

GROUND INVESTIGATION REPORT

PROPOSED SCHOOL EXPANSION
MOORLANDS PRIMARY SCHOOL
CHURCH END LANE
READING

Prepared for:
Hampshire County Council

June 2017

Report No: 5846/GI



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Proposed School Expansion,
Moorlands Primary School, Church
End Lane, Reading

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Executive Summary

Hampshire County Council is proposing the expansion of the existing teaching facilities at Moorlands Primary School, Church End Lane, Reading. The proposed development is to include four areas of new teaching extensions, two areas of refurbishment, a new canopy link and car parking areas.

The geological mapping of the area shows the site to be underlain by the London Clay Formation, typically comprising blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. Superficial deposits of the Winter Hill Gravel are shown to overlie the site, comprising variably clayey and sandy gravel.

In order to confirm the underlying ground conditions a ground investigation comprising eight mini percussive boreholes, two machine excavated trial pits with in-situ soakaway testing, four hand excavated inspection pits and four in-situ CBR tests was carried out on during May 2017.

The soil sequence beneath the proposed development consisted of variable made ground to a depth of typically between 0.30m and 0.95m. The made ground was underlain by Winter Hill Gravels comprising typically firm to very stiff, orangey brown to brown, sandy gravelly clay to a depth of between 1.90m and 3.00m. These deposits became more granular with depth comprising medium dense to very dense gravelly clayey sand to the maximum investigated depth of 5.00m. Groundwater strikes were encountered within WS1 and SA1 only at depths of between 2.90m and 3.00m respectively.

We recommend that mass concrete strip/trench foundations be extended into the underlying Winter Hill Gravels comprising typically firm to very stiff, orangey brown to brown, sandy gravelly clay. The depth to the above in-situ founding horizons is likely to vary between typically 0.30m and 0.95m below the existing ground level.

For the above foundations founded within the above in-situ material, an allowable bearing pressure of 100kN/m² may be used for design purposes. To avoid any potential differential settlement all foundations should lie within cohesive deposits. If variability is encountered then reinforcement should be incorporated into the design.

If higher loadings than those stated above are required then consideration should be given to deepening the foundations.

Plasticity tests have shown that the shallow Winter Hill Gravels exhibit typically no to medium shrinkage potential. Therefore, the base of any foundations should lie at least 900mm below final ground level.

If design loads of the floor slabs are less than or equal to typically 5kN/m², floor slabs can be designed as ground bearing. Alternatively the floor slabs may be designed as suspended.

All buried shallow concrete should, as a minimum, conform to Class AC1 of BRE Special Digest 1 (2005).

Six samples of soil collected from the site were tested for a site specific suite of contaminants. The soil chemical testing has revealed that the determinants tested were all below relevant guidelines for a Public Open Space (POS) – Residential scenario.

Based on the results of the WAC testing, the shallow deposits from beneath the site have been classed as inert waste.

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SECTION 1 Introduction and Proposed Development

Hampshire County Council is proposing the expansion of the existing teaching facilities at Moorlands Primary School, Church End Lane, Reading.

The proposed development consists of three development zones, comprising a new two-storey teaching block to the rear, a central entrance/admin extension and refurbishment, as well as a single-storey teaching block to the front of the site. There are also proposed car park extensions both on the school site and onto an existing car park, to the South.

Hampshire County Council are also the Consulting Structural Engineers and Architects for the proposed development.

Terra Firma (South) has been commissioned by the Geotechnics Group of Hampshire County Council to carry out a ground investigation of the above site.

The main objectives of the ground investigation were to:

- Determine the type, strength and bearing characteristics of the shallow superficial deposits and underlying solid geology.
- Provide recommendations for a suitable and economic foundation/floor slab solution for the development.
- Provide recommendations with regards to any other geo-technical aspects pertaining to the development.
- Collect representative samples for laboratory chemical analysis and provide an evaluation of the results.

In order to achieve the above objectives, Terra Firma (South) carried out an assessment programme including a review of existing data, followed by a field investigation to determine the prevailing ground conditions and also to collect and analyse soil samples from selected locations around the site.

1.1 Limitations and Exceptions of Investigation

Hampshire County Council has requested that a Ground Investigation (GI) be performed in order to establish the ground conditions at the site, determine an appropriate foundation solution for the proposed development and collect representative samples for laboratory analysis.

The GI was conducted and this report has been prepared for the sole internal reliance of Hampshire County Council and their design and construction partners. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (South). If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The report represents the findings and opinions of experienced geo-environmental and geo-technical consultants. Terra Firma (South) does not provide legal advice and the advice of lawyers may also be required.

The subsurface geological profiles, any contamination and other plots are generalised by necessity and have been based on the information found at the locations of the exploratory holes and depths sampled and tested.

1.1 Limitations and Exceptions of Investigation (Continued)

The site investigation was limited by the following site constraints:

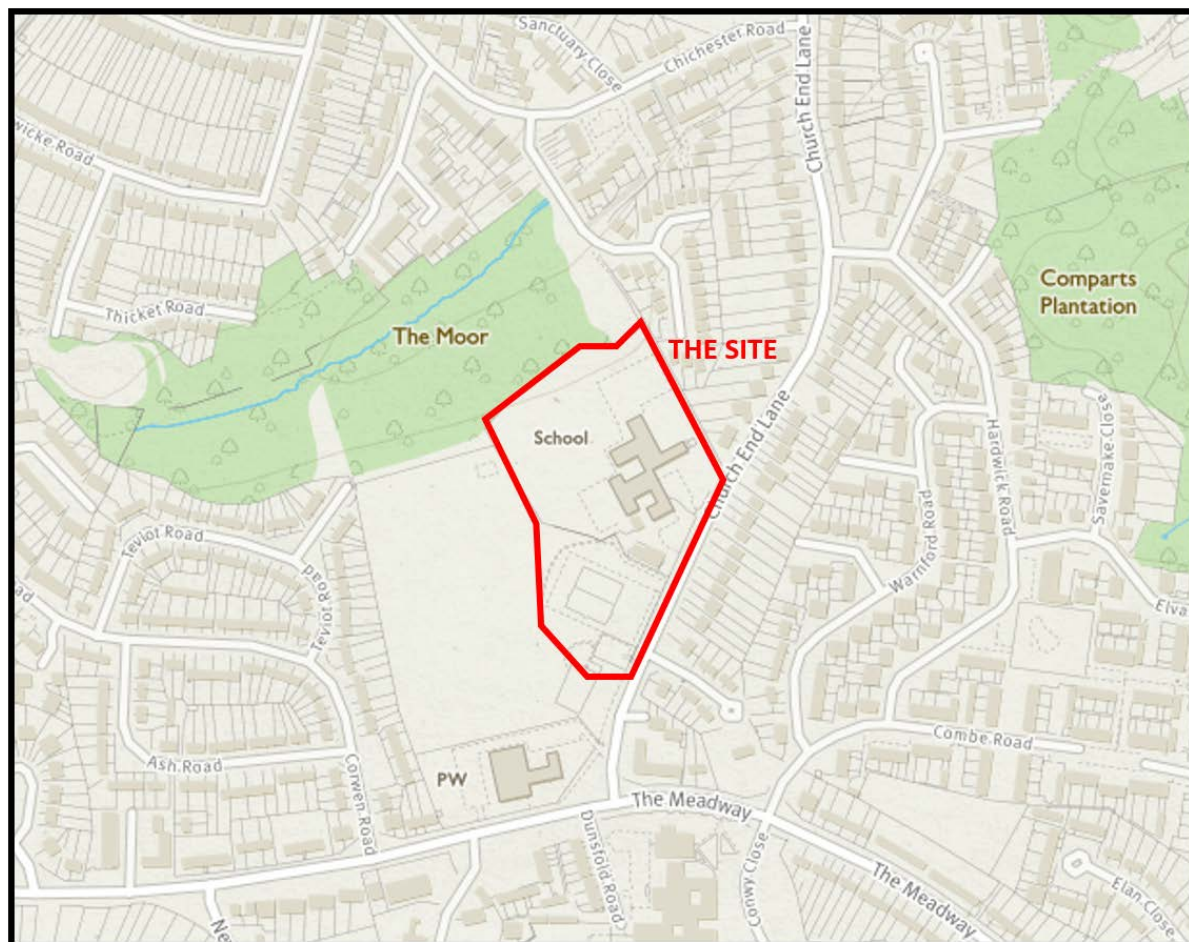
- Underground services and utilities, and
- Time restrictions associated with working within a school.

SECTION 2 Review of Existing Data

2.1 Physical Setting

The proposed development is to be located within the property boundaries of Moorlands Primary School, Church End Lane, Reading, RG30 4UN.

The site is centred approximately on National Grid Reference (NGR) 467574 173420. The site location is presented in **Drawing 1.1** below.



Drawings 2.1: Site Location Plan

The site is irregular in shape with a plan area of approximately 2.1 hectares and sits between approximately 90m and 93m above ordnance datum (aod).

The topography of the site is typically flat. The topography of the surrounding area typically slopes towards the west.

The site is bound by woodland to the north, a park of open fields and tennis courts to the west, Church End Lane to the south and a residential area to the east.

2.2 Current Use and Site Conditions

The site was visited on the 30th May 2017 by a Terra Firma (South) Engineer.

2.2 Current Use and Site Conditions (Continued)

The site currently comprises the existing school buildings, playing fields, hard standing playgrounds, car parking areas and access roads.

The site is accessed from Church End Lane to the south-east, which leads directly to the entrance and car parking areas of the school.

No evidence of surface contamination was observed during the walkover survey.

2.3 Phase 1 Risk Assessment

A Phase 1 Contaminated Land Risk Assessment was undertaken by Terra Firma (South) in November 2016 (Report number 5846) and should be read in conjunction with this report.

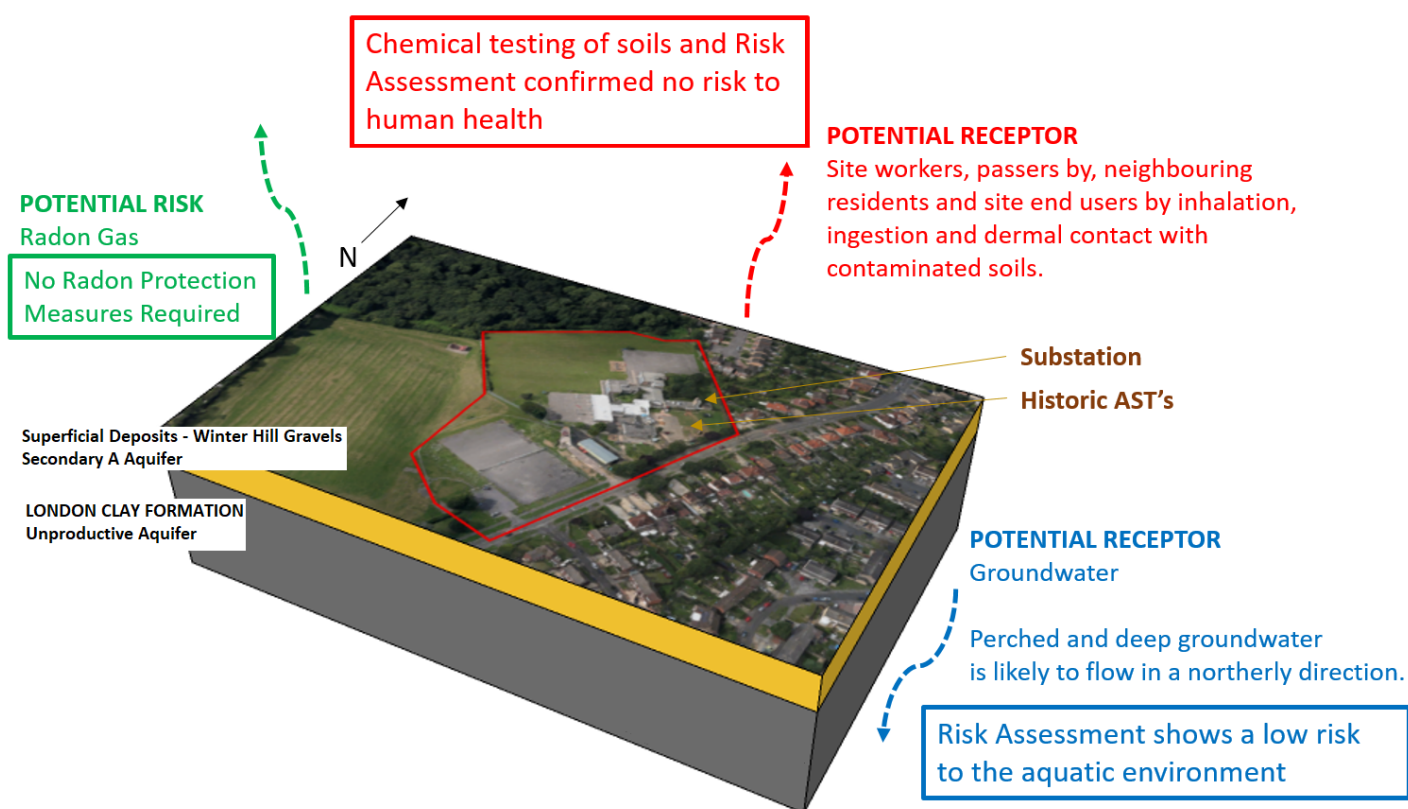
A summary of the report is detailed below:

Geology		The 1:50, 000-scale Geological Map of the area shows the site to be underlain by the London Clay Formation of the Paleogene. The London Clay Formation typically comprise bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. Superficial deposits in the form of the Winter Hill Gravel are shown to overlie the solid geology of the area. These deposits typically comprise variably clayey and sandy gravel.
Mining		In summary, the risk from underground and/or surface mining activity is likely to be Low .
Preliminary Geotechnical Risk Assessment		The preliminary geotechnical risk assessment has revealed that a Low to Moderate risk is present from geotechnical aspects, with particular risk specifically associated with the underlying high plasticity (shrink-swell) shallow deposits and potentially aggressive ground conditions.
Recommendations		In order to confirm the above preliminary geotechnical risk assessment it is recommended that a Phase 2 Intrusive Site Investigation is undertaken in order to determine the ground conditions and confirm relevant geotechnical aspects.
Potential Sources of Contamination	On-site	Historically, the site has typically comprised open grassland/field from at least 1881 to 1969. From then, the Moorlands Primary School, present today, was erected. This building has maintained the same footprint from 1969 to present with little or no change on site. No boiler house has been identified; however this should be confirmed by buildings maintenance. From recent aerial photography, it can be seen that sometime between 2009 and 2010, possible bunded Above Ground Storage Tanks (AST's) were installed in the south-east corner of the school. These remained present until sometime before 2014. Present day and historical uses of the site have a number of potential contamination sources including an electricity sub-station an electricity sub-station, AST's, car parking areas and potential made ground.
	Off-site	Historically, the surrounding area (<250m) has typically comprised small local residencies from before 1900 with a gravel pit present 250m west from 1910. By 1932, significant residential development had taken place to the east, gaining momentum through until 1968 where vast residential expansion had taken place. Extensive development continued to sometime before 1976, from which gradual residential expansion continues to present. Based on the above it is considered that no contaminative sources are within influencing distance of the site. Therefore, significant levels of contamination are not expected from off-site sources.

	Gas Migration	Due to the absence of any influencing active or historic landfills, underlying organic material (e.g. peat) and significant made ground, the presence of ground gas is considered unlikely.
	Preliminary Human Health & Environmental Risk Assessment	The preliminary human health and environmental risk assessment has revealed that due to the sites and surrounding areas current and past land uses that a Low to Moderate risk is present from localised contamination present beneath the site, with particular risk specifically associated with the Electricity sub-station, AST's, Car parking Areas and Potential Made Ground. In addition, No risk is present from the migration of radon gas, a Low risk from the migration of landfill gas and a Low risk from the migration of ground gas.
	Recommendations	Based on a Low to Moderate overall risk rating, in order to confirm the above preliminary human health and environmental risk assessment it is recommended that a Phase 2 Ground Investigation is undertaken comprising site specific soil chemical testing in order to determine the ground conditions, soil chemistry and any environmental liability associated with the site.

2.3.1 Preliminary Site Conceptual Model

The following illustration represents a theorised model through the site. The drawing is generalised and not to scale.



Drawing 2.2: Preliminary Conceptual Site Model

2.4 Previous Investigations

There are records of two investigations for two different sites within the surrounding area, which have been outlined below:

2.4 Previous Investigations (Continued)

St. Michael's Primary School (20718 V1.1): Undertaken by REC in June 2014

Site Address	Church End Primary School, Usk Road, Tilehurst, Reading, RG30 4HP	
National Grid Reference	467550, 172870, Land Ranger SU 675728	
Site Area	1.61 hectares (ha)	
Conceptual Site Model		
The initial conceptual site model identified that Made Ground associated within the current and historical development of the site was the only source of on-site contamination which has the potential to present a risk to the identified receptors. An in filled historic gravel pit located 105m south-west has been identified as a potential off-site source of ground gas that could present a risk to future site users.		
Site Investigation		
Investigation Findings	Made Ground – general coarse grained	Maximum thickness of 0.60m
	Superficial Deposits – Winter Hill Gravel	Maximum thickness of 2.50m
	Bedrock – London Clay Formation	Unproven thickness of 3.60m
	Sulphate Class (natural)	DS1, AC-1 (Shallow) DS2, AC-3z (Deep)
	Plasticity (natural)	Intermediate to High
	Volume Change (natural)	Medium
	Consistency (natural)	Firm to Stiff
	Permeability (natural)	N/A
	Groundwater	0.50m - 0.84m (strikes)
	Ground Gas	CS1
Geotechnical Assessment		
Southern Extension		
Within the area of the proposed northern extension it is estimated that utilising conventional foundations (pad or strip) at depth of 1.40 m bgl, a likely achievable allowable bearing capacity of between 120 to 150 kPa could be achievable bearing onto the within the medium dense coarse grained soils of the Winter Hill Gravel Formation.		
Northern Extension		
Within the area of the proposed northern extension it is estimated that utilising conventional foundations (pad or strip) at depth of 1.50 m bgl, a likely achievable allowable bearing capacity of between 140 kPa could be achievable bearing onto the within the medium dense coarse grained soils of the Winter Hill Gravel Formation.		
NHBC Chapter 4.2 Building Near Trees recommends a minimum founding depth of >1.0mbgl in the absence of existing or any proposed tree planting.		
Given the relatively poor permeability and high water table it is unlikely that soakaways could be adopted for the proposed scheme.		
Revised Conceptual Site Model		
The Human Health and controlled waters risk assessments have not identified any concentrations that are considered to present a significant risk to the identified receptors with the exception of asbestos (chrysotile) in the form of cement bonded sheeting within HP206. It is recommended that the extent of this asbestos is identified and suitably trained persons qualified in the removal and recognition of asbestos are employed to hand pick the area of any potential asbestos containing material (ACM).		

2.4 Previous Investigations (Continued)

Church End Primary School (20710 V1.1): Undertaken by REC in July 2014

Site Address	St. Michaels Primary School, Dee Road, Tilehurst, Reading, RG30 4AS	
National Grid Reference	468079,172995	
Site Area	1.66 hectares (ha)	
Conceptual Site Model		
The initial conceptual site model has identified that made ground associated within the current development of the site is the only source of on-site contamination which has the potential to present a risk to the identified receptors.		
Site Investigation		
Investigation Findings	Made Ground	Maximum thickness 1.00m
	Natural Strata – Winter Hill Gravel Formation	Maximum thickness 3.00m
	Natural Strata – London Clay	Maximum thickness 10.50m
	Natural Strata – Lambeth Group	Base Not Proven
	Sulphate Class (natural)	Generally DS1, AC-1 but increasing to DS4, AC4s within deeper London Clay.
	Plasticity (natural)	Intermediate to high
	Volume Change (natural)	Medium to high
	Consistency (natural)	Firm to Stiff
	Permeability (natural)	1.50 x 10 ⁻⁵ to 4.83 x 10 ⁻⁷ m/s
	Groundwater	1.05m – 1.00m
Geotechnical Assessment		
Medium strength clay and coarse grained soils of the Winter Hill Gravel Formation circa 1.50mbgl are believed to be able to provide a bearing capacity in excess of 80kN/m ² and as such shallow foundations (pad or strip) could be adopted for the proposed scheme bearing onto this stratum.		
NHBC Chapter 4.2 Building Near Trees recommends a minimum founding depth of >1.0mbgl in the absence of existing or any proposed tree planting.		
Given the relatively poor permeability and high water table it is unlikely that soakaways could be adopted for the proposed scheme.		
Revised Conceptual Site Model		
The Human Health and controlled waters risk assessment has not identified any concentrations that are considered to present a significant risk to the identified receptors.		
Recommendations		
It is considered that the site is suitable for the intended use without the requirement for remediation works.		

SECTION 3 Field Investigation

3.1 Site Works

A ground investigation scoped by Hampshire County Council and comprising eight mini percussive boreholes, two machine excavated trial pits with in-situ soakaway testing, four hand excavated inspection pits, four in-situ CBR tests and laboratory chemical testing of soils and soil property testing was carried out on the 30th and 31st of May 2017.

Prior to the site investigation, arrangements were made with the caretaker of the school, in order to outline the schedule of works. It was requested that site works be completed within the half-term school holidays to avoid disruption to the schools working day.

The windowless sampling boreholes were bored using a mini percussive drilling rig. These were used to investigate the shallow ground conditions and undertake in-situ strength tests at regular intervals.

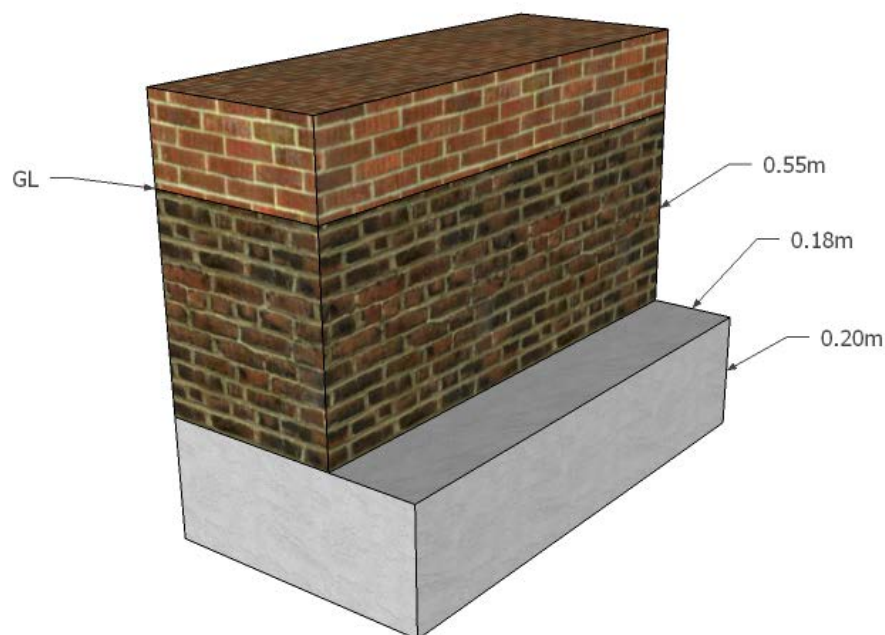
The machine excavated trial pits were excavated using a wheeled JCB 3CX mechanical excavator.

Deep in-situ permeability tests were undertaken within the trial pit locations, in order to provide conventional soakaway design detail.

A 2000 gallon tanker was used to rapidly fill the excavation with water.

The hand excavated inspection pits were sunk using conventional digging tools. The pits were used to expose existing foundations of the school buildings.

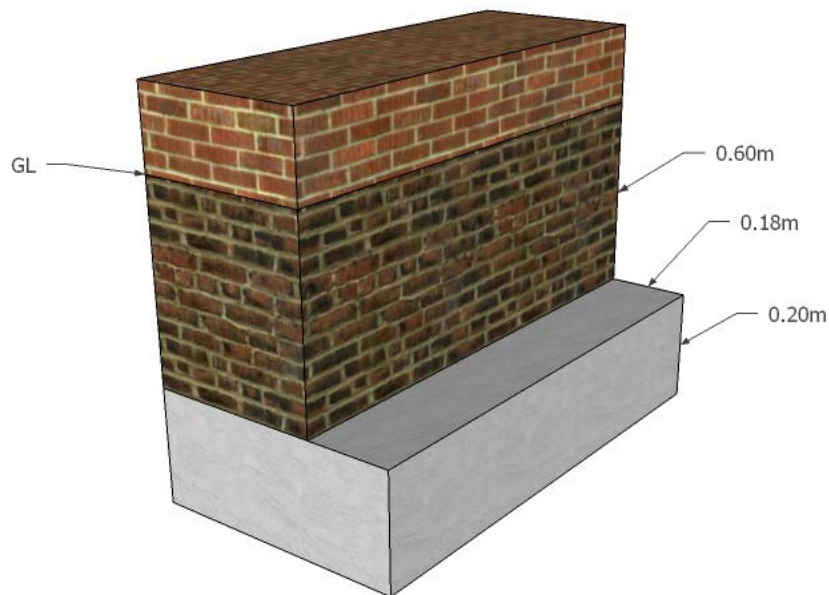
HDTP1 was excavated to expose the existing foundations on the western side of the Infant School building. A concrete foundation was encountered at 0.55mbgl, stepping out 0.18m from the external wall and was 0.20m thick. A schematic drawing of the inspection pit is given below:



The bearing strata of the foundations encountered at HDTP1 were the Winter Hill Gravels comprising firm orange brown to brown sandy gravelly clay.

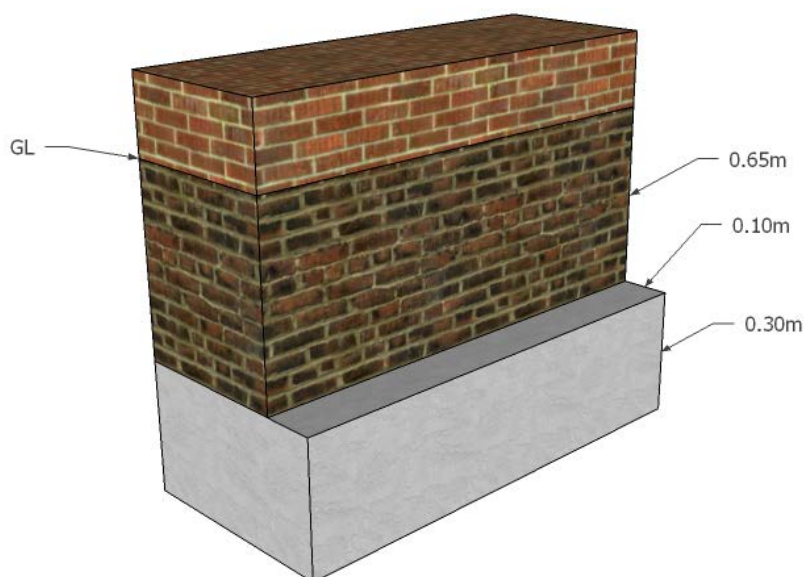
3.1 Site Works (Continued)

HDTP2 was also excavated to expose the existing foundations on the western side of the Infant School building. A concrete foundation was encountered at 0.60mbgl, stepping out 0.18m from the external wall and was 0.20m thick. A schematic drawing of the inspection pit is given below:



The bearing strata of the foundations encountered at HDTP2 were the Winter Hill Gravels comprising firm orange brown to brown sandy gravelly clay.

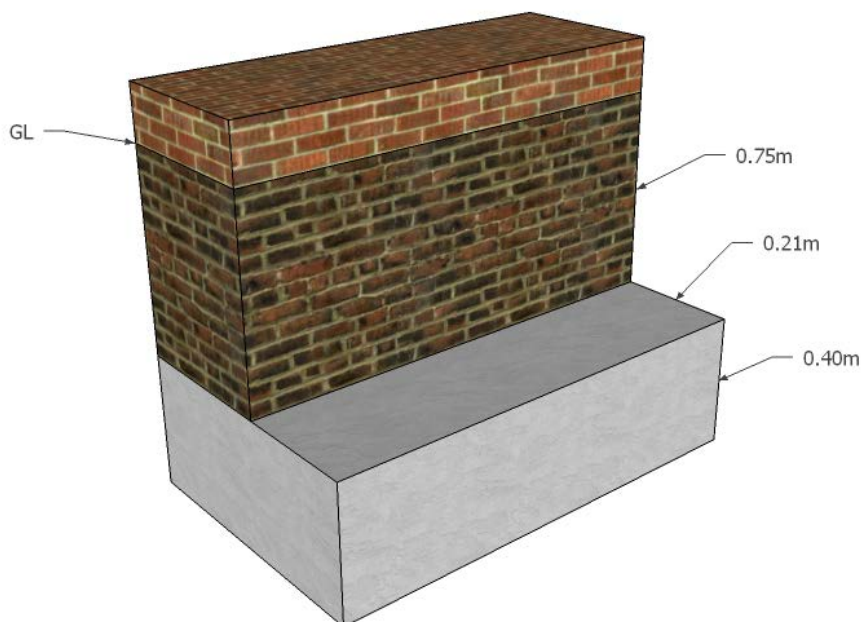
HDTP3 was excavated to expose the existing foundations on the southern side of the Primary School Main Building. A concrete foundation was encountered at 0.65mbgl, stepping out 0.10m from the external wall and was 0.30m thick. A schematic drawing of the inspection pit is given below:



The bearing strata of the foundations encountered at HDTP3 were the Winter Hill Gravels comprising firm orange brown to brown sandy gravelly clay.

3.1 Site Works (Continued)

HDTP4 was also excavated to expose the existing foundations on the southern side of the Primary School Main Building. A concrete foundation was encountered at 0.75mbgl, stepping out 0.21m from the external wall and was 0.40m thick. A schematic drawing of the inspection pit is given below:



The bearing strata of the foundations encountered at HDTP4 were the Winter Hill Gravels comprising firm orange brown to brown sandy gravelly clay.

The in-situ CBR tests were carried out using a MEXE Probe at formation depth.

Before any intrusive works commenced a CAT survey was undertaken at all locations to clear them of any services.

The fieldworks were supervised by Terra Firma (South), who also logged the boreholes, trial pits and hand dug trial pits to the requirements of Eurocode 7.

The windowless sampling borehole logs, trial pit logs and hand excavated inspection pit logs are presented in **Annex A**, **Annex B** and **Annex C** respectively and are shown on **Drawing 02**.

3.2 Exploratory Strategy

The boreholes, trial pits and hand excavated inspection pits were undertaken at locations provided by Hampshire County Council.

3.3 Sampling Quality Assurance

Care was taken to ensure that sampling quality assurance occurred during site works. This included the following measures:

- The use of nitrile gloves at each sampling point.

3.3 Sampling Quality Assurance (Continued)

- Stainless steel shovels were used to collect soil samples. The tool was cleaned with distilled water between each sample point.
- Soil samples were stored at a temperature below 4 degrees.
- Soil samples were stored within sample containers according to the chemical testing required.
- No head space was left in sample containers.

3.4 Sampling Regime

3.4.1 Soil Chemical Test Sampling

During the intrusive investigation small disturbed soil samples were collected for chemical testing. The sampling regime was conducted in accordance with BS5930: 1999 in order to satisfy the criteria below:

- Identify and confirm suspected sources of contamination
- Determine type and concentration of contamination
- Determine lateral and vertical spread of contaminants
- Ensure representation of the entire site
- Provide sufficient data to determine suitable remedial measures if necessary

The sample locations and depths are illustrated in the table on the following page:

Table 3.1 Soil Chemical Test Sample Descriptions			
Sample No.		Soil Type	Sample Description
WS1	0.25m	Topsoil	Dark brown sandy gravelly CLAY
WS5	0.25m	Made Ground	Dark brown sandy gravelly CLAY
WS6	0.25m	Made Ground	Dark brown slightly gravelly sandy CLAY
WS7	0.20m	Made Ground	Dark brown clayey gravelly SAND
SA1	0.20m	Made Ground	Dark brown sandy gravelly CLAY
HDTP2	0.30m	Made Ground	Brown sandy gravelly CLAY
HDTP4	0.60m	Made Ground	Brown sandy gravelly CLAY
HDTP5	0.30m	Topsoil	Dark brown sandy gravelly CLAY

In addition, Waste Acceptance Criteria (WAC) testing was undertaken on a representative sample of material due for possible removal from site.

The sample location and depth are illustrated in the following table.

Table 3.2 WAC Test Sample Descriptions			
Sample No.		Soil Type	Sample Description
WS4	0.30m	Topsoil	Dark brown slightly gravelly sandy CLAY
SA2	0.45m	Made Ground	Dark brown sandy gravelly CLAY

3.4.2 Soil Property Test Sampling

During the intrusive investigation bulk soil samples were collected for soil property testing.

The sample locations and depths are illustrated in the table on the following page.

3.4.2 Soil Property Test Sampling (Continued)

Table 3.3 Soil Property Test Sample Descriptions			
Sample No.		Test	Laboratory Description
WS1	0.50 – 1.00m	MC, PI, BRE	Yellowish brown slightly gravelly sandy CLAY
WS1	2.50 – 3.00m	MC, PI	Yellowish brown sandy clayey GRAVEL
WS2	1.50 – 2.00m	MC, PI	Yellowish brown sandy clayey GRAVEL
WS2	2.50 – 3.00m	PSD, S	Yellowish brown clayey very sandy GRAVEL
WS3	0.50 – 1.00m	MC, PI	Yellowish brown slightly gravelly slightly sandy CLAY
WS3	1.50 – 2.00m	MC, PI	Yellowish brown gravelly CLAY
WS4	1.50 – 2.00m	MC, PI, BRE	Yellowish brown slightly gravelly clayey SAND
WS5	1.50 – 2.00m	MC, PI	Yellowish brown gravelly sandy CLAY
WS5	3.50 – 4.00m	PSD, S	Brown clayey very gravelly SAND
WS6	0.50 – 0.80m	MC, PI, BRE	Brown gravelly clayey SAND
WS6	1.50 – 2.00m	MC, PI	Yellowish brown with grey gravelly sandy CLAY
WS7	1.50 – 2.00m	MC, PI, BRE	Brown with grey slightly sandy gravelly CLAY
WS7	2.50 – 3.00m	PSD, S	Yellowish brown clayey very sandy GRAVEL
WS8	0.50 – 1.00m	MC, PI, BRE	Yellowish brown slightly sandy gravelly CLAY
WS8	1.50 – 2.00m	MC, PI	Orangish brown gravelly clayey SAND
SA1	0.60m	MC, PI	Yellowish brown gravelly sandy CLAY
SA1	1.90m	MC, PI	Yellowish brown sandy clayey GRAVEL
SA2	0.80m	MC, PI	Yellowish brown slightly sandy gravelly CLAY

Notes MC: Moisture Content Test
 PI: Plasticity Index (PI) Test
 PSD: Particle Size Distribution (PSD) Test
 S: Sedimentation Analysis
 BRE: Concrete Design Parameter Test (Suite D)

3.5 Ground Conditions

The ground conditions encountered by the boreholes and trial pits varied slightly across the site but can in general be summarised as shown in Table 3.4 on the following page:

3.5 Ground Conditions (Continued)

Table 3.4 Summary of Ground Conditions					
Depth (m)			Thickness (m)	Stratum	
GL	-	0.30/0.95	0.30/0.95	MADE GROUND: Grass or asphalt over soft brown to dark brown, sandy gravelly CLAY . Gravels are sub-angular to sub-rounded, fine to coarse of flint, brick, concrete, ash and glass	<i>Made Ground</i>
0.30/0.95	-	1.90/3.00	0.95/2.70	Firm to very stiff orange brown to brown sandy gravelly CLAY . Gravels are sub-angular to sub-rounded, fine to coarse of flint.	<i>Winter Hill Gravel</i>
1.90/3.00	-	>5.00	-	Medium dense to very dense, orange brown, brown and dark brown, gravelly clayey SAND . Gravels are sub-angular to sub-rounded, fine to coarse of flint.	

It should be noted that the lower granular Winter Hill Gravels was only proven within WS1, WS2, WS5 and WS7. Within the other hole locations the mini-percussive drilling rig refused on the top of this very dense strata.

Typical SPT strength tests within the superficial Winter Hill Gravel deposits revealed an average N value of 31.9 (range: 8 to >50). The strength of the Winter Hill Gravels typically increased with depth.

The sides of the trial pit excavations were found to be relatively stable.

3.6 Water Strikes

Groundwater strikes were encountered within WS1 and SA1 only at depths of between 2.90m and 3.00m respectively.

3.7 In-situ Soakaway Testing

During the site investigation, in-situ soakaway tests were undertaken at three locations, SA1 and SA2 at a depth of 3.00m and where possible were carried out to the requirements of BRE Digest 365.

The appropriate calculation sheets are presented in **Annex D** and the results are discussed in Section 6.7.

3.8 In-situ California Bearing Ratio (CBR) Testing

The in-situ CBR tests (4No) were carried out using a MEXE probe at formation level.

All CBR tests were at the limit of the MEXE probe (>15%).

3.9 Laboratory Chemical Testing

During the recent site works six soil samples were taken and despatched to the laboratories of DETS for laboratory chemical testing.

The following standard chemical testing suite for common contaminants was undertaken:

Metals	Semi Metals/Non-Metals	Organic Chemicals
Cadmium	Arsenic	Phenol
Chromium	Selenium	Poly-Aromatic Hydrocarbons (PAH)
Hexavalent Chromium	Boron	Petroleum Hydrocarbons (EPH)
Lead		Poly-chlorinated biphenyls (PCB)
Mercury	Inorganic Chemicals	
Thiocyanate	Cyanide	
Nickel	Sulphate	Others
Zinc	Sulphide	pH (acidity)
Copper	Ammoniacal Nitrogen	Asbestos

It should be noted that one sample was obtained directly down-stream of the on-site electrical sub-station and tested for Poly-chlorinated biphenyls (PCB's).

In order to assess the aggressiveness of the soil deposits underlying the site, three samples were also tested for the BRE SD1 Suite D.

The results of the above soil chemical tests are presented in **Annex E** and evaluated in Section 4.

3.10 Soil Property Testing

Eighteen bulk samples were collected, and dispatched to the laboratories of i2 Analytical for soil property testing. The following soil property tests were undertaken:

3.10.1 Classification Testing

In order to assess classification characteristics underlying the site, bulk samples were collected and dispatched to the laboratories of i2 Analytical for Moisture Content (MC), Plasticity Index (PI), Particle Size Distribution (PSD) and Sedimentation testing.

In addition, four samples were also tested for the BRE SD1 Suite D.

The test results are presented in **Annex F** and the results are discussed in Section 5.

SECTION 4 Risk Assessment and Evaluation of Analytical Results

4.1 Risk Assessment

4.1.1 Introduction

The results obtained from the investigation, which are discussed in detail in **Section 4.2**, were used to conduct an environmental risk assessment for the site. The risk assessment aimed to:

- Identify sensitive receptors
- Determine pathways for contaminant migration to the receptors
- Estimate contaminant impact on receptors
- Establish whether remedial action is required
- Calculate remediation target levels if required

The future use of the site i.e. whether it is to be used for residential or commercial has an impact on any risk assessment. In the case of this development the site is to be used for educational development.

Given the working criteria of a school and that development proposals do not include any garden areas; all soil test results have been compared to thresholds for a Public Open Space (POS) – Residential development.

4.1.2 Methodology

Soils

Environmental risk assessment evaluates the risk to receptors via an analysis of the ‘source-pathway-target’ linkage. In order for a risk to be present, there must be a contaminant source capable of causing a health risk, a vulnerable receptor, and a pathway linking the two.

This sort of risk assessment is usually conducted using a tiered approach. Tier 1 consists of a comparison of the analytical results obtained from the site investigation with Soil Guideline Values (SGV’s) specific to the type of development obtained from The Environment Agency Contaminated Land Exposure Assessment (CLEA) Guidelines.

The CLEA model, technical guidance and Soil Guideline Values are currently under review, as a direct result of the publication published by DEFRA (2006) ‘Soil Guideline Values: The Way Forward’. The technical guidance CLR 9 and CLR 10 have been superseded by Science Reports (SR) 2 and SR3.

Whilst the toxicological and risk assessment framework is under review, the most contemporary Soil Guideline Values will be used in the risk assessments.

Where SGV values are not available reference has been made to the Land Quality management (LQM) Chartered Institute of Environmental Health (CIEH) Generic Assessment Criteria (GAC) and Provisional Category 4 Screening Levels (C4SL).

All receptor profiles, source inputs and toxicological parameters comply with both peer reviewed literature and CLR 7 to CLR 10. As with SGV’s the SSV’s and CIEH GAC are not yet updated to SR2 and SR3.

4.1.2 Methodology (Continued)

Should Tier 1 levels be exceeded, a choice is made either to remediate the site to conservative Tier 1 levels, or proceed to Tier 2.

Tier 2 makes use of site-specific data to evaluate acceptable concentrations of chemicals for the particular conditions present at the site.

At each tier, the amount and detail of investigation work increases as more site-specific data are needed to refine the characterisation of the site. Conversely, as site conditions are better understood, a more site-specific remediation strategy can be determined.

Groundwater

In the case of groundwater and/or leachate, the acceptable concentrations are sourced from the Environment Agency Chemical Standards Report for each individual substance. The report presents a variety of target concentrations specific to protection goals and environmental media in which the standard applies. The most applicable protection goal and environmental media for this project is the protection of aquatic life in a freshwater environment.

Where there is no standard for a freshwater environment, the target concentrations are derived from UK standards for drinking water (for human consumption). In the absence of any published guideline, a conservative threshold is suggested.

4.1.3 Sources

The sources of contamination considered in the risk assessment are taken to be concentrations of chemicals beneath the site.

4.1.4 Pathways

The various pathways considered in the risk assessment are given below:

- Direct contact/inhalation/ingestion of affected superficial soils, up to 1.0m in depth
- Wind born dust from affected superficial soils
- Leaching from soils to groundwater
- Groundwater transport

4.1.5 Potential Receptors

Potential receptors include site workers, future visitors, residents in the area surrounding the site, persons who may come into contact with water in the vicinity of the site, the underlying minor aquifer and nearby surface waters and aquatic life in these waters.

4.2 Evaluation of Analytical Results

4.2.1 Soils

For Tier 1, the site itself is considered to be the receptor. Therefore, attenuation of contaminants between the source and receptor is not considered.

A summary of the chemical test results compared with generic regulatory guideline levels are given in Table 4.1 on the following page:

4.2.1 Soils (Continued)

Table 4.1 Summary of Chemical Test Results: General Contaminants

Substance	SGV/SSV (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of exceedences	95% UCL ***
			Minimum	Maximum		
Arsenic	79	C4SL	11	16	0	-
Cadmium	220	C4SL	<0.1	0.2	0	-
Boron	21000	CIEH	0.4	1.4	0	-
Chromium	1500	CIEH	13	28	0	-
Chromium VI	21	C4SL	<1.0	<1.0	0	-
Lead	630	C4SL	16	47	0	-
Mercury	120	CIEH	<0.05	0.07	0	-
Ammoniacal Nitrogen as N	570	GAC	9.6	20	0	-
Selenium	1100	CIEH	0.6	0.8	0	-
Copper	12000	CIEH	11	26	0	-
Nickel	230	CIEH	8.2	15	0	-
Thiocyanate	170	CLEA	<0.6	0.9	0	-
Zinc	81000	CIEH	27	51	0	-
Total PAH**	-	-	<1.6	<1.6	-	-
Total Cyanide	8	CLEA	<0.1	0.2	0	-
Free Cyanide	-	-	<0.1	0.2	-	-
Phenols	440	CIEH	<0.3	3.0	0	-
Sulphate	2400*	BRE	0.02	0.09	See concrete assessment	-
Sulphide	-	-	16	36	-	-
Sulphur	-	-	<0.01	0.03	-	-
Organic Matter	-	-	0.2	2.5	-	-
pH	-	-	7.6	9.3	-	-
EPH (C10–C40)	3800****	CIEH	<10	43	0	-
Total PCB	0.008	CLEA	<0.01	<0.01	BDL	-

Table 4.1 Notes:

- C4SL - Provisional Category 4 Screening Levels for Public Open Space (POS) – Residential

4.2.1 Evaluation of Analytical Results (Continued)

- CIEH - Chartered Institute of Environmental Health Land Quality Management S4UL Generic Assessment Criteria (based upon worse-case 1% SOM content) for Public Open Space (POS) – Residential
- CLEA - Soil guideline values for residential development
- GAC - generic assessment criteria calculated using the CLEA model
- PAH - Poly-Aromatic Hydrocarbons
- BRE - Building Research Establishment - Considered in concrete aggressive assessment.
- PCB - Total PCB - Poly-Chlorinated Bi-phenol's, Euro 7
- BDL - Below Detection Limits
- * - Sulphate considered in assessment of concrete environment.
- ** See speciated PAH results
- *** - 95% Upper Confidence Limit (UCL) statistical analysis not undertaken on contaminants with no exceedences and/or insufficient number of samples
- **** - Based on worse-case CIEH guideline for Aromatic C₁₆-C₂₁ fraction
- - No comparable target concentration / guideline value
- A total of six samples were tested for these substances, other than PCB's where one sample was tested

In addition, Asbestos screening on all six samples revealed NAD (No Asbestos Detected).

It should be noted that for contamination concentrations, which are measured to be lower than the detection limits, then the detection limit has been included in the statistical assessment.

In order to accurately assess the risk from Total PAH, further testing comprising speciation was also undertaken. Speciation splits the total PAH concentration into its sixteen components. It is important to know which components make up the total, as some are relatively harmless in comparison to others.

The speciated Poly-Aromatic Hydrocarbons (PAH) soil chemical test results are shown in Table 4.2 on the following page.

4.2.1 Soils (Continued)

Table 4.2 Summary of Soil Chemical Test Results – Speciated PAH						
Substance	GAC (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of exceedences	95% UCL *
			Minimum	Maximum		
Naphthalene	4900	CIEH	<0.1	<0.1	-	0
Acenaphthylene	15000	CIEH	<0.1	<0.1	-	0
Acenaphthene	15000	CIEH	<0.1	<0.1	-	0
Fluorene	9900	CIEH	<0.1	0.1	-	0
Phenanthrene	3100	CIEH	<0.1	<0.1	-	0
Anthracene	74000	CIEH	<0.1	<0.1	-	0
Fluoranthene	3100	CIEH	<0.1	0.2	-	0
Pyrene	7400	CIEH	<0.1	0.2	-	0
Benzo(a)anthracene	29	CIEH	<0.1	<0.1	-	0
Chrysene	57	CIEH	<0.1	<0.1	-	0
Benzo(b)fluoranthene	7.1	CIEH	<0.1	<0.1	-	0
Benzo(k)fluoranthene	190	CIEH	<0.1	<0.1	-	0
Benzo(a)pyrene	10	C4SL	<0.1	<0.1	-	0
Dibenzo(a,h)anthracene	0.57	CIEH	<0.1	<0.1	-	0
Benzo(g,h,i)perylene	640	CIEH	<0.1	<0.1	-	0
Indeno(1,2,3-c,d)pyrene	82	CIEH	<0.1	<0.1	-	0

Table 4.2 Notes:

- CIEH – Chartered Institute of Environmental Health Land Quality Management Generic Assessment Criteria (based upon worse-case 1% SOM content)
- C4SL – Provisional Category 4 Screening Levels for Public Open Space (POS) – Residential
- * - 95% Upper Confidence Limit (UCL) statistical analysis not undertaken on contaminants with no exceedences and/or insufficient number of samples
- A total of six samples were tested for these substances

4.3 Contaminants of Concern in Soils

4.3.1 Soils

Contaminants of concern are those whose measured concentrations or 95% Upper Confidence Limit exceeds the relevant Tier 1 CLEA Soil Guideline Value or CIEH Generic Assessment Criteria.

4.3.1 Soils (Continued)

It can be seen from Tables 4.1 and 4.2, that all of the substances tested for were found to be below the Tier 1 guideline values for a Public Open Space (POS) - Residential development. Therefore, the site as a whole can be considered uncontaminated.

4.4 Waste Acceptance Procedure

Any materials to be removed from site should be subject to the Waste Acceptance Procedure (WAP) in order to appropriately classify the waste for the correct type of landfill.

Based on the results of the WAC testing, the shallow deposits from WS4 @ 0.30m and SA2 @ 0.45m have been classed as inert waste.

It is recommended that all results are sent to the receiving landfill for confirmation before haulage.

The results of the WAC testing have been included in **Annex E**.

SECTION 5 Qualitative Risk Assessment/Mitigation Measures

The following is a representation of environmental processes on the site and its immediate vicinity. Its purpose is to identify potential contaminants, pathways and receptors with a view to identifying potential and significant pollution linkages.

5.1 Site Summary

Historically, the site has typically comprised open grassland/field from at least 1881 to 1969. From then, the Moorlands Primary School, present today, was erected. This building has maintained the same footprint from 1969 to present with little or no change on site. No boiler house has been identified; however this should be confirmed by buildings maintenance. From recent aerial photography, it can be seen that sometime between 2009 and 2010, possible banded Above Ground Storage Tanks (AST's) were installed in the south-east corner of the school. These remained present until sometime before 2014.

Historically, the surrounding area (<250m) has typically comprised small local residencies from before 1900 with a gravel pit present 250m west from 1910. By 1932, significant residential development had taken place to the east, gaining momentum through until 1968 where vast residential expansion had taken place. Extensive development continued to sometime before 1976, from which gradual residential expansion continues to present.

The preliminary human health and environmental risk assessment has revealed that due to the sites and surrounding areas current and past land uses that a low to moderate risk is present from localised contamination present beneath the site, with particular risk specifically associated with the Electricity sub-station, AST's, Car parking Areas and Potential Made Ground.

The geological Map of the area shows the site to be underlain by the London Clay Formation of the Paleogene. The London Clay Formation typically comprise bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. Superficial deposits in the form of the Winter Hill Gravel are shown to overlie the solid geology of the area. These deposits typically comprise variably clayey and sandy gravel.

The site investigation has revealed a layer of variable made ground to a depth of typically between 0.30m and 0.95m. The made ground was underlain by Winter Hill Gravels comprising typically firm to very stiff, orangey brown to brown, sandy gravelly clay to a depth of between 1.90m and 3.00m. These deposits became more granular with depth comprising medium dense to very dense gravelly clayey sand to the maximum investigated depth of 5.00m.

Groundwater strikes were encountered within WS1 and SA1 only at depths of between 2.90m and 3.00m respectively.

The Aquifer Designation Map for the area shows the underlying Superficial Deposits and Bedrock Geology beneath the site to comprise a Secondary Aquifer and Unproductive Strata respectively.

Surface and perched groundwater flows from the site are likely to be in an westerly direction, following the natural topography of the wider area. These waters will probably be collected by the nearest surface water feature, indicated as the Thames River, located approximately 1.5 km to the North of the site.

5.2 Potential Contaminants

5.2.1 Soils

Soil chemical testing has revealed no elevations above the threshold guideline values for a Public Open Space (POS) – Residential development.

Therefore, there are no contaminants of concern and the site as a whole can be considered uncontaminated.

5.3 Potential Receptors

During Construction

- Construction workers
- Neighbouring site users
- Passers-by
- The Aquatic Environment - Surface waters, perched groundwater, groundwater.

Following Construction

- Site End Users - Child students, adult workers, visitors, maintenance contractors
- The Aquatic Environment - Surface waters, perched groundwater, groundwater
- Building Materials – these are potentially at risk from aggressive ground conditions
- Vegetation upon the site is potentially at risk from phytotoxic contaminants

5.4 Potential Pathways

The proposed development consists of an extension to the existing school facilities.

How the proposed development finish affects the various possible contamination pathways is considered below and evaluated in Table 6.1.

Potential risks are present during and following construction of the development to potential receptors from ingestion, inhalation, dermal contact, surface water run-off, leaching and groundwater transport. By adhering to the following protection measures any risks can be considered very low.

Ingestion of soil/soil dust, dermal contact and ingestion of site grown vegetables

Any combustible materials found during excavations should be removed and replaced with suitable materials. The combustible materials should be suitably disposed of.

If materials are imported, which are not a natural quarry product with British Standard Certification, or are not sourced from a builders merchant, DIY store or retail outlet in bagged bulk form, analytical validation testing will be required, to ensure that imported materials is suitable and will not cause pollution to the site, and pose a risk to human health.

Any materials to be removed from site should be subject to the Waste Acceptance Procedure (WAP) in order to appropriately classify the waste for the correct type of landfill.

All service runs should be backfilled with inert materials to ensure that future maintenance workers / contractual workers do not come into contact with contaminated soils.

5.4 Potential Pathways (Continued)

If during the development materials or abnormal ground conditions are encountered that are significantly different to those encountered in the investigation, the occurrence should be reported to the Engineer and appropriate action taken prior to continuing with the works.

The appointed contractor(s) should as a minimum;

1. Comply with all current Health and Safety regulations
2. Provide Method Statements and Risk Assessments in place to deal with measures set out in this section
3. Comply with Control of Substances Hazardous to Health (COSHH) Assessment
4. Maintain a good level of Personal Protection Equipment (PPE)
5. Maintain a good level of hygiene by site workers
6. Put in place dust suppression measures when necessary

The contractor(s) must also strictly adhere to the relevant Pollution Prevention Guidelines which aim to minimise detrimental harm to the environment and health.

Within the documentation prepared by the contractor(s), the following information should be provided, but not limited to:

1. Project Description
2. Key participants/contractor(s)
3. Technical procedures
4. Phasing of works and approximate timescales
5. Site plans to scale
6. Details of consents or license needed
7. Health and Safety, COSHH Assessment, Method Statements and Risk Assessments
8. Emergency contingencies

In addition, the following precautions should also be taken.

1. All potential chemicals and associated risks and emergency procedures for spills/leaks should be considered in the site risk assessment and the details provided to all site employees
2. Any potential pollutant materials or chemicals/detergents used on site should be adequately stored in suitable containers, with clear labelling.
3. Any oil or hazardous substance containers and associated pipe works should be enclosed within a bund.
4. Care taken during delivery of materials, with correct supervision and labelling detailing the substance and its quantities.
5. All delivery drivers should be informed of procedures and restrictions
6. Any materials on delivery should be covered to ensure no spillage from the vehicle.
7. Any detergents, paints, chemicals etc. should not be allowed to be discharged into surface drains or water courses
8. Washing out and cleaning of concrete/cement plant should be carried out in a contained area with adequate measures to collect all run-off water.
9. Security and prevention of vandalism, especially of oil drums/containers.

It is considered that the site will be sufficiently fenced off during development and that dust suppression measures will be made if required, meaning there will be no risk to neighbouring site occupants and passers-by.

5.4 Potential Pathways (Continued)

The determinants tested were all present at concentrations below the relevant guidelines and therefore, there are no contaminants of concern. Therefore it is considered that the human health risks are low and that no mitigation measures will be required for the development.

Inhalation of soil dust /ground gas/radon

Protection of site workers from soil dust inhalation can be minimised by simple health and safety measures and dust suppression.

Neighbouring site occupants and passers-by will similarly not be at risk with dust suppression.

It is considered that site workers, passers-by and neighbouring site occupants are not at risk from ground gas or vapours.

Site end users, upon completion, will similarly not be at risk from soil dust/vapours. In addition, chemical testing has revealed that all Volatile Petroleum Hydrocarbons were below guideline values.

A low risk has been identified from landfill and/or ground gas migration based on the Contaminated Land Desk Study Report.

There is a low risk present from radon gas to the site end users and no radon protection measures are required.

Surface water run-off/leaching into the groundwater/groundwater transport

1. Short-term

In respect of physical effects of the site works during the construction period, there is a low risk to the environment/adjacent land and water bodies from digging foundations, moving contaminated soil, runoff from construction materials and/or exposed ground, wheel washings and oil or chemical spills.

All adverse effects should however be preventable by due diligence to good construction practice and housekeeping in preventing surface runoff and the spillage of materials. The basic measures that should be taken are as follows:

- Prepare a drainage plan
- Carry out any activities that could cause pollution in a designated, bunded area, away from rivers or boreholes
- Use settlement ponds to remove silty water
- Store all oils and chemicals in a fully bunded area to prevent leaks or spills

It should be noted that the appointed contractor should provide Method Statements and Risk Assessments to deal with these matters.

2. Long-term

The chemical analysis of soil beneath the site constitutes a Level 2 assessment in terms of Remedial Targets Methodology, where the primary receptor/compliance point is the groundwater.

5.4 Potential Pathways (Continued)

No leachate or groundwater chemical testing has been undertaken; however it is considered that the low levels of total contaminants will have correspondingly low levels of leachate and will, therefore, not pose a risk to the aquatic environment.

In addition, it is considered that the risk to the aquatic environment is low due to environmental setting as detailed below:

1. Underlying Secondary/Unproductive Aquifer ,
2. Distance to the nearest surface water body (1.5km), and
3. Combined with the effect of natural attenuation, dilution and absorption.

It is therefore considered that that there is likely to be a low risk to the aquatic environment and that the next level of assessment (Level 3) is not required given the environmental setting detailed above.

Permeation of Water Pipes

If water pipes are to be laid beneath the site an assessment should be made, by the water provider, of soils along the route of the pipe with reference to the material selection criteria using the UKWIR methodology.

5.5 Human Health Risks

A Qualitative Risk Assessment on the potential human health effects is detailed in Table 5.1 below.

Table 5.1 – Human Health Risk Assessment				
Source	Pathway	Target	Risk Assessment	Mitigation Measures
Made Ground	Dermal contact with soil/dust. Inhalation and ingestion of soil/soil dust	Construction workers	Low Risk with protection measures	COSHH assessment and good level of PPE/ hygiene by site workers/ staff; dust suppression measures if required
Made Ground	Dermal contact with soil/dust. Inhalation and ingestion of soil/soil dust	Neighbouring site occupants, Passers-by	Low Risk during excavation phase of development and on completion	Site screening and dust suppression measures if required
Made Ground	Dermal contact with soil/dust. Inhalation and ingestion of soil/soil dust, ingestion of site grown vegetables	Site end users	Low Risk	Contamination testing revealed no contaminants tested were above the regulatory guidelines
Landfill and Ground Gas	Inhalation	Site end users	Low Risk	No historic or active landfills within 250m of the site.

Radon Gas	Inhalation	Site end users	Low Risk	Radon protective measures are not required
Made Ground	Permeation of water pipes	Site end users	Potential Risk	Assessment of soils along the route of pipes. Made ground in service trenches should be removed and replaced with clean fill

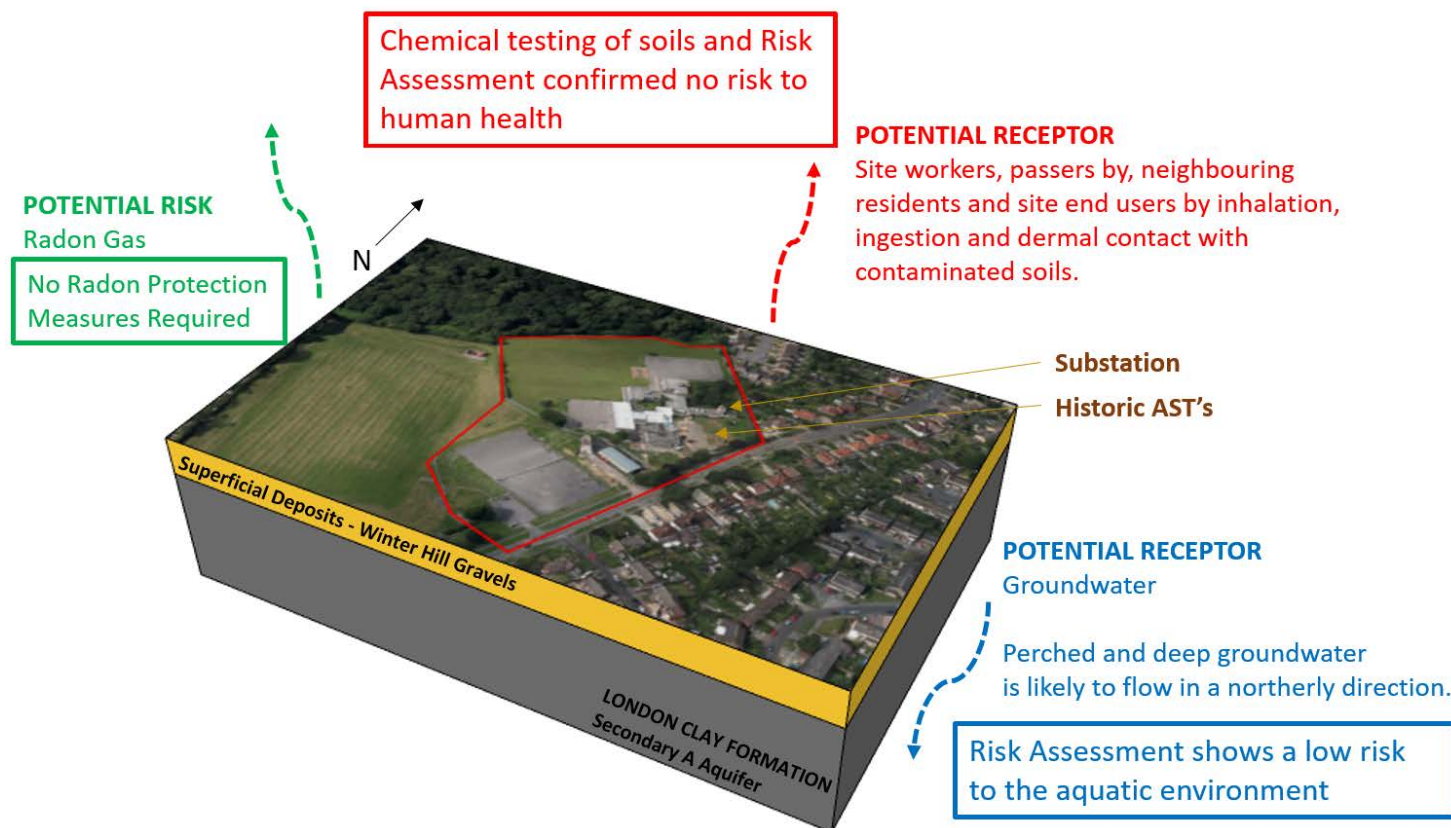
5.6 Risks to the Aquatic Environment

A Qualitative Risk Assessment on the potential effects to the aquatic environment is detailed in Table 5.2 below.

Table 5.2 Risks to the Aquatic Environment				
Source	Pathway	Target	Risk Assessment	Mitigation Measures
Made Ground	Surface water run-off	Surface Water	Low Risk due to the environmental setting	Not Applicable
	Leaching into Groundwater	Groundwater	Reduced risk of contaminant migration and deep transmission is due to the installation of drainage systems and the effect of natural attenuation, dilution and absorption.	
Made Ground	Leaching into Groundwater	Groundwater	Low Risk during construction and excavation phase of development	Measures to avoid accidental spillage of materials during earthmoving activities, and to control surface run off

5.7 Site Conceptual Model

A schematic cross-section of the site is presented on the following page. The cross section is based on the information available from the recent desk study and site investigation. The model is schematic and not to scale.



5.7 Limitations of the Site Conceptual Model

The areas of uncertainty within the conceptual site model are:

- Presence of and composition of the groundwater within the bedrock
- Direction of groundwater flow

SECTION 6 Geotechnical Laboratory Testing

6.1 Classification Testing

A summary of the Plasticity Index (PI) and moisture content results is presented below. The laboratory test results are presented in **Annex F**.

Table 6.1 Plasticity and Moisture Content Test Results						
Sample No.		Stratum	Plasticity Index (%)	% Passing 425µm	Moisture Content (%)	Modified Shrinkage Potential
WS1	0.50 – 1.00m	Winter Hill Gravel	29	99	20	Medium
WS1	2.50 – 3.00m	Winter Hill Gravel	20	27	11	None
WS2	1.50 – 2.00m	Winter Hill Gravel	21	29	15	None
WS3	0.50 – 1.00m	Winter Hill Gravel	18	82	20	Low
WS3	1.50 – 2.00m	Winter Hill Gravel	27	63	22	Low
WS4	1.50 – 2.00m	Winter Hill Gravel	18	97	15	Low
WS5	1.50 – 2.00m	Winter Hill Gravel	35	55	15	Low
WS6	0.50 – 0.80m	Winter Hill Gravel	17	54	13	None
WS6	1.50 – 2.00m	Winter Hill Gravel	43	64	20	Medium
WS7	1.50 – 2.00m	Winter Hill Gravel	21	60	15	Low
WS8	0.50 – 1.00m	Winter Hill Gravel	22	63	15	Low
WS8	1.50 – 2.00m	Winter Hill Gravel	16	62	11	Low
SA1	0.60m	Winter Hill Gravel	37	69	23	Medium
SA1	1.90m	Winter Hill Gravel	25	26	9.0	Low
SA2	0.80m	Winter Hill Gravel	29	61	14	Low

The results of the plasticity testing reveal that the underlying Winter Hill Gravels exhibit typically none to medium shrinkage potential with moisture content of between 9% and 23%.

A summary of the particle size distribution test results is presented on the following page. The laboratory test results are presented in **Annex F**.

6.1 Classification Testing (Continued)

Table 6.2 Particle Size Distribution Test Results							
Sample No.		Stratum	Soil Fraction (Total %)				
			Cobbles	Gravel	Sand	Silt	Clay
WS2	2.50 – 3.00m	Winter Hill Gravel	0	52.2	38.7	9.1	
WS5	3.50 – 4.00m	Winter Hill Gravel	0	22.8	71.6	5.6	
WS7	2.50 – 3.00m	Winter Hill Gravel	0	46.5	44.5	9.3	

Table 6.2 Notes:

- For full % Passing results see **Annex F**

The results show that the underlying Winter Hill Gravels comprise cobble fractions of zero, gravel fractions of between 22.8% and 52.2%, sand fractions of between 38.7% and 71.6% and silt/clay fractions of between 5.6% and 9.3%.

Sedimentation analysis was not undertaken due to the amount of fines being below 10%.

A summary of the BRE SD1 test results is presented below. The laboratory test results are also presented in **Annex F**.

Table 6.3 BRE SD1 Suite Test Results							
Sample No.		Stratum	Water Soluble Sulphate (mg/l)	Total Potential Sulphate (%)	Total Sulphur (%)	Water Soluble Chloride (mg/l)	pH Value
WS1	0.50 – 1.00m	Winter Hill Gravel	<1.25	0.013	0.009	2.2	7.0
WS4	1.50 – 2.00m	Winter Hill Gravel	3.08	0.006	0.006	0.6	6.9
WS5	0.25m	Made Ground	47	0.05	0.02	-	9.3
WS6	0.50 – 0.80m	Winter Hill Gravel	17.7	0.020	0.011	1.7	6.9
WS7	1.50 – 2.00m	Winter Hill Gravel	10.5	0.007	<0.005	6.2	7.1
WS8	0.50 – 1.00m	Winter Hill Gravel	40.8	0.012	0.008	1.7	6.8
HDTP2	0.30m	Made Ground	<10	0.02	<0.01	-	8.0
HDTP4	0.60m	Made Ground	94	0.09	0.03	-	8.4

The results of the BRE testing reveal that the underlying Made Ground Deposits comprises of Water Soluble Sulphate values of between <10 and 94mg/l. The pH values ranged between 8.0 and 9.3.

The underlying Winter Hill Gravels comprises of Water Soluble Sulphate values of between <1.25 and 40.8mg/l. The pH values ranged between 6.8 and 7.1.

SECTION 7 Engineering Recommendations

7.1 Preparation of Site

Prior to the main site works, any buildings to be demolished should be subject to a full asbestos survey.

A structural survey should be undertaken of any existing buildings and structures (road and pavement structures,) including pictorial records. This should be updated throughout the site development phases.

Any existing buildings, foundations, floor slabs, concrete/tarmac hard standings beneath the proposed buildings should be broken up and removed from site and disposed of at a suitable landfill facility. Alternatively, the crushed site won materials may be re-used as structural fill, subject to laboratory chemical testing.

Significant allowances should be made for dealing with any historic foundations, floor slabs, basement structures and other buried obstructions.

The existing grass and scrub vegetation, including all roots and any trees to be removed (and not subject to preservation orders) should be grubbed up and removed from beneath the proposed buildings and roadways.

The reduced levels should be brought up to the required levels with well, compacted imported granular materials. Department of Transport (DoT) Type 2 sub-base or similar may be used and should be compacted in layers, in accordance with the Specification for Highway Works. Alternatively, appropriate selected inert imported fill could be used.

Allowances should be made for removing any 'soft spots/area' and their replacement with well compacted granular materials as previously described. The excavated materials will be unacceptable as structural fill and should be removed from site and taken to an appropriately licensed tip.

All materials to be removed from site should be subject to the appropriate Waste Acceptance Protocol (WAP) and taken to an appropriately licensed tip.

Significant contingencies should be made for the protection/diversion of any underground services present beneath the site brought about as a result of the proposed works.

Contingencies should also be made for the protection and any necessary temporary/permanent support of nearby walls.

7.2 Foundation and Floor Slab Solution

The soil sequence beneath the proposed development consisted of variable made ground to a depth of typically between 0.30m and 0.95m. The made ground was underlain by Winter Hill Gravels comprising typically firm to very stiff, orangey brown to brown, sandy gravelly clay to a depth of between 1.90m and 3.00m. These deposits became more granular with depth comprising medium dense to very dense gravelly clayey sand to the maximum investigated depth of 5.00m.

Groundwater strikes were encountered within WS1 and SA1 only at depths of between 2.90m and 3.00m respectively.

7.2 Foundation and Floor Slab Solution (Continued)

The underlying made ground is variable in respect to its geotechnical properties and if foundations were extended into this stratum it would lead to unacceptable levels of differential settlement.

Therefore, in order to avoid unacceptable levels of differential settlement we recommend that mass concrete strip/trench foundations be extended into the Winter Hill Gravels comprising typically firm to very stiff, orangey brown to brown, sandy gravelly clay.

The depth to the above in-situ founding horizons is likely to vary between typically 0.30m and 0.95m below the existing ground level.

For the above foundations founded within the above in-situ material, an allowable bearing pressure of 100kN/m^2 may be used for design purposes. This value is based on the engineer's logs and in-situ strength testing.

For the given foundation solution and bearing pressure, maximum total settlements of 25mm should result, with differential movements (δ/l) of the superstructure not exceeding 1:750 where δ is the differential settlement between two points of a foundation and l is the distance between these points.

To avoid any potential differential settlement all foundations should lie within cohesive deposits. If variability is encountered then reinforcement should be incorporated into the design.

Plasticity tests, summarised in Section 5.1, show the shallow Winter Hill Gravels beneath the site exhibit typically no to medium shrinkage potential. Therefore, given the foundation solution recommended above, to avoid damage from frost heave and or thermal shrinkage, the base of the foundations should lie at least 900mm below final ground level, or sit on non-frost susceptible material extending to this depth.

It is also recommended that the foundations achieve a minimum penetration of 200mm into the above in-situ materials.

In addition, it should be noted that deeper foundation depths than those quoted above may be required within influencing distance of the tree root system of the trees located around the site. The National House Building Council (NHBC) Chapter 4.2 gives Guidelines as to the appropriate depth of foundation based on the type of tree, distance of the foundation from the tree and the plasticity index of the in-situ materials.

If design loads of the floor slabs are less than or equal to typically 5kN/m^2 (imposed load), floor slabs can be designed as ground bearing provided the following recommendations are adhered to:

- Floor slab is designed of adequate strength and durability,
- Uses concrete mixed and reinforced as necessary to support floor loads safely and resist chemical and frost action,
- Is a minimum of 100mm thick, and
- All soft spots/areas are removed from the formations and replaced with well compacted granular materials.

Alternatively, the floor slabs can be designed as suspended.

7.2 Foundation and Floor Slab Solution (Continued)

Allowances should be made for the removal of any 'soft spots' and their replacement with a suitable concrete mix or well-compacted granular material in layers to the specification for Highway Works.

All foundation formations should be inspected by a suitably qualified Engineer before being concreted.

If higher loadings than those stated above are required then consideration should be given to deepening the foundations.

7.3 Excavations and Formations

Most shallow excavations should be possible with normal soil excavating machinery, although significant allowances should be made for a hydraulic breaker when excavating out any historic foundations, concrete floor slabs and other buried obstructions.

Groundwater was locally encountered at depths of between 2.90m and 3.00m. Therefore, excavations are unlikely to encounter groundwater inflows. Any inflows, along with rainwater infiltration should be dealt with by conventional pumping techniques.

It should also be noted that during times of high rainfall a higher groundwater table may be encountered.

The sides of any excavations deeper than 1.00m, especially within any granular deposits, should be supported by planking and strutting or other proprietary means.

The sub-formations/formations will be susceptible to loosening, softening and deterioration by exposure to weather (rain, frost and drying conditions), the action of water (flood water or removal of groundwater) and site traffic. As a minimum the formation/base of excavations must be protected by concrete blinding or a minimum thickness of 200mm of hard-core immediately after exposure.

Formations should never be left unprotected and continuously exposed to rain causing degradation, or left exposed/uncovered overnight, unless permitted by a qualified engineer.

Construction plant and other vehicular traffic should not be operated on unprotected formations.

As a minimum the formation/excavation surfaces must be protected by a minimum thickness of 200mm of hard cover immediately after exposure.

Allowances should be made for trimming, re-trimming and re-compaction if necessary and for the removal of soft spots and their replacement with well compacted granular materials.

It is also recommended that if concerns still remain then a number of plate loading tests are carried out at formation level to confirm the suitability of the formations.

Allowances should be made for special precautions to prevent formation deterioration in addition to the above.

It is recommended that approval be gained from a qualified engineer of the formation condition before covering them with any subsequent construction.

7.4 Earthworks

As summarised in Section 5.1 soil property testing comprising Plasticity Index (PI) and Particle Size Distribution (PSD) testing was undertaken on natural samples across the site.

Based on the above testing and due to the varying nature of the underlying deposits, two classes should be adopted for any proposed earthworks:

Cohesive ‘Natural’ Deposits

- Class 2B (General Cohesive Fill)

Granular ‘Natural’ Deposits

The particle distribution curves showed that the shallow granular deposits will conform to the following classes as defined in the Specification of Highways Works (1992):

- Class 1B (General Granular Fill)

It is likely that the in-situ materials can be used as structural fill. This material should be placed at or close to its optimum moisture content/maximum dry density and compacted in layers as per the requirements of the Specification for Highway Works, Table 6/4 Method 3 for granular material and Table 6/4 Method 2 for cohesive material. These requirements should be followed by the appointed groundwork’s contractor.

In order to reduce the risk of structural failure it is recommended that the roller compaction plant should not transfer any load onto the adjacent foundations. An exclusion zone extending from a 45° angle from the base of the foundations should be used.

Where the roller compaction plant is unable to compact the fill due to this exclusion zone a vibrating plate compactor or vibro-tamper should be used.

7.5 Storm Drainage

Two in-situ permeability/soakaway tests were undertaken, in accordance with the requirements of BRE Digest 365. The infiltration rates are as follows:

Table 6.1 Permeability Test Results			
Soak away Test	Depth (m)	Soil Type	Soil Permeability (m/s)
SA1	3.00	Winter Hill Gravels	N/A*
SA2	3.00	Winter Hill Gravels	N/A*

Notes:

- * The test did not sufficiently drain over the effective storage depth in accordance with BRE365

It should also be noted that soakaways would only be effective above the depth of the groundwater table.

7.6 Protection of Buried Concrete

The laboratory chemical tests revealed total sulphate contents within the shallow deposits of between <1.25mg/l and 40.8mg/l, and pH values variable between 6.8 and 7.1.

7.6 Protection of Buried Concrete (Continued)

Therefore, all buried concrete should, as a minimum, conform to Class AC-1 of BRE Special Digest 1 (2005).

ANNEX A
Mini Percussive Borehole Logs

Project Name Moorlands Primary School		Project No. 5846	Date 30/05/2017 to 30/05/2017			Hole Type WLS
Client Hampshire County Council		Co-ords E: N: L:	Water Strike Details			Logged By SR
Contractor 360 Drilling Ltd			Plant Used Competitor Dart	Depth Strike	Time Elapsed	Rose To
				2.90	0	0.00
						Approved By PS
						Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend	Well
Depth	Type	Results					
0.25	ES		(0.30)		TOPSOIL		
0.50 - 1.00	B		0.30		Soft, dark-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint.		
1.00	SPT(C)	N=9 (1,1/2,2,2,3)	1		Soft becoming firm, orange-brown, slightly gravelly sandy CLAY. gravels are subangular to subrounded, fine to coarse of flint.		
			(1.80)				
2.00	SPT(C)	N=44 (1,3/5,8,11,20)	2				
			2.10		Firm, orange-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint.		
2.50 - 3.00	B		(0.90)				
3.00	SPT(C)	N=42 (14,9/12,11,11,8)	3				
			3.00		Dense, brown, slightly gravelly slightly clayey SAND. Gravels are subangular to subrounded, fine of flint.		
4.00	SPT(C)	N=25 (4,4/5,6,6,8)	4				
			(2.00)				
5.00	SPT(C)	N=35 (9,10/12,12,8,3)	5				
			5.00		End of Borehole at 5.00m		
5.50	SPT(C)	N=26 (3,5/6,7,6,7)					
6.00	SPT(C)	N=28 (7,7/7,7,6,8)	6				

Remarks	Borehole Diameter		
	Base Depth	Diameter	Remarks

Project Name Moorlands Primary School	Project No. 5846	Date 30/05/2017 to 30/05/2017	Hole Type WLS
Client Hampshire County Council	Co-ords E: N: L:	Water Strike Details Depth Strike Time Elapsed Rose To	Logged By SR
Contractor 360 Drilling Ltd	Plant Used Competitor Dart		Approved By PS
			Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend	Well
Depth	Type	Results					
0.50	ES		(0.95)		MADE GROUND Grass over soft, brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint, brick, ash, glass.		
1.00	SPT(C)	N=21 (1,2/3,5,6,7)	1 0.95		Firm to stiff, orange-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint.		
1.50 - 2.00	B		(0.95)				
2.00	SPT(C)	N=46 (10,9/9,10,13,14)	2 1.90		Dense, orange-brown, clayey gravelly SAND. Gravels are subangular to subrounded, fine to coarse of flint.		
2.50 - 3.00	B		(1.10)		2.50 to 2.60m - Band of white quartz.		
3.00	SPT(C)	50 (10,14/50 for 200mm)	3 3.00		End of Borehole at 3.00m		
			4				
			5				
			6				

Remarks	Borehole Diameter		
	Base Depth	Diameter	Remarks

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

Project Name Moorlands Primary School				Project No. 5846	Date 30/05/2017 to 30/05/2017			Hole Type WLS		
Client Hampshire County Council				Co-ords E: N: L:	Water Strike Details			Logged By SR		
Contractor 360 Drilling Ltd					Plant Used Competitor Dart	Depth Strike	Time Elapsed	Rose To	Approved By PS	
								Scale 1:50		
Samples and Results			Depth, (Thickness)	Level	Stratum Description				Legend	Well
Depth	Type	Results								
0.30	ES		(0.40)		MADE GROUND Soft, dark-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine of brick, flint and ash.					
0.50 - 1.00	B		0.40		Firm, brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint.					
1.00	SPT(C)	N=20 (5,6/6,6,4,4)	1							
1.50 - 2.00	B		(2.60)							
2.00	SPT(C)	N=31 (7,7/9,7,7,8)	2							
3.00	SPT(C)	50 (12,13/50 for 210mm)	3	3.00	End of Borehole at 3.00m					
			4							
			5							
			6							

Remarks

Borehole Diameter

Base Depth	Diameter	Remarks
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Consulting Geo-Technical & Geo-Environmental Engineers
Site Investigation Contractors

The Pump House, 44 Marlborough Road,
Exeter, Devon, EX2 4LL
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www.terrafirmasouth.co.uk

Borehole No.
WS4
Sheet 1 of 1

Project Name Moorlands Primary School				Project No. 5846		Date 30/05/2017 to 30/05/2017			Hole Type WLS	
Client Hampshire County Council				Co-ords E: N: L:		Water Strike Details			Logged By SR	
Contractor 360 Drilling Ltd.						Plant Used Competitor Dart			Approved By PS Scale 1:50	
Samples and Results			Depth, (Thickness)	Level	Stratum Description				Legend	Well
Depth	Type	Results								
0.30	ES		(0.30)		TOPSOIL Soft, dark-brown, slightly gravelly sandy CLAY. Gravels are subangular to subrounded, fine to coarse of flint. Firm, brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint.					
			0.30							
			(0.40)		Firm to stiff, orange-brown, slightly gravelly slightly sandy CLAY. Gravels are subangular to subrounded, fine to coarse of flint.					
			0.70							
1.00	SPT(C)	N=14 (1,2/2,3,4,5)	(0.30)	1	Soft to stiff, slightly gravelly very sandy CLAY. Gravels are subangular to subrounded, fine to coarse of flint.					
			1.00							
1.50 - 2.00	B									
			(1.70)							
2.00	SPT(C)	N=27 (3,3/6,6,7,8)		2						
2.50 - 3.00	B									
			2.70		End of Borehole at 2.70m					
3.00	SPT(C)	N=50 (14,9/14,15,15,6)		3						
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										

Remarks

Borehole Diameter

Base Depth	Diameter	Remarks

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

Project Name Moorlands Primary School	Project No. 5846	Date 30/05/2017 to 30/05/2017	Hole Type WLS
Client Hampshire County Council	Co-ords E: N: L:	Water Strike Details Depth Strike Time Elapsed Rose To	Logged By SR
Contractor 360 Drilling Ltd.	Plant Used Competitor Dart		Approved By PS
			Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend	Well
Depth	Type	Results					
0.25	ES		(0.35)		Soft, dark-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint and concrete.		
			0.35		Firm, orange-brown, slightly gravelly sandy CLAY. Gravels are subangular to subrounded, fine to coarse of flint.		
1.00	SPT(C)	N=18 (3,3/3,5,5,5)	1 (1.15)				
1.50 - 2.00	B		1.50 (0.30)		Medium dense to dense, orange brown, clayey SAND.		
2.00	SPT(C)	N=32 (7,7/7,7,8,10)	2 (1.20)		Firm to stiff, orange-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint.		
3.00	SPT(C)	N=49 (2,8/14,12,13,10)	3 3.00		Medium dense, dark-brown, clayey gravelly SAND. Gravels are subangular to subrounded, fine of flint.		
3.50 - 4.00	B						
4.00	SPT(C)	N=25 (2,6/5,6,6,8)	4 (2.00)				
5.00	SPT(C)	N=21 (4,4/5,5,5,6)	5 5.00		End of Borehole at 5.00m		
5.50	SPT(C)	N=35 (7,7/7,9,9,10)					
			6				

Remarks	Borehole Diameter		
	Base Depth	Diameter	Remarks

 Consulting Geo-Technical & Geo-Environmental Engineers Site Investigation Contractors				The Pump House, 44 Marlborough Road, Exeter, Devon, EX2 4LL 01392 438982 www.terrafirmasouth.co.uk				Borehole No. WS6 Sheet 1 of 1			
Project Name Moorlands Primary School				Project No. 5846		Date 31/05/2017 to 31/05/2017		Hole Type WLS			
Client Hampshire County Council				Co-ords E: N: L:		Water Strike Details			Logged By SR		
Contractor 360 Drilling Ltd.						Depth Strike Time Elapsed Rose To			Approved By PS Scale 1:50		
Plant Used Competitor Dart											
Samples and Results			Depth, (Thickness)	Level	Stratum Description				Legend	Well	
Depth	Type	Results									
0.25	ES		(0.30)		MADE GROUND Soft, dark-brown, slightly gravelly sandy CLAY. Gravels are subangular to subrounded, fine to coarse of flint and fine brick. Firm, brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint.						
0.50 - 0.80	B		(0.55)								
1.00	SPT(C)	N=8 (1,1/2,2,2,2)	0.85	1	Firm, orange-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint.						
1.50 - 2.60	B		(1.15)								
2.00	SPT(C)	N=50 (8,9/50 for 235mm)	2.00	2	End of Borehole at 2.00m						
Remarks					Borehole Diameter						
					Base Depth	Diameter	Remarks				
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.											

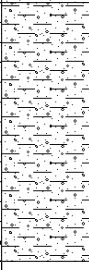
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Remarks	Borehole Diameter		
	Base Depth	Diameter	Remarks
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.			

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

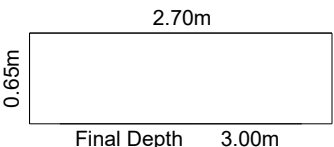
ANNEX B
Trial Pit Logs

 Consulting Geo-Technical & Geo-Environmental Engineers Site Investigation Contractors					The Pump House, 44 Marlborough Road, Exeter, Devon, EX2 4LL 01392 438982 www.terrafirmasouth.co.uk					Borehole No. SA1 Sheet 1 of 1	
Project Name Moorlands Primary School					Project No. 5846		Date 31/05/2017 to 31/05/2017			Hole Type TP	
Client Hampshire County Council					Co-ords E: N: L:		Water Strike Details			Logged By SR	
Contractor John Stacey Plant Hire							Plant Used JCB 3CX		Depth Strike 3.00		Remarks
										Approved By PS Scale 1:50	

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Depth	Type				
	0.20	ES	(0.30)		MADE GROUND Grass over soft to firm, dark-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint and brick Firm, brown, slightly gravelly sandy CLAY. Gravels are subangular to subrounded, fine to coarse of flint.	
	0.60	B				
			1 (1.40)			
			1.70			
	1.90	B		2	Firm to stiff, orange-brown, slightly gravelly to gravelly sand CLAY. Gravels are subangular to subrounded, fine to coarse of flint.	
			(1.30)			
			3 3.00		End of Trial Pit at 3.00m	
				4		

Remarks

Pit Stability
 Relatively stable



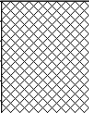
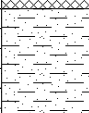
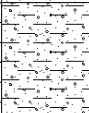
0.65m

2.70m

Final Depth 3.00m

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

Project Name Moorlands Primary School	Project No. 5846	Date 31/05/2017 to 31/05/2017	Hole Type TP
Client Hampshire County Council	Co-ords E: N: L:	Water Strike Details Depth Strike Remarks	Logged By SR
Contractor John Stacey	Plant Used JCB 3CX		Approved By PS
			Scale 1:50

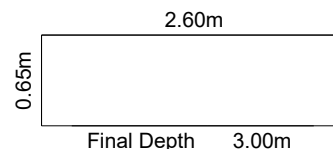
Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Depth	Type				
	0.45	ES	(0.60)		MADE GROUND Soft, dark-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of brick, plastic and flint.	
	0.80	B	0.60		Firm to stiff, orange-brown, slightly gravelly sandy CLAY. Gravels are subangular to subrounded, fine to coarse of flint.	
			1.10	1		
			1.70		Firm to stiff, orange-brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of flint	
	2.00	B	(1.30)	2		
			3.00	3	End of Trial Pit at 3.00m	
				4		

Remarks

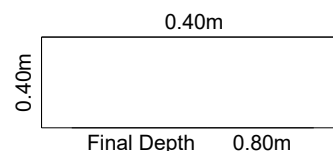
Pit Stability

Relatively stable

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.



ANNEX C Hand Excavated Inspection Pit Logs
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Project Name Moorlands Primary School	Project No. 5846	Date 30/05/2017 to 30/05/2017	Hole Type IP
Client Hampshire County Council	Co-ords E: N: L:	Water Strike Details Depth Strike Remarks	Logged By SR
Contractor 360 Drilling Ltd	Plant Used Hand Tools		Approved By PS
			Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Depth	Type				
	0.30	ES	(0.20) 0.20 (0.70) 0.90		MADE GROUND Asphalt MADE GROUND Soft to firm, brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse of brick, ash, flint and concrete.	
			1		End of Trial Pit at 0.90m	
			2			
			3			
			4			

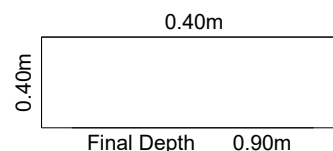
Remarks

Concrete foundations were encountered at a depth of 0.60mbgl, stepping out by 0.18m, before descending a further 0.20m. The final depth of foundation lies at 0.80mbgl.

Pit Stability

Relatively stable.

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.



Project Name Moorlands Primary School	Project No. 5846	Date 31/05/2017 to 31/05/2017	Hole Type IP
Client Hampshire County Council	Co-ords E: N: L:	Water Strike Details Depth Strike Remarks	Logged By SR
Contractor 360 Drilling Ltd	Plant Used Hand Tools		Approved By PS
			Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Depth	Type				
			(0.90)		MADE GROUND Firm, brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse or brick, flint and concrete.	
			0.90			
			1		End of Trial Pit at 1.00m	
			2			
			3			
			4			

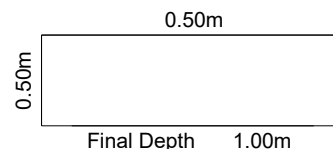
Remarks

Concrete foundations were encountered at a depth of 0.65mbgl, stepping out by 0.10m, before descending a further 0.30m. The final depth of foundation lies at 0.95mbgl.

Pit Stability

Relatively stable

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.



Project Name Moorlands Primary School	Project No. 5846	Date 31/05/2017 to 31/05/2017	Hole Type IP
Client Hampshire County Council	Co-ords E: N: L:	Water Strike Details Depth Strike Remarks	Logged By SR
Contractor 360 Drilling Ltd	Plant Used Hand Tools		Approved By PS
			Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Depth	Type				
	0.60	ES	(1.15)		MADE GROUND Firm, brown, sandy gravelly CLAY. Gravels are subangular to subrounded, fine to coarse or brick, flint and concrete.	
			1			
			1.15		End of Trial Pit at 1.15m	
			2			
			3			
			4			

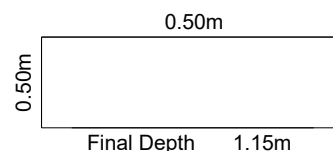
Remarks

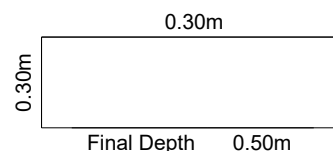
Concrete foundations were encountered at a depth of 0.75mbgl, stepping out by 0.21m, before descending a further 0.40m. The final depth of foundation lies at 1.15mbgl.

Pit Stability

Relatively stable

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.





ANNEX D In-situ Soakaway Calculation Sheets

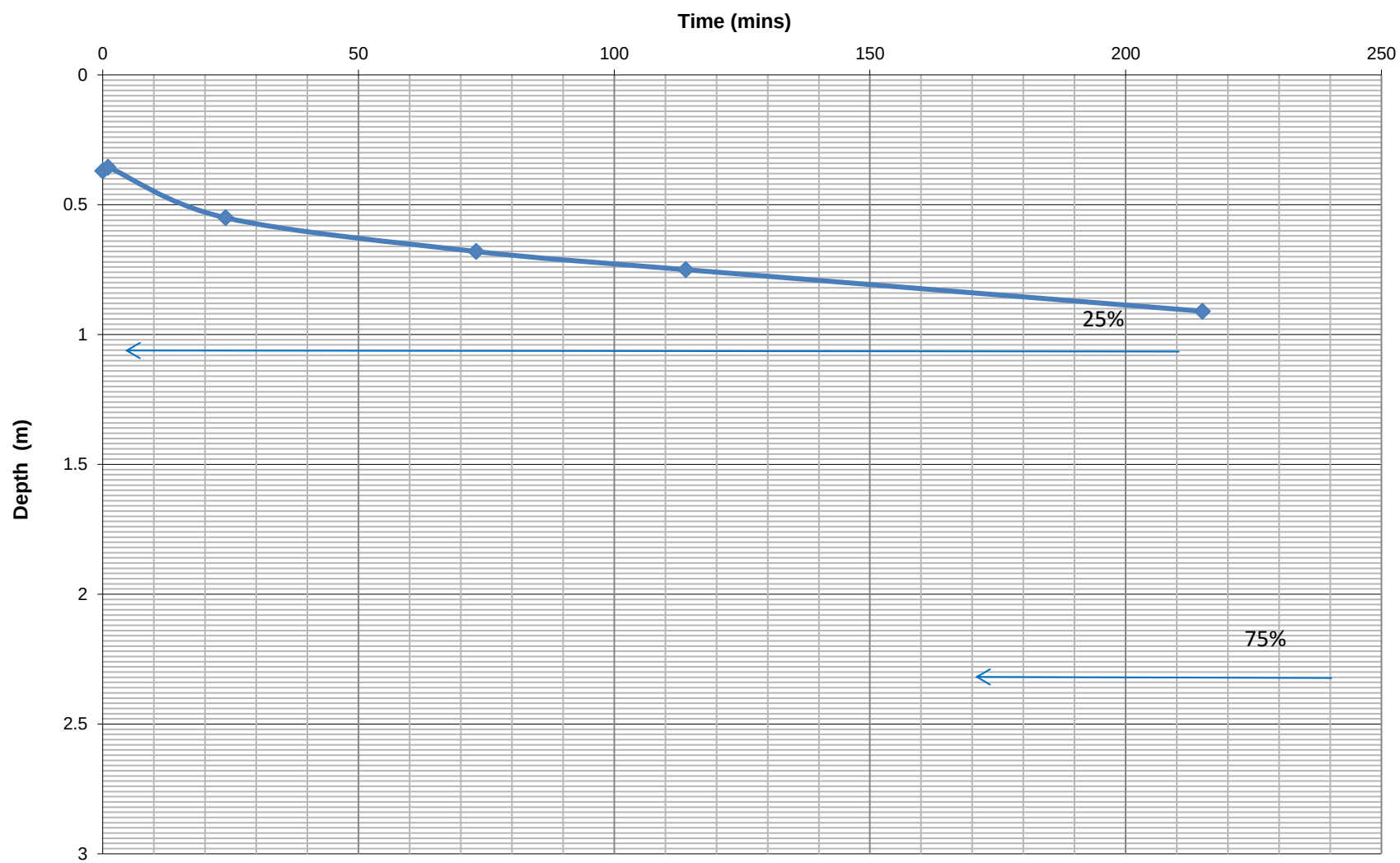
Site Name:	Moorlands Primary School	Job No.: 5846	Date Undertaken: 31/05/2017
Trial Pit No.:	SA1	Test No.: 1	

	Depth to Water (m)	Time (Mins)
(Top of test / effective depth - 100%)	0.37	0
	0.355	1
	0.55	24
	0.68	73
	0.75	114
	0.91	215
(Base of pit / effective depth - 0%)	3.000	

Length of Trial Pit (m)	2.7
Width of Trial Pit (m)	0.65
Depth of Trial Pit (m)	3
Effective Storage Depth (m)	2.630
Vp25	1.0275
Vp75	2.3425
Vp75-25	2.308
50% effective depth (m)	1.315
Mean Surface area ap50 (m2)	10.566
Time for 25% Outflow (tp25)	
Time for 75% Outflow (tp75)	
tp75 - 25	0
Soil Infiltration Rate (m/s)	#DIV/0!

Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BRE Digest 365- September 1991'. This worksheet can be used to determine soil infiltration rates from trial pit field measurements. Worksheet options are identified by a green background

Soil Infiltration Measurements - SA1, Test 1

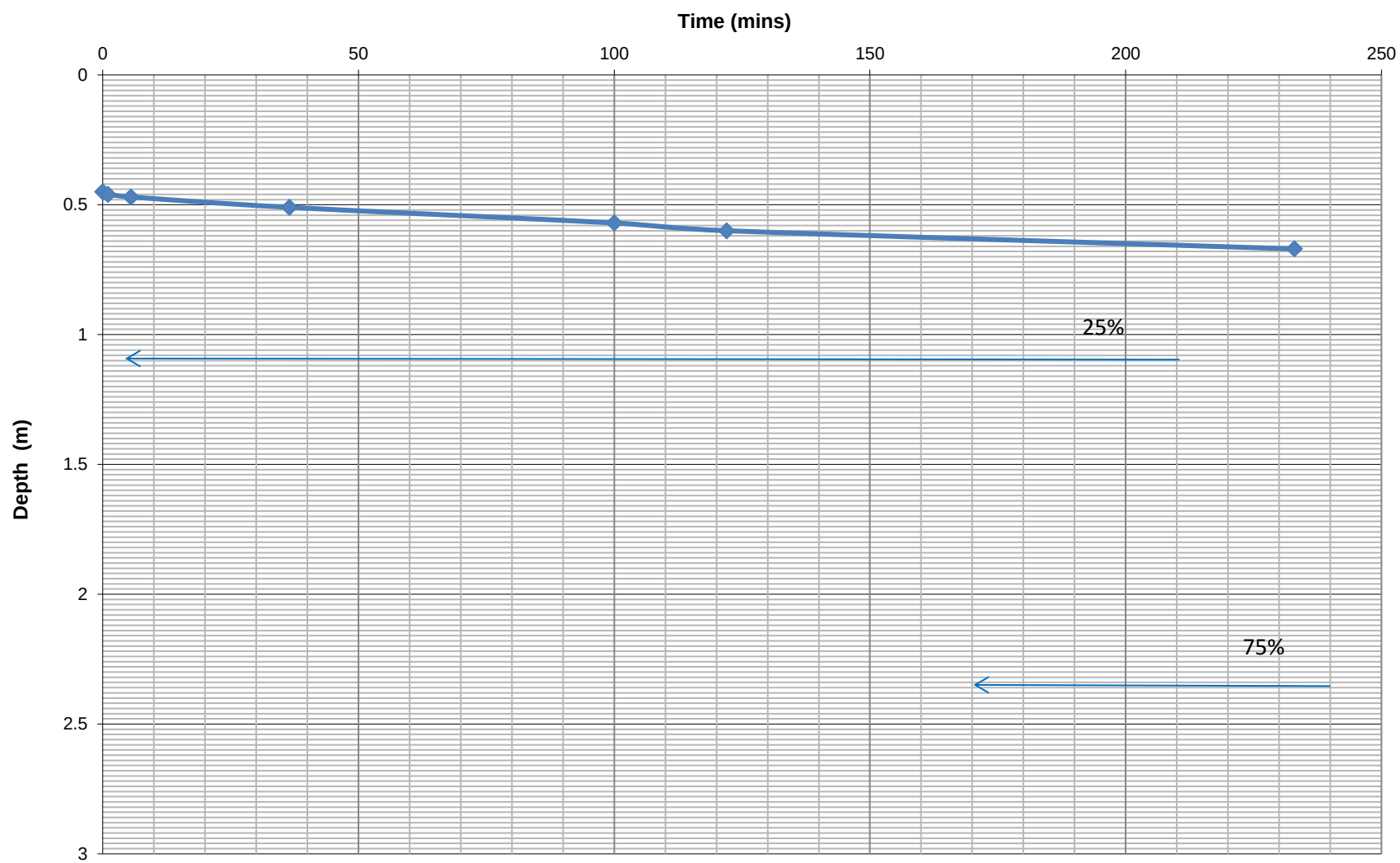


Site Name:	Moorlands Primary School	Job No.: 5846	Date Undertaken: 31/05/2017
Trial Pit No.:	SA2	Test No.: 1	

	Depth to Water (m)	Time (Mins)
(Top of test / effective depth - 100%)	0.45	0
	0.46	1
	0.47	5.5
	0.51	36.5
	0.57	100
	0.6	122
	0.67	233
(Base of pit / effective depth - 0%)	3.000	
Length of Trial Pit (m)	2.6	
Width of Trial Pit (m)	0.65	
Depth of Trial Pit (m)	3	
Effective Storage Depth (m)	2.550	
Vp25	1.0875	
Vp75	2.3625	
Vp75-25	2.155	
50% effective depth (m)	1.275	
Mean Surface area ap50 (m2)	9.978	
Time for 25% Outflow (tp25)		
Time for 75% Outflow (tp75)		
tp75 - 25	0	
Soil Infiltration Rate (m/s)	#DIV/0!	

Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BRE Digest 365- September 1991'. This worksheet can be used to determine soil infiltration rates from trial pit field measurements. Worksheet options are identified by a green background

Soil Infiltration Measurements - SA2, Test 1



ANNEX E Laboratory Soil Chemical Test Results
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Certificate of Analysis

Certificate Number 17-02168

26-Jun-17

Client Terra Firma South
Pump House
44 Marlbro Road
Exeter
Devon
EX2 4LL

Our Reference 17-02168

Client Reference 5846

Order No (not supplied)

Contract Title Moorlands Primary

Description 10 Soil samples, 4 Leachate samples.

Date Received 09-Jun-17

Date Started 09-Jun-17

Date Completed 26-Jun-17

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 10725 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 17-02168

Client Ref 5846

Contract Title Moorlands Primary

Lab No	1186554	1186556	1186557	1186558	1186559	1186561
Sample ID	WS1	WS5	WS6	WS7	SA1	HDP2
Depth	0.25	0.25	0.25	0.20	0.20	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	30/05/17	30/05/17	31/05/17	31/05/17	31/05/17	31/05/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETS 2301#	0.2	mg/kg	15		12	13	11	17
Boron, Water Soluble	DETS 2123#	0.2	mg/kg	0.4		1.2	1.4	0.5	0.5
Cadmium	DETS 2301#	0.1	mg/kg	0.1		0.1	0.2	< 0.1	< 0.1
Chromium	DETS 2301#	0.15	mg/kg	19		14	16	13	28
Chromium, Hexavalent	DETS 2204*	1	mg/kg	< 1.0		< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETS 2301#	0.2	mg/kg	16		15	26	11	16
Lead	DETS 2301#	0.3	mg/kg	34		29	47	22	16
Mercury	DETS 2325#	0.05	mg/kg	0.07		0.06	0.06	0.07	< 0.05
Nickel	DETS 2301#	1	mg/kg	10		8.4	8.9	8.2	12
Selenium	DETS 2301#	0.5	mg/kg	0.6		0.6	0.6	0.8	0.8
Zinc	DETS 2301#	1	mg/kg	43		39	51	27	31
Inorganics									
pH	DETS 2008#			7.8	9.3	7.6	8.7	8.2	8.0
Cyanide, Total	DETS 2130#	0.1	mg/kg	0.2		0.2	0.2	0.1	< 0.1
Cyanide, Free	DETS 2130#	0.1	mg/kg	0.1		0.2	0.1	< 0.1	< 0.1
Thiocyanate	DETS 2130#	0.6	mg/kg	< 0.6		0.9	0.8	< 0.6	< 0.6
Organic matter	DETS 2002#	0.1	%	1.1		1.7	2.5	0.6	0.2
Ammoniacal Nitrogen as N	DETS 2119#	0.5	mg/kg	20		16	11	11	11
Sulphate Aqueous Extract as SO4	DETS 2076#	10	mg/l		47				< 10
Sulphide	DETS 2024#	10	mg/kg	36		24	28	16	32
Sulphur as S, Total	DETS 2320	0.01	%	0.02	0.02	0.02	0.03	< 0.01	< 0.01
Sulphate as SO4, Total	DETS 2321#	0.01	%	0.03	0.05	0.04	0.06	0.03	0.02
Petroleum Hydrocarbons									
EPH (C10-C40)	DETS 3311#	10	mg/kg	43		32	< 10	< 10	< 10
PAHs									
Naphthalene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	0.1	< 0.1	< 0.1
Phenanthrene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETS 3301	0.1	mg/kg	< 0.1		0.2	0.2	0.1	< 0.1
Pyrene	DETS 3301	0.1	mg/kg	< 0.1		0.2	0.2	0.1	< 0.1
Benzo(a)anthracene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETS 3301	0.1	mg/kg	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis Soil Samples

Our Ref 17-02168

Client Ref 5846

Contract Title Moorlands Primary

Lab No	1186554	1186556	1186557	1186558	1186559	1186561
Sample ID	WS1	WS5	WS6	WS7	SA1	HDTP2
Depth	0.25	0.25	0.25	0.20	0.20	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	30/05/17	30/05/17	31/05/17	31/05/17	31/05/17	31/05/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6		< 1.6	< 1.6	< 1.6	< 1.6
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg						
PCB 52	DETSC 3401#	0.01	mg/kg						
PCB 101	DETSC 3401#	0.01	mg/kg						
PCB 118	DETSC 3401#	0.01	mg/kg						
PCB 153	DETSC 3401#	0.01	mg/kg						
PCB 138	DETSC 3401#	0.01	mg/kg						
PCB 180	DETSC 3401#	0.01	mg/kg						
PCB 7 Total	DETSC 3401#	0.01	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3		< 0.3	3.0	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 17-02168

Client Ref 5846

Contract Title Moorlands Primary

Lab No	1186562	1186563
Sample ID	HDTP4	HDTP5
Depth	0.60	0.30
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	31/05/17	31/05/17
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	16	
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	0.5	
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	
Chromium	DETSC 2301#	0.15	mg/kg	27	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	17	
Lead	DETSC 2301#	0.3	mg/kg	29	
Mercury	DETSC 2325#	0.05	mg/kg	0.06	
Nickel	DETSC 2301#	1	mg/kg	15	
Selenium	DETSC 2301#	0.5	mg/kg	0.6	
Zinc	DETSC 2301#	1	mg/kg	40	
Inorganics					
pH	DETSC 2008#			8.4	
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	
Thiocyanate	DETSC 2130#	0.6	mg/kg	< 0.6	
Organic matter	DETSC 2002#	0.1	%	0.8	
Ammoniacal Nitrogen as N	DETSC 2119#	0.5	mg/kg	9.6	
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	94	
Sulphide	DETSC 2024#	10	mg/kg	36	
Sulphur as S, Total	DETSC 2320	0.01	%	0.03	
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.09	
Petroleum Hydrocarbons					
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	
PAHs					
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	

Summary of Chemical Analysis

Soil Samples

Our Ref 17-02168

Client Ref 5846

Contract Title Moorlands Primary

Lab No	1186562	1186563
Sample ID	HDTP4	HDTP5
Depth	0.60	0.30
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	31/05/17	31/05/17
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	
PCBs					
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg		< 0.01
PCB 52	DETSC 3401#	0.01	mg/kg		< 0.01
PCB 101	DETSC 3401#	0.01	mg/kg		< 0.01
PCB 118	DETSC 3401#	0.01	mg/kg		< 0.01
PCB 153	DETSC 3401#	0.01	mg/kg		< 0.01
PCB 138	DETSC 3401#	0.01	mg/kg		< 0.01
PCB 180	DETSC 3401#	0.01	mg/kg		< 0.01
PCB 7 Total	DETSC 3401#	0.01	mg/kg		< 0.01
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	

Summary of Asbestos Analysis

Soil Samples

Our Ref 17-02168

Client Ref 5846

Contract Title Moorlands Primary

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1186554	WS1 0.25	SOIL	NAD	none	Chris Samms
1186557	WS6 0.25	SOIL	NAD	none	Chris Samms
1186558	WS7 0.20	SOIL	NAD	none	Chris Samms
1186559	SA1 0.20	SOIL	NAD	none	Chris Samms
1186561	HDTP2 0.30	SOIL	NAD	none	Chris Samms
1186562	HDTP4 0.60	SOIL	NAD	none	Chris Samms

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 17-02168
Client Ref 5846
Contract Title Moorlands Primary
Sample Id WS4 0.30

Sample Numbers 1186555 1186564 1186565
Date Analysed 16/06/2017

Test Results On Waste		
Determinand and Method Reference	Units	Result
DETSC 2084* Total Organic Carbon	%	0.8
DETSC 2003# Loss On Ignition	%	3.6
DETSC 3321# BTEX	mg/kg	< 0.04
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01
DETSC 3311# TPH (C10 - C40)	mg/kg	< 10
DETSC 3301 PAHs	mg/kg	< 1.6
DETSC 2008# pH	pH Units	7.8
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1

WAC Limit Values		
Inert Waste	SNRHW	Hazardous Waste
3	5	6
n/a	n/a	10
6	n/a	n/a
1	n/a	n/a
500	n/a	n/a
100	n/a	n/a
n/a	>6	n/a
n/a	TBE	TBE
n/a	TBE	TBE

Test Results On Leachate				
Determinand and Method Reference	Conc in Eluate ug/l		Amount Leached mg/kg	
	2:1	8:1	LS2	LS10
DETSC 2306 Arsenic as As	0.6	0.46	< 0.002	< 0.01
DETSC 2306 Barium as Ba	2.1	1.8	< 0.02	< 0.1
DETSC 2306 Cadmium as Cd	< 0.03	< 0.03	< 0.004	< 0.02
DETSC 2306 Chromium as Cr	1	0.57	< 0.02	< 0.1
DETSC 2306 Copper as Cu	1.9	1.4	< 0.004	< 0.02
DETSC 2306 Mercury as Hg	< 0.01	< 0.01	< 0.0004	< 0.002
DETSC 2306 Molybdenum as Mo	< 1.1	< 1.1	< 0.02	< 0.1
DETSC 2306 Nickel as Ni	< 0.5	< 0.5	< 0.02	< 0.1
DETSC 2306 Lead as Pb	0.85	0.57	< 0.01	< 0.05
DETSC 2306 Antimony as Sb	0.19	< 0.17	< 0.01	< 0.05
DETSC 2306 Selenium as Se	< 0.25	< 0.25	< 0.006	< 0.03
DETSC 2306 Zinc as Zn	< 1.3	< 1.3	< 0.002	< 0.01
DETSC 2055 Chloride as Cl	3900	3000	< 20	< 100
DETSC 2055* Fluoride as F	130	< 100	0.26	0.19
DETSC 2055 Sulphate as SO4	2900	2500	< 20	< 100
DETSC 2009* Total Dissolved Solids	26000	18000	52	192
DETSC 2130 Phenol Index	< 100	< 100	< 0.2	< 1
* Dissolved Organic Carbon	< 2000	< 2000	< 10	< 50

WAC Limit Values		
Limit values for LS10 Leachate		
Inert Waste	SNRHW	Hazardous Waste
0.5	2	25
20	100	300
0.04	1	5
0.5	10	70
2	50	100
0.01	0.2	2
0.5	10	30
0.4	10	40
0.5	10	50
0.06	0.7	5
0.1	0.5	7
4	50	200
800	15,000	25,000
10	150	500
1000	20,000	50,000
4000	60,000	100,000
1	n/a	n/a
500	800	1000

Additional Information

DETSC 2008 pH	7.4	7.1
DETSC 2009 Conductivity uS/cm	37.5	25.4
* Temperature*	18	18

Mass of Sample Kg	0.130
Mass of dry Sample Kg	0.121

Stage 1

Volume of Leachant L2	0.234
Volume of Eluate VE1	0.182

Stage 2

Volume of Leachant L8	0.971
Volume of Eluate VE2	0.91

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive
Hazardous Waste

Disclaimer: The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 17-02168
Client Ref 5846
Contract Title Moorlands Primary
Sample Id SA2 0.45

Sample Numbers 1186560 1186566 1186567
Date Analysed 16/06/2017

Test Results On Waste		
Determinand and Method Reference	Units	Result
DETSC 2084* Total Organic Carbon	%	0.8
DETSC 2003# Loss On Ignition	%	3.9
DETSC 3321# BTEX	mg/kg	< 0.04
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01
DETSC 3311# TPH (C10 - C40)	mg/kg	< 10
DETSC 3301 PAHs	mg/kg	< 1.6
DETSC 2008# pH	pH Units	7.9
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1

WAC Limit Values		
Inert Waste	SNRHW	Hazardous Waste
3	5	6
n/a	n/a	10
6	n/a	n/a
1	n/a	n/a
500	n/a	n/a
100	n/a	n/a
n/a	>6	n/a
n/a	TBE	TBE
n/a	TBE	TBE

Test Results On Leachate				
Determinand and Method Reference	Conc in Eluate ug/l		Amount Leached mg/kg	
	2:1	8:1	LS2	LS10
DETSC 2306 Arsenic as As	0.75	0.69	< 0.002	< 0.01
DETSC 2306 Barium as Ba	3.2	2.6	< 0.02	< 0.1
DETSC 2306 Cadmium as Cd	< 0.03	< 0.03	< 0.004	< 0.02
DETSC 2306 Chromium as Cr	0.7	0.32	< 0.02	< 0.1
DETSC 2306 Copper as Cu	2.9	1.5	0.006	< 0.02
DETSC 2306 Mercury as Hg	< 0.01	0.01	< 0.0004	< 0.002
DETSC 2306 Molybdenum as Mo	1.4	2.1	< 0.02	< 0.1
DETSC 2306 Nickel as Ni	< 0.5	< 0.5	< 0.02	< 0.1
DETSC 2306 Lead as Pb	0.91	0.5	< 0.01	< 0.05
DETSC 2306 Antimony as Sb	< 0.17	0.33	< 0.01	< 0.05
DETSC 2306 Selenium as Se	< 0.25	1.5	< 0.006	< 0.03
DETSC 2306 Zinc as Zn	< 1.3	< 1.3	< 0.002	< 0.01
DETSC 2055 Chloride as Cl	3500	3100	< 20	< 100
DETSC 2055* Fluoride as F	250	120	0.5	1.4
DETSC 2055 Sulphate as SO4	3400	2400	< 20	< 100
DETSC 2009* Total Dissolved Solids	40000	27000	80	290.3
DETSC 2130 Phenol Index	< 100	< 100	< 0.2	< 1
* Dissolved Organic Carbon	< 2000	< 2000	< 10	< 50

WAC Limit Values		
Limit values for LS10 Leachate		
Inert Waste	SNRHW	Hazardous Waste
0.5	2	25
20	100	300
0.04	1	5
0.5	10	70
2	50	100
0.01	0.2	2
0.5	10	30
0.4	10	40
0.5	10	50
0.06	0.7	5
0.1	0.5	7
4	50	200
800	15,000	25,000
10	150	500
1000	20,000	50,000
4000	60,000	100,000
1	n/a	n/a
500	800	1000

Additional Information

DETSC 2008 pH	6.8	6.9
DETSC 2009 Conductivity uS/cm	57.4	38.7
* Temperature*	18	18

Mass of Sample Kg	0.120
Mass of dry Sample Kg	0.116

Stage 1

Volume of Leachant L2	0.229
Volume of Eluate VE1	0.182

Stage 2

Volume of Leachant L8	0.932
Volume of Eluate VE2	0.87

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive
Hazardous Waste

Disclaimer: The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.

Information in Support of the Analytical Results

Our Ref 17-02168
Client Ref 5846
Contract Moorlands Primary

Containers Received & Deviating Samples

Lab No	Sample ID	Date		Containers Received	Holding time exceeded for tests	Inappropriate container for tests
		Sampled				
1186554	WS1 0.25 SOIL	30/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186555	WS4 0.30 SOIL	30/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186556	WS5 0.25 SOIL	30/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186557	WS6 0.25 SOIL	31/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186558	WS7 0.20 SOIL	31/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186559	SA1 0.20 SOIL	31/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186560	SA2 0.45 SOIL	31/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186561	HDTP2 0.30 SOIL	31/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186562	HDTP4 0.60 SOIL	31/05/17		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1186563	HDTP5 0.30 SOIL	31/05/17		GJ 250ml, GJ 60ml, PT 1L		
1186564	WS4 0.30 LEACHATE	30/05/17		GJ 250ml, GJ 60ml, PT 1L		
1186565	WS4 0.30 LEACHATE	30/05/17		GJ 250ml, GJ 60ml, PT 1L		
1186566	SA2 0.45 LEACHATE	31/05/17		GJ 250ml, GJ 60ml, PT 1L		
1186567	SA2 0.45 LEACHATE	31/05/17		GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

ANNEX E Geotechnical Laboratory Test Results
--



TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

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



Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
764389	1	SA1	0.6	Not Given	B	Yellowish brown gravelly sandy CLAY	23
764390	2	SA1	1.9	Not Given	B	Yellowish brown sandy clayey GRAVEL	9.0
764391	1	SA2	0.8	Not Given	B	Yellowish brown slightly sandy gravelly CLAY	14
764374	1	WS1	0.5	1	B	Yellowish brown slightly gravelly sandy CLAY	20
764375	2	WS1	2.5	3	B	Yellowish brown sandy clayey GRAVEL	11
764376	1	WS2	1.5	2	B	Yellowish brown sandy clayey GRAVEL	15
764378	1	WS3	0.5	1	B	Yellowish brown slightly gravelly slightly sandy CLAY	20
764379	2	WS3	1.5	2	B	Yellowish brown gravelly CLAY	22
764380	1	WS4	1.5	2	B	Yellowish brown slightly gravelly clayey SAND	15
764381	1	WS5	1.5	2	B	Yellowish brown gravelly sandy CLAY	15

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 22/06/2017

for and on behalf of i2 Analytical Ltd

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Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

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Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
764383	1	WS6	0.5	0.8	B	Brown gravelly clayey SAND	13
764384	2	WS6	1.5	2	B	Yellowish brown with grey gravelly sandy CLAY	20
764385	1	WS7	1.5	2	B	Brown with grey slightly sandy gravelly CLAY	15
764387	1	WS8	0.5	1	B	Yellowish brown slightly sandy gravelly CLAY	15
764388	2	WS8	1.5	2	B	Orangish brown gravelly clayey SAND	11

Remarks

Approved:

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PL Laboratory Manager
Geotechnical Section

Signed:

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Technical Manager
(Geotechnical Division)

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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



Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

Client: Terrafirma South
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Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764374

Sample Reference: 1

Description: Yellowish brown slightly gravelly sandy CLAY

Location: WS1

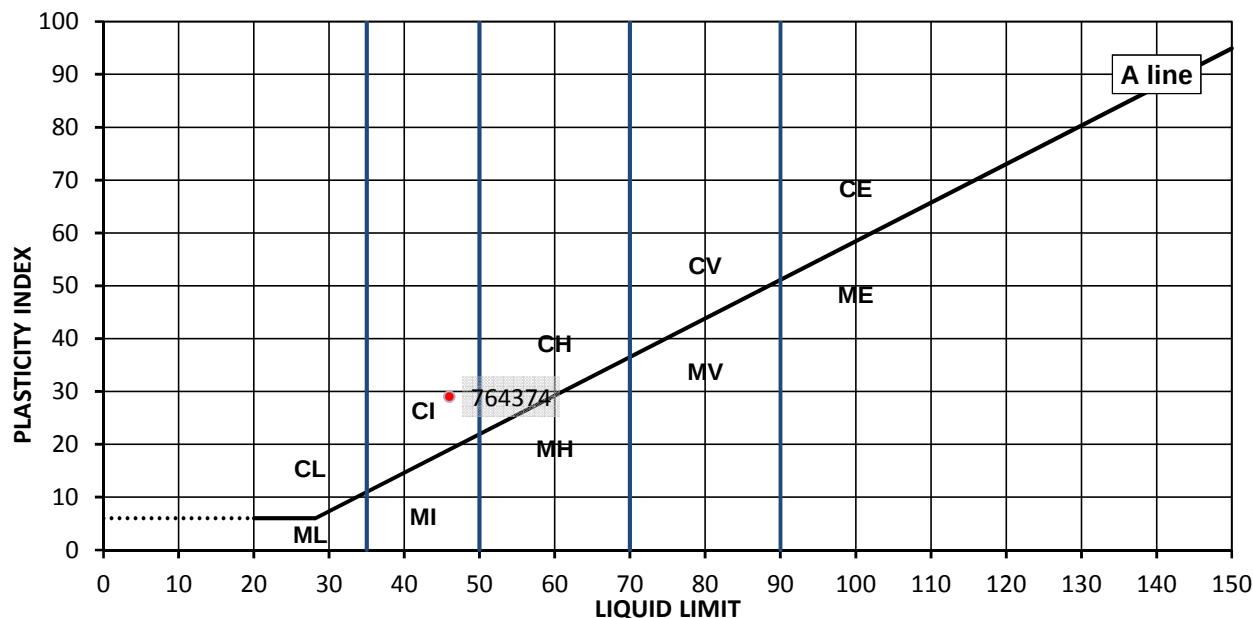
Sample Preparation: Tested after >425um removed by hand

Sample Type: B

Depth Top [m]: 0.5

Depth Base [m]: 1

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
20	46	17	29	99



Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

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Technical Manager
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Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

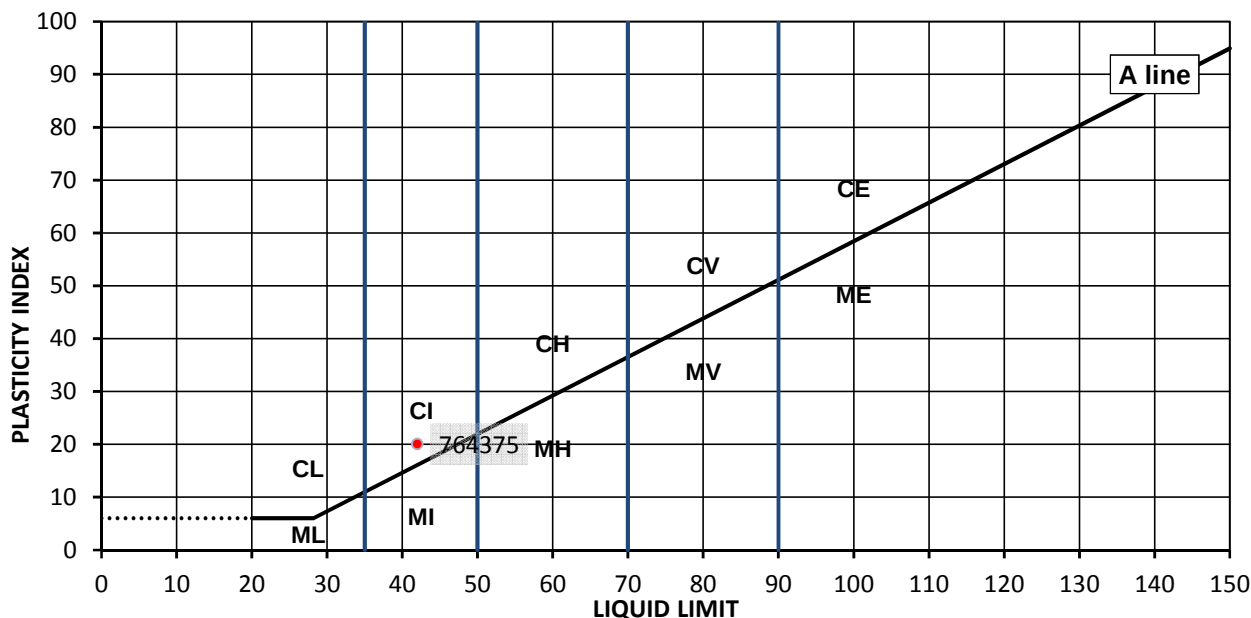
TEST RESULTS

Laboratory Reference: 764375
Sample Reference: 2

Description: Yellowish brown sandy clayey GRAVEL
Location: WS1
Sample Preparation: Tested after washing to remove >425um

Sample Type: B
Depth Top [m]: 2.5
Depth Base [m]: 3

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
11	42	22	20	27



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

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

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

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Client Address: The Pump House
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Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764376

Sample Reference: 1

Description: Yellowish brown sandy clayey GRAVEL

Location: WS2

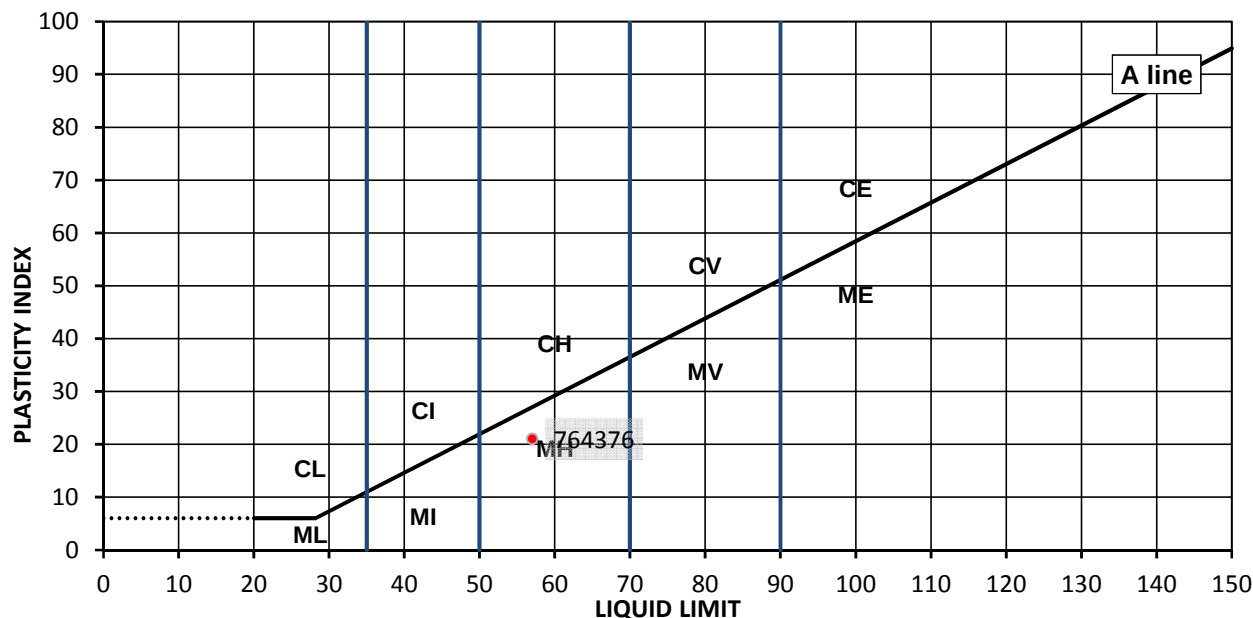
Sample Preparation: Tested after washing to remove >425um

Sample Type: B

Depth Top [m]: 1.5

Depth Base [m]: 2

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
15	57	36	21	29



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

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

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Piotrowski

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

S. Sharda

Date Reported: 22/06/2017

for and on behalf of i2 Analytical Ltd

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Watford Herts WD18 8YS



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Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764378

Sample Reference: 1

Description: Yellowish brown slightly gravelly slightly sandy CLAY

Location: WS3

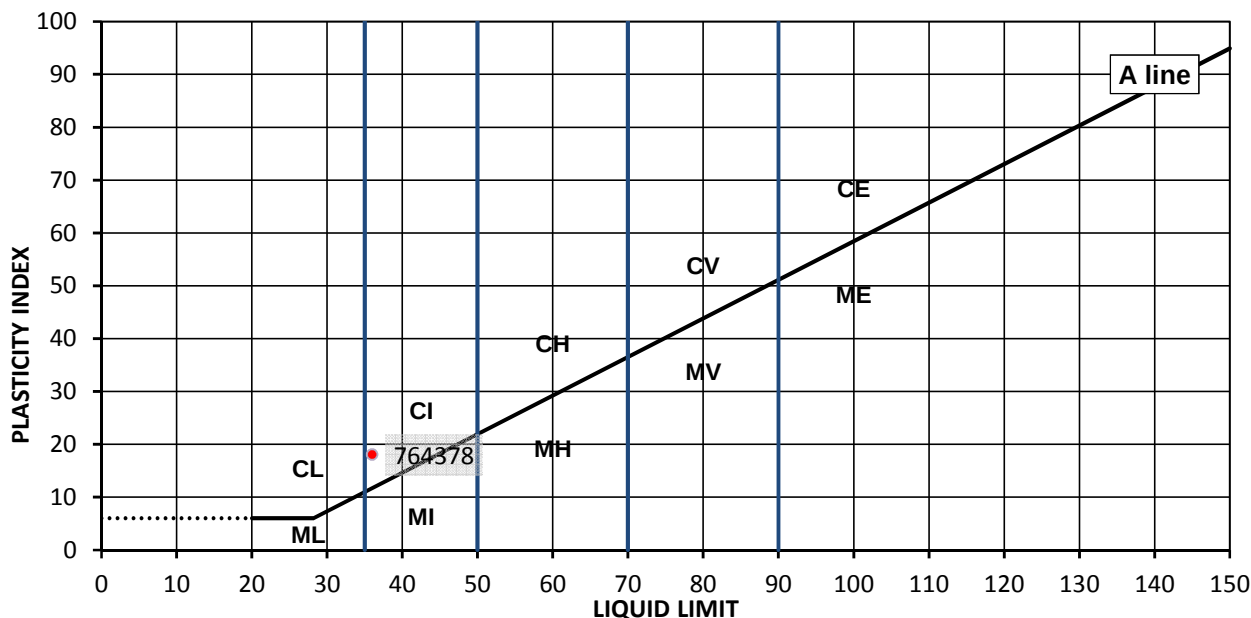
Sample Preparation: Tested after washing to remove >425um

Sample Type: B

Depth Top [m]: 0.5

Depth Base [m]: 1

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
20	36	18	18	82



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

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

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 22/06/2017

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Watford Herts WD18 8YS



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Client Address: The Pump House
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Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

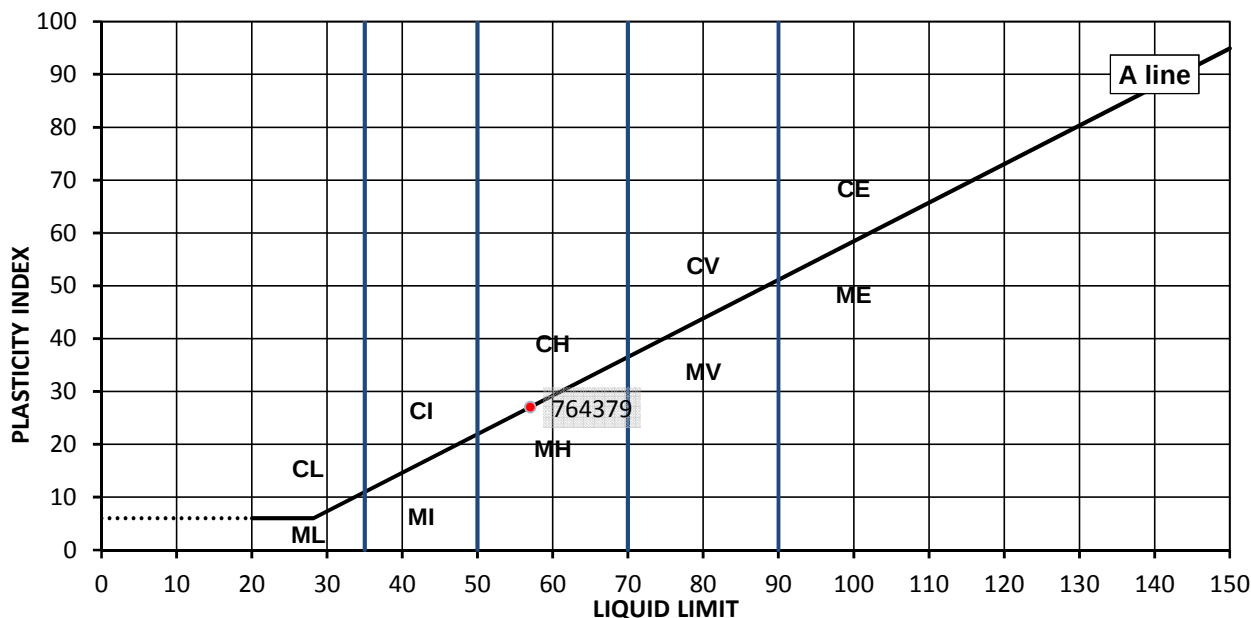
TEST RESULTS

Laboratory Reference: 764379
Sample Reference: 2

Description: Yellowish brown gravelly CLAY
Location: WS3
Sample Preparation: Tested after washing to remove >425um

Sample Type: B
Depth Top [m]: 1.5
Depth Base [m]: 2

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	57	30	27	63



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

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	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: 22/06/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

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44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764380

Sample Reference: 1

Description: Yellowish brown slightly gravelly clayey SAND

Location: WS4

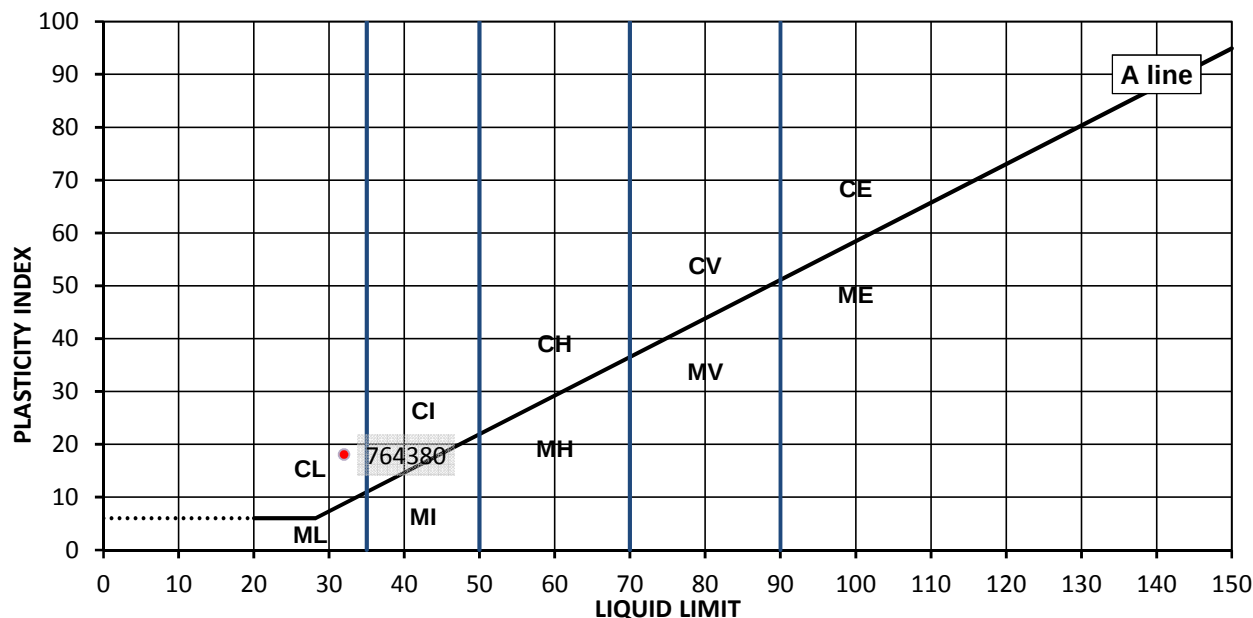
Sample Preparation: Tested after >425um removed by hand

Sample Type: B

Depth Top [m]: 1.5

Depth Base [m]: 2

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
15	32	14	18	97



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

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	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

Signed:

Sushil Sharda
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44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764381

Sample Reference: 1

Description: Yellowish brown gravelly sandy CLAY

Location: WS5

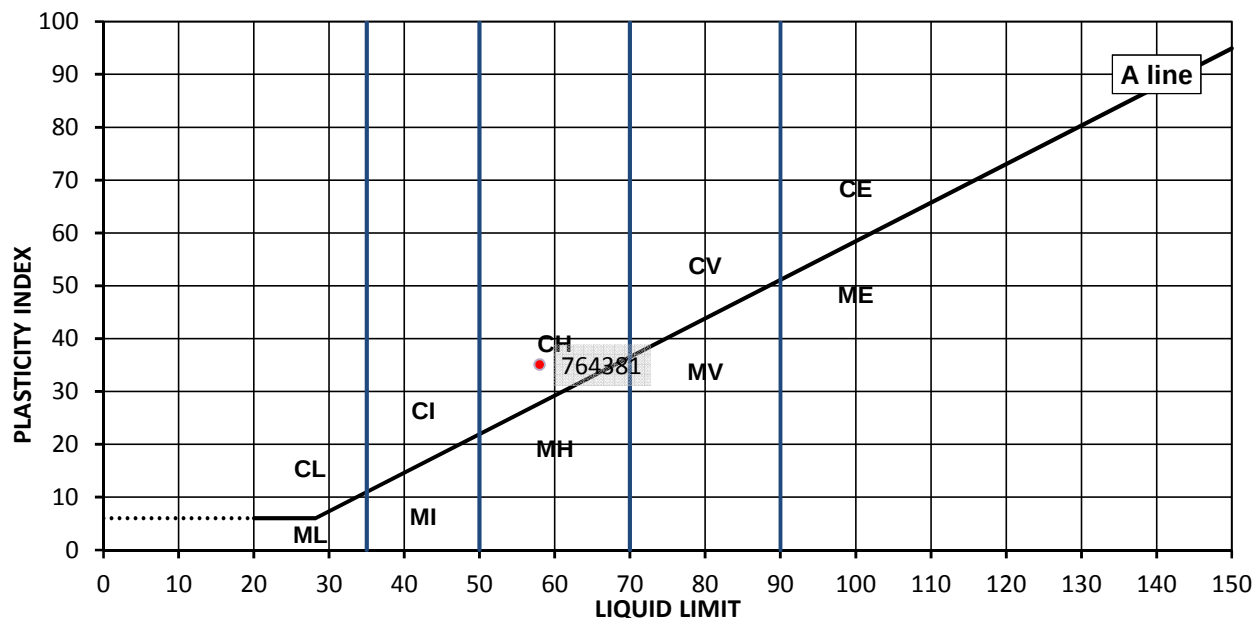
Sample Preparation: Tested after washing to remove >425um

Sample Type: B

Depth Top [m]: 1.5

Depth Base [m]: 2

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
15	58	23	35	55



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

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	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

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

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Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

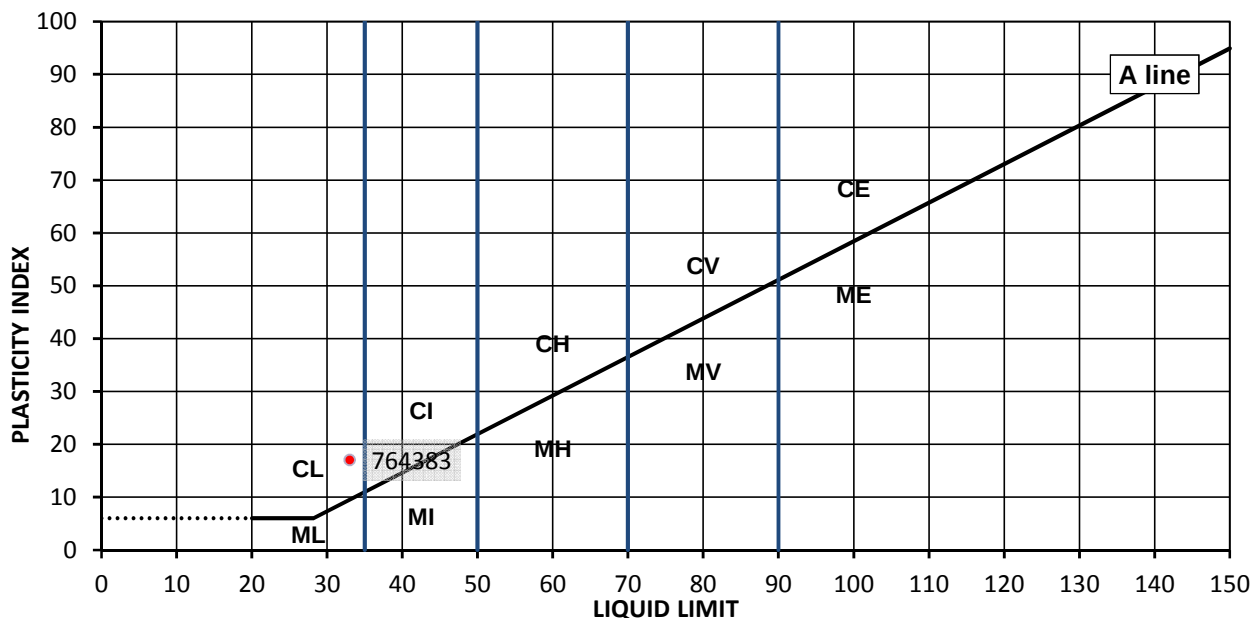
TEST RESULTS

Laboratory Reference: 764383
Sample Reference: 1

Description: Brown gravelly clayey SAND
Location: WS6
Sample Preparation: Tested after washing to remove >425um

Sample Type: B
Depth Top [m]: 0.5
Depth Base [m]: 0.8

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
13	33	16	17	54



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

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	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: 22/06/2017

Signed:

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Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764384

Sample Reference: 2

Description: Yellowish brown with grey gravelly sandy CLAY

Location: WS6

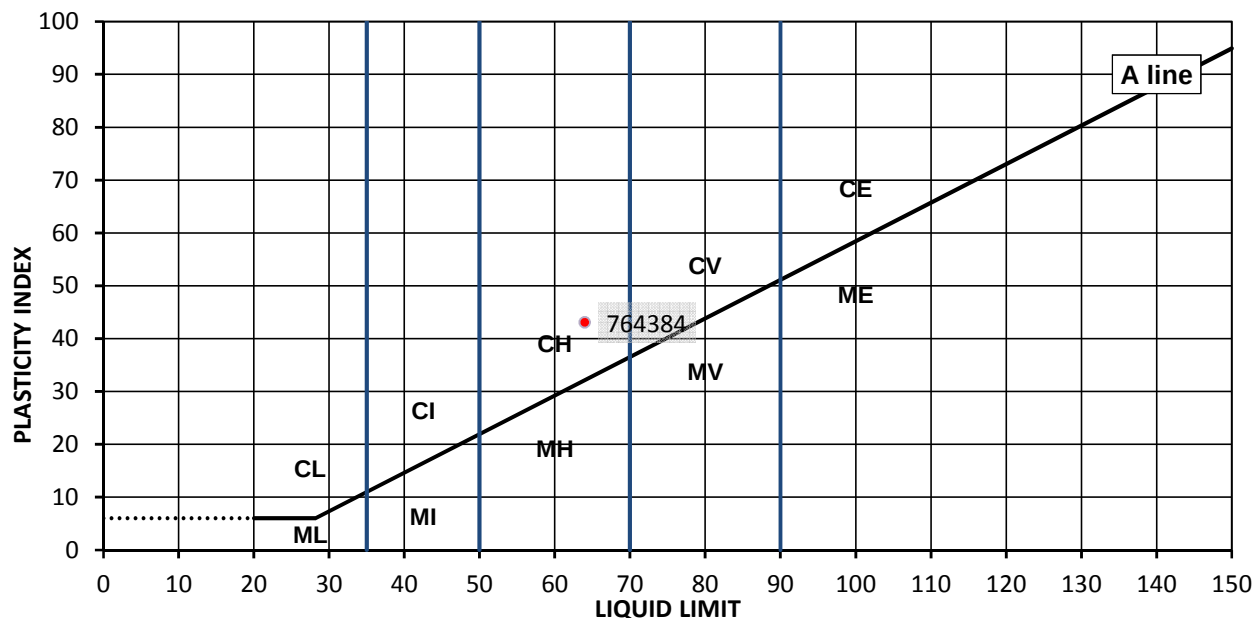
Sample Preparation: Tested after washing to remove >425um

Sample Type: B

Depth Top [m]: 1.5

Depth Base [m]: 2

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
20	64	21	43	64



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

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	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

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Signed:

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EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764385

Sample Reference: 1

Description: Brown with grey slightly sandy gravelly CLAY

Location: WS7

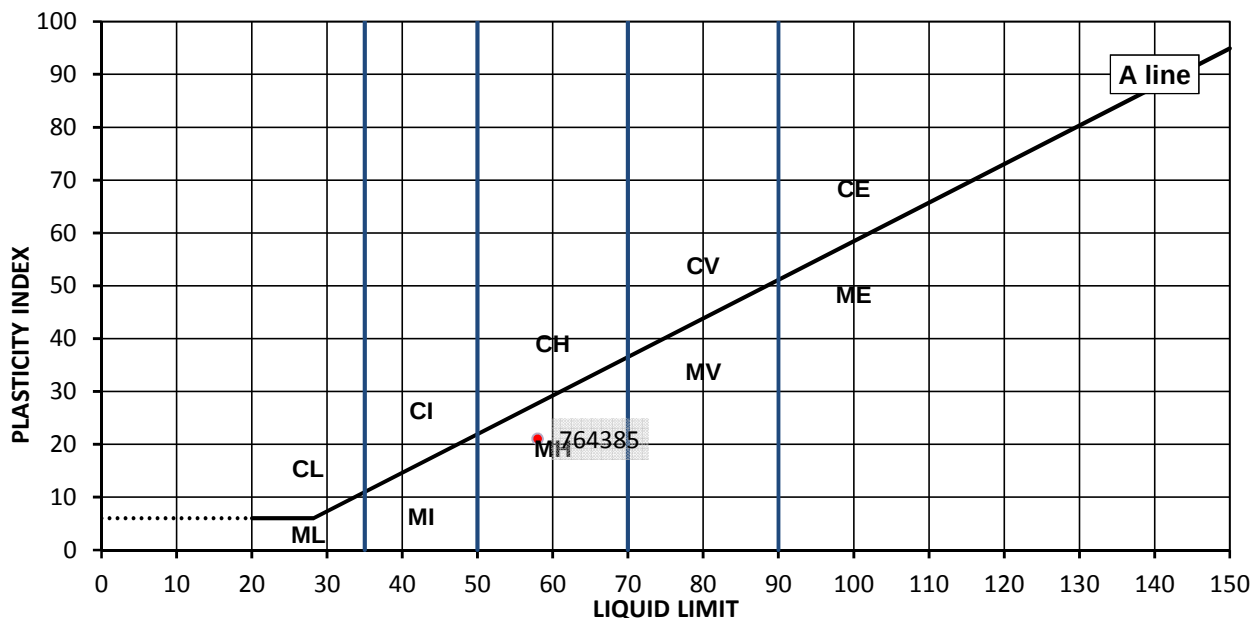
Sample Preparation: Tested after washing to remove >425um

Sample Type: B

Depth Top [m]: 1.5

Depth Base [m]: 2

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
15	58	37	21	60



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

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L Low	50 to 70
	I Medium	70 to 90
	H High	exceeding 90
	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: 22/06/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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



Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764387

Sample Reference: 1

Description: Yellowish brown slightly sandy gravelly CLAY

Location: WS8

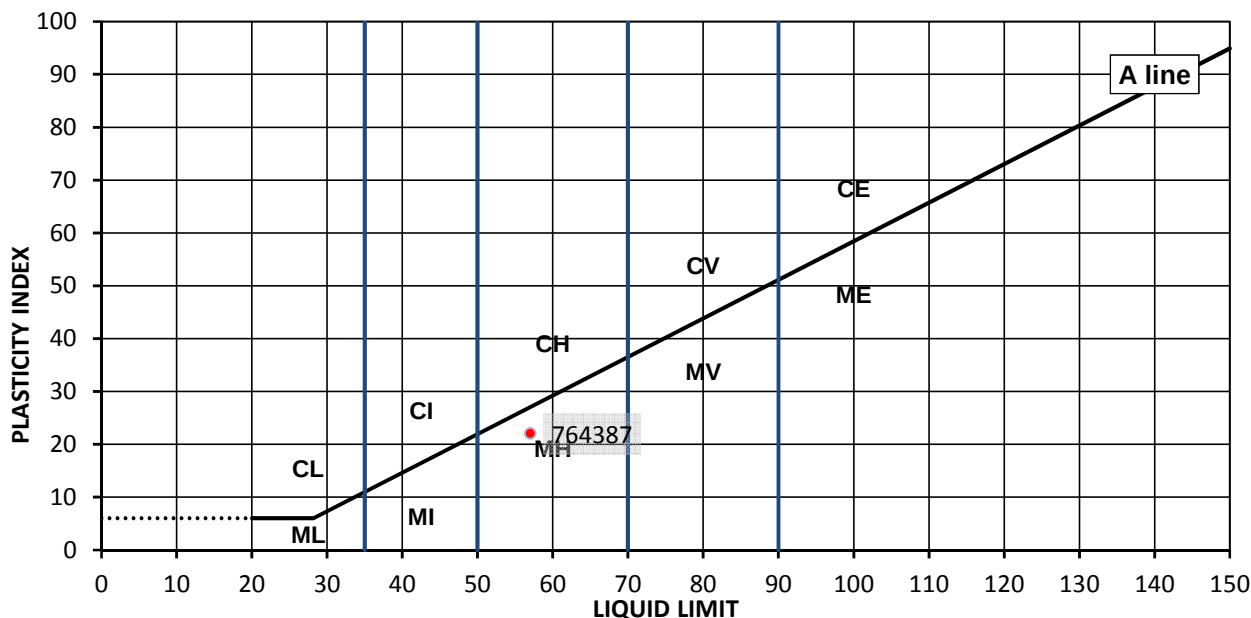
Sample Preparation: Tested in natural condition

Sample Type: B

Depth Top [m]: 0.5

Depth Base [m]: 1

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
15	57	35	22	63



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

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L Low	50 to 70
	I Medium	70 to 90
	H High	exceeding 90
	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: 22/06/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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



Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

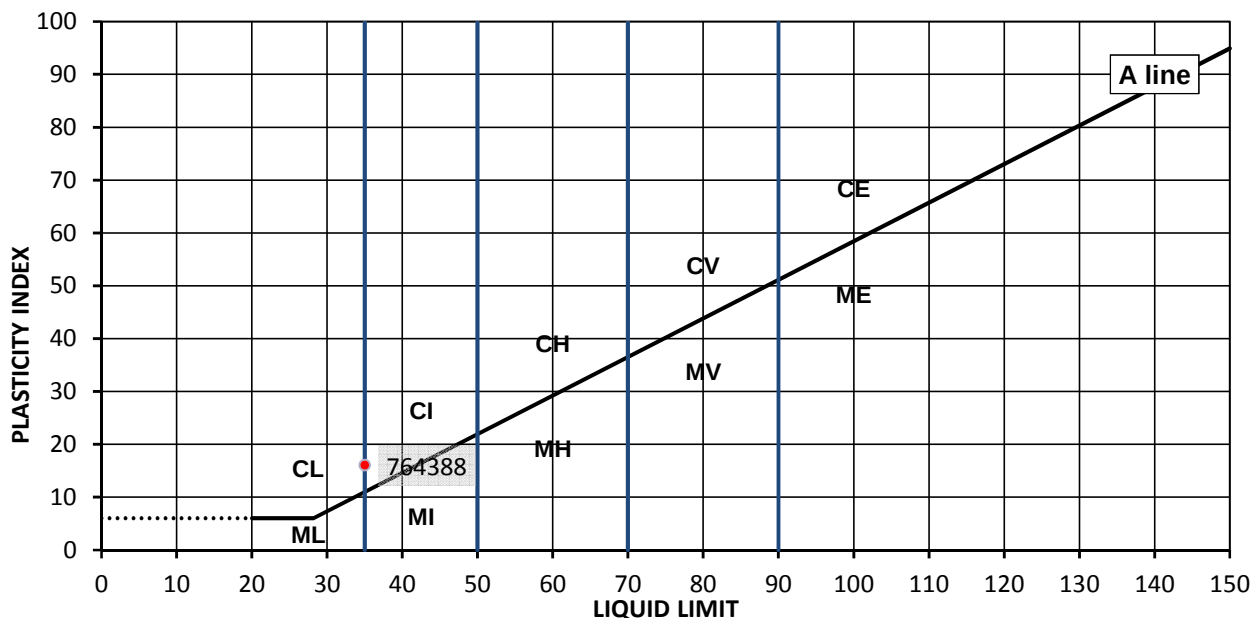
TEST RESULTS

Laboratory Reference: 764388
Sample Reference: 2

Description: Orangish brown gravelly clayey SAND
Location: WS8
Sample Preparation: Tested after washing to remove >425um

Sample Type: B
Depth Top [m]: 1.5
Depth Base [m]: 2

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
11	35	19	16	62



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

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

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 22/06/2017

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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



Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

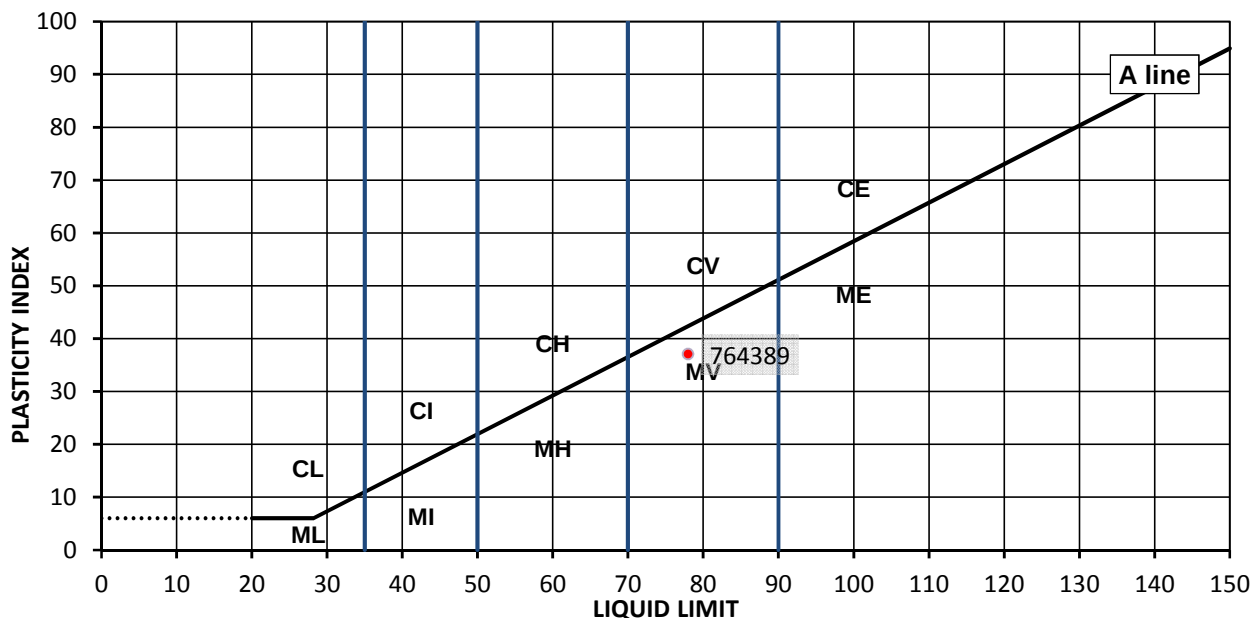
TEST RESULTS

Laboratory Reference: 764389
Sample Reference: 1

Description: Yellowish brown gravelly sandy CLAY
Location: SA1
Sample Preparation: Tested after washing to remove >425um

Sample Type: B
Depth Top [m]: 0.6
Depth Base [m]: 0

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
23	78	41	37	69



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

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

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 22/06/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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



Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

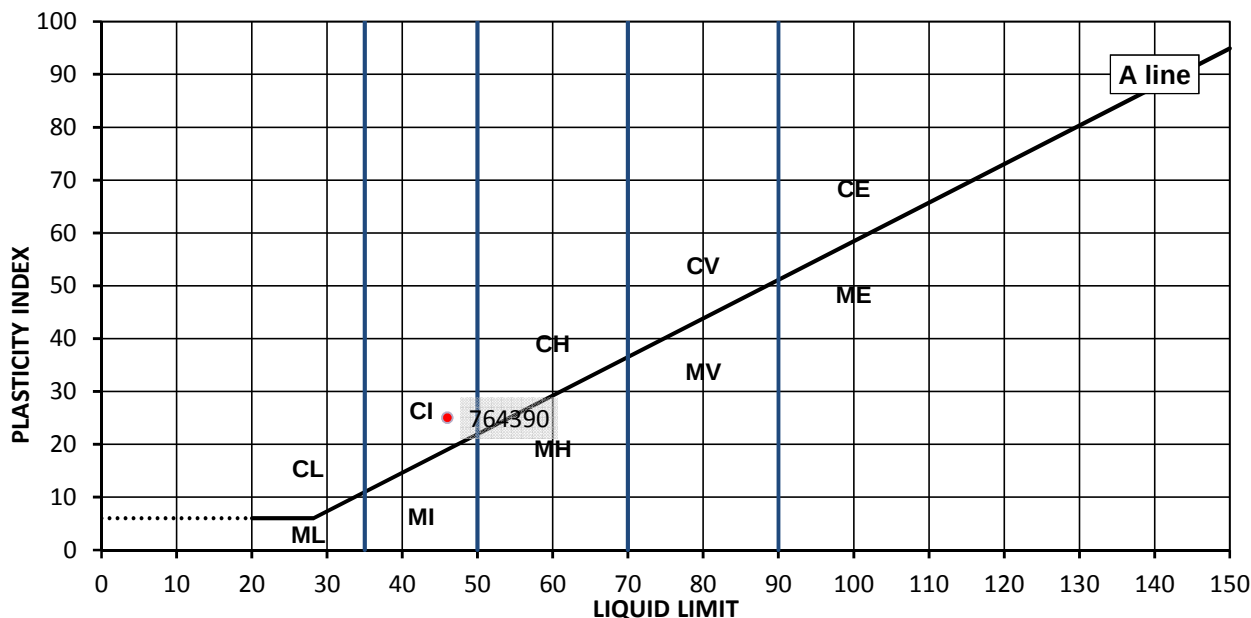
TEST RESULTS

Laboratory Reference: 764390
Sample Reference: 2

Description: Yellowish brown sandy clayey GRAVEL
Location: SA1
Sample Preparation: Tested after washing to remove >425um

Sample Type: B
Depth Top [m]: 1.9
Depth Base [m]: 0

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
9.0	46	21	25	26



Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 22/06/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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



Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764391

Sample Reference: 1

Description: Yellowish brown slightly sandy gravelly CLAY

Location: SA2

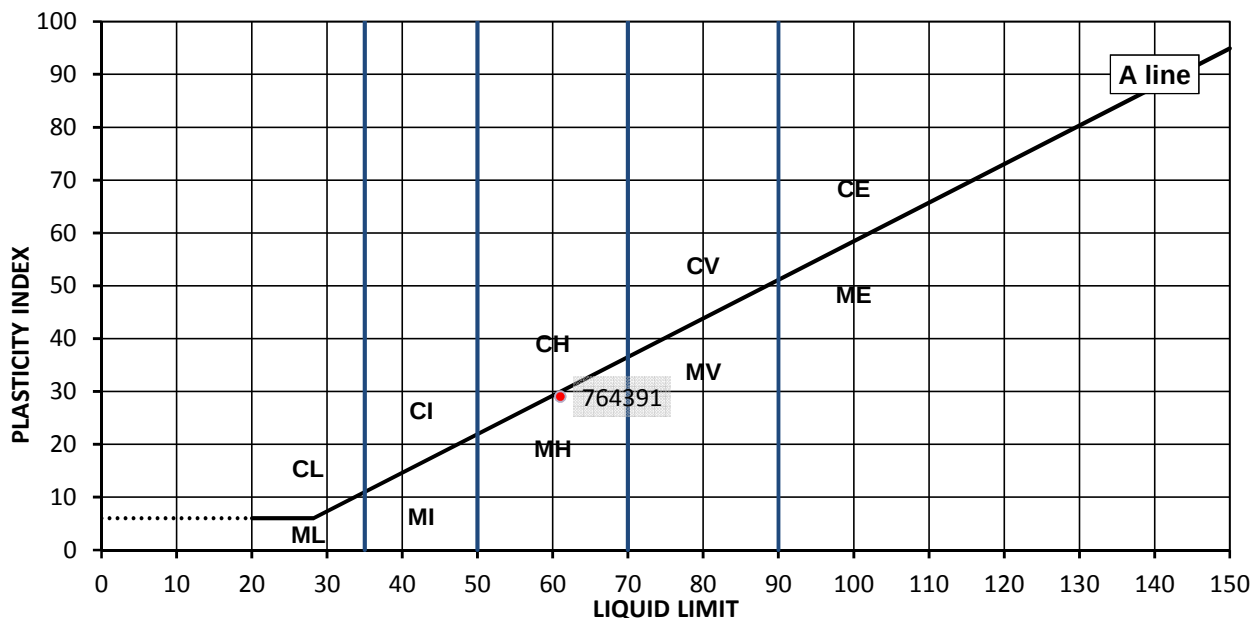
Sample Preparation: Tested after washing to remove >425um

Sample Type: B

Depth Top [m]: 0.8

Depth Base [m]: 0

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
14	61	32	29	61



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

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	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: 22/06/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

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



Client: Terraforma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m3	Mg/m3		%	%	%	%	%
764389	SA1	1	0.60	Not Given	B	Yellowish brown gravelly sandy CLAY			23	69	78	41	37	
764390	SA1	2	1.90	Not Given	B	Yellowish brown sandy clayey GRAVEL			9.0	26	46	21	25	
764391	SA2	1	0.80	Not Given	B	Yellowish brown slightly sandy gravelly CLAY			14	61	61	32	29	
764374	WS1	1	0.50	1.00	B	Yellowish brown slightly gravelly sandy CLAY			20	99	46	17	29	
764375	WS1	2	2.50	3.00	B	Yellowish brown sandy clayey GRAVEL			11	27	42	22	20	
764376	WS2	1	1.50	2.00	B	Yellowish brown sandy clayey GRAVEL			15	29	57	36	21	
764378	WS3	1	0.50	1.00	B	Yellowish brown slightly gravelly slightly sandy CLAY			20	82	36	18	18	
764379	WS3	2	1.50	2.00	B	Yellowish brown gravelly CLAY			22	63	57	30	27	
764380	WS4	1	1.50	2.00	B	Yellowish brown slightly gravelly clayey SAND			15	97	32	14	18	
764381	WS5	1	1.50	2.00	B	Yellowish brown gravelly sandy CLAY			15	55	58	23	35	

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 22/06/2017

Signed:

Sushil Sharda
Technical Manager (Geotechnical
Division)

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

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



Client: Terraforma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m3	Mg/m3		%	%	%	%	%
764383	WS6	1	0.50	0.80	B	Brown gravelly clayey SAND			13	54	33	16	17	
764384	WS6	2	1.50	2.00	B	Yellowish brown with grey gravelly sandy CLAY			20	64	64	21	43	
764385	WS7	1	1.50	2.00	B	Brown with grey slightly sandy gravelly CLAY			15	60	58	37	21	
764387	WS8	1	0.50	1.00	B	Yellowish brown slightly sandy gravelly CLAY			15	63	57	35	22	
764388	WS8	2	1.50	2.00	B	Orangish brown gravelly clayey SAND			11	62	35	19	16	

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 22/06/2017

Signed:

Sushil Sharda
Technical Manager (Geotechnical
Division)

for and on behalf of i2 Analytical Ltd

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4041

TEST CERTIFICATE**Determination of Particle Size Distribution**

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



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

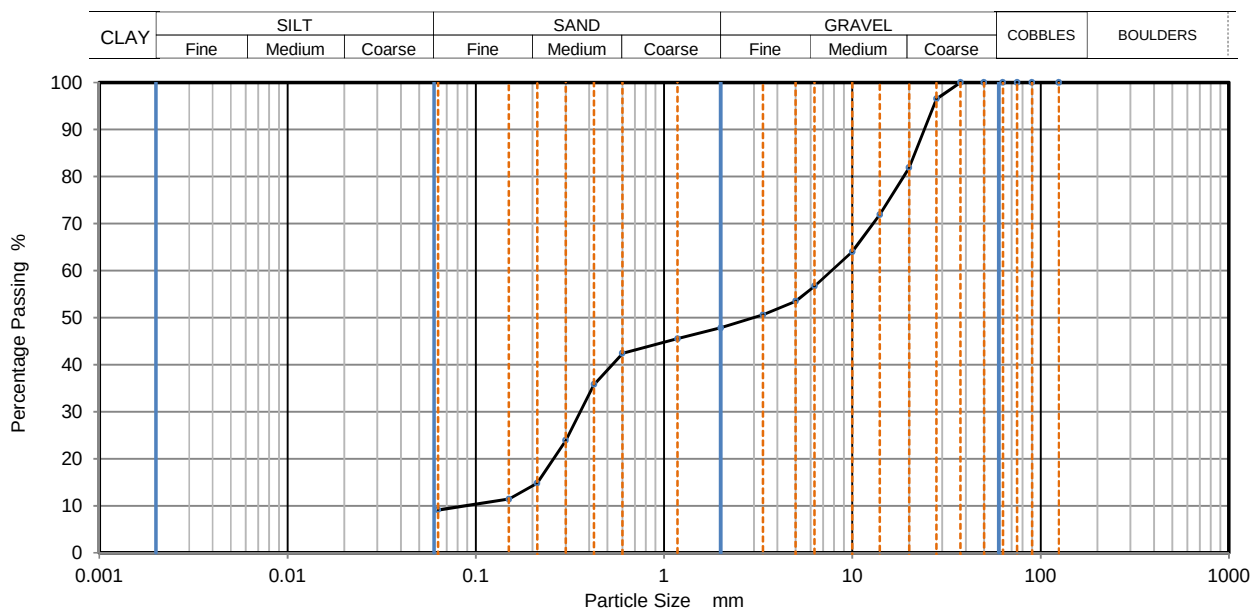
Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764377
Sample description: Yellowish brown clayey very sandy GRAVEL
Location: WS2
Supplier: Not Given

Sample Reference: 2
Sample Type: B
Depth Top [m]: 2.5
Depth Base [m]: 3



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	82		
14	72		
10	64		
6.3	57		
5	54		
3.35	51		
2	48		
1.18	46		
0.6	42		
0.425	36		
0.3	24		
0.212	15		
0.15	11		
0.063	9		

Dry Mass of sample [g]: 3824

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	52.20
Sand	38.70
Fines <0.063mm	9.10

Grading Analysis	
D100	mm 37.5
D60	mm 7.77
D30	mm 0.358
D10	mm 0.0898
Uniformity Coefficient	87
Curvature Coefficient	0.18

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 22/06/2017

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Determination of Particle Size Distribution**

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



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

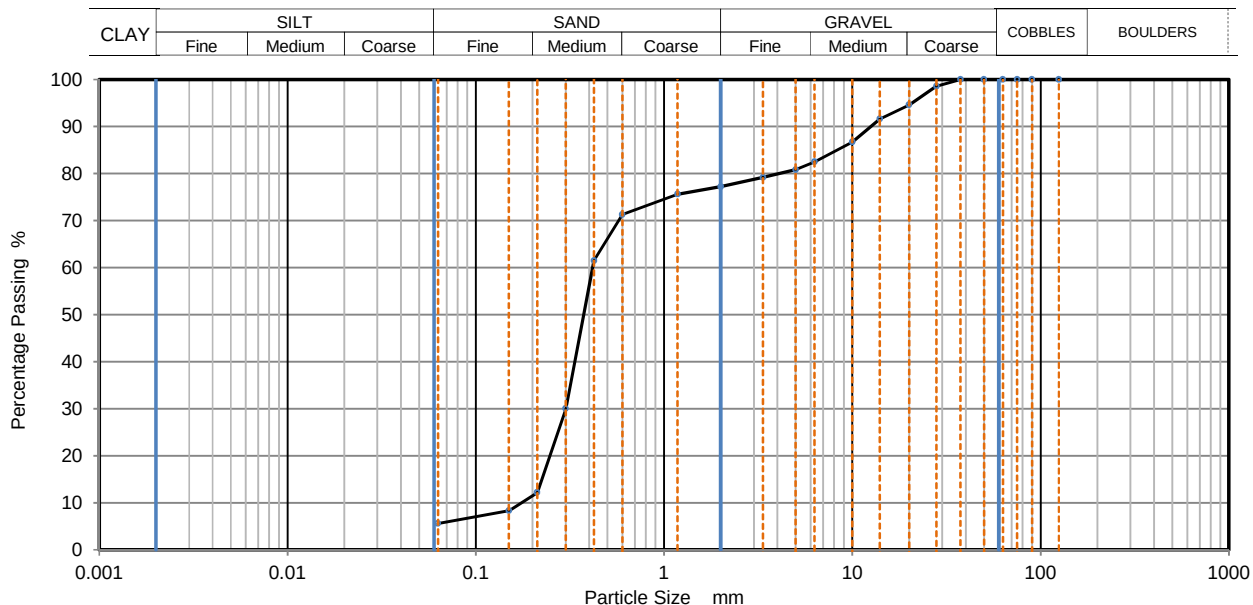
Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764382
Sample description: Brown clayey very gravelly SAND
Location: WS5
Supplier: Not Given

Sample Reference: 2
Sample Type: B
Depth Top [m]: 3.5
Depth Base [m]: 4



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	95		
14	92		
10	87		
6.3	83		
5	81		
3.35	79		
2	77		
1.18	76		
0.6	71		
0.425	62		
0.3	30		
0.212	12		
0.15	8		
0.063	6		

Dry Mass of sample [g]: 2707

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	22.80
Sand	71.60
Fines <0.063mm	5.60

Grading Analysis	
D100	mm 37.5
D60	mm 0.418
D30	mm 0.3
D10	mm 0.174
Uniformity Coefficient	2.4
Curvature Coefficient	1.2

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 22/06/2017

for and on behalf of i2 Analytical Ltd

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4041

TEST CERTIFICATE**Determination of Particle Size Distribution**

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



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

Client: Terrafirma South
Client Address: The Pump House
44 Marlborough Road
Exeter
EX2 4 LL
Contact: Sam Reed
Site Name: Moorlands Primary
Site Address: Not Given

Client Reference: 5846
Job Number: 17-51061
Date Sampled: Not Given
Date Received: 09/06/2017
Date Tested: 19/06/2017
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 764386

Sample Reference: 2

Sample description: Yellowish brown clayey very sandy GRAVEL

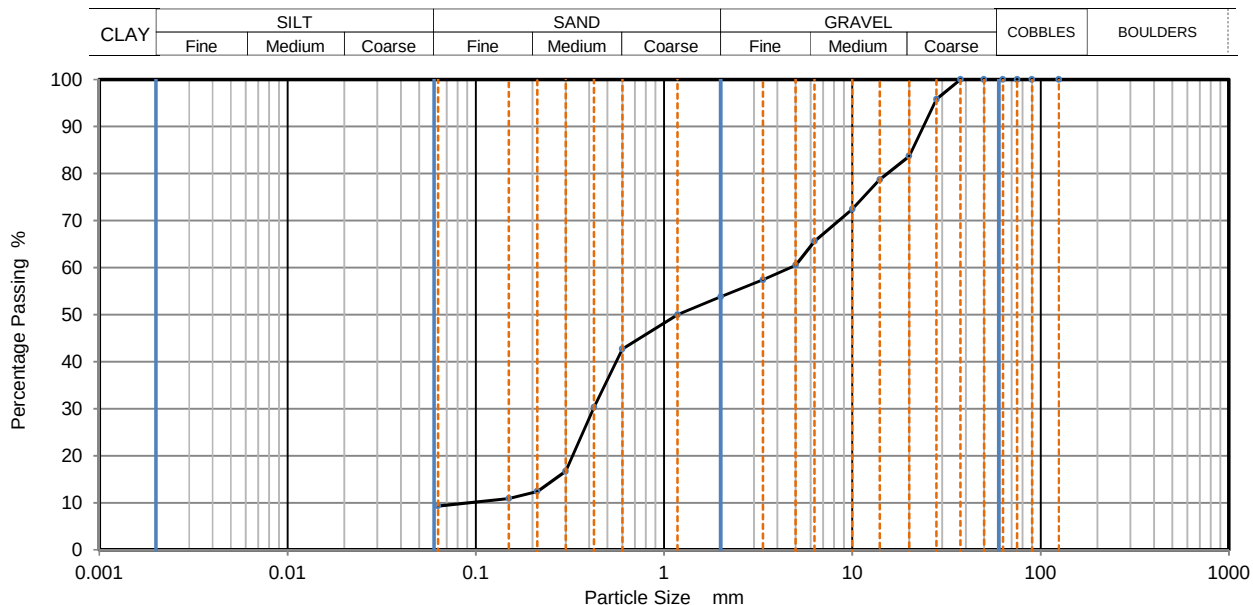
Sample Type: B

Location: WS7

Depth Top [m]: 2.5

Supplier: Not Given

Depth Base [m]: 3



Dry Mass of sample [g]: 2480

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	96		
20	84		
14	79		
10	72		
6.3	66		
5	61		
3.35	57		
2	54		
1.18	50		
0.6	43		
0.425	30		
0.3	17		
0.212	12		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	46.20
Sand	44.50
Fines <0.063mm	9.30

Grading Analysis	
D100	mm 37.5
D60	mm 4.7
D30	mm 0.422
D10	mm 0.092
Uniformity Coefficient	51
Curvature Coefficient	0.41

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Signed:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 22/06/2017

for and on behalf of i2 Analytical Ltd

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**Sam Reed**

Terrafirma South
The Pump House
44 Marlborough Road
Exeter
EX2 4LL

t: 01392438982

e: info@terrafirmasouth.co.uk

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 17-50882

Project / Site name: Moorlands Primary

Samples received on: 09/06/2017

Your job number: 5846

Samples instructed on: 09/06/2017

Your order number:

Analysis completed by: 19/06/2017

Report Issue Number: 1

Report issued on: 19/06/2017

Samples Analysed: 5 soil samples

Signed:

Dr Irma Doyle
Senior Account 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: 17-50882

Project / Site name: Moorlands Primary

Lab Sample Number				763326	763327	763328	763329	763330
Sample Reference				WS1	WS4	WS6	WS7	WS8
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50-1.00	1.50-2.00	0.50-0.80	1.50-2.00	0.50-1.00
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
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	57	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	8.0	9.3	5.5	9.6	16
Total mass of sample received	kg	0.001	NONE	0.39	0.41	0.39	0.44	0.51

General Inorganics

	pH Units	N/A	MCERTS	7.0	6.9	6.9	7.1	6.8
pH - Automated	%	0.005	MCERTS	0.013	0.006	0.020	0.007	0.012
Total Sulphate as SO ₄	mg/l	1.25	MCERTS	< 1.25	3.08	17.7	10.5	40.8
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	< 0.0013	0.0031	0.0177	0.0105	0.0408
Water Soluble SO ₄ as SO ₄ (2:1) Gallery 16h extraction	mg/l	0.5	MCERTS	2.2	0.6	1.7	6.2	1.7
Water Soluble Chloride (2:1) (leachate equivalent)	%	0.005	MCERTS	0.009	0.006	0.011	< 0.005	0.008
Total Sulphur	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Water Soluble Nitrate (2:1) as N (leachate equivalent)								

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Magnesium (leachate equivalent)	mg/l	2.5	NONE	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5



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* 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 *
763326	WS1	None Supplied	0.50-1.00	Brown sandy clay with vegetation.
763327	WS4	None Supplied	1.50-2.00	Brown sandy clay.
763328	WS6	None Supplied	0.50-0.80	Brown loam and clay with gravel and stones.
763329	WS7	None Supplied	1.50-2.00	Brown clay and sand with gravel.
763330	WS8	None Supplied	0.50-1.00	Brown clay and sand with gravel.

Analytical Report Number : 17-50882

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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
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests. 2:1 extraction.	L082-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
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 by Gallery 16hr	Determination of water soluble Sulphate by discrete analyser (precipitation method).	In house method based on BS1377-3: 1990.	L082B-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests"	L038	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038	W	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-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
WS1		S	17-50882	763326	a			
WS4		S	17-50882	763327	a			
WS6		S	17-50882	763328	a			
WS7		S	17-50882	763329	a			
WS8		S	17-50882	763330	a			



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**Project: Moorlands Primary School,
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**Drawing A – Exploratory
Hole Location Plan
NTS**