved By:					
					FIG No. Fig 2							

Job No:
A1816

Date Started:26/09/2018
Date Completed:26/09/2018

[illegible]

[illegible]

Equipment & Methods. PM Sampling LtdSupport Used:None				Project Name: Sutton Bridge Project Location: Spalding, Lincolnshire Client: Lincoln Jack Ltd / Alan Brown Development Services Ltd				Job No: A1816	
Co-ordinates: E: N:				Ground Level (m):		Date Started:27/09/2018 Date Completed:27/09/2018			
Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)	
Depth (m)	No.	Type	Result						
0.10- 0.20 0.25 0.45 0.50- 0.70	WS6	D	PP=294.0 PP=294.0 PP=137.0 PP=235.0	2,2/3,4,4,4	MADE GROUND: Turf over topsoil (Made Ground) Fine light brown sandy firm SILT (Tidal Flat Deposits) ...from 0.50 Occasional sand bands	-0.20		0.20	
0.85 0.95 1.00- 1.25 1.00- 1.45	WS6	D SPTLS	PP=177.0 PP=108.0 SN=15						
1.55- 1.70 1.65 1.75 1.85	WS6	D	PP=10.0 PP=20.0 PP=39.0 PP=59.0	3,3/4,4,3,4	...from 2.80 Becoming dark grey with organic material			(5.25)	
2.00- 2.45 2.55 2.70- 2.70 2.75 2.85 2.95 3.00- 3.20 3.00- 3.45	WS6	D SPTLS	PP=69.0 PP=59.0 PP=44.0 PP=29.0 SN=25						
3.55 3.65 3.75 3.85	WS6	D SPTLS	PP=88.0 PP=69.0 PP=167.0 PP=88.0	4,5/5,6,7,7					
4.00- 4.20 4.00- 4.45			SN=17						
4.55 4.75 4.85- 5.00 4.95	WS6	D	PP=54.0 PP=98.0 PP=64.0 PP=39.0	3,4/5,4,4,4					
5.00- 5.45	WS6	SPTLS	SN=13						
				2,3/3,4,3,3		-5.45		5.45	
						End of W/S 5.45 m (Thickness of basal layer not proven)			
Remarks:						Logged By:		Checked By:	
						CS			
						Scale: 1:50		Approved By:	
Notes: For explanation of symbols and abbreviations, see Key Sheet.						FIG No. Fig 2			

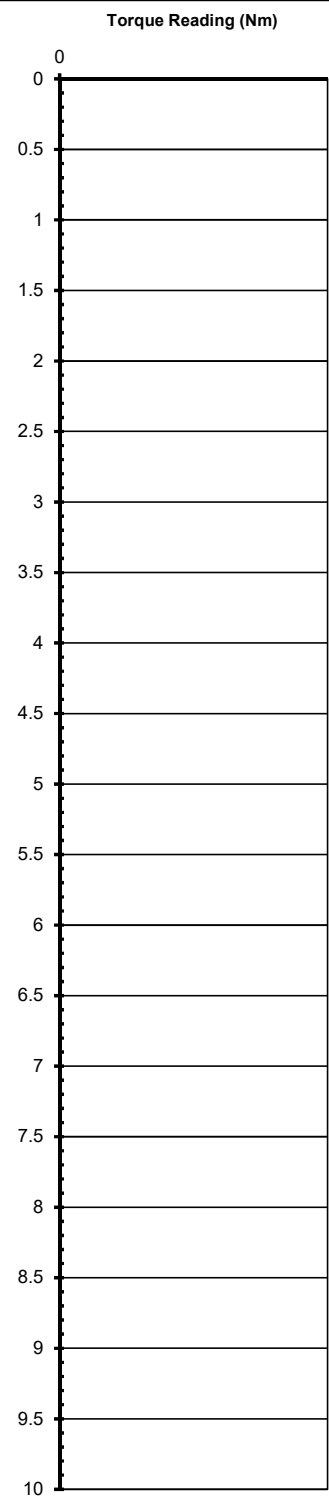
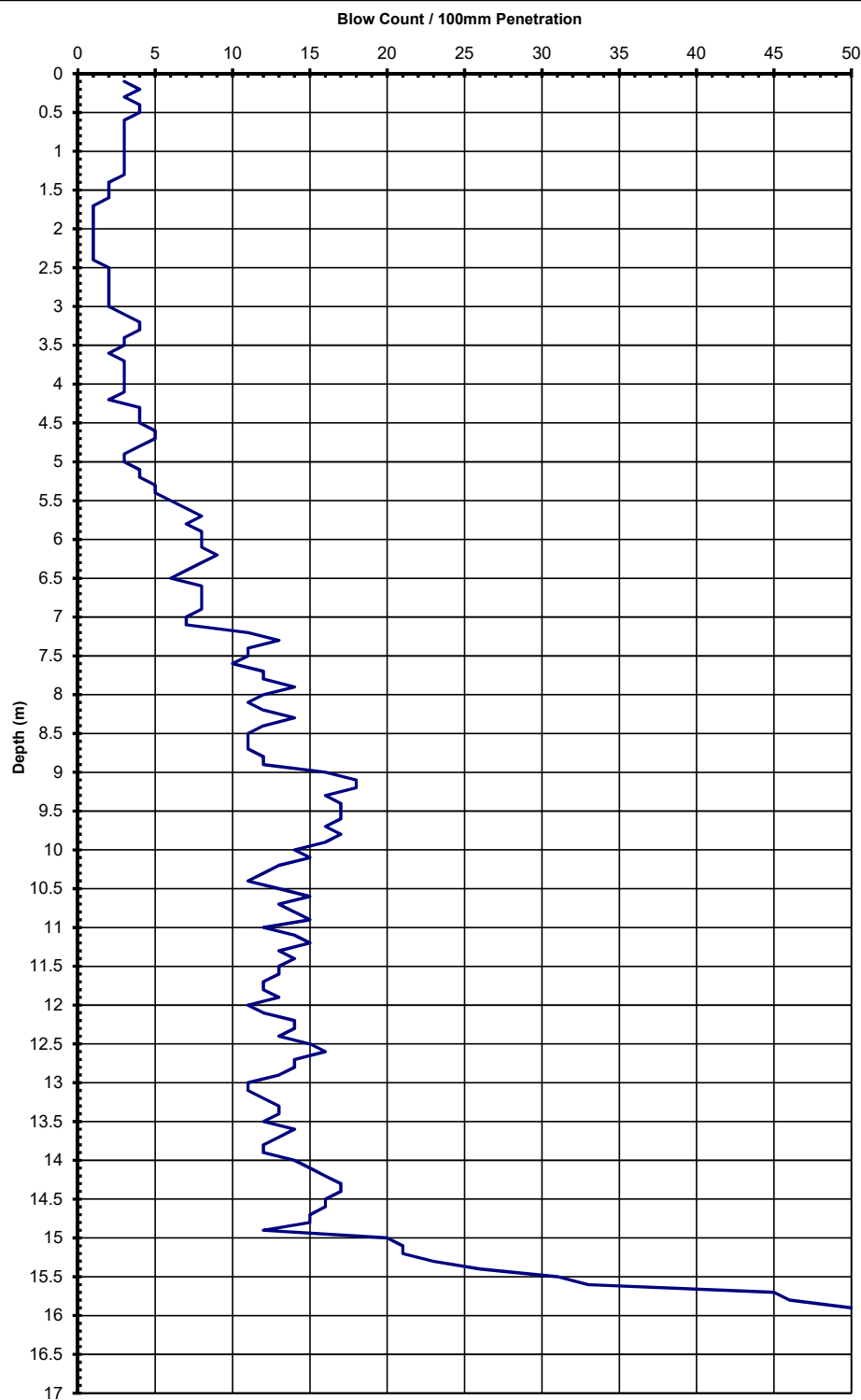
Equipment & Methods. PM Sampling LtdSupport Used:None				Project Name: Sutton Bridge Project Location: Spalding, Lincolnshire Client: Lincoln Jack Ltd / Alan Brown Development Services Ltd				Job No: A1816													
Co-ordinates: E: N:				Ground Level (m):			Date Started:27/09/2018 Date Completed:27/09/2018														
Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)													
Depth (m)	No.	Type	Result																		
0.10	WS7	J TUB		2,2/2,2,3,3	MADE GROUND: Turf over topsoil (Made Ground)	-0.40		(0.40)													
0.35	WS7	D	PP=118.0		Fine light brown / yellow sandy, firm SILT (Tidal Flat Deposits)				-0.40		0.40										
0.40- 0.50		J	PP=157.0																		
0.50		TUB																			
0.75	WS7	D	PP=152.0											-2.80		2.80					
0.85		D	PP=93.0																		
0.90- 1.00		SPTLS	SN=10																		
1.10- 1.20	WS7	D															2,2/3,4,4,3		-2.80		
1.00- 1.45		SPTLS	SN=14																		
		D																			
1.55	WS7	D	PP=44.0	3,4/4,5,4,4		-5.45		5.45													
1.65		D	PP=44.0																		
1.75		D	PP=59.0																		
1.80- 2.00	WS7	D	PP=49.0						Fine dark grey / dark brown sandy, firm SILT (Tidal Flat Deposits)		-5.45										
2.00- 2.45		SPTLS	SN=17																		
2.20- 2.30		D																			
2.55	WS7	D	PP=34.0											...from 3.50 to 5.00 Becoming incredibly waterlogged		-5.45					
2.65		D	PP=39.0																		
2.75		D	PP=39.0																		
2.80- 3.00	WS7	D	PP=39.0	End of W/S 5.45 m (Thickness of basal layer not proven)		-5.45															
2.95		SPTLS	SN=11																		
3.00- 3.45		D																			
3.55	WS7	D	PP=49.0						4,4/3,3,2,2		-5.45										
3.65		D	PP=83.0																		
3.75		D	PP=108.0																		
3.80- 4.00	WS7	D	PP=69.0													-5.45					
3.85		SPTLS	SN=10																		
3.95		D																			
4.00- 4.45	WS7	D	PP=78.0	2,2/3,2,3,3		-5.45															
		SPTLS	SN=10																		
		D																			
4.55	WS7	D	PP=44.0								-5.45										
4.65		D	PP=59.0																		
4.75		D	PP=69.0																		
4.80- 5.00	WS7	D	PP=69.0													-5.45					
4.85		SPTLS	SN=11																		
4.95		D																			
5.00- 5.45	WS7	D	PP=39.0			-5.45															
		SPTLS	SN=11																		
		D																			
Remarks:									Logged By: CS		Checked By:										
									Scale: 1:50		Approved By:										
Notes: For explanation of symbols and abbreviations, see Key Sheet.									FIG No.		Fig 2										

Equipment & Methods. PM Sampling LtdSupport Used:None				Project Name: Sutton Bridge Project Location: Spalding, Lincolnshire Client: Lincoln Jack Ltd / Alan Brown Development Services Ltd		Job No: A1816							
Co-ordinates: E: N:				Ground Level (m):		Date Started:27/09/2018 Date Completed:27/09/2018							
Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)					
Depth (m)	No.	Type	Result										
0.05 ~~0.10~~ 0.25 ~~0.20~~ 0.35 0.45 ~~0.50~~ 0.65 0.75	WS8	D	PP=240.0 PP=294.0 PP=196.0	3,2/3,3,4,3	MADE GROUND: Turf over topsoil (Made Ground)	-0.40		(0.40) 0.40					
0.20- 0.50 0.35 0.45 0.50- 0.80 0.65 0.75	WS8	J TUB D	PP=54.0 PP=0.0 PP=157.0 PP=98.0 PP=103.0		Fine light brown sandy SILT, with occasional silty sand layers (Tidal Flat Deposits)			-1.60		1.20 1.60			
1.00- 1.45 1.20- 1.30 1.40- 1.50 1.55 1.65 1.70- 1.80 1.75 1.85 1.95	WS8	SPTLS D J TUB D	SN=13 PP=20.0 PP=34.0 PP=29.0 PP=39.0 PP=29.0		Fine dark brown / grey sandy coarse SILT (Tidal Flat Deposits)						-5.45		1.60 <

Appendix 3

Dynamic Probe Soundings

DYNAMIC PROBE TEST RESULTS						Probe No:	DP1 (WS9)
Project Name:	Sutton Bridge					Lab. Order No:	n/a
Client Name:	Lincoln Jack Ltd					Project No:	A1816
Hammer Weight:	63.5 kg	Cone Diameter:	50.5 +/- .5			Date:	03/10/2018
Hammer Drop:	750 +/- 20	Rod Diameter:	35 mm			Ground Level (m)	0.00



AGS Ground Solutions

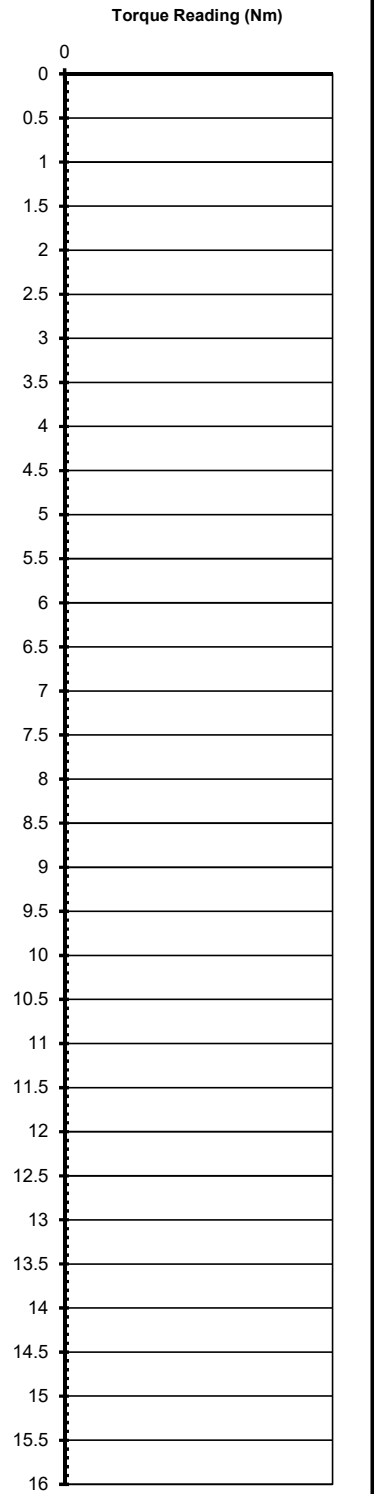
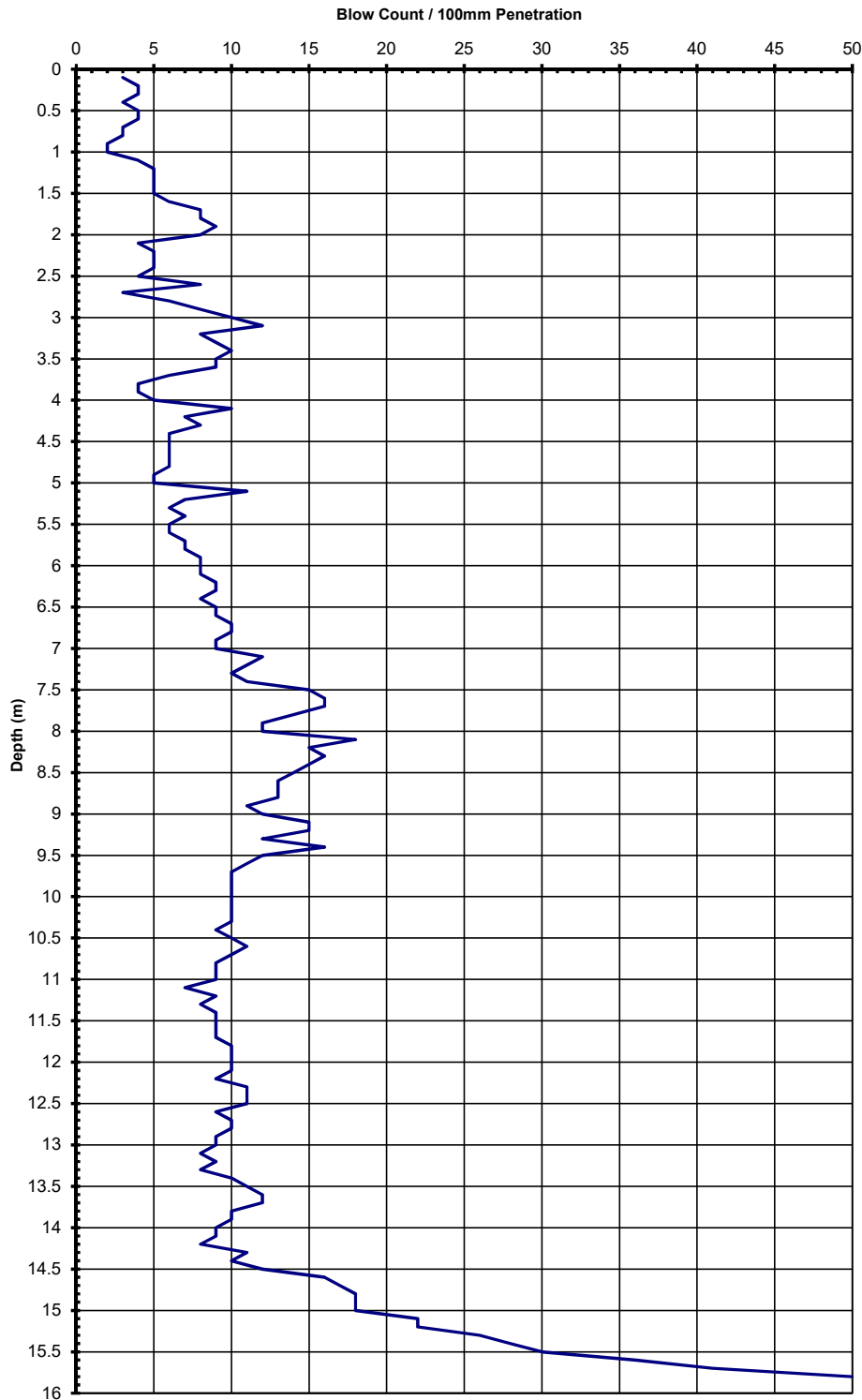
www.agsgroundolutions.com

Tested By: PM Sampling Approved By: PF

Checked By: CS



DYNAMIC PROBE TEST RESULTS						Probe No:	DP2 (WS10)
Project Name:	Sutton Bridge					Lab. Order No:	n/a
Client Name:	Lincoln Jack Ltd					Project No:	A1816
Hammer Weight:	63.5 kg	Cone Diameter:	50.5 +/- .5			Date:	03/10/2018
Hammer Drop:	750 +/- 20	Rod Diameter:	35 mm			Ground Level (m)	0.00



AGS Ground Solutions www.agsgroundolutions.com		
Tested By: PMS	Approved By: PF	
Checked By: CS		

Appendix 4

Trial Pit Logs

Equipment & Methods.
Pit Dimensions 1.60m by 0.65m.
Support Used:None

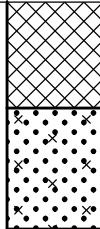
Project Name: Sutton Bridge
Project Location: Spalding, Lincolnshire
Client: Lincoln Jack Ltd / Alan Brown Development Services Ltd

Job No:
A1816

Co-ordinates.
E:
N:

Ground Level (m):

Date Started:27/09/2018
Date Completed:27/09/2018

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.70- 0.80 0.80	TP2 TP2	CC D		131 blows	MADE GROUND: Turf over topsoil (Made Ground)	-0.70		(0.70) 0.70 (0.80) 1.50
1.40- 1.60	TP2	U38			Fine yellow/brown SAND with abundant coarse silt. Little to no plasticity, and some cohesion (Tidal Flat Deposits)			
						End of Trial Pit 1.50 m (Thickness of basal layer not proven)		

Remarks:

Logged By: CS	Checked By:
------------------	-------------

Scale: 1:50	Approved By:
----------------	--------------

FIG No. **Fig 2**

Notes: For explanation of symbols and abbreviations, see Key Sheet.

AGS Ground Solutions Ltd 4 Bond Street, Redruth, Cornwall TR15 2QB 01209 202 409 agsgroundsolutions.com Trial Pit No. TP3 Trial Pit Log Sheet: 1 of 1																		
Equipment & Methods. Pit Dimensions 2.20m by 0.70m. Support Used:None					Project Name: Sutton Bridge Project Location: Spalding, Lincolnshire Client: Lincoln Jack Ltd / Alan Brown Development Services Ltd					Job No: A1816								
Co-ordinates: E: N:					Ground Level (m):					Date Started:27/09/2018 Date Completed:27/09/2018								
Samples and In situ Testing					Field Records					DESCRIPTION					Reduced Level (m)	Legend	Depth (Thick) (m)	
Depth (m)	No.	Type	Result															
	TP3 TP3	D U38		125 blows	MADE GROUND: Turf over topsoil (Made Ground)					-0.70		(0.70) 0.70						
1.30- 1.40 1.45 1.50	TP3 TP3 TP3	CC J TUB D			Fine yellow/brown SAND with abundant coarse silt. Little to no plasticity (Tidal Flat Deposits)					-2.30		(1.60) 2.30						
2.30	TP3	D			Fine dark grey/black SAND / coarse SILT. Organic, incredibly wet silicates. (Tidal Flat Deposits)					-3.00		(0.70) 3.00						
3.00	TP3	D			End of Trial Pit 3.00 m (Thickness of basal layer not proven)													
Remarks:															Logged By: CS		Checked By:	
															Scale: 1:50		Approved By:	
Notes: For explanation of symbols and abbreviations, see Key Sheet.															FIG No.		Fig 2	

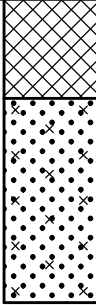
Job No:
A1816

Date Started:27/09/2018
Date Completed:27/09/2018

End of Trial Pit 3.00 m
(Thickness of basal layer not proven)

FIG No. **Fig 2**

Notes: For explanation of symbols and abbreviations, see Key Sheet.

 AGS Ground Solutions Ltd 4 Bond Street, Redruth, Cornwall TR15 2QB 01209 202 409 agsgroundsolutions.com					Trial Pit No. TP5 Trial Pit Log Sheet: 1 of 1						
Equipment & Methods. Pit Dimensions 2.20m by 0.70m. Support Used:None					Project Name: Sutton Bridge Project Location: Spalding, Lincolnshire Client: Lincoln Jack Ltd / Alan Brown Development Services Ltd					Job No: A1816	
Co-ordinates: E: N:					Ground Level (m):		Date Started:27/09/2018 Date Completed:27/09/2018				
Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)			
Depth (m)	No.	Type	Result								
0.80 0.80- 1.00	TP5 TP5	D U38		130 blows	MADE GROUND: Turf over topsoil (Made Ground)	-0.65		(0.65)			
1.45	TP5	D			Fine yellow/brown SAND with abundant coarse silt. Little to no plasticity, and some cohesion (Tidal Flat Deposits)			(1.35)			
2.00	TP5	D						-2.00	2.00		
						End of Trial Pit 2.00 m (Thickness of basal layer not proven)					
Remarks:							Logged By: CS		Checked By:		
							Scale: 1:50		Approved By:		
							FIG No. Fig 2				
Notes: For explanation of symbols and abbreviations, see Key Sheet.											

AGS-GS STANDARD TRIAL PIT LOG V2 A1816 SUTTON BRIDGE.GPJ GSG-AGS3-STD TEMPLATE.GDT 4/10/18

Job No:
A1816

Date Started:27/09/2018
Date Completed:27/09/2018

Reduced Level (m)	Legend	Depth (Thick) (m)
-0.40		(0.40)
		0.40
		(1.70)
-2.10		2.10

End of Trial Pit 2.10 m
(Thickness of basal layer not proven)

FIG No. **Fig 2**

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Appendix 5

Percolation Test Results

Soakaway Test Pit Results

Job Number: A1816	Trial Pit: TP1
Site: Sutton Bridge	Test No: 1
Location: Spalding, Lincolnshire	Of: 1
Client: Lincoln Jack Ltd / ABDS	Date: 03/10/2018
	Weather: Overcast / Windy

TRIAL PIT DIMENSIONS

Length (m): 1.6

Width (m): 0.65

Depth (m): 1.5

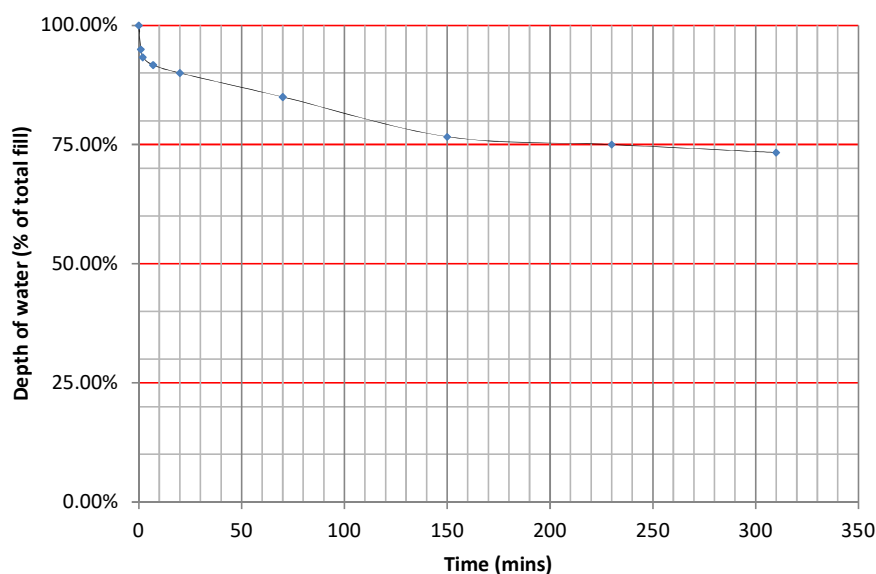
Invert Depth (m): 0.9

Test Time (mins): 310

% Drained: 26.67%

SOAKAGE RESULTS

Depth	(%)	Time
0.9	100.00%	0
0.93	95.00%	1
0.94	93.33%	2
0.95	91.67%	7
0.96	90.00%	20
0.99	85.00%	70
1.04	76.67%	150
1.05	75.00%	230
1.06	73.33%	310



INFILTRATION RATE

Depth (B.G.L) (m)	Infiltration Rate (m/s)
0.9 - 1.5	2.23E-07

Notes:

Departures from Specified Test Method:

Tested / Input By: CS Date: 03-Oct	Checked By: PF Date: 03-Oct	Approved By: PF Date: 03-Oct
---------------------------------------	--------------------------------	---------------------------------

AGS Ground Solutions: Site Investigation - Geotechnics - Mining - Contaminated Land

enquiries@agsgroundslutions.com - 01209 202 409

www.agsgroundslutions.com

Soakaway Test Pit Results

Job Number: A1816	Trial Pit: TP2
Site: Sutton Bridge	Test No: 1
Location: Spalding, Lincolnshire	Of: 1
Client: Lincoln Jack Ltd / ABDS	Date: 03/10/2018
	Weather: Overcast / Windy

TRIAL PIT DIMENSIONS

Length (m): 1.6

Width (m): 0.65

Depth (m): 1.5

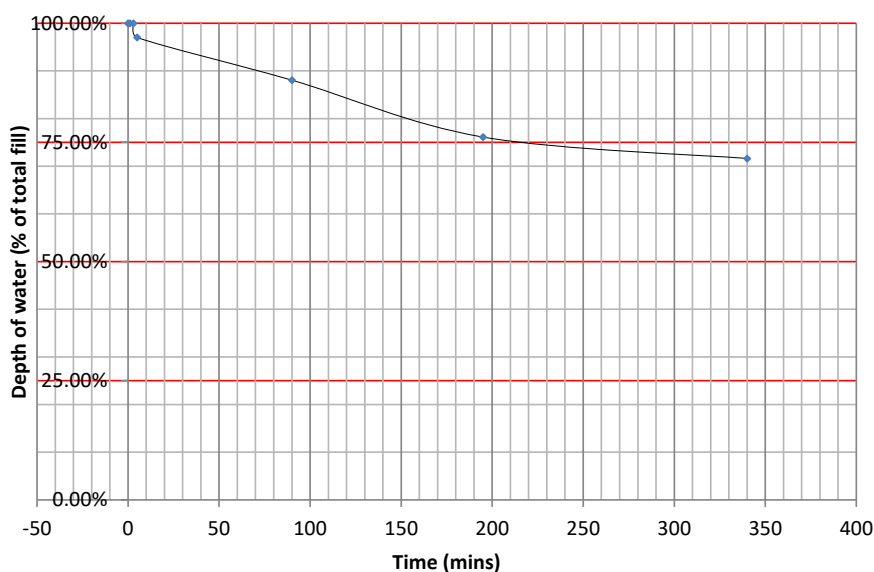
Invert Depth (m): 0.83

Test Time (mins): 340

% Drained: 28.36%

SOAKAGE RESULTS

Depth	(%)	Time
0.83	100.00%	0
0.83	100.00%	1
0.83	100.00%	3
0.85	97.01%	5
0.91	88.06%	90
0.99	76.12%	195
1.02	71.64%	340



INFILTRATION RATE

Depth (B.G.L) (m)	Infiltration Rate (m/s)
0.83 - 1.5	2.71E-07

Notes:

Departures from Specified Test Method:

Tested / Input By: CS Date: 03-Oct	Checked By: PF Date: 03-Oct	Approved By: PF Date: 03-Oct
--	-----------------------------------	------------------------------------

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enquiries@agsgroundslutions.com - 01209 202 409

www.agsgroundslutions.com

Appendix 6

Geotechnical Laboratory Test Results



TEST CERTIFICATE

Liquid and Plastic Limits

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



4041

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

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 09/10/2018
Sampled By: Not Given

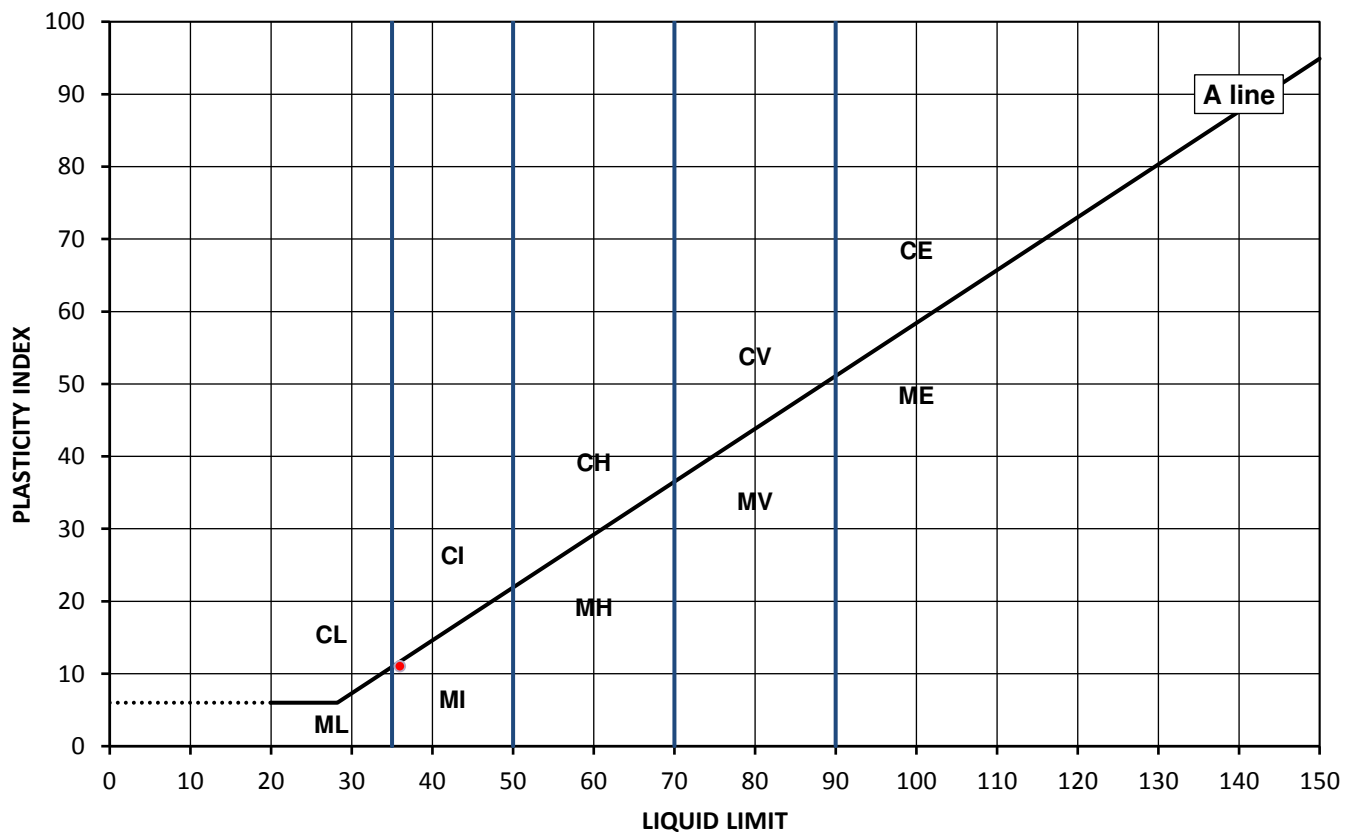
Test Results

Laboratory Reference: 1058098
Hole No.: TP2
Sample Reference: Not Given
Soil Description: Brown sandy CLAY

Depth Top [m]: 0.70
Depth Base [m]: Not Given
Sample Type: C

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
11	36	25	11	100



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

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

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

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The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland.*



TEST CERTIFICATE

Liquid and Plastic Limits

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



4041

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

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 09/10/2018
Sampled By: Not Given

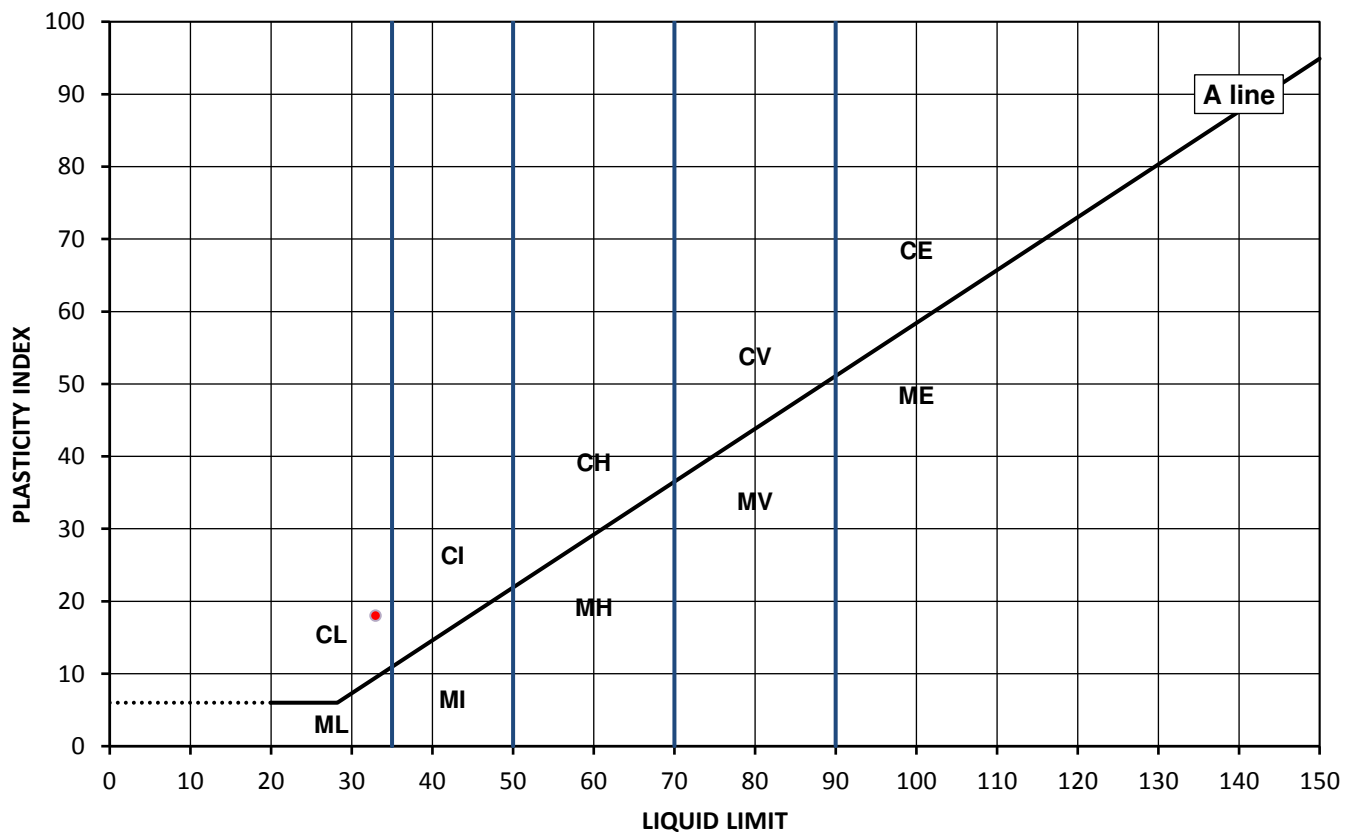
Test Results

Laboratory Reference: 1058101
Hole No.: TP3
Sample Reference: Not Given
Soil Description: Brown very clayey SAND

Depth Top [m]: 1.30
Depth Base [m]: Not Given
Sample Type: C

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
27	33	15	18	100



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

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

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

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TEST CERTIFICATE

Liquid and Plastic Limits

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



4041

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

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 09/10/2018
Sampled By: Not Given

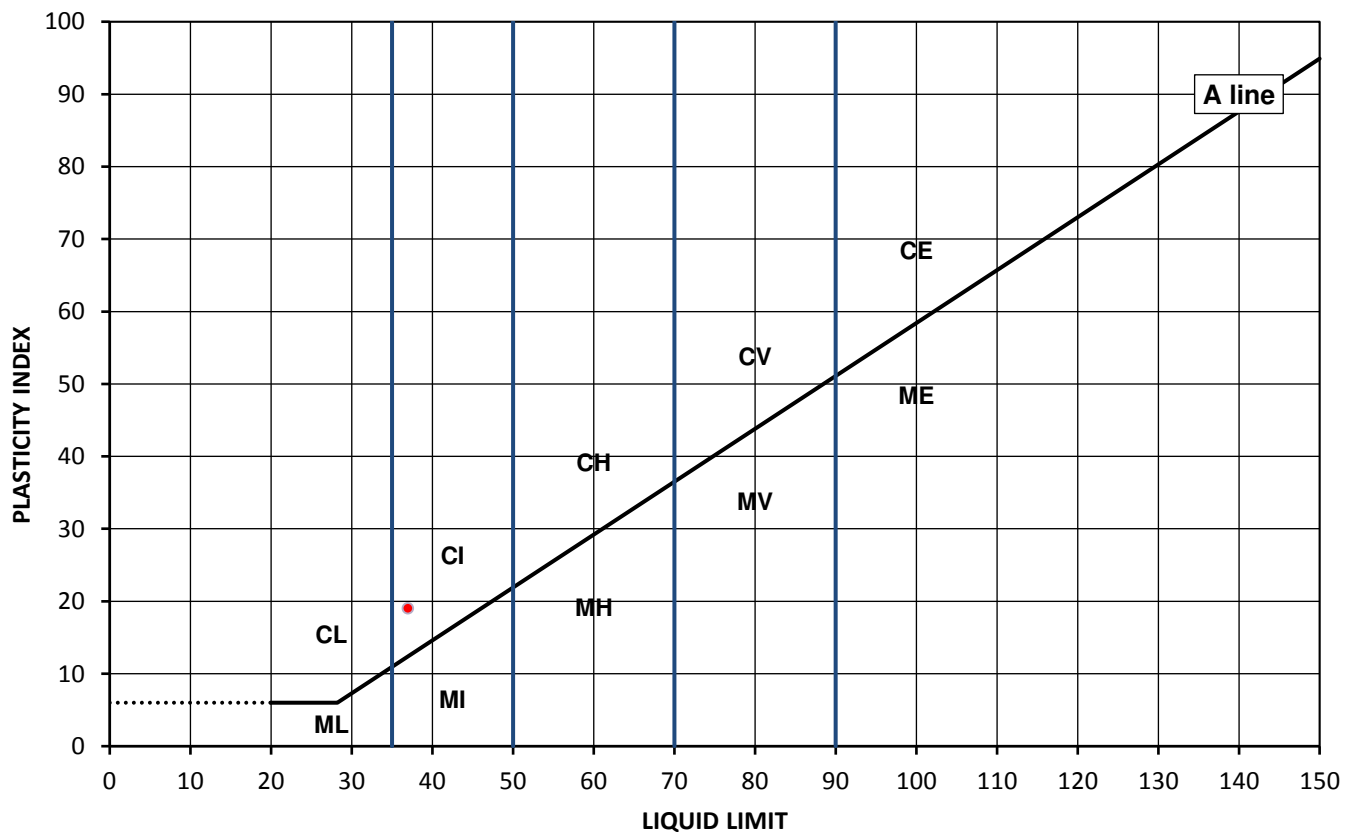
Test Results

Laboratory Reference: 1058105
Hole No.: TP7
Sample Reference: Not Given
Soil Description: Brown slightly sandy CLAY

Depth Top [m]: 1.10
Depth Base [m]: Not Given
Sample Type: C

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	37	18	19	100



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

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

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

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



4041

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

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

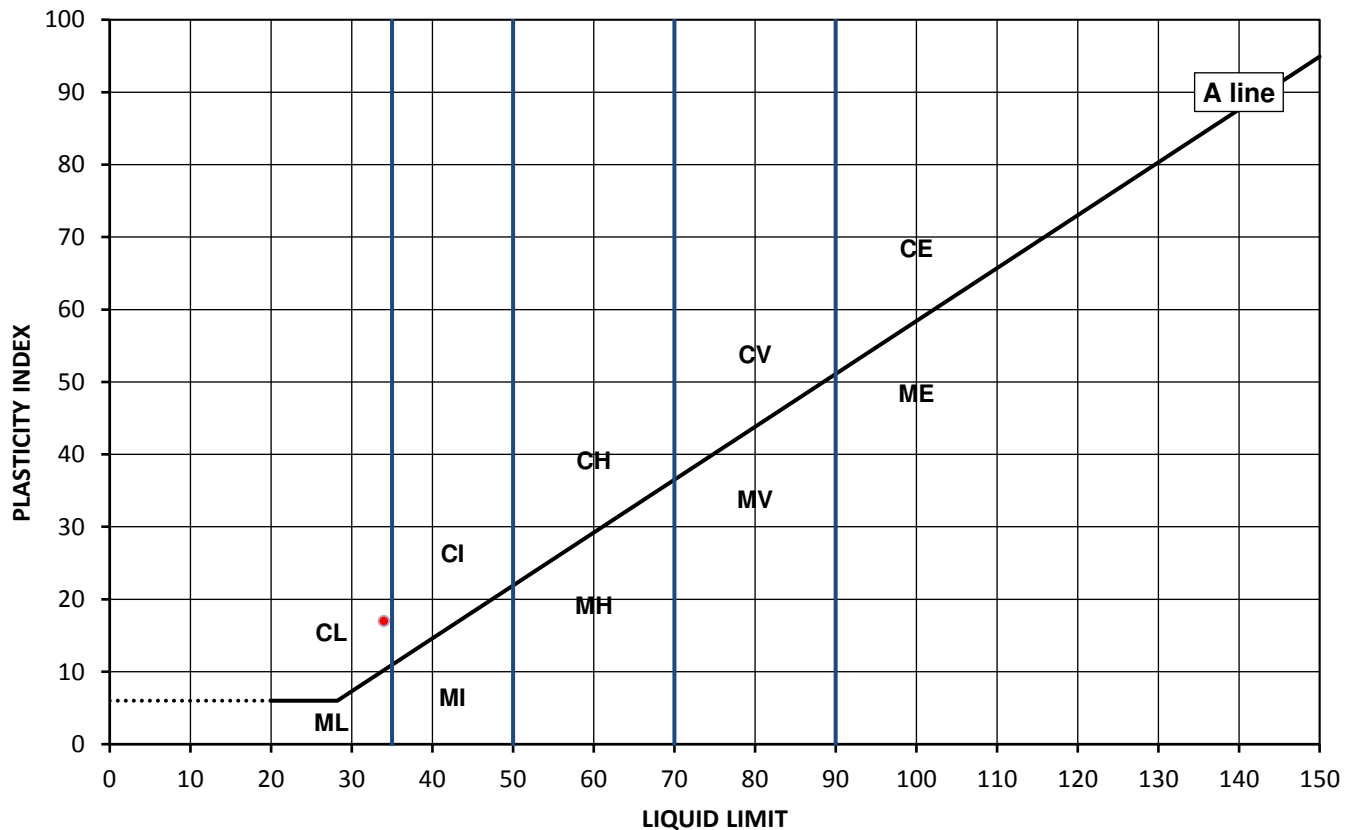
Test Results

Laboratory Reference: 1058107
Hole No.: WS1
Sample Reference: Not Given
Soil Description: Brown clayey SAND

Depth Top [m]: 3.70
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
27	34	17	17	100



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

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

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

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TEST CERTIFICATE

Liquid and Plastic Limits

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



4041

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

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

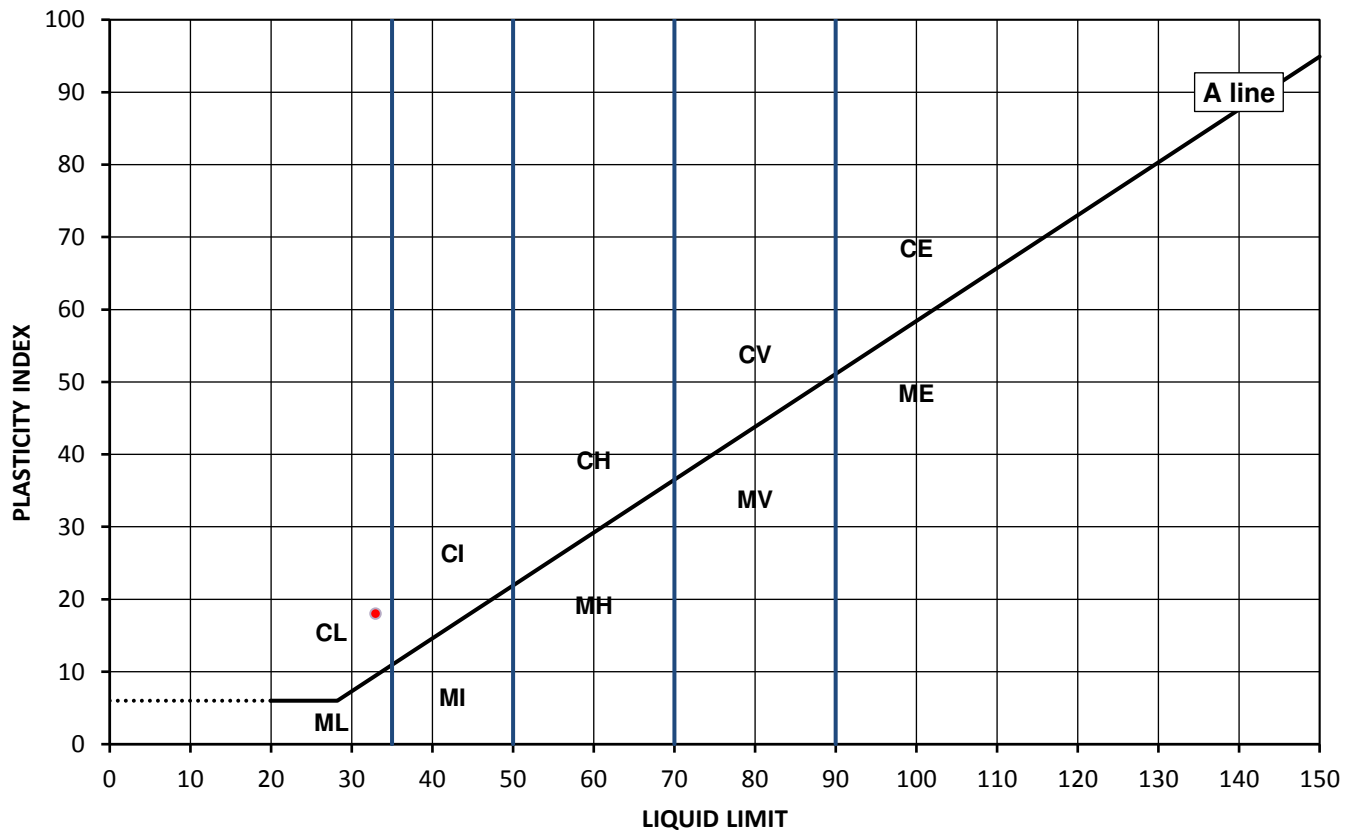
Test Results

Laboratory Reference: 1058108
Hole No.: WS3
Sample Reference: Not Given
Soil Description: Brown clayey SAND

Depth Top [m]: 4.70
Depth Base [m]: 4.80
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	33	15	18	100



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

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

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

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TEST CERTIFICATE

Liquid and Plastic Limits

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



4041

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

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

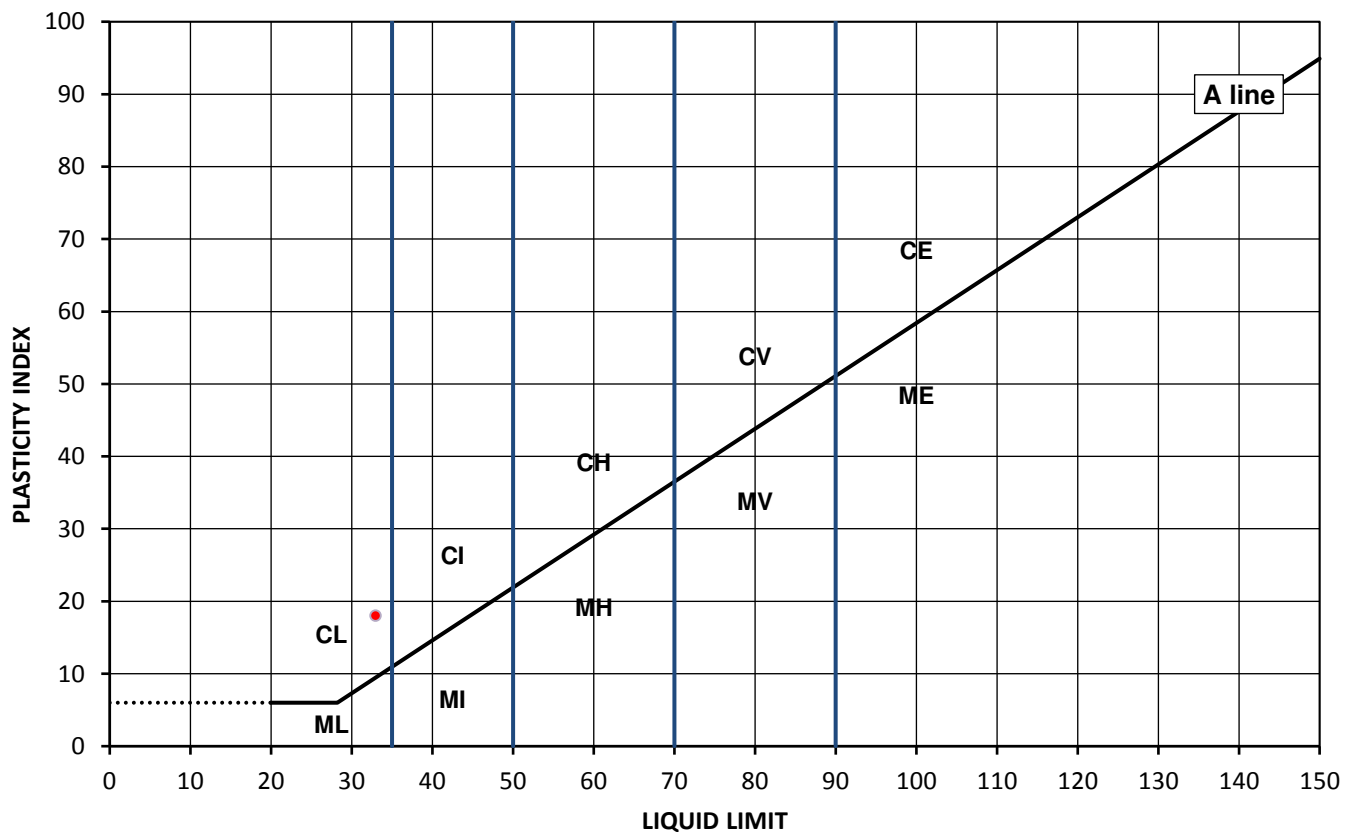
Test Results

Laboratory Reference: 1058109
Hole No.: WS5
Sample Reference: Not Given
Soil Description: Brown clayey SAND

Depth Top [m]: 2.40
Depth Base [m]: 2.50
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	33	15	18	100



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

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

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



TEST CERTIFICATE

Liquid and Plastic Limits

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



4041

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

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

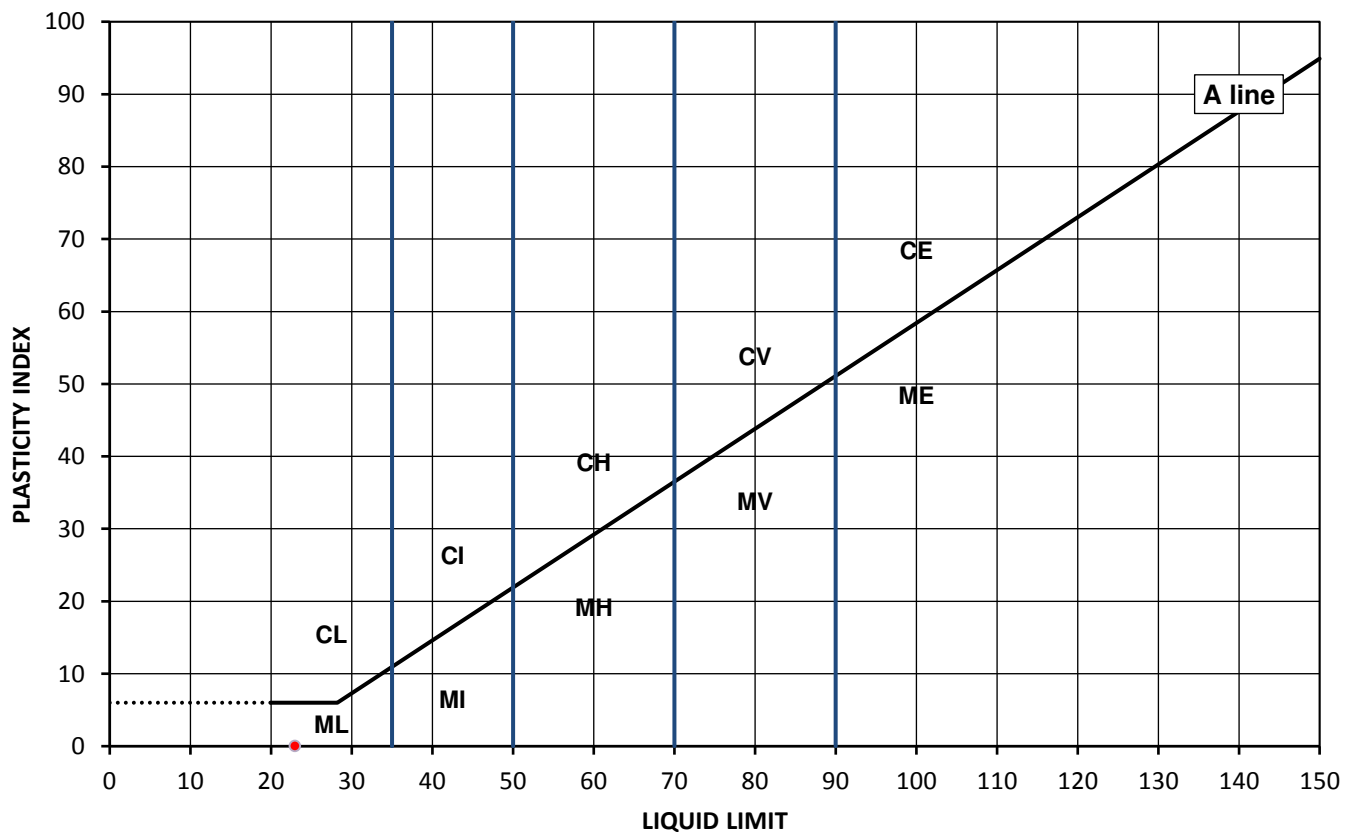
Test Results

Laboratory Reference: 1058119
Hole No.: WS6
Sample Reference: Not Given
Soil Description: Brown clayey SAND

Depth Top [m]: 1.50
Depth Base [m]: 1.70
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	23	NP	N/A	100



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

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

Remarks: NP – non plastic

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

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TEST CERTIFICATE

Liquid and Plastic Limits

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



4041

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

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

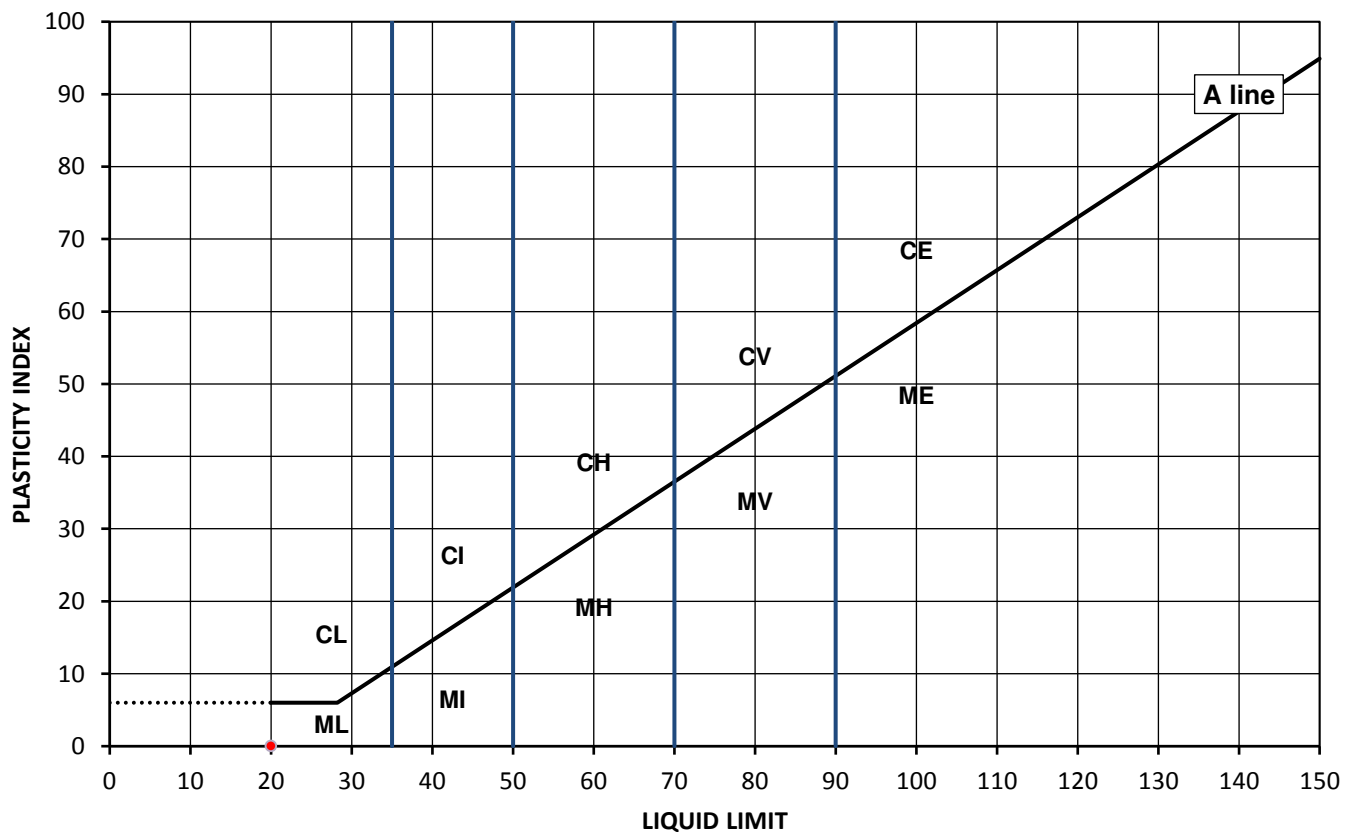
Test Results

Laboratory Reference: 1058121
Hole No.: WS6
Sample Reference: Not Given
Soil Description: Brown very clayey SAND

Depth Top [m]: 3.00
Depth Base [m]: 3.20
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	20	NP	N/A	100



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

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

Remarks: NP – non plastic

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

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4041

Client: AGS Ground Solutions Ltd
 Client Address: 4 Bond Street
 Redruth
 Cornwall, TR15 2QB
 Contact: Chloe Sheppard-Muir
 Site Name: A1816
 Site Address: Not Given

SUMMARY REPORT

Summary of Classification Test Results

Tested in Accordance with:

MC by BS 1377-2: 1990: Clause 3.2; Atterberg by BS 1377-2: 1990: Clause 4.3, Clause 4.4 and 5; PD by BS 1377-2: 1990: Clause 8.2

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



Environmental Science

Client Reference: A1816
 Job Number: 18-12570
 Date Sampled: Not Given
 Date Received: 01/10/2018
 Date Tested: 19/10/2018
 Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	MC#	Atterberg#				Density		Total Porosity				
		Reference	Depth Top m	Depth Base m	Type				% Passing 425um %	LL %	PL %	PI %	bulk Mg/m3	PD Mg/m3					
1058097	TP1	Not Given	0.70	Not Given	U	Light brown SILTSTONE		9.9											
1058098	TP2	Not Given	0.70	Not Given	C	Brown sandy CLAY	Atterberg 1 Point	11	100	36	25	11							
1058099	TP2	Not Given	1.40	Not Given	U	Brown silty CLAY		26											
1058100	TP3	Not Given	0.75	Not Given	U	Brown clayey SAND		22											
1058101	TP3	Not Given	1.30	Not Given	C	Brown very clayey SAND	Atterberg 1 Point	27	100	33	15	18							
1058102	TP4	Not Given	1.50	Not Given	U	Brown clayey SAND		22											
1058103	TP5	Not Given	0.80	Not Given	U	Brown silty CLAY		24											
1058104	TP6	Not Given	0.90	Not Given	U	Brown clayey SAND		25											
1058105	TP7	Not Given	1.10	Not Given	C	Brown slightly sandy CLAY	Atterberg 1 Point	22	100	37	18	19							
1058106	TP8	Not Given	0.90	Not Given	U	Brown silty CLAY		22											

Note: # UKAS accredited; NP - Non plastic

Comments:

Approved: Dariusz Piotrowski
 PL Laboratory Manager Geotechnical Section
 Date Reported: 23/10/2018

Signed: Darren Berrill
 Geotechnical General Manager

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4041

Client: AGS Ground Solutions Ltd
 Client Address: 4 Bond Street
 Redruth
 Cornwall, TR15 2QB
 Contact: Chloe Sheppard-Muir
 Site Name: A1816
 Site Address: Not Given

SUMMARY REPORT

Summary of Classification Test Results

Tested in Accordance with:

MC by BS 1377-2: 1990: Clause 3.2; Atterberg by BS 1377-2: 1990: Clause 4.3, Clause 4.4 and 5; PD by BS 1377-2: 1990: Clause 8.2

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



Environmental Science

Client Reference: A1816
 Job Number: 18-12570
 Date Sampled: Not Given
 Date Received: 01/10/2018
 Date Tested: 08/10/2018
 Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	MC#	Atterberg#				Density		Total Porosity				
		Reference	Depth Top m	Depth Base m	Type				% Passing 425um %	LL %	PL %	PI %	bulk Mg/m3	PD Mg/m3					
1058107	WS1	Not Given	3.70	Not Given	D	Brown clayey SAND	Atterberg 1 Point	27	100	34	17	17							
1058108	WS3	Not Given	4.70	4.80	D	Brown clayey SAND	Atterberg 1 Point	26	100	33	15	18							
1058109	WS5	Not Given	2.40	2.50	D	Brown clayey SAND	Atterberg 1 Point	26	100	33	15	18							
1058110	WS5	Not Given	4.90	5.00	D	Brown SAND		24											
1058111	WS6	Not Given	0.50	0.70	D	Brown sandy CLAY		17											
1058119	WS6	Not Given	1.50	1.70	D	Brown clayey SAND	Atterberg 1 Point	22	100	23	NP	N/A							
1058120	WS6	Not Given	2.50	2.70	D	Brown SAND		26											
1058121	WS6	Not Given	3.00	3.20	D	Brown very clayey SAND	Atterberg 1 Point	22	100	20	NP	N/A							
1058122	WS6	Not Given	4.00	4.20	D	Brown SAND		21											
1058123	WS6	Not Given	4.80	5.00	D	Brown SAND		24											

Note: # UKAS accredited; NP - Non plastic

Comments:

Approved: Dariusz Piotrowski
 PL Laboratory Manager Geotechnical Section
 Date Reported: 23/10/2018

Signed:

Darren Berrill
 Geotechnical General Manager

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TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

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



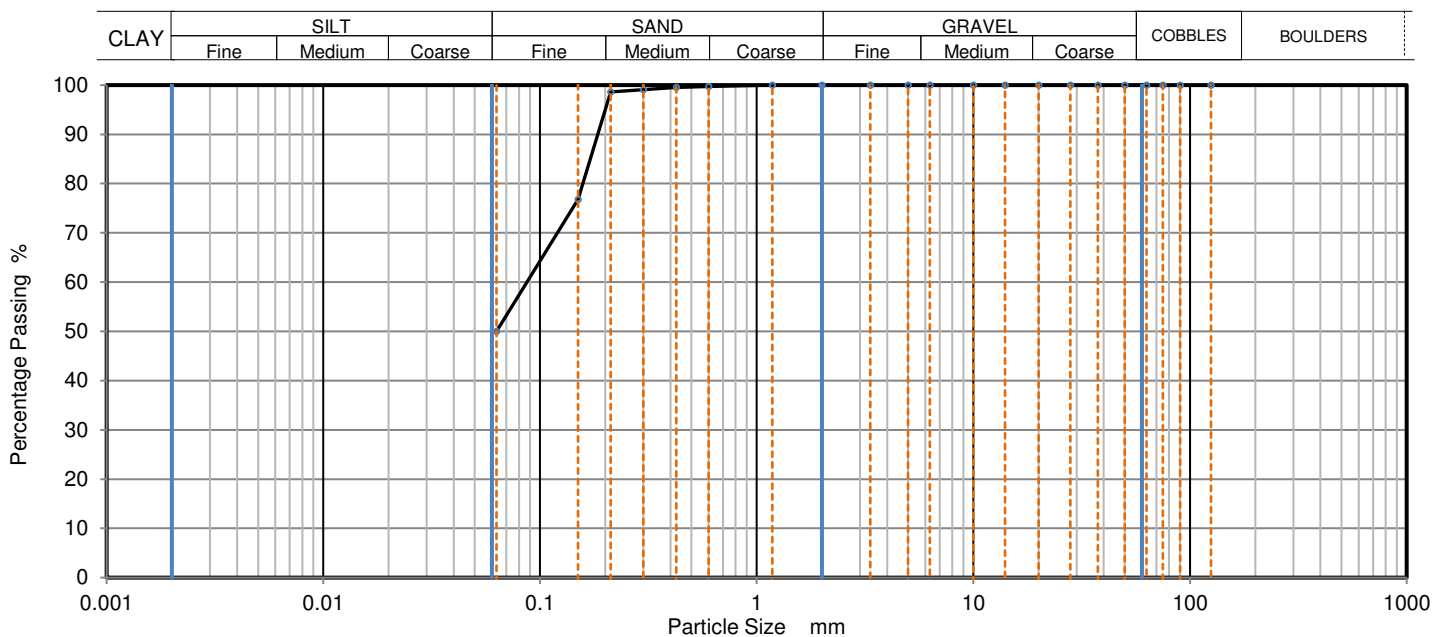
Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 09/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: 1058098
Hole No.: TP2
Sample Reference: Not Given
Sample Description: Brown sandy CLAY

Depth Top [m]: 0.70
Depth Base [m]: Not Given
Sample Type: C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	99		
0.15	77		
0.063	51		

Dry Mass of sample [g]: 302

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	49.30
Fines <0.063mm	50.70

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

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TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

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



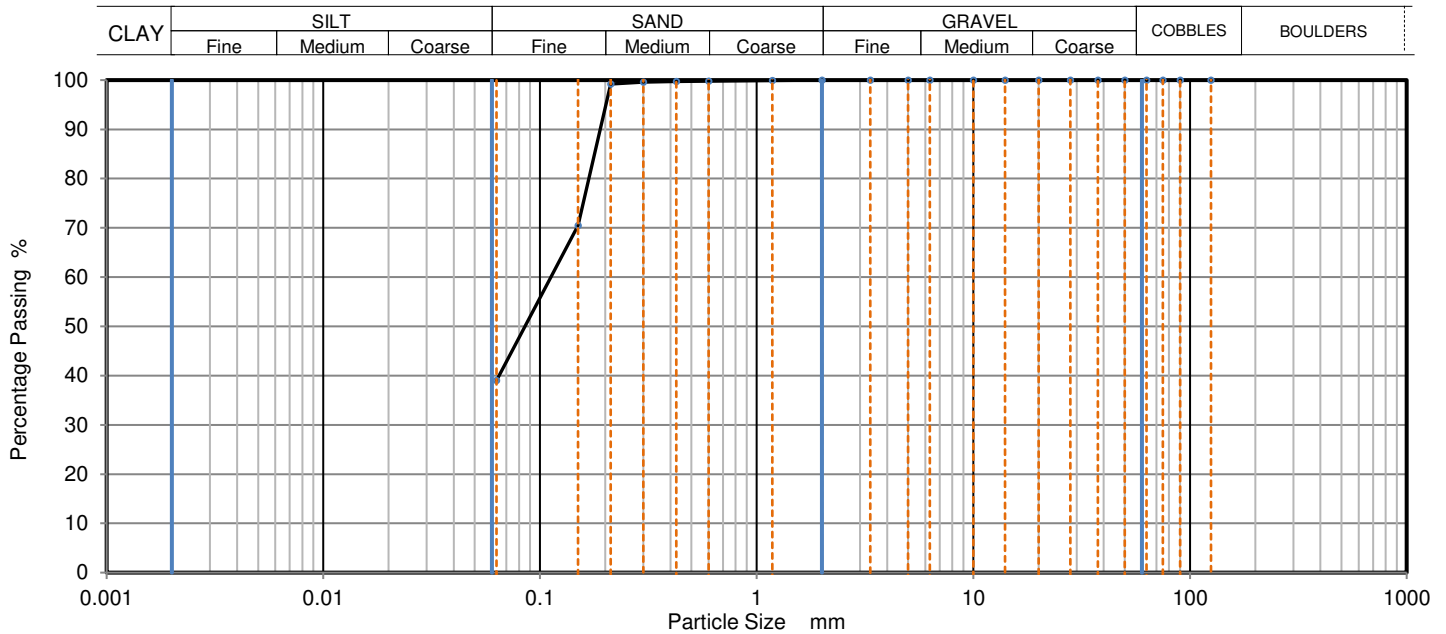
Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 09/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: 1058101
Hole No.: TP3
Sample Reference: Not Given
Sample Description: Brown very clayey SAND

Depth Top [m]: 1.30
Depth Base [m]: Not Given
Sample Type: C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	99		
0.15	71		
0.063	39		

Dry Mass of sample [g]: 252

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	60.60
Fines <0.063mm	39.40

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

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TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

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



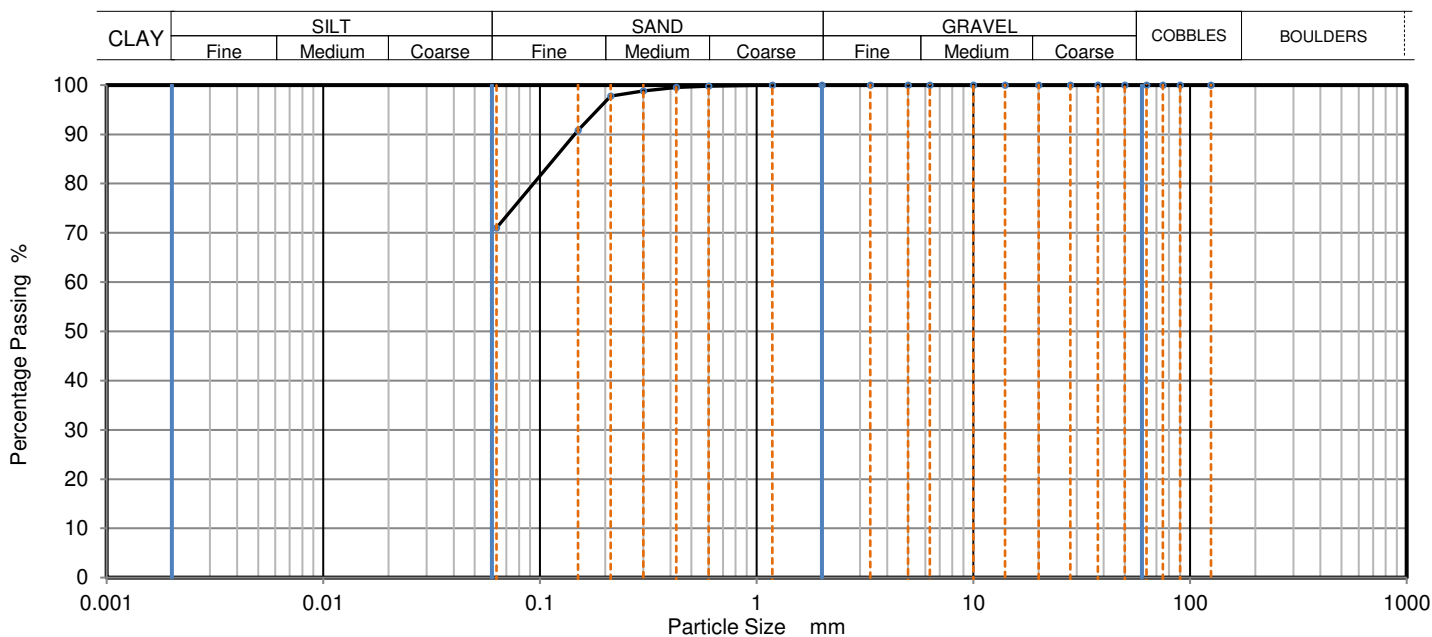
Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 09/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: 1058105
Hole No.: TP7
Sample Reference: Not Given
Sample Description: Brown slightly sandy CLAY

Depth Top [m]: 1.10
Depth Base [m]: Not Given
Sample Type: C



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	98		
0.15	91		
0.063	72		

Dry Mass of sample [g]: 272

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	28.10
Fines <0.063mm	71.90

Grading Analysis		
D100	mm	2
D60	mm	
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

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TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

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



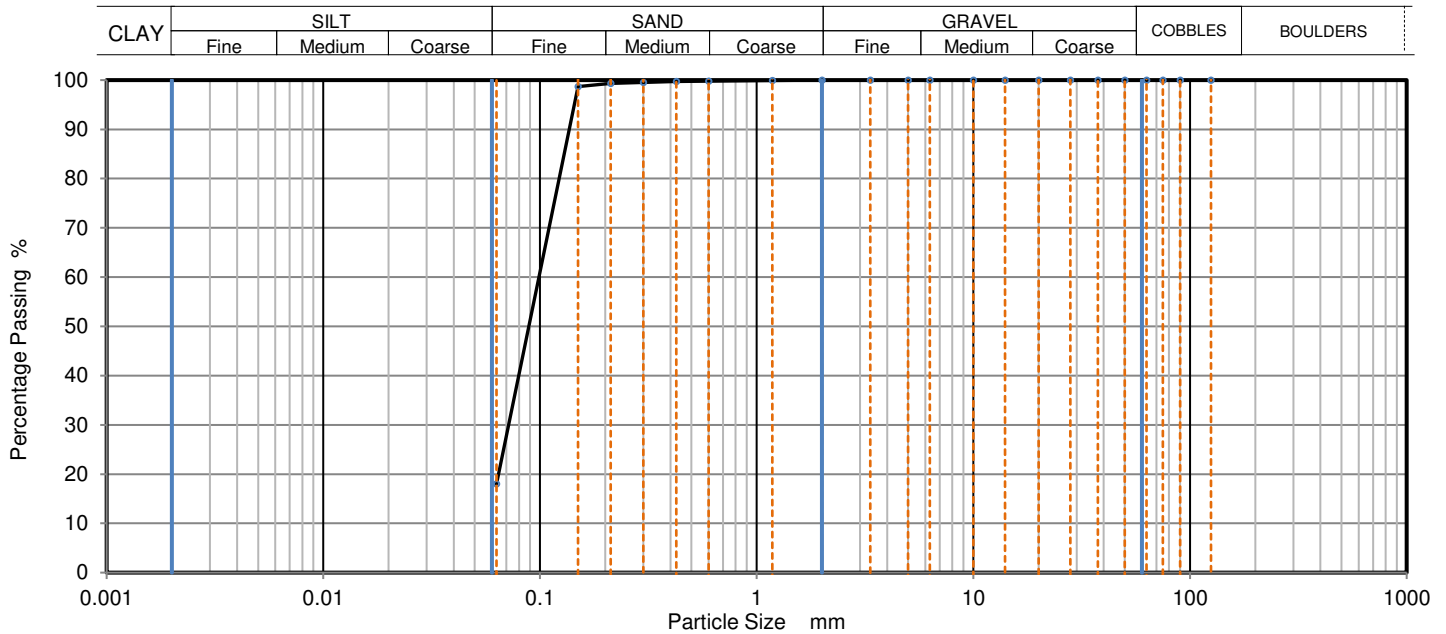
Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: 1058107
Hole No.: WS1
Sample Reference: Not Given
Sample Description: Brown clayey SAND

Depth Top [m]: 3.70
Depth Base [m]: Not Given
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	99		
0.15	99		
0.063	19		

Dry Mass of sample [g]: 118

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	81.30
Fines <0.063mm	18.70

Grading Analysis	
D100	mm 3.35
D60	mm 0.0986
D30	mm 0.0712
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

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TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

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



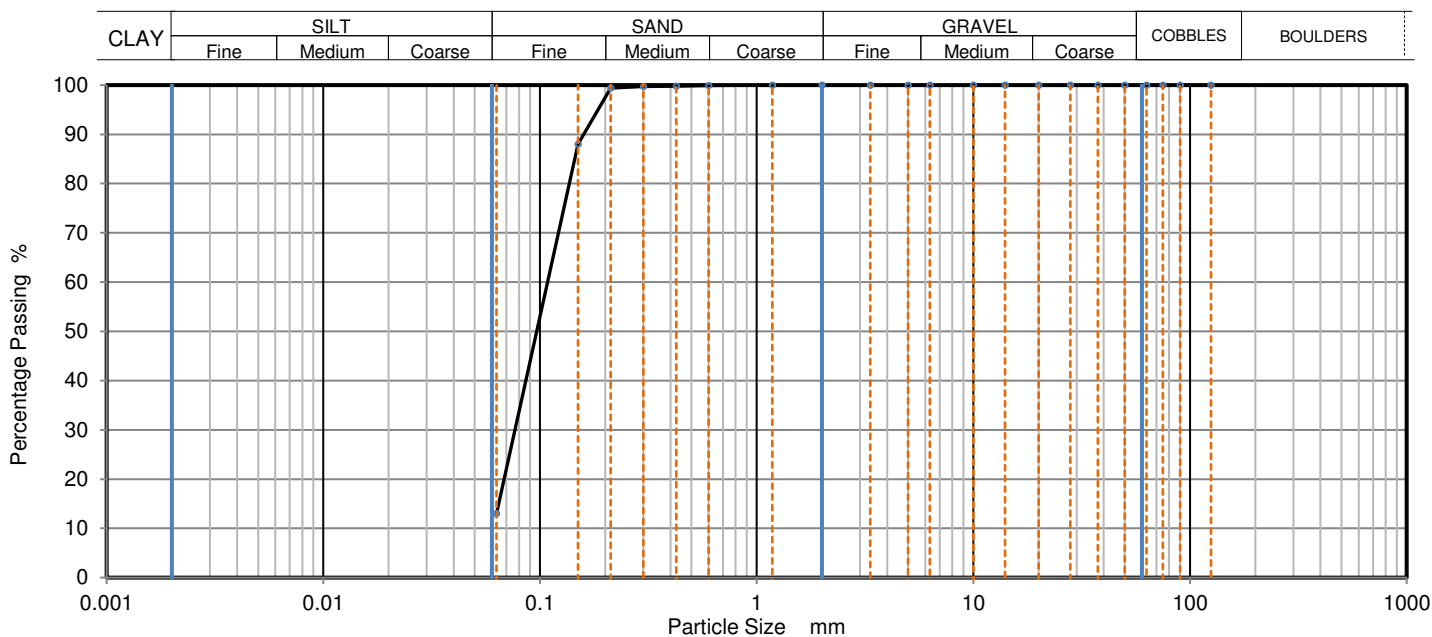
Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: 1058108
Hole No.: WS3
Sample Reference: Not Given
Sample Description: Brown clayey SAND

Depth Top [m]: 4.70
Depth Base [m]: 4.80
Sample Type: D





TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

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



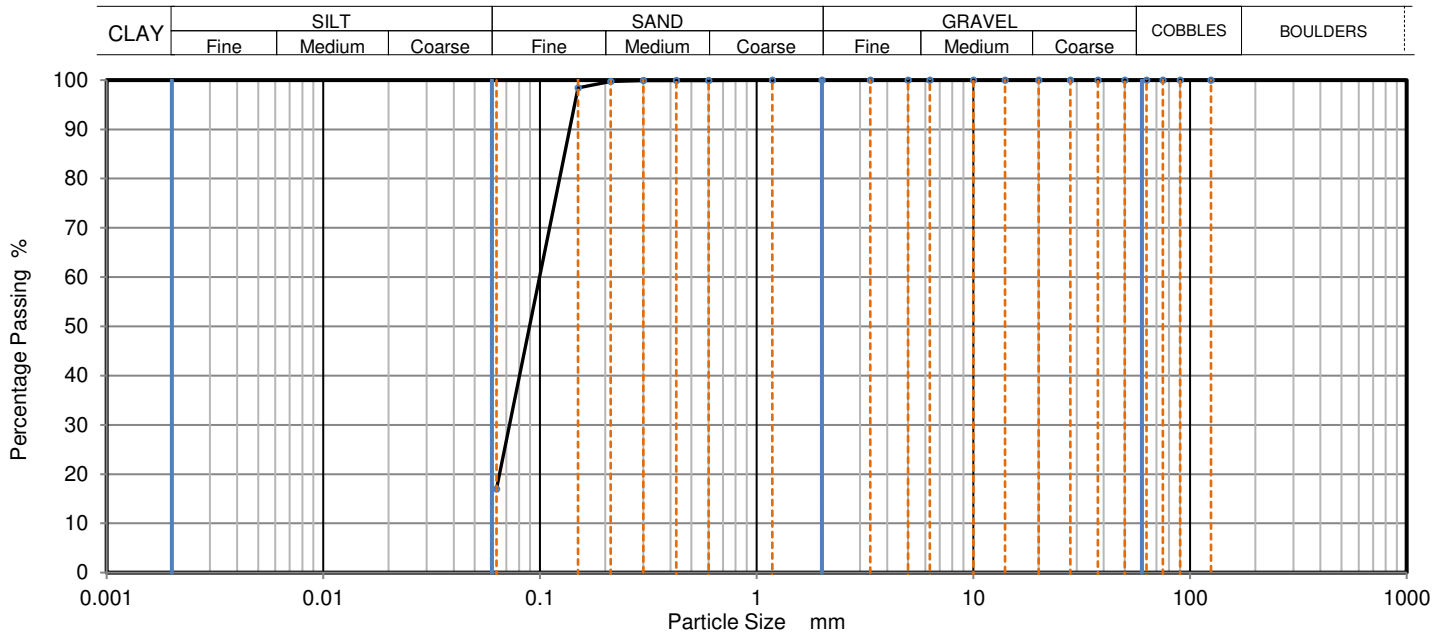
Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: 1058109
Hole No.: WS5
Sample Reference: Not Given
Sample Description: Brown clayey SAND

Depth Top [m]: 2.40
Depth Base [m]: 2.50
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	98		
0.063	17		

Dry Mass of sample [g]: 182

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	83.00
Fines <0.063mm	17.00

Grading Analysis		
D100	mm	2
D60	mm	0.0996
D30	mm	0.0724
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

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TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

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



Environmental Science

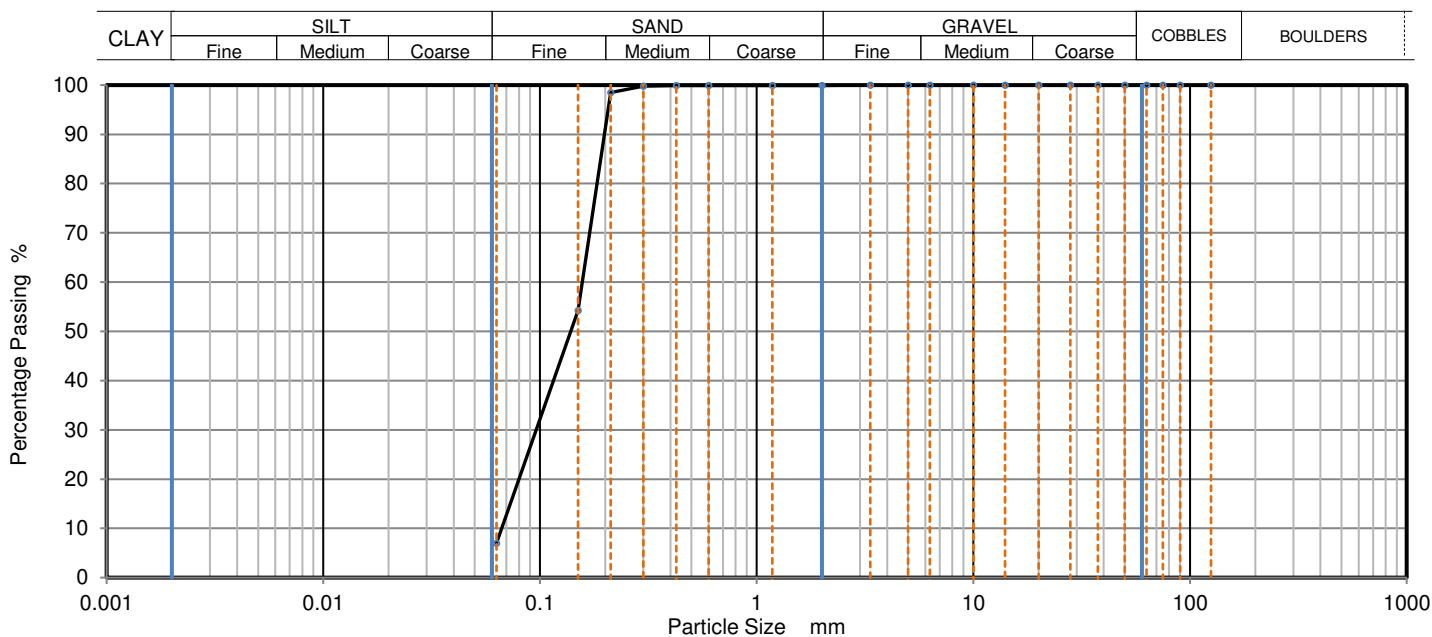
Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: 1058119
Hole No.: WS6
Sample Reference: Not Given
Sample Description: Brown clayey SAND

Depth Top [m]: 1.50
Depth Base [m]: 1.70
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	99		
0.15	54		
0.063	8		

Dry Mass of sample [g]: 176

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.10
Sand	92.50
Fines <0.063mm	7.50

Grading Analysis		
D100	mm	3.35
D60	mm	0.157
D30	mm	0.0957
D10	mm	0.066
Uniformity Coefficient		2.4
Curvature Coefficient		0.88

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

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TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

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



Environmental Science

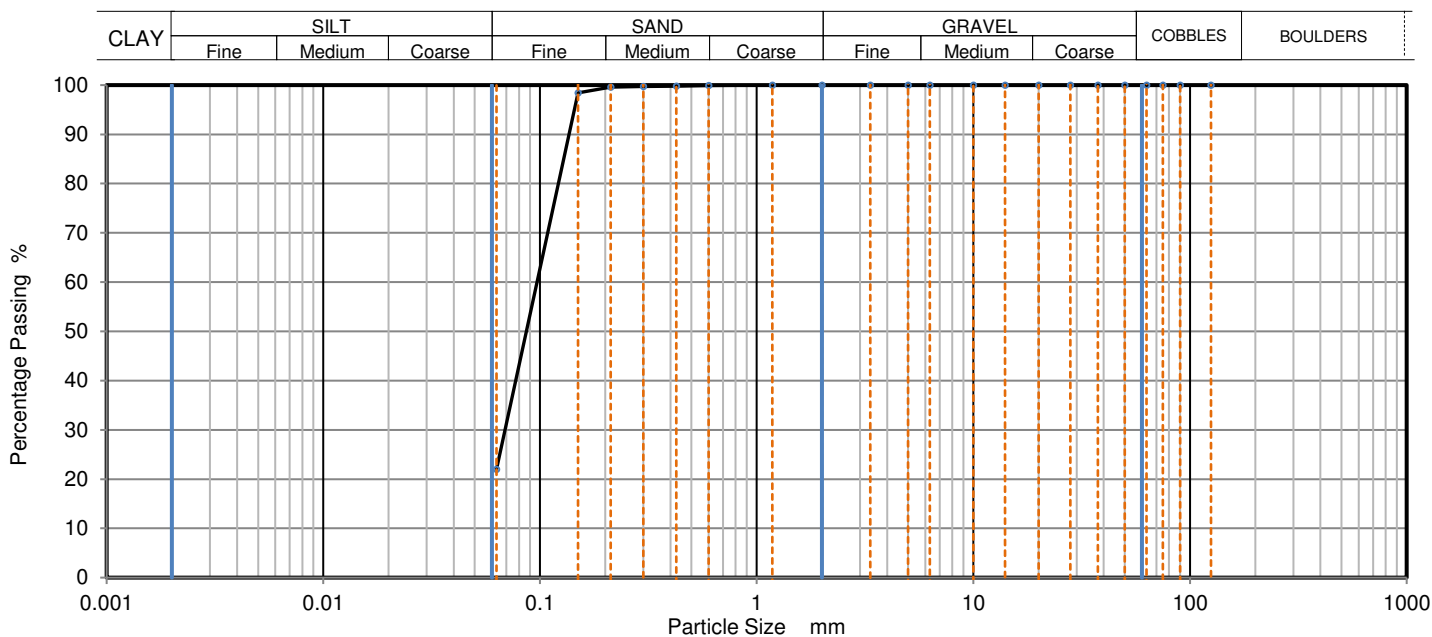
Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: 1058121
Hole No.: WS6
Sample Reference: Not Given
Sample Description: Brown very clayey SAND

Depth Top [m]: 3.00
Depth Base [m]: 3.20
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	98		
0.063	22		

Dry Mass of sample [g]: 131

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	77.60
Fines <0.063mm	22.40

Grading Analysis		
D100	mm	2
D60	mm	0.0968
D30	mm	0.0687
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

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One Dimensional Consolidation Test



Environmental Science

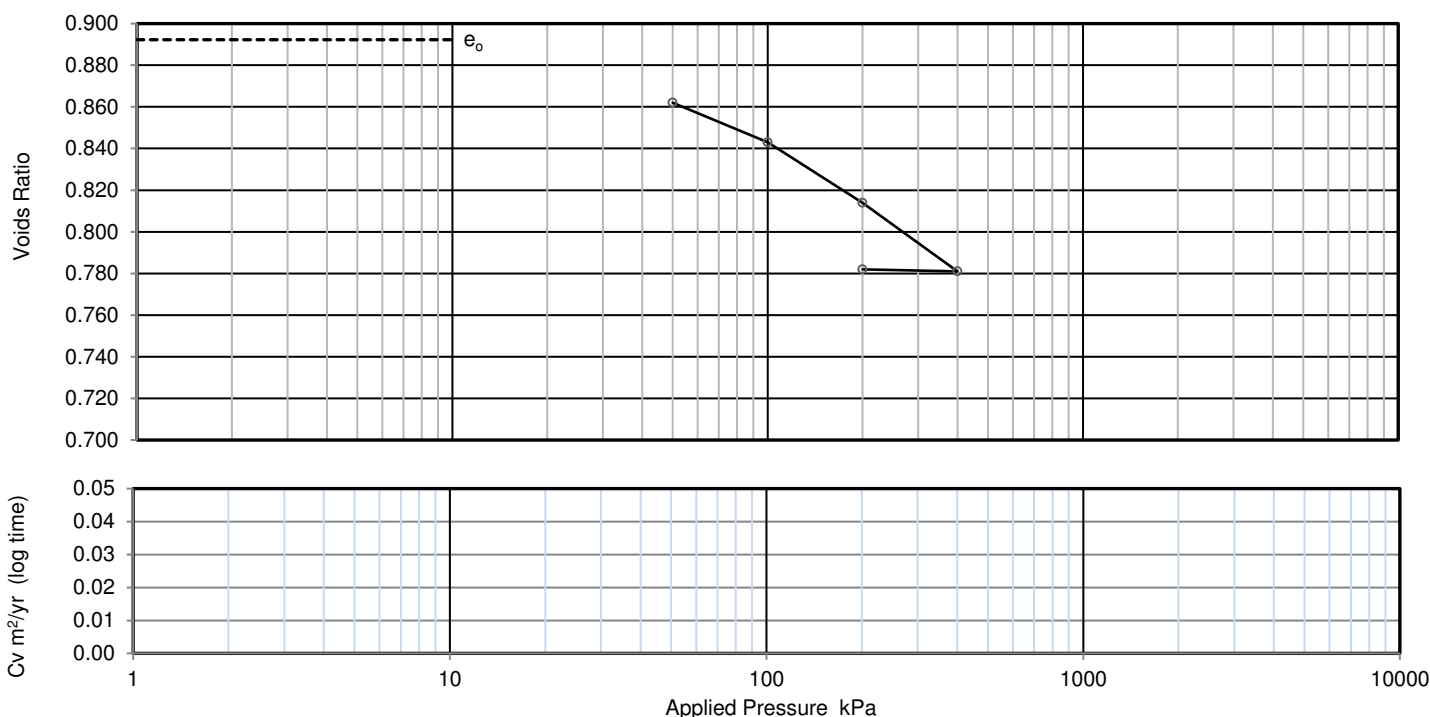
Tested in Accordance with: BS 1377-5: 1990: Clause 3

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 09/10/2018
Sampled By: Not Given

Laboratory Reference: Not Given
Hole No.: TP2
Sample Reference: 1058098
Sample Description: Brown sandy CLAY

Depth Top [m]: 0.70
Depth Base [m]: Not Given
Sample Type: C

[illegible]

Preparation

Index tests

Orientation of the sample

Particle density

Liquid limit

Plastic limit

Specimen details

Diameter

Height

Moisture Content

Bulk density

Dry density

Voids Ratio

Saturation

Avg. temperature for test

Swelling Pressure

Settlement on saturation

Vertical	
assumed	2.65 Mg/m3
N/A	%
N/A	%

Initial	Final	
50.01	-	mm
20.00	18.84	mm
11	28	%
1.55	1.91	Mg/m3
1.40	1.49	Mg/m3
0.892	0.782	
31	96	%
22.0		°C
Not measured		kPa
		%

Note: Cv corrected to 20°C

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
 **Date Reported:** 23/10/2018

Signed:

Darren Berrill
Geotechnical General Manager

GF 172.10

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One Dimensional Consolidation Test



Environmental Science

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 09/10/2018
Sampled By: Not Given

Depth Top [m]: 1.30
Depth Base [m]: Not Given
Sample Type: C



Initial	Final	
50.00	-	mm
19.96	18.95	mm
27	27	%
1.94	2.04	Mg/m3
1.52	1.61	Mg/m3
0.738	0.651	
97	110	%
22.0		°C
Not measured		kPa
		%

for and on behalf of i2 Analytical Ltd

One Dimensional Consolidation Test

Tested in Accordance with: BS 1377-5: 1990: Clause 3

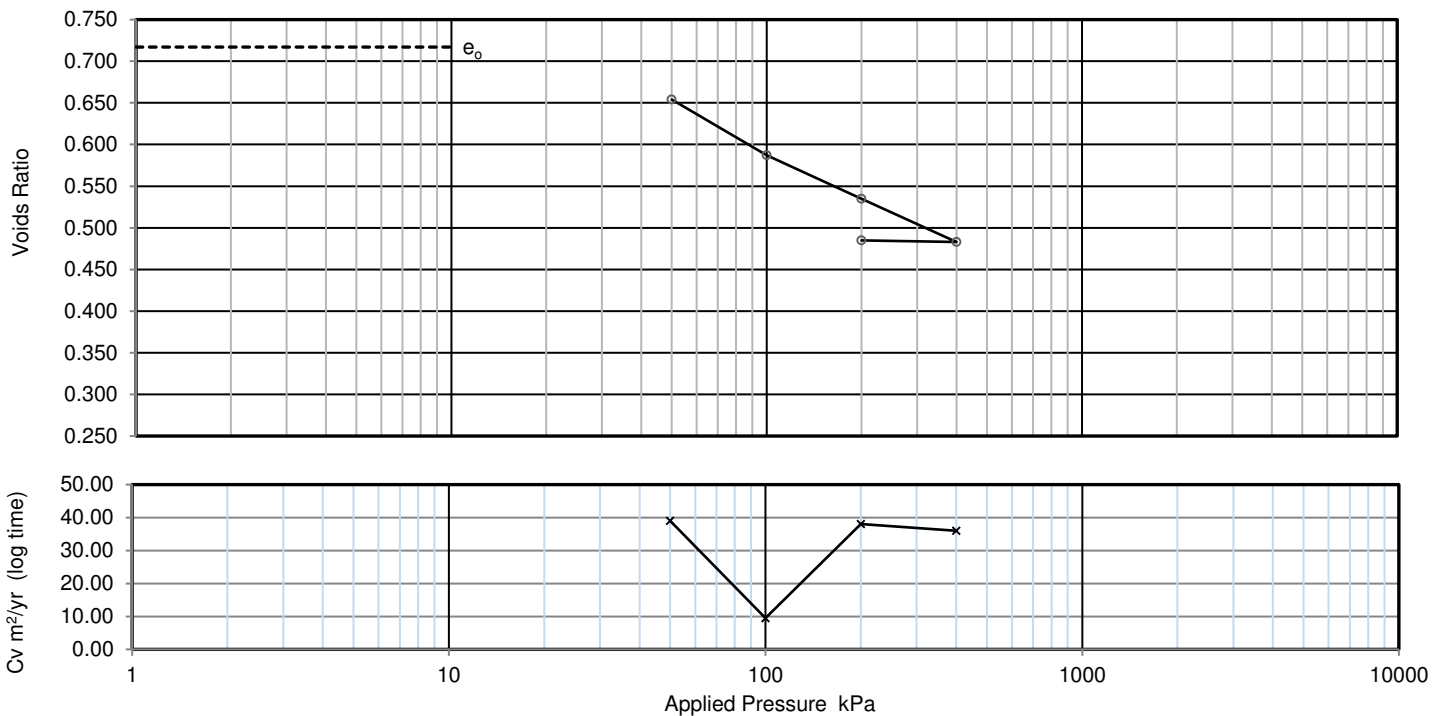
Client:	AGS Ground Solutions Ltd
Client Address:	4 Bond Street Redruth Cornwall, TR15 2QB
Contact:	Chloe Sheppard-Muir
Site Name:	A1816
Site Address:	Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 03/10/2018
Sampled By: Not Given

Test Results:

Laboratory Reference: Not Given
Hole No.: TP7
Sample Reference: 1058105
Sample Description: Brown slightly sandy CLAY

Depth Top [m]: 1.10
Depth Base [m]: Not Given
Sample Type: C

[illegible]

Preparation

Index tests

Orientation of the sample

Particle density

Liquid limit

Plastic limit

Specimen details

Diameter

Height

Moisture Content

Bulk density

Dry density

Voids Ratio

Saturation

Avg. temperature for test

Swelling Pressure

Settlement on saturation

Vertical		
assumed	2.65	Mg/m3
N/A		%
N/A		%

Initial	Final	
50.30	-	mm
20.27	17.53	mm
22	25	%
1.89	2.23	Mg/m3
1.54	1.78	Mg/m3
0.717	0.485	
83	136	%
22.0		°C
Not measured		kPa
		%

Note: Cv corrected to 20°C

Remarks:

Approved: Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section

Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 172.10

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TEST CERTIFICATE

Density Tests - Summary of Results

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



Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 01/10/2018
Date Tested: 08/10/2018
Sampled By: Not Given

Test results

Laboratory Reference	Location	Sample				Soil Description	Linear Measurement			Immersion in water			Water displacement			OMC/MDD		
		Reference	Top	Base	Type		Bulk density	Dry density	w	Bulk density	Dry density	w	Bulk density	Dry density	w	Bulk density	Dry density	w
							Mg/m3	Mg/m3	%	Mg/m3	Mg/m3	%	Mg/m3	Mg/m3	%	Mg/m3	Mg/m3	%
1058098	TP2	Not Given	0.70	Not Given	C	Brown sandy CLAY	1.55	1.40	10.5									
1058101	TP3	Not Given	1.30	Not Given	C	Brown very clayey SAND	1.94	1.52	27.1									
1058105	TP7	Not Given	1.10	Not Given	C	Brown slightly sandy CLAY	1.91	1.56	22.3									

Legend w moisture content of the density test specimen

Notes

Tests carried out in accordance with BS1377:Part2:1990 and the following clauses unless annotated otherwise

Tests carried out in accordance with BS1377:Part4:1990 and the following clause unless annotated otherwise

Linear measurement

Immersion in water

Water displacement

OMC/MDD by 2.5kg rammer

clause 7.2

clause 7.3

clause 7.4

clause 3.3

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 23/10/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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4041

TEST CERTIFICATE**Unconsolidated Undrained****Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

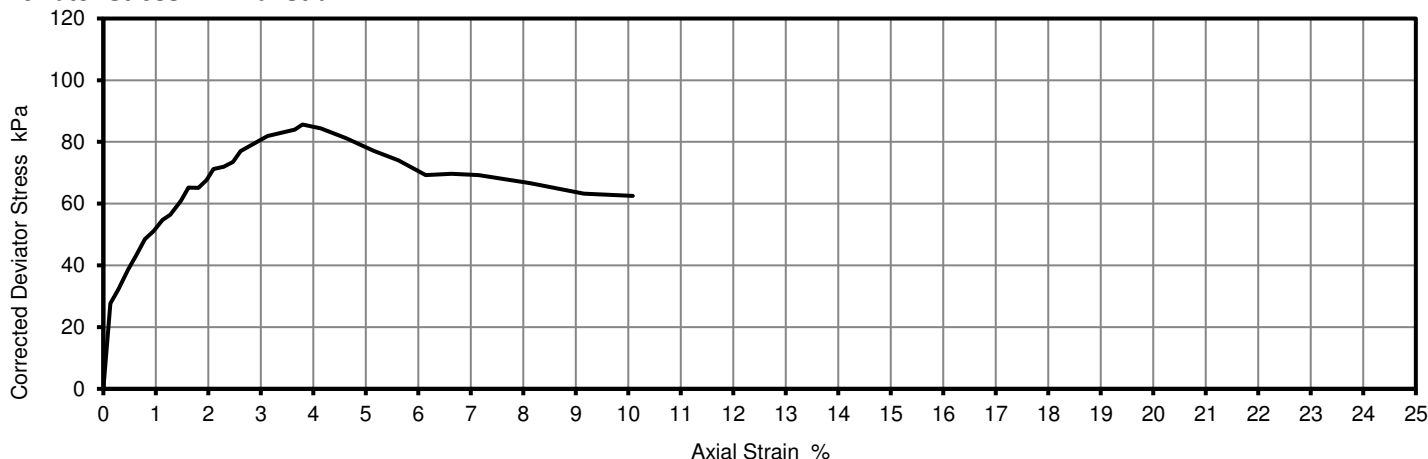
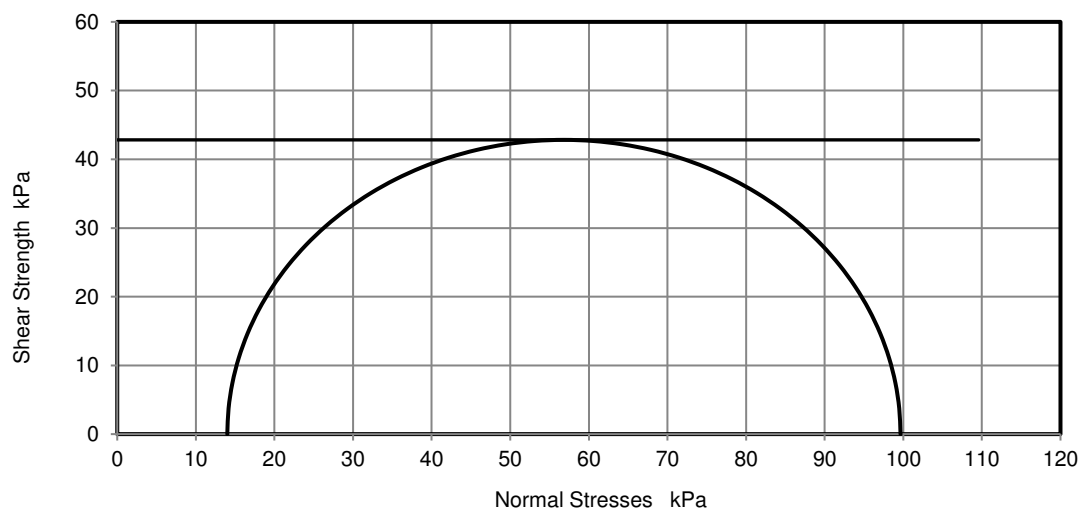
Environmental Science

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not GivenClient Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 10/01/2018
Date Tested: 09/10/2018
Sampled By: Not Given**Test Result**Laboratory Reference: 1058099
Hole No.: TP2
Sample Reference: Not Given
Sample Description: Brown silty CLAYDepth Top [m]: 1.40
Depth Base [m]: Not Given
Sample Type: U

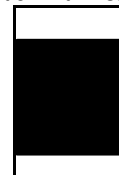
Test Number	1
Length	83.39 mm
Diameter	37.09 mm
Bulk Density	2.00 Mg/m ³
Moisture Content	26 %
Dry Density	1.59 Mg/m ³
Membrane Correction	0.73 kPa

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
14	kPa
3.8	%
86	kPa
43	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Compound	
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:**Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 23/10/2018Signed: Darren Berrill
Geotechnical General Manager

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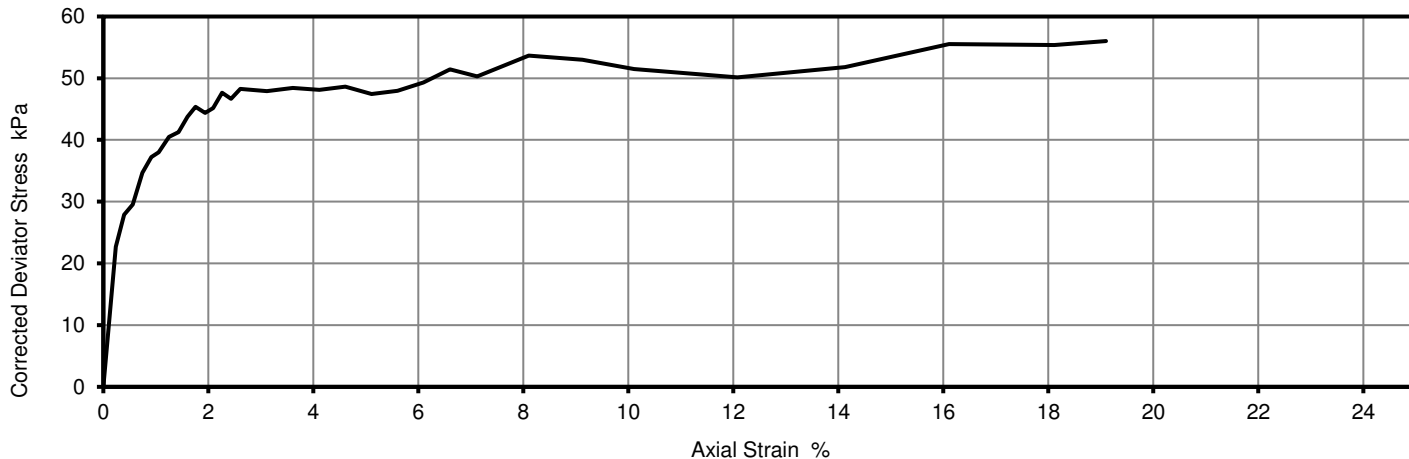
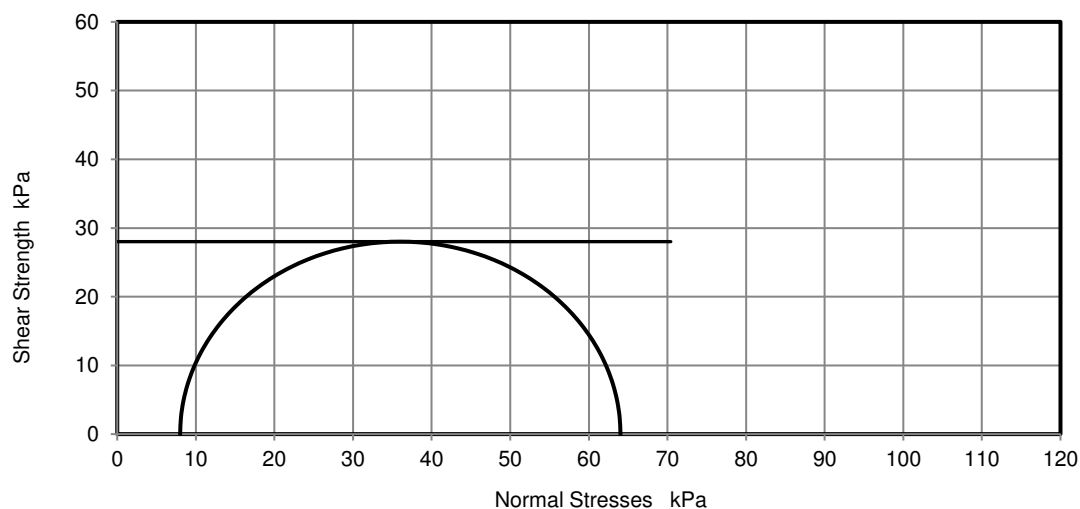
TEST CERTIFICATE**Unconsolidated Undrained****Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Environmental Science

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not GivenClient Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 10/01/2018
Date Tested: 09/10/2018
Sampled By: Not Given**Test Result**Laboratory Reference: 1058100
Hole No.: TP3
Sample Reference: Not Given
Sample Description: Brown clayey SANDDepth Top [m]: 0.75
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	71.21 mm
Diameter	38.11 mm
Bulk Density	1.95 Mg/m ³
Moisture Content	22 %
Dry Density	1.59 Mg/m ³
Membrane Correction	2.14 kPa

Rate of Strain	2.00 %/min
Cell Pressure	8 kPa
Axial Strain at failure	19.1 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	56 kPa
Undrained Shear Strength, c_u	28 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.22 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:**Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 23/10/2018Signed: Darren Berrill
Geotechnical General Manager

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TEST CERTIFICATE**Unconsolidated Undrained****Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Environmental Science

Client: AGS Ground Solutions Ltd
 Client Address: 4 Bond Street
 Redruth
 Cornwall, TR15 2QB
 Contact: Chloe Sheppard-Muir
 Site Name: A1816
 Site Address: Not Given

Client Reference: A1816
 Job Number: 18-12570
 Date Sampled: Not Given
 Date Received: 10/01/2018
 Date Tested: 09/10/2018
 Sampled By: Not Given

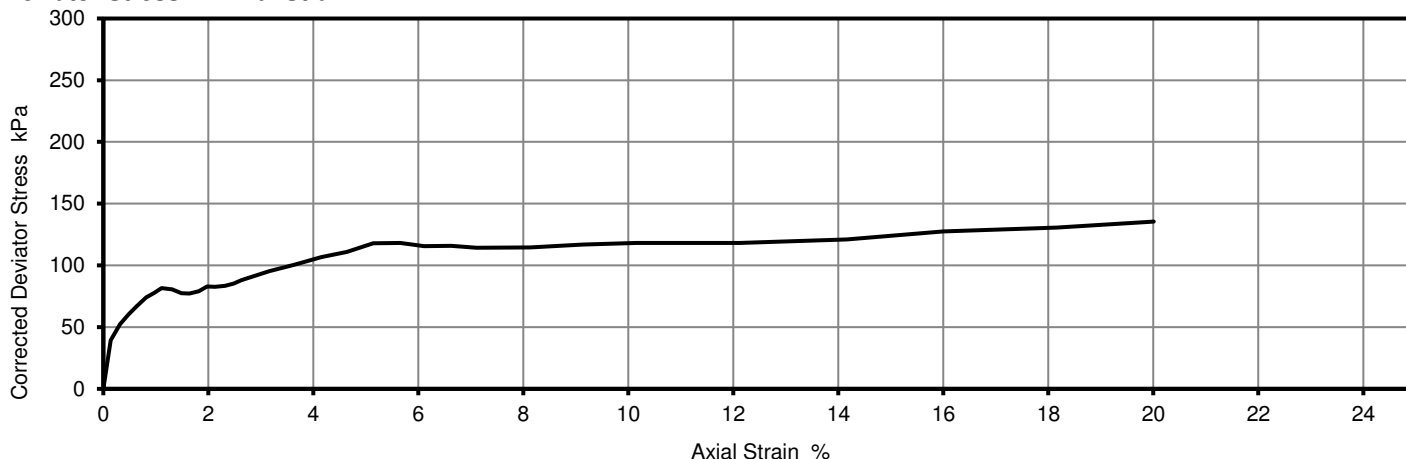
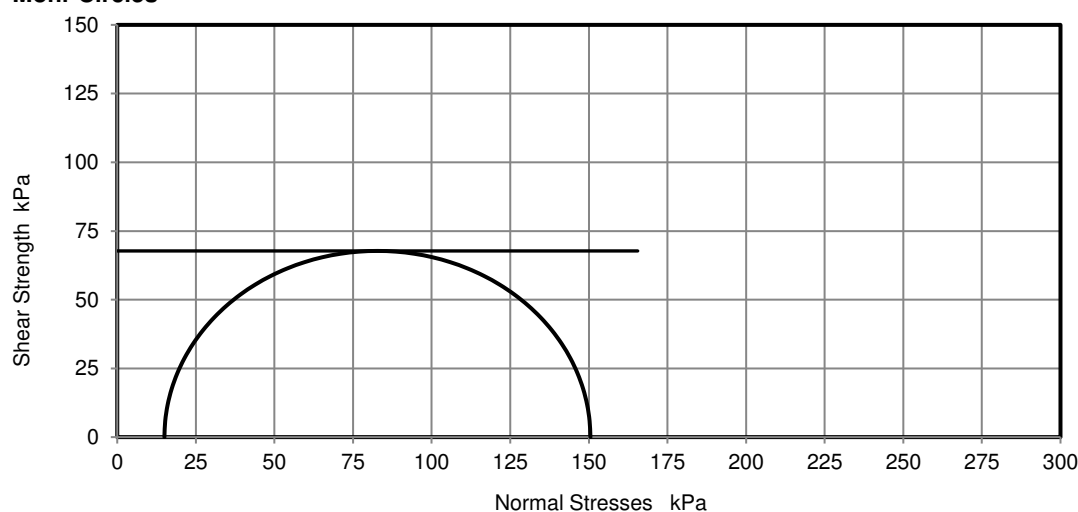
Test Result

Laboratory Reference: 1058102
 Hole No.: TP4
 Sample Reference: Not Given
 Sample Description: Brown clayey SAND

Depth Top [m]: 1.50
 Depth Base [m]: Not Given
 Sample Type: U

Test Number	1
Length	79.37 mm
Diameter	35.50 mm
Bulk Density	1.96 Mg/m ³
Moisture Content	22 %
Dry Density	1.61 Mg/m ³
Membrane Correction	2.71 kPa

Rate of Strain	2.00 %/min
Cell Pressure	15 kPa
Axial Strain at failure	20.0 %
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	Plastic
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:

Approved: Dariusz Piotrowski
 PL Geotechnical Laboratory Manager
 Date Reported: 23/10/2018

Signed: Darren Berrill
 Geotechnical General Manager

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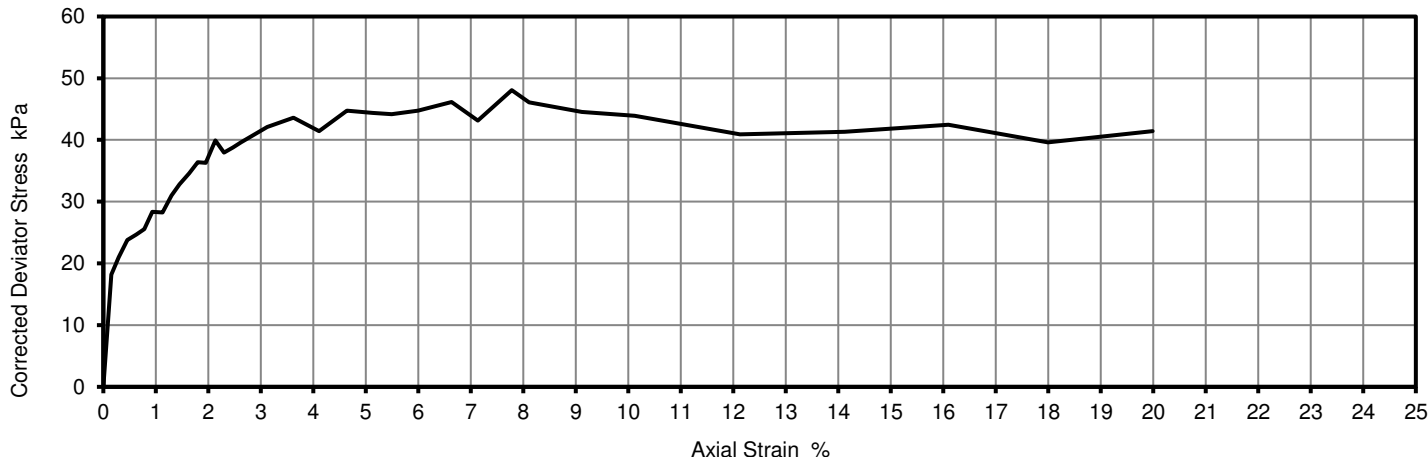
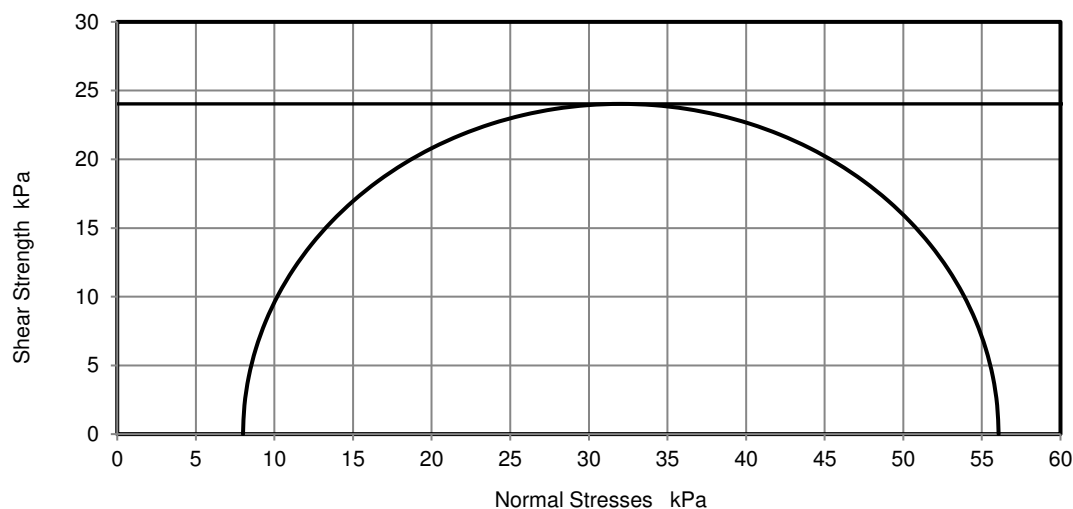
TEST CERTIFICATE**Unconsolidated Undrained****Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Environmental Science

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not GivenClient Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 10/01/2018
Date Tested: 09/10/2018
Sampled By: Not Given**Test Result**Laboratory Reference: 1058103
Hole No.: TP5
Sample Reference: Not Given
Sample Description: Brown silty CLAYDepth Top [m]: 0.80
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	71.75 mm
Diameter	36.41 mm
Bulk Density	2.00 Mg/m ³
Moisture Content	24 %
Dry Density	1.61 Mg/m ³
Membrane Correction	1.54 kPa

Rate of Strain	2.00 %/min
Cell Pressure	8 kPa
Axial Strain at failure	7.8 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	48 kPa
Undrained Shear Strength, c_u	24 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:**Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 23/10/2018Signed: Darren Berrill
Geotechnical General Manager

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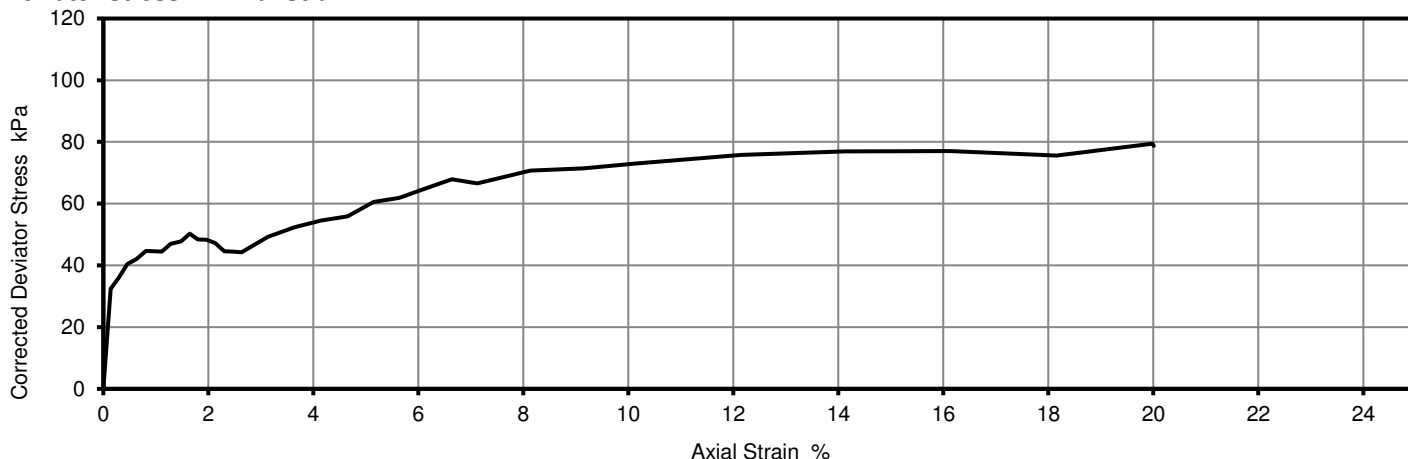
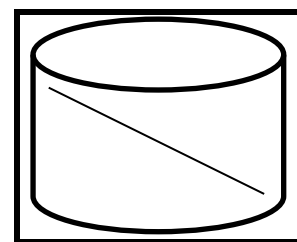
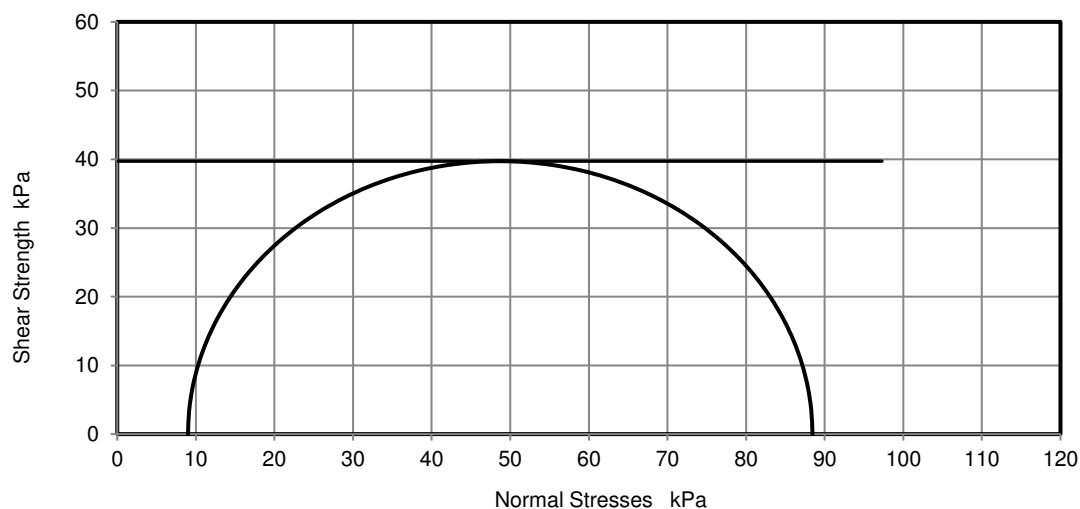
TEST CERTIFICATE**Unconsolidated Undrained****Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Environmental Science

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not GivenClient Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 10/01/2018
Date Tested: 09/10/2018
Sampled By: Not Given**Test Result**Laboratory Reference: 1058104
Hole No.: TP6
Sample Reference: Not Given
Sample Description: Brown clayey SANDDepth Top [m]: 0.90
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	84.97 mm
Diameter	37.54 mm
Bulk Density	1.94 Mg/m ³
Moisture Content	25 %
Dry Density	1.55 Mg/m ³
Membrane Correction	2.97 kPa

Rate of Strain	2.00 %/min
Cell Pressure	9 kPa
Axial Strain at failure	20.0 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	79 kPa
Undrained Shear Strength, c_u	40 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.29 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: Unable to take a photo

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 23/10/2018Signed: Darren Berrill
Geotechnical General Manager

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4041

TEST CERTIFICATE**Unconsolidated Undrained****Triaxial Compression**Tested in Accordance with:
BS 1377-7: 1990: Clause 8i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Environmental Science

Client: AGS Ground Solutions Ltd
Client Address: 4 Bond Street
Redruth
Cornwall, TR15 2QB
Contact: Chloe Sheppard-Muir
Site Name: A1816
Site Address: Not Given

Client Reference: A1816
Job Number: 18-12570
Date Sampled: Not Given
Date Received: 10/01/2018
Date Tested: 09/10/2018
Sampled By: Not Given

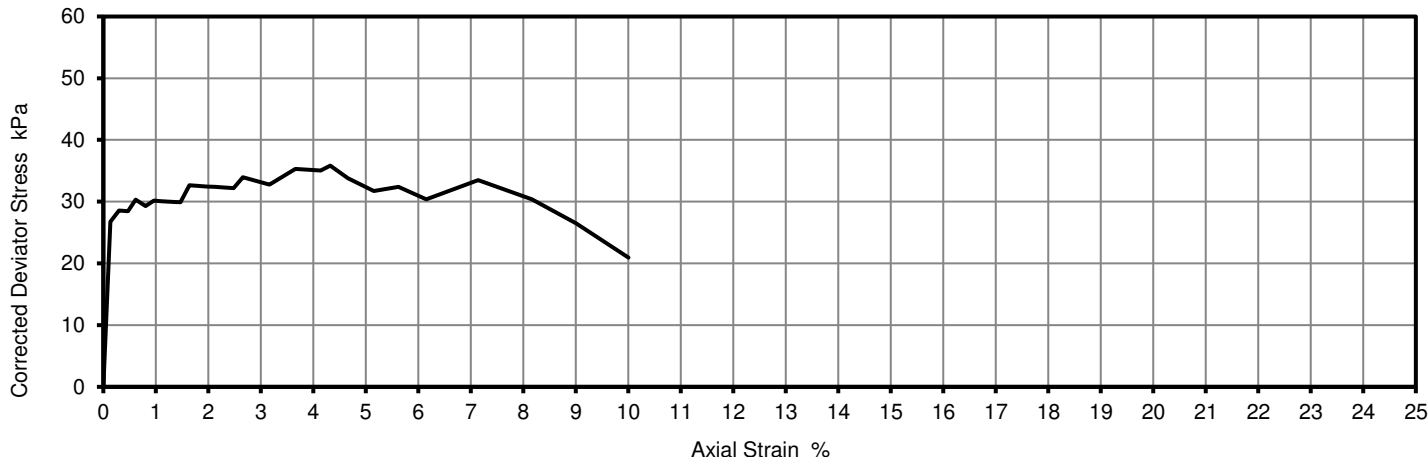
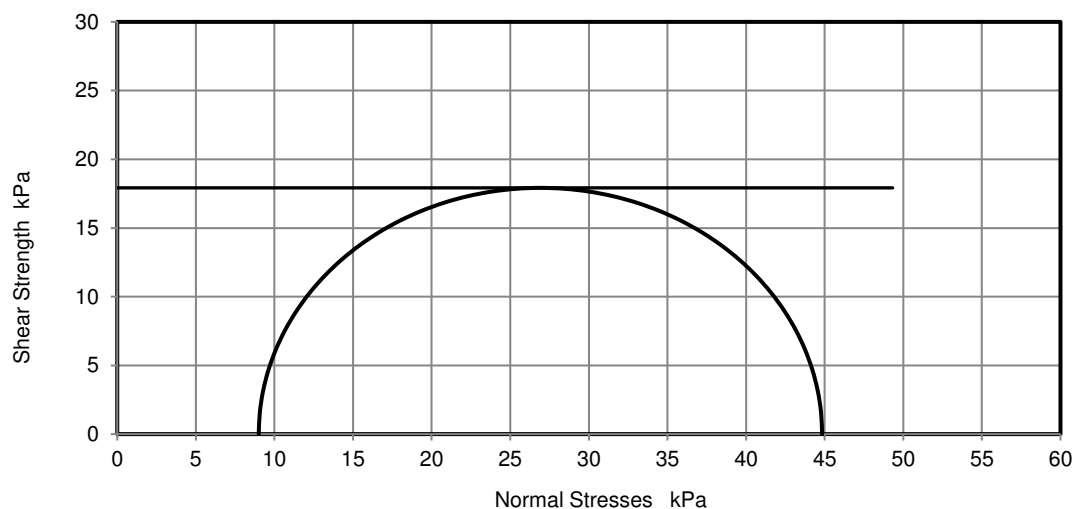
Test Result

Laboratory Reference: 1058106
Hole No.: TP8
Sample Reference: Not Given
Sample Description: Brown silty CLAY

Depth Top [m]: 0.90
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	80.98 mm
Diameter	36.48 mm
Bulk Density	2.04 Mg/m ³
Moisture Content	22 %
Dry Density	1.66 Mg/m ³
Membrane Correction	0.78 kPa

Rate of Strain	2.00 %/min
Cell Pressure	9 kPa
Axial Strain at failure	4.3 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	36 kPa
Undrained Shear Strength, c_u	18 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.24 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:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Piotrowski
Date Reported: 23/10/2018

Signed: Darren Berrill
Geotechnical General Manager
Berrill

GF 184.6

"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.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."

Appendix 7

Analytical Laboratory Test Results



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Analytical Report Number : 18-12577

Project / Site name:	A1816	Samples received on:	01/10/2018
Your job number:	A1816	Samples instructed on:	01/10/2018
Your order number:		Analysis completed by:	10/10/2018
Report Issue Number:	1	Report issued on:	11/10/2018
Samples Analysed:	4 soil samples		

Signed 

Jordan Hill
Reporting Manager
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

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Analytical Report Number: 18-12577

Project / Site name: A1816

Lab Sample Number				1058139	1058140	1058141	1058142	
Sample Reference				WS1	WS3	WS5	WS6	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				3.70	4.70-4.80	4.90-5.00	4.00-4.20	
Date Sampled				Deviating	Deviating	Deviating	Deviating	
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	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	20	19	18	17	
Total mass of sample received	kg	0.001	NONE	0.30	0.41	0.41	0.48	

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.5	8.3	8.5	8.6	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.076	0.087	0.058	0.036	



Analytical Report Number : 18-12577

Project / Site name: A1816

* 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 *
1058139	WS1	None Supplied	3.70	Brown clay with vegetation.
1058140	WS3	None Supplied	4.70-4.80	Brown clay with vegetation.
1058141	WS5	None Supplied	4.90-5.00	Brown clay with vegetation.
1058142	WS6	None Supplied	4.00-4.20	Brown clay.

Analytical Report Number : 18-12577

Project / Site name: A1816

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.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical 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.

Sample Deviation Report



Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS1		S	18-12577	1058139	a			
WS3		S	18-12577	1058140	a			
WS5		S	18-12577	1058141	a			
WS6		S	18-12577	1058142	a			

**Paul Foster**

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Analytical Report Number : 18-12237

Project / Site name:		Samples received on:	28/09/2018
Your job number:		Samples instructed on:	28/09/2018
Your order number:		Analysis completed by:	05/10/2018
Report Issue Number:	1	Report issued on:	05/10/2018
Samples Analysed:	10 soil samples - 1 water sample		

Signed

Jordan Hill
Reporting Manager
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

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Analytical Report Number: 18-12237

Lab Sample Number				1056380	1056381	1056382	1056383	1056384
Sample Reference				TP1	WS1	WS1	WS2	WS4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.40	0.30	0.70	0.20	0.10
Date Sampled				27/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018
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	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	20	12	16	14	16
Total mass of sample received	kg	0.001	NONE	0.39	0.35	0.41	0.32	0.32

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.6	8.1	8.5	7.8	7.7
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	24	23	21	34	31
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.012	0.011	0.011	0.017	0.016
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	12.0	11.4	10.7	17.2	15.6
Organic Matter	%	0.1	MCERTS	0.9	2.1	1.1	5.5	5.0

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.24
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.48
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.42
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	1.14
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Analytical Report Number: 18-12237

Lab Sample Number	1056380	1056381	1056382	1056383	1056384
Sample Reference	TP1	WS1	WS1	WS2	WS4
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.40	0.30	0.70	0.20	0.10
Date Sampled	27/09/2018	26/09/2018	26/09/2018	26/09/2018	26/09/2018
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	5.4	10	7.4	11	10
Boron (water soluble)	mg/kg	0.2	MCERTS	1.1	1.5	0.6	2.5	3.0
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	27	21	22	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	8.1	15	12	16	21
Lead (aqua regia extractable)	mg/kg	1	MCERTS	7.9	19	11	20	24
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15	22	16	17	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	35	60	42	55	60

Monoaromatics

Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	ug/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	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 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	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

Analytical Report Number: 18-12237

Lab Sample Number	1056385	1056386	1056387	1056388	1056389
Sample Reference	WS4	WS5	WS5	WS8	WS8
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.10	0.50	0.40	1.40
Date Sampled	26/09/2018	27/09/2018	27/09/2018	27/09/2018	27/09/2018
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	5.9	19
Total mass of sample received	kg	0.001	NONE	0.33	0.38

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.3	7.5	8.1	8.2	8.7
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	17	38	17	25	18
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0086	0.019	0.0083	0.013	0.0089
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	8.6	18.8	8.3	12.7	8.9
Organic Matter	%	0.1	MCERTS	1.2	8.5	1.7	2.0	0.2

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
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Analytical Report Number: 18-12237

Lab Sample Number				1056385	1056386	1056387	1056388	1056389
Sample Reference				WS4	WS5	WS5	WS8	WS8
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.10	0.50	0.40	1.40
Date Sampled				26/09/2018	27/09/2018	27/09/2018	27/09/2018	27/09/2018
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	8.5	12	12	9.7	2.9
Boron (water soluble)	mg/kg	0.2	MCERTS	0.8	3.1	1.9	1.2	0.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	14	22	26	17	3.2
Copper (aqua regia extractable)	mg/kg	1	MCERTS	7.9	24	17	14	2.5
Lead (aqua regia extractable)	mg/kg	1	MCERTS	8.5	19	14	16	3.6
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	18	20	16	3.1
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	29	57	50	44	9.4

Monoaromatics

Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	ug/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	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 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	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10



Analytical Report Number: 18-12237

Lab Sample Number				1056390				
Sample Reference				WS8				
Sample Number				None Supplied				
Depth (m)				None Supplied				
Date Sampled				27/09/2018				
Time Taken				None Supplied				
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

General Inorganics

pH	pH Units	N/A	ISO 17025	7.2				
Sulphate as SO ₄	µg/l	45	ISO 17025	30000				
Sulphate as SO ₄	mg/l	0.045	ISO 17025	30.0				
Dissolved Organic Carbon (DOC)	mg/l	0.1	NONE	13.0				

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10				
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01				
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01				
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01				
Fluorene	µg/l	0.01	ISO 17025	< 0.01				
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01				
Anthracene	µg/l	0.01	ISO 17025	< 0.01				
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Pyrene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01				
Chrysene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01				
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01				
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01				

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16				
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	0.15	ISO 17025	2.85				
Boron (dissolved)	µg/l	10	ISO 17025	170				
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02				
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0				
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2				
Copper (dissolved)	µg/l	0.5	ISO 17025	0.8				
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2				
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05				
Nickel (dissolved)	µg/l	0.5	ISO 17025	5.4				
Selenium (dissolved)	µg/l	0.6	ISO 17025	2.7				
Zinc (dissolved)	µg/l	0.5	ISO 17025	8.9				



Analytical Report Number: 18-12237

Lab Sample Number				1056390				
Sample Reference				WS8				
Sample Number				None Supplied				
Depth (m)				None Supplied				
Date Sampled				27/09/2018				
Time Taken				None Supplied				
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

Monoaromatics

Benzene	µg/l	1	ISO 17025	< 1.0				
Toluene	µg/l	1	ISO 17025	< 1.0				
Ethylbenzene	µg/l	1	ISO 17025	< 1.0				
p & m-xylene	µg/l	1	ISO 17025	< 1.0				
o-xylene	µg/l	1	ISO 17025	< 1.0				
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0				

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10				

TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10				

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 18-12237

Project / Site name:

* 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 *
1056380	TP1	None Supplied	1.40	Brown sandy clay.
1056381	WS1	None Supplied	0.30	Brown clay and sand with vegetation.
1056382	WS1	None Supplied	0.70	Brown clay and sand.
1056383	WS2	None Supplied	0.20	Brown loam and sand with gravel and vegetation.
1056384	WS4	None Supplied	0.10	Brown loam and clay with gravel and vegetation.
1056385	WS4	None Supplied	0.50	Light brown sandy clay with gravel and vegetation.
1056386	WS5	None Supplied	0.10	Brown loam and clay with gravel and vegetation.
1056387	WS5	None Supplied	0.50	Brown loam and clay with gravel and vegetation.
1056388	WS8	None Supplied	0.40	Brown loam and clay with gravel and vegetation.
1056389	WS8	None Supplied	1.40	Light brown sand.

Analytical Report Number : 18-12237

Project / Site name:

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
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
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
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-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
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
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
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
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
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
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025

Iss No 18-12237-1

Analytical Report Number : 18-12237

Project / Site name:

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
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 water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	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
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L088/76-PL	W	MCERTS
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE

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.

Sample Deviation Report



Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS8		W	18-12237	1056390	bc	BTEX and MTBE in water (Monoaromatics)	L073B-PL	b
WS8		W	18-12237	1056390	bc	pH at 20oC in water (automated)	L099-PL	c



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Analytical Report Number : 18-12601

Project / Site name:		Samples received on:	03/10/2018
Your job number:		Samples instructed on:	03/10/2018
Your order number:		Analysis completed by:	09/10/2018
Report Issue Number:	1	Report issued on:	09/10/2018
Samples Analysed:	1 soil sample		

Signed

Jordan Hill
Reporting Manager
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

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Analytical Report Number: 18-12601

Lab Sample Number				1058212				
Sample Reference				TP4				
Sample Number				None Supplied				
Depth (m)				2.40				
Date Sampled				27/09/2018				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	20				
Total mass of sample received	kg	0.001	NONE	0.80				

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2				
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.069				
Organic Matter	%	0.1	MCERTS	0.3				

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05				
Fluorene	mg/kg	0.05	MCERTS	< 0.05				
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05				
Anthracene	mg/kg	0.05	MCERTS	< 0.05				
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Pyrene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05				
Chrysene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05				

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80				
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.7				
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	7.9				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	5.6				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	4.5				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	6.0				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	16				

Analytical Report Number: 18-12601

Lab Sample Number				1058212				
Sample Reference				TP4				
Sample Number				None Supplied				
Depth (m)				2.40				
Date Sampled				27/09/2018				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Monoaromatics

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

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0				
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0				
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10				

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10				
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10				
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10				



Analytical Report Number : 18-12601

Project / Site name:

* 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 *
1058212	TP4	None Supplied	2.40	Brown sand.

Analytical Report Number : 18-12601

Project / Site name:

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
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
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
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
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
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 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
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, 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
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	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 30oC.

Sample Deviation Report



Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
TP4		S	18-12601	1058212	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
TP4		S	18-12601	1058212	b	Monohydric phenols in soil	L080-PL	b
TP4		S	18-12601	1058212	b	Speciated EPA-16 PAHs in soil	L064-PL	b
TP4		S	18-12601	1058212	b	TPHCWG (Soil)	L088/76-PL	b