



PHASE II GEO-ENVIRONMENTAL ASSESSMENT

LAND OFF HELME LANE, MELTHAM
HD9 5RJ

REC REFERENCE: 106245P1R0

REPORT PREPARED FOR: ELLUC PROJECTS LTD

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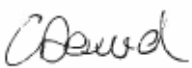


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EXECUTIVE SUMMARY	
Site Address	Land off Helme Lane, Meltham, HD9 5RJ
Grid Reference	E: 409935 N: 411276
Site Area	12.75 hectares
Intrusive Ground Investigation	
Ground Conditions	Topsoil: Greyish brown slightly gravelly sandy friable Clay with rootlets, up to 0.4m thick. Drift: Firm light brown / grey (mottled) gravelly sandy Clay with a variable cobble content to depths of between 1.5m and 2.55mbgl. Solid Geology: Grey Weathered Sandstone or Grey weathered Mudstone. Groundwater: Groundwater was not encountered during the ground investigation, subsequent monitoring has encountered groundwater locally between 1.7m and 2.68m bgl.
Tier 2 Contaminated Land Risk Assessment	
Human Health	No significant exceedances recorded for the tested determinands.
Controlled Waters	The site has been historically farmland, minimal made ground deposits were encountered during the investigation. REC consider that the concentrations of contaminants encountered within soils do not present a risk to controlled waters receptors.
Ground Gas	Data obtained from 3 No. ground gas monitoring visits indicates the site is characterised as Characteristic Situation 1.
Geotechnical Assessment	
Foundation Options	Based on the ABCs recorded it is considered that bearing capacities, typically in excess of 75kN/m ² can be obtained. For that reason, standard shallow strip foundations are considered to be the most suitable foundation option for the site with the target stratum being the medium to high strength clay. Foundation design should be undertaken by a specialist contractor.
Sulphate Assessment	Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005).
Conceptual Site Model (CSM)	
Human Health The Tier II Human Health Risk concluded that the screening values had only been marginally exceeded for one contaminant in one location, REC therefore do not consider that this represents a significant risk to human health. Controlled Waters The concentrations of contaminants encountered are not considered to pose a risk to Controlled Waters Receptors. Ground Gas After 3 No. ground gas monitoring visits the site is characterised as Characteristic Situation 1.	
Recommendations	
REC recommend the following: Ensure the ground gas assessment undertaken to date and recommended protection measures are agreed with the local authority prior to their adoption on-site.	





TABLE OF CONTENTS

EXECUTIVE SUMMARY	II
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Proposed Development	1
1.3 Objectives	1
1.4 Limitations of the Study	1
1.5 Confidentiality	1
2.0 SITE SETTING	2
2.1 Site Details	2
2.2 Current Site Use	2
2.3 Geology & Hydrogeology	2
3.0 SITE INVESTIGATION	3
3.1 In-Situ Testing	3
3.1.1 Pocket Penetrometer	3
3.1.2 Standard Penetration Tests	3
3.2 Laboratory Analysis	3
3.2.1 Soil Chemical Analysis	3
3.2.2 Geotechnical Laboratory Analysis	3
3.3 Gas and Groundwater Monitoring	4
4.0 GROUND AND GROUNDWATER CONDITIONS	5
4.1 Ground Conditions	5
4.1.1 Topsoil	5
4.1.2 Superficial Deposits	5
4.1.3 Solid Geology	5
4.1.4 Contamination	5
4.1.5 Soil Consistency	5
4.1.6 Soil Plasticity	5
4.1.7 Particle Size Distribution (PSD)	6
4.1.8 pH and Sulphate	6
4.2 Groundwater	6
4.3 Ground Gas	6
5.0 TIER II GENERIC QUANTITATIVE CONTAMINATED LAND RISK ASSESSMENT	8
5.1 Human Health Risk Assessment	8
5.2 Controlled Waters	10





5.3	Ground Gas	10
5.4	Conceptual Site Model	10
	Risk Classification	10
	Severity	11
	Likelihood	11
	Risk Rating	12
6.0	GEOTECHNICAL ASSESSMENT	14
6.1	Proposed Development	14
6.2	Summary of Ground Conditions	14
6.3	Site Preparation	14
6.4	Foundation Conditions and Bearing Capacity	14
6.5	Ground Floor Slabs	15
6.6	Drainage	16
6.7	Concrete Durability	16
6.8	Excavations	16
7.0	CONCLUSIONS & RECOMMENDATIONS	17

APPENDICES

Appendix I	Limitations
Appendix II	Glossary
Appendix III	Drawings
	Drawing No. 106245-001 – Site Location Plan
	Drawing No. 106245-002 – Exploratory Hole Location Plan
	Farrar Bamforth Associates Ltd DWG No 16/D29/10
Appendix IV	REC Exploratory Hole Logs
Appendix V	In-Situ Testing Results
Appendix VI	Geotechnical Testing results
Appendix VII	Chemical Testing Results





1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants Ltd (REC) has been commissioned by ELLUC on behalf of Conroy Homes Ltd to undertake a Phase II Site Investigation at their site located off Helme Lane, Meltham.

1.2 Proposed Development

Up to 30 No. low rise residential dwellings with private gardens and an associated access roadway. A proposed development plan from Farrar Bamforth Associates Ltd Dwg No 16/D29/10 is provided in Appendix III.

1.3 Objectives

The objective of the geo-environmental work is to:

- ▶ Undertake an intrusive investigation with sampling and analysis to provide an overview of environmental issues identified;
- ▶ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors;
- ▶ Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs; and,
- ▶ Provide recommendations regarding future works required.

1.4 Limitations of the Study

The limitations of this report are presented in Appendix I.

1.5 Confidentiality

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.





2.0 SITE SETTING

2.1 Site Details

Site details are included within the table below

Table 2.1 Key Site Details

Site Address	Land off Helme Lane, Meltham, HD9 5RJ
National Grid Reference	E: 409935 N: 411276
Site Area	12.75 ha

All acronyms used within this report are defined in the Glossary presented in Appendix II. A site location plan drawing No 104992-001 is presented in Appendix III.

2.2 Current Site Use

The site is an undeveloped and roughly rectangular shaped parcel of land located off Helme Lane in Meltham. The site comprises former agricultural fields which exhibit a general downward slope from north-west to south-east. An un-vegetated strip dissects the site and marks the location of a former separating wall. The site is bordered by agricultural fields to the north, woodland to the east, and residential housing to the south and west.

2.3 Geology & Hydrogeology

The British Geological Survey (BGS) map for the site, (Sheet 086, 1:50,000, Glossop, Solid edition) indicates that the site is underlain by the following geological bedrock sequence:

Geological Unit	Classification	Description	Aquifer Classification	Sensitivity
Solid	Huddersfield White Rock	Sandstone	Principal Aquifer	High





3.0 SITE INVESTIGATION

The ground investigation comprised five window sample probeholes and seven trial pit excavations with installations as detailed in Table 3.1 below.

Table 3.1 Summary of Fieldwork

Location Hole	Potential Source/Rationale	Type	Maximum Depth (m bgl)	Monitoring Wells Response Zone
WS101	Ground / baseline conditions	Window Sample Borehole	2.45	1.00-2.00
WS102	Ground / baseline conditions		3.40	1.00-3.00
WS103	Ground / baseline conditions		2.15	1.00-2.00
WS104	Ground / baseline conditions		1.79	0.79-1.79
WS105	Ground / baseline conditions		1.78	0.78-1.78
TP101-TP107	Ground conditions / In-Situ Testing	Trial Pit Excavation	0.60	N/A

Notes

m bgl – metres below ground level.

The window sample probeholes were designed to provide geotechnical information, and to retrieve environmental samples for chemical testing in order to confirm the findings of the CSM.

3.1 In-Situ Testing

3.1.1 Pocket Penetrometer

In-situ pocket penetrometer testing was completed in the cohesive deposits with results presented in Appendix VI and discussed in Section 4 and 6 of this report.

3.1.2 Standard Penetration Tests

Standard Penetration Tests (SPT) were carried out in all window sample locations at 1m intervals to provide information about ground consistency and strength. The results of the in-situ testing are presented in Appendix VI and discussed in Sections 4 and 6.

3.2 Laboratory Analysis

3.2.1 Soil Chemical Analysis

Selected soil samples were submitted for a range of chemical analysis comprising, metals, pH, total sulphate, water soluble sulphate (2:1 extract), sulphide, cyanide, phenols, total and speciated poly-aromatic hydrocarbons (PAHs), asbestos identification, total organic carbon (TOC) and soil organic matter (SOM), and banded total petroleum hydrocarbons (TPH). Test certificates are included in Appendix VII and the results are discussed in Section 5.

3.2.2 Geotechnical Laboratory Analysis

Selected soil samples were scheduled for the following geotechnical testing:

- ▶ 7 No. Particle Size Density tests; and,
- ▶ 9 No. Atterberg Limits Determinations.

The results of the geotechnical analysis are presented in Appendices VI and discussed in Sections 4 and 6.





Chemical analysis on soil samples included pH and sulphate (2:1 extraction) analysis to aid concrete design. The results of these tests are included within the soil chemical test data in Appendix VII and discussed in Sections 4.1.8 and 6.0.

3.3 Gas and Groundwater Monitoring

3 No. Gas with 1 No. combined groundwater monitoring visit have been completed to date. A total of 6 No. ground gas visits are to be undertaken and this report will be updated on completion of the final round.

Concentrations of methane (CH_4), carbon dioxide (CO_2), oxygen (O_2), hydrogen sulphide (H_2S) and carbon monoxide (CO) were measured using an infra-red gas analyser (GFM436), calibrated to a reference standard (before and after each survey) and gas flow rates were measured using an attached flow pod. Gas measurements were recorded for a minimum of sixty seconds at each location, at which point the maximum concentration of CH_4 , CO_2 , H_2S and CO together with the lowest concentration of O_2 were recorded.

Groundwater monitoring was undertaken using an electronic dip meter and interface probe to record the depth to groundwater and the thickness of any free phase hydrocarbon product, if present.

Ground gas results are discussed in Section 5.3 and the recorded groundwater levels are summarised in Section 4.2 and discussed within Section 5.2.





4.0 GROUND AND GROUNDWATER CONDITIONS

4.1 Ground Conditions

Ground conditions are summarised in Table 4.1 below.

Table 4.1 Summary of Strata

Strata	Typical Description	Min Depth to Top of Strata (m)	Max Depth to Top of Strata (m)	Max Thickness (m)
TOPSOIL	Greyish brown slightly gravelly sandy friable CLAY with rootlets.	0.00	0.00	0.40
CLAY	Firm light brown / grey (mottled) gravelly sandy Clay with a variable cobble content.	0.15	0.40	2.25
SAND	Orangeish brown clayey gravelly SAND with medium cobble content. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse Sandstone and Siltstone. Cobbles are angular Sandstone. Probable Weathered Sandstone	1.2	1.75	0.55
SANDSTONE	Grey weathered sandstone	2.0	2.0	0.45
MUDSTONE	Grey weathered mudstone	1.4	2.55	0.85

4.1.1 Topsoil

Topsoil was encountered across the site and consisted of dark greyish brown slightly gravelly sandy friable clay with rootlets.

4.1.2 Superficial Deposits

Whilst superficial deposits are not recorded on the BGS mapping, both clay and sand were encountered to depths of between 1.4m and 2.55m bgl.

4.1.3 Solid Geology

Bedrock was encountered in all exploratory hole locations at depths of between 1.4m and 2.55m bgl, described as either grey weathered sandstone, interpreted to be the Huddersfield White Rock or grey weathered mudstone, interpreted to be the Marsden Formation.

4.1.4 Contamination

No visual or olfactory evidence of contamination was observed.

4.1.5 Soil Consistency

The clay was noted to be medium to very high strength and of stiff to very stiff consistency. Results of the Standard Penetration Tests, including undrained shear strengths derived from SPTs are included in Appendix VII.

4.1.6 Soil Plasticity

The Atterberg Limits determinations, summarised in Table 4.2 below, show the clay to be of low to intermediate plasticity. The modified plasticity index shows the clay is of low intermediate to high plasticity, with low to medium volume change potential.





Table 4.2 Summary of Plasticity Index Test Results

Location	Depth (m)	Natural Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Percentage passing 425µm sieve (%)	Modified Plasticity Index (%)	Plasticity	Volume Change Potential
WS101	1.0	14	19	39	20	97	19.4	Intermediate	Low
WS102	2.0	14	21	43	22	100	22	Intermediate	Medium
WS103	1.0	13	20	38	18	100	18	Intermediate	Low
WS104	1.0	28	26	52	26	100	26	High	Medium
WS105	1.0	18	22	46	24	100	24	Intermediate	Medium
TP101	1.1	13	18	36	18	87	15.6	Intermediate	Low
TP104	1.5	13	19	37	18	77	13.9	Intermediate	Low
TP105	1.6	18	19	39	20	72	14.4	Intermediate	Low
TP106	0.7	31	26	59	33	100	33	High	Medium

4.1.7 Particle Size Distribution (PSD)

Seven samples were analysed for their particle size distribution, the results are shown in Table 4.3 below.

Table 4.3 Summary of PSD Results

Location	Depth	% Represented				Description
		Cobbles	Gravel	Sand	Silt / Clay	
TP101	1.6	0	68	15	17	Brown sandy very clayey GRAVEL.
TP102	0.6	0	2	19	79	Brown slightly gravelly sandy CLAY.
TP103	1.7	0	77	11	12	Brown sandy clayey GRAVEL.
TP104	1.5	0	14	18	68	Brown gravelly sandy CLAY.
TP105	1.5	0	19	16	65	Brown gravelly sandy CLAY.
TP106	1.9	0	6	18	76	Brown slightly gravelly sandy CLAY.
TP107	1.9	0	17	11	72	Brown gravelly sandy CLAY.

4.1.8 pH and Sulphate

Chemical analyses for pH and soluble sulphate content shows that the soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005).

Table 4.4 Summary of pH and Sulphate Data

Location	WS102	WS105	TP1	TP3	TP5
Depth (m)	0.6m	1.65m	0.6m	1.6m	0.8m
pH Value	5.2	4.9	6.1	5.9	5.1
Sulphate Aqueous Extract as SO ₄ (mg/l)	<10	<10	<10	<10	<10

4.2 Groundwater

Groundwater strikes were not encountered during drilling. All subsequent groundwater records are presented in Table 4.3 overleaf.

4.3 Ground Gas

The results of the first 3No. rounds of ground gas monitoring are presented in Table 4.5 overleaf.





Table 4.5 - Summary of Ground Gas and Groundwater Monitoring Results

Well	Date	CH ₄ Max %v/v	CH ₄ Steady %v/v	CH ₄ GSV l/hr	CO ₂ Max %v/v	CO ₂ Steady %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos(mb)	Atmos. Dynamic	Flow Max (l/hr)	Flow Steady (l/hr)	Response Zone (mbgl)	Depth to Base (mbgl)	Depth to Water (mbgl)
WS101	05/10/2018	0.0	0.0	0.0	0.0	0.0	0.0	19.6	992	Falling	0.1	0.0	1.0 – 2.0	1.957	Dry
	19/10/2018	0.0	0.0	0.0	1.7	1.7	0.0017	17.9	1008	Falling	0.0	0.0		1.970	1.718
	02/11/2018	0.0	0.0	0.0	2.1	2.1	0.0084	17.1	1004	Steady	0.4	0.1		2.00	1.990
WS102	05/10/2018	0.0	0.0	0.0	1.4	1.4	0.0028	18.9	992	Falling	0.2	0.2	1.0 - 3.0	2.809	Dry
	19/10/2018	0.0	0.0	0.0	2.0	2.0	0.008	18.4	1007	Falling	0.4	0.4		2.818	2.682
	02/11/2018	0.0	0.0	0.0	1.8	1.8	0.0018	18.9	1004	Steady	0.0	0.0		2.915	2.910
WS103	05/10/2018	0.0	0.0	0.0	1.6	1.6	0.0048	16.9	990	Falling	0.3	0.3	1.0 – 2.1	1.960	Dry
	19/10/2018	0.0	0.0	0.0	1.9	1.7	0.0038	16.3	1007	Falling	0.2	0.2		1.958	Dry
	02/11/2018	0.0	0.0	0.0	1.3	1.3	0.0013	17.9	1004	Steady	0.1	0.1		2.040	2.025
WS104	05/10/2018	0.0	0.0	0.0	0.7	0.7	0.00	18.8	990	Falling	0.0	0.0	0.8 – 1.8	1.655	Dry
	19/10/2018	0.0	0.0	0.0	1.6	0.7	0.0016	16.8	1006	Falling	0.1	0.1		1.665	Dry
	02/11/2018	0.0	0.0	0.0	1.0	1.0	0.0010	16.1	1004	Steady	0.1	0.0		1.775	Dry
WS105	05/10/2018	0.0	0.0	0.0	0.7	0.7	0.00	19.6	988	Falling	0.0	0.0	0.8-1.8	1.527	Dry
	19/10/2018	0.0	0.0	0.0	0.9	0.9	0.00	18.6	1006	Falling	0.0	0.0		1.530	Dry
	02/11/2018	0.0	0.0	0.0	0.6	0.6	0.006	15.8	1004	Steady	0.1	0.0		1.765	1.745



5.0 TIER II GENERIC QUANTITATIVE CONTAMINATED LAND RISK ASSESSMENT

REC has undertaken a Tier II qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

5.1 Human Health Risk Assessment

At a Tier II stage, the long term (chronic) toxicity risk to human health is assessed by utilising appropriate and conservative generic assessment criteria (GAC) to determine whether there are actual or potential unacceptable risks at the site and if any viable pollutant linkages are present.

Within the context of the proposed development GAC values have been used for a residential end use with plant uptake.

The assessment has primarily adopted the S4UL (Suitable for Use Levels reference values published by LQM/CIEH in 2015, the S4ULs). Currently, no published GAC value is available for cyanide and therefore REC has utilised the Environment Agency Contaminated Land Exposure Assessment Tool (CLEA v1.06) to derive the relevant GAC for this proposed land use. Due to the absence of a published lead GAC for direct use within the planning regime, the 2014 Defra C4SL (Category 4 Screening Level) has been used as this value is considered to incorporate the latest toxicological, bioaccessibility and exposure modelling research to date.

Table 5.1: Summary of Human Health Toxicity Assessment for a Residential End Use

Determinand	Units	GAC	GAC Source	n	Max. Conc.	Location / Strata	Primary Pathways	Assessment
Inorganics								
Arsenic	mg/kg	37	(i)	11	21	N/A	1	No Further Action
Cadmium	mg/kg	11	(i)	11	<1		1	
Chromium (VI)	mg/kg	6	(i)	11	<1		1	
Lead	mg/kg	200	(iv)	11	120		1	
Mercury [Inorganic]	mg/kg	40	(i)	11	<1		1	
Nickel	mg/kg	130	(i)	11	30		1	
Selenium	mg/kg	250	(i)	11	<3		1	
Copper	mg/kg	2,400	(i)	11	46		1	
Zinc	mg/kg	3,700	(i)	11	85		1	
Cyanide [Total]	mg/kg	791	(v)	11	<1		1	
Asbestos	-	D.	-	5	N.D			
Organics – PAHs and Phenol								
Phenols	mg/kg	280	(ii)	11	<0.1	N/A	5	No Further Action
Naphthalene	mg/kg	2.3	(ii)	11	0.2		4	
Acenaphthylene	mg/kg	170	(ii)	11	<0.1		1	
Acenaphthene	mg/kg	210	(ii)	11	0.4		1	
Fluorene	mg/kg	170	(ii)	11	0.3		1	
Phenanthrene	mg/kg	95	(ii)	11	1.5		1	
Anthracene	mg/kg	2,400	(ii)	11	0.6		1	
Fluoranthene	mg/kg	280	(ii)	11	2.5		1	
Pyrene	mg/kg	620	(ii)	11	2.2		1	





Determinand	Units	GAC	GAC Source	n	Max. Conc.	Location / Strata	Primary Pathways	Assessment
Benzo(a) Anthracene	mg/kg	7.2	(ii)	11	1.8		1	
Chrysene	mg/kg	15	(ii)	11	1.8		1	
Benzo(b) Fluoranthene	mg/kg	2.6	(ii)	11	1.4		1	
Benzo(k) Fluoranthene	mg/kg	77	(ii)	11	1.2		1	
Benzo(a)Pyrene	mg/kg	2.2	(ii)	11	1.3		1	
Indeno (123-cd)Pyrene	mg/kg	27	(ii)	11	0.6		1	
Dibenzo(a,h) Anthracene	mg/kg	0.24	(ii)	11	0.3	TP3 0.3m Topsoil	1	Marginal exceedance no further action required
Benzo(ghi) Perylene	mg/kg	320	(ii)	11	0.6		1	No Further Action
Organics – TPHs								
TPH C ₅ -C ₆	mg/kg	42	(iii)	11	<0.20	N/A	4	No Further Action
TPH C ₆ -C ₈	mg/kg	100	(iii)	11	<0.20		4	
TPH C ₈ -C ₁₀	mg/kg	27	(iii)	11	<0.20		4	
TPH C ₁₀ -C ₁₂	mg/kg	74	(iii)	11	2		4	
TPH C ₁₂ -C ₁₆	mg/kg	140	(iii)	11	6		1, 4	
TPH C ₁₆ -C ₂₁	mg/kg	260	(iii)	11	26		1	
TPH C ₂₁ -C ₃₅	mg/kg	1,100	(iii)	11	88		1	
Key [mc] Maximum Concentration Recorded D. Detected N.D. None Detected (Limit of Detection = <0.0001%)								
Primary Pathways 1 Ingestion of soil and indoor dust and / or oral background exposure; 2 Consumption of home-grown produce and attached soil; 3 Inhalation of dust (background and indoor); 4 Inhalation of vapour (background and indoor); 5 Direct dermal / skin contact.								
Generic Assessment Criteria (GAC) Source (i) LQM/CIEH Suitable For Use Level (S4UL) (2015); (ii) S4UL – Conservative Assessment Approach of 1% SOM; (iii) S4UL –1% SOM and assumed worst case aliphatic / aromatic compound; (iv) Defra Category 4 Screening Level (2014); (v) CLEA 1.06 Derived Value.								

GACs have only been exceeded for dibenzo(a,h)anthracene, encountered in TP103 at 0.3m bgl. Given that the exceedance is marginal and concentrations of all other samples are below the screening criteria, it is considered that no further assessment is required.





5.2 Controlled Waters

No groundwater strikes were encountered during drilling and on return monitoring insufficient volumes of groundwater were present to obtain a representative sample. However, given the absence of Made Ground, the site's history as farmland and the absence of any notable concentrations of contaminants within the soils it is considered that there is negligible risk to controlled waters receptors.

5.3 Ground Gas

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 (*Assessing risks posed by hazardous ground gases to buildings*, 2007) and CL:AIRE Research Bulletin 17 (*A Pragmatic Approach to Hazardous Ground Gas Risk Assessment*, 2012) (RB17).

Based on a low risk of gas generation for a high sensitivity residential development with a very low gas generation potential, 6 No. monitoring visits were proposed over a 3 month period in order to obtain an assessment of the ground gas regime at the site. To date three monitoring visits have been undertaken. To date methane has not been detected in any of the boreholes. A maximum concentration of 2.1 %v/v of carbon dioxide was recorded. Atmospheric pressures were recorded at between 988mbar and 1006 mbar. Flow rates were low peaking at 0.4 l/hr.

In accordance with the methodology outlined with the CIRIA publication C665, REC has utilised the results of the ground gas monitoring surveys to calculate a tentative Gas Screening Value (GSV). The maximum GSV calculated for methane was 0.0001 l/hr and for carbon dioxide was 0.0048l/hr (WS103).

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area. CIRIA C665 states that the maximum GSV for carbon dioxide and methane is <0.07l/hr for Characteristic Situation 1 / Green in line with the NHBC Traffic Light System, 0.07l/hr to <0.7 for Characteristic Situation 2, 0.70 to <3.5l/hr for Characteristic Situation 3 and 3.5 to <15l/hr for Characteristic Situation 4.

Three rounds of gas monitoring are to be completed and this section of the report will subsequently be updated.

5.4 Conceptual Site Model

The conceptual site model has been developed for the proposed future land use and summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors.

Risk Classification

REC has utilised the available data to classify the site on the basis of its likely contaminated land liability and potential for geotechnical constraints in relation to the property development. The risk classification definitions are summarised below:

CIRIA 552: Contaminated Land Risk Assessment 'A Guide to Good Practice' provides guidance on risk assessment taking into account factors such as severity of the potential harm that may arise from a successful pollutant linkage, potential magnitude of the hazard, and the sensitivity of the target





receptor. Risk assessment is initially assessed by determining the severity of the potential hazard, which takes into account receptor sensitivity and the magnitude of the potential impact as detailed in Tables 5.2 & 5.3 below.

Severity

Table 5.2 Receptor Sensitivity

Category	Example Human sensitivity	Example Environmental sensitivity
Very Low	Ground workers	Non-sensitive water course
Low	Commercial / Industrial	Secondary Aquifer
Moderate	Residential without plant uptake	Principal Aquifer / Sensitive Watercourse / Groundwater protection Zone 2/3
High	Residential with plant uptake	Groundwater Source Protection Zone 1

Table 5.3 Magnitude of Impact

Category	Example
No Impact	No identified or potential pollutants present / Greenfield site
Slight Impact	Minor leaks and spills from fuel infrastructure, inert landfills / Residential, retail or Offices / made ground of natural origin
Moderate Impact	Major leaks and spills from fuel infrastructure / Railways, Collieries, Scrapyards / non hazardous landfill sites
Gross Impact	Heavily contaminated industrial sites, hazardous landfills / Gas works, Chemical Works / known fuel or chemical leaks

Magnitude of impact is ultimately assessment on site-specific basis hence does not always follow what is indicated in the table above.

Severity is subsequently assessed considering the potential receptor and magnitude of impact as outlined within Table 5.4.

Table 5.4 Determination of level of severity for potential hazards

	Receptor Sensitivity			
	Very Low	Low	Moderate	High
No Impact	Negligible	Minor	Minor	Medium
Slight Impact	Minor	Minor	Mild	Medium
Moderate Impact	Minor	Mild	Mild	Medium
Gross Impact	Mild	Medium	Medium/Severe	Severe

Likelihood

The likelihood of an event is assessed while considering the potential for presence of a contaminant, presence of receptor, and the substantiality of the pollutant pathway. Likelihood is broken down into four separate categories within the CSM as shown in Table 5.5 below:





Table 5.5 Definitions of likelihood categories

Category	Definition
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable.
Low Likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
High Likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor.

Risk Rating

Table 5.6 demonstrates the methodology used to provide an overall risk rating within the revised CSM in Section 5.4 with respect to any potential sources of contamination that may affect the site. An overall risk rating is assigned to each potential contaminant considering the assessed likelihood and severity as determined using the methodologies within Tables 5.2 to 5.5.

Table 5.6 Level of risk rating for hazard definition

	Consequence			
	Minor	Mild	Medium	Severe
Unlikely	Very Low risk	Very Low risk	Low risk	Low / Moderate risk
Low Likelihood	Very Low risk	Low risk	Low / Moderate risk	Moderate risk
Likely	Low risk	Low / Moderate risk	Moderate risk	High risk
High Likelihood	Low / Moderate risk	Moderate risk	High risk	Very High risk

The conceptual site model is presented on Table 5.7 overleaf.





Table 5.7 Revised Conceptual Site Model

Source	Contaminant	Potential migration pathway	Potential Receptors	Likelihood of Occurrence	Severity	Overall Risk Rating	Potential Mitigation / Further Assessment
On-Site							
Shallow Deposits of Topsoil, sands and clays.	Heavy metals including As, Cd, Cu, Pb, Ni, Zn	Vertical and lateral migration within groundwater	Surface Water Features	Low Likelihood	Minor	Very Low	The presence of low permeability clays underlying the site are considered to be acting as an aquiclude to the underlying principal bedrock aquifer and nearby surface water courses.
			Principal aquifer in bedrock	Low Likelihood	Mild	Low	
	Polycyclic Aromatic Hydrocarbons (PAHs)	Vertical and lateral migration within groundwater	Surface Water Features	Low Likelihood	Minor	Very Low	The one minor exceedances encountered is not considered to present a significant risk to controlled waters.
			Principal aquifer in bedrock	Low Likelihood	Mild	Low	
	Production of bulk ground gas (CH ₄ and CO ₂)	Inhalation of ground gases	Future Site Users	Low Likelihood	Mild	Low	Following three monitoring visits, the site would fall under Characteristic Situation 1/ Green and consequently gas protection measures would not be required. However, this assessment is required to be agreed with the Local Authority prior to their adoption on-site.
	Sulphates & pH	Attack on building foundations	Building Foundations	Low Likelihood	Medium	Low	Soils present at the site are consistent with design sulphate class DS-1 and ACEC AC-1s.



6.0 GEOTECHNICAL ASSESSMENT

6.1 Proposed Development

REC has assessed the foundation options for the proposed residential buildings. Details of the proposed loadings are not known at this stage and therefore a line loading of 75kN/m^2 has been assumed for preliminary assessment purposes only.

6.2 Summary of Ground Conditions

Ground conditions identified at the site are summarised in Table 4.1, Section 4.0 and comprise Topsoil to a maximum depth of 0.40m bgl overlying superficial gravelly sandy clay to depths of between 1.5mbgl and 2.55m bgl. Bedrock comprised either grey weathered sandstone or grey weathered mudstone.

Soil plasticity testing indicates the cohesive material is of Intermediate to high plasticity and low to medium volume change potential.

6.3 Site Preparation

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the Specification for Highway Works. This should include:

- ▶ Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill; and
- ▶ Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.

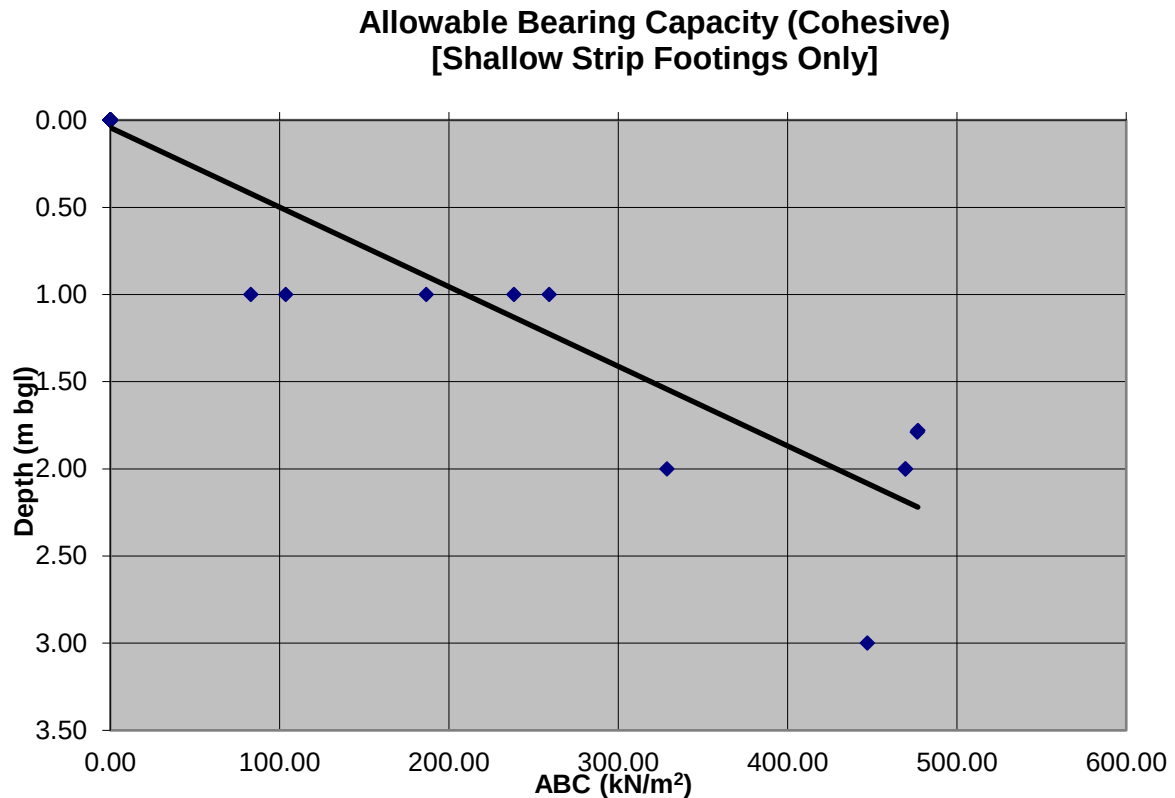
6.4 Foundation Conditions and Bearing Capacity

An assessment of the Allowable Bearing Capacity (ABC) for both granular and cohesive has been undertaken using data obtained from in-situ SPT tests and hand shear vane tests.





Graph 6.1 ABC Cohesive



Graph 6.1 shows that the shallow clay deposits across the site show a general increase in strength with depth.

Foundation Options

The shallow superficial deposits typically comprise topsoil or Made Ground over typically firm Clay. An assessment of the Allowable Bearing Capacity (ABC) for the cohesive Clay deposits has been undertaken using data obtained from in-situ SPT tests. The results of the SPTs, corrected for depth and energy, are produced in Graph 6.1.

Based on the ABCs in Graph 6.1, it is considered that bearing capacities, typically in excess of 75kN/m² can be obtained. For that reason, standard shallow strip foundations are considered to be the most suitable foundation option for the site with the target stratum being the medium strength clay.

Foundation design should be undertaken by a specialist contractor. It should be noted that foundation depths should take account the presence of existing and proposed trees with foundations deepened locally in accordance with the requirements of NHBC Standards (see NHBC Standards, Chapter 4.2 and Trees in Relation to Construction). It is recommended that a foundation schedule is prepared for the development taking account of the soil plasticity and the locations and types of trees when finalised.

6.5 Ground Floor Slabs

The Atterberg Limits determinations summarised in Table 4.2 in Section 4 show the natural clays to be of low to medium volume change potential and as such could be liable to heave. It is considered that should a ground improvement technique be utilised, that this is extended over the entirety of the building footprint to enable a ground bearing floor slab to be utilised. If a piled solution is preferred,



a suspended floor slab or void former is recommended; a void former would allow a ground bearing floor slab to be used subject to suitable design.

6.6 Drainage

The presence of substantial depths of clays across the site may result in settlement. It is therefore recommended that drain runs are designed using steeper gradients and flexible joints to allow for some differential settlement.

6.7 Concrete Durability

Based upon the results of the chemical analyses summarised in Table 4.3 it is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE Special Digest 1 (2005).

6.8 Excavations

Site observations indicated that excavations should be feasible in the near surface with normal plant.





7.0 CONCLUSIONS & RECOMMENDATIONS

Geotechnical Assessment
Foundation Recommendation Based on the ABCs in Graph 6.1, it is considered that bearing capacities, typically in excess of 75kN/m² can be obtained. For that reason, standard shallow strip foundations are considered to be the most suitable foundation option for the site with the target stratum being the medium strength clay. Foundation design should be undertaken by a specialist contractor.
Revised Conceptual Site Model
Human Health The Tier II Human Health Risk concluded that the one screening value marginally exceeded does not pose a significant risk to Human Health. Controlled Waters On the basis of the site's history as farmland and the concentrations of contaminants encountered within the soils REC consider that the site does not pose a risk to the controlled waters receptors. Ground Gas After 3 No. ground gas monitoring visits the site has been characterised as Characteristic Situation 1. Further monitoring is being undertaken.
Recommendations
REC recommend the following: Ensure the ground gas assessment undertaken to date and recommended protection measures are agreed with the local authority prior to their adoption on-site.

END OF REPORT





APPENDIX I
LIMITATIONS





1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
5. In addition to the above REC Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
8. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man-made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.
9. REC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.
10. Rather, this investigation has been undertaken to provide a preliminary characterisation of the existing sub-surface geotechnical characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.
11. This investigation has been undertaken to reasonably characterise existing sub-surface conditions and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.





APPENDIX II
GLOSSARY





TERMS

ABC	Actual Bearing Capacity
ACM	Asbestos Containing Materials
AST	Above Ground Storage Tank
BGS	British Geological Survey
BSI	British Standards Institute
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
C4SLs	Category 4 Screening Levels
CBR	California Bearing Ratio
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research Association
CLEA	Contaminated Land Exposure Assessment
CSM	Conceptual Site Model
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	General Assessment Criteria
GL	Ground Level
GSV	Gas Screening Value
HCV	Health Criteria Value
ICSM	Initial Conceptual Site Model
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene)
ND	Not Detected
LMRL	Lower Method Reporting Limit
NR	Not Recorded
PAH	Poly Aromatic Hydrocarbon
PCB	Poly-Chlorinated Biphenyl
PID	Photo Ionisation Detector
QA	Quality Assurance
S4UL	Suitable for Use Levels
SGV	Soil Guideline Value
SPT	Standard Penetration Test
SuDS	Sustainable Urban Drainage System
SVOC	Semi Volatile Organic Compound
TPH	Total Petroleum Hydrocarbon
TPHCWG	Total Petroleum Hydrocarbon (Criteria Working Group)
UKWIR	United Kingdom Water Industry Research
UST	Underground Storage Tank
VCCs	Vibro Concrete Columns
VOC	Volatile Organic Compound
WTE	Water Table Elevation





APPENDIX III

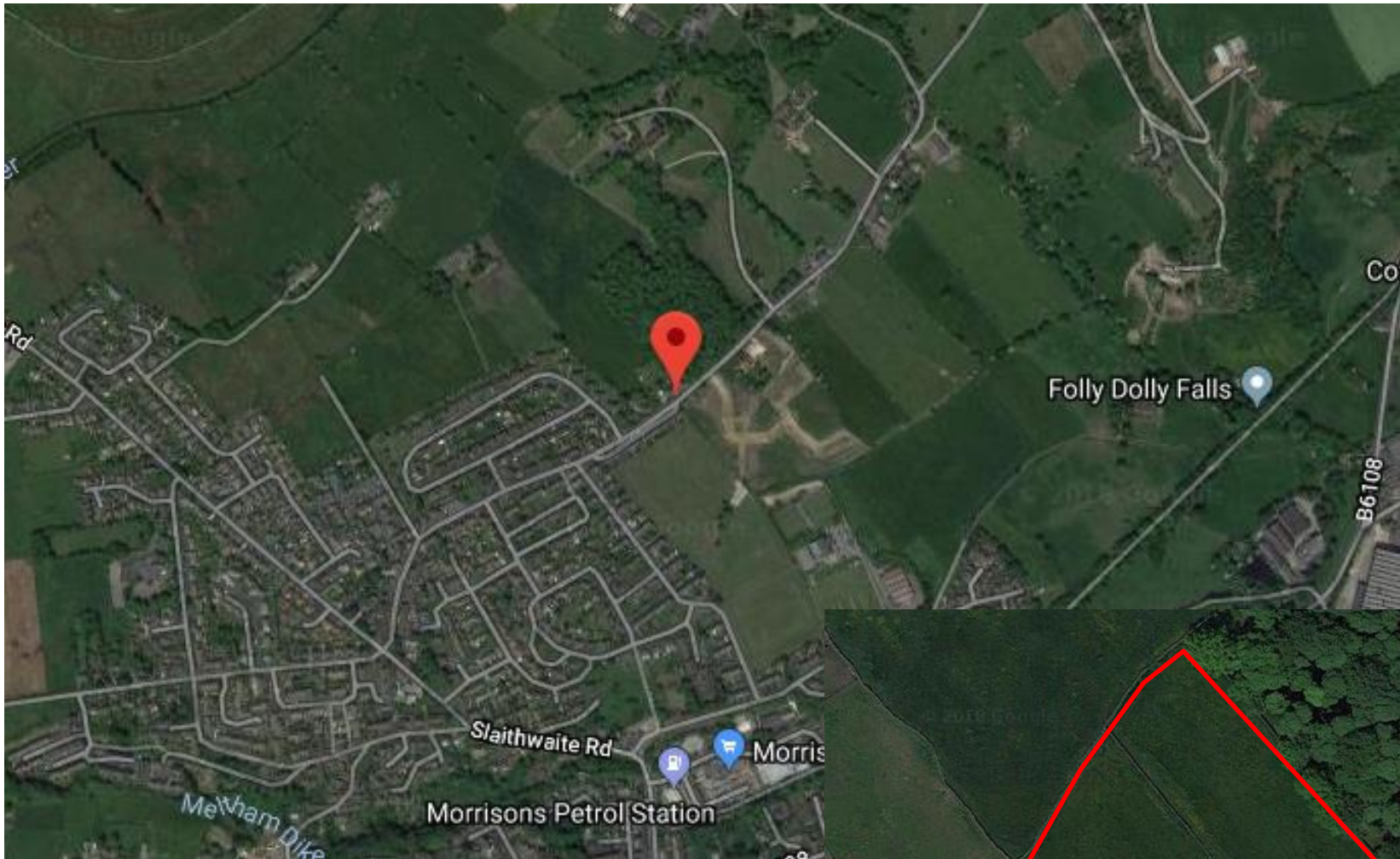
DRAWINGS



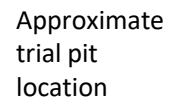
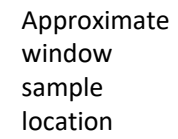
KEY:



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	REC Ltd Osprey House, Pacific Quay, Broadway, Manchester, M50 2UE T: +44 161 868 1300 recLtd.co.uk	Job Title: Helme Lane	Client: ELLUC	Job No: 106245 - 001	Notes:	Drawing Title: Site Location
				Drawn By: CD		
				Approved by: PH		



The site plan illustrates a residential development with a central 'OPEN SPACE' area. The plan shows a network of roads including 'PRIVATE DRIVE' and 'ESTATE ROAD'. A red dashed line, labeled 'ROOT PROTECTION', runs diagonally across the site. Green circles with an 'X' mark indicate tree protection zones (TP101-TP107), while red circles with a cross mark indicate proposed works (WS101-WS105). The plan also shows 'Existing trees' and a 'Pond'. A blue dashed line runs through the 'OPEN SPACE' area, and a yellow dashed line runs along the bottom left. A blue hatched area is located near the bottom right. The plan includes various labels for buildings, roads, and other features.

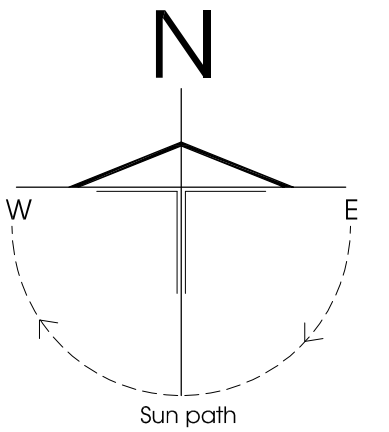


Helme Lane

ELLUC

Approved by: PH

Exploratory Hole Location Plan



Rev B: Vendor plots added (X1 & X2)
Rev A: Layout redesigned
Revisions:

22.05.18
27.04.18

Residential Development

at Land adj 125
Helme Lane
Meltham
Holmfirth

for Conroy Homes Ltd

Feasibility Sketch C

Farrar Bamforth Associates Ltd.

Chartered Architectural Technologists

51, Trinity Street, Huddersfield HD1 4DN
Tel. (01484) 424008 Fax. (01484) 512305
E-mail: design@farrarbamforth.co.uk
Website: www.farrarbamforth.co.uk

Drawn DRH

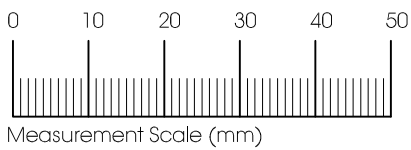
Date February 2018

Scales 1:500 @ A2

Drawing No. 16/D29/10

Rev. B

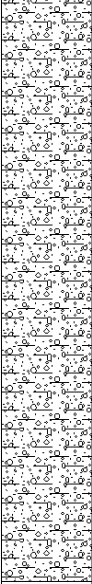
INDICATIVE LAYOUT

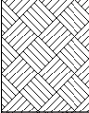
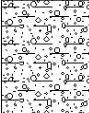
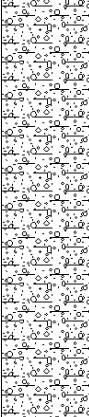


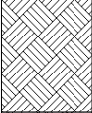
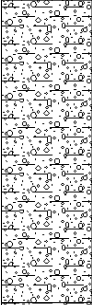
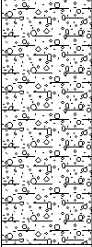


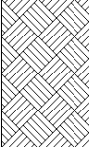
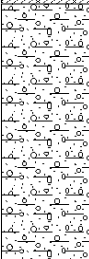
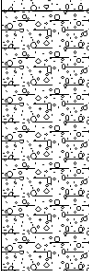
APPENDIX IV
EXPLORATORY LOGS



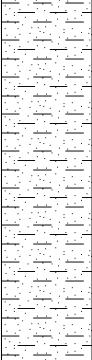
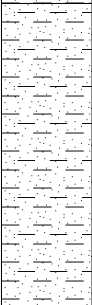
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Location: Meltham, Huddersfield			Plant: 5 Tonne Tracked Excavator		Level (m AOD): Final Depth (m): 1.75		Scale: 1:20		
Client: ELLUC			Crew: MT Kaill		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: H. Fogglin		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.20	ES		0.20			TOPSOIL: Grass overlies locally soft dark brown slightly sandy friable CLAY. Sand is fine to medium. Frequent rootlets present	
		0.50 - 0.60	D						Stiff to very stiff orangeish brown mottled light grey slightly gravelly sandy CLAY with a low cobble content. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse Sandstone. Cobbles are angular Sandstone.
		0.60 - 0.70	ES						
		0.90 - 1.00	B						
		1.10 - 1.20	D						
		1.30 - 1.40	ES						
		1.60 - 1.70	B					<i>Below 1.20m bgl: Medium cobble content.</i>	
			1.75			End of Borehole at 1.75m			
Remarks: Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground. No Groundwater encountered. Bedrock encountered at 1.75m bgl. Stability: Stable									
						Pit Dimensions Length: 1.80 Width: 0.45 Depth: 1.75		 CONCEPT LIFE SCIENCES DELIVERING SCIENCE	

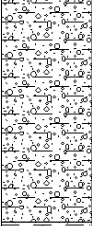
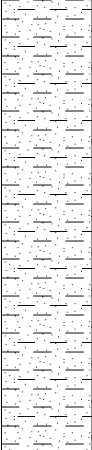
   		Trial Pit Log			Borehole No. TP102				
Project Name: Helme Lane, Meltham		Proj. ID: 106245		Easting: Northing:		Hole Type TP			
Location: Meltham, Huddersfield		Plant: 5 Tonne Tracked Excavator		Level (m AOD): Final Depth (m): 1.70		Scale: 1:20			
Client: ELLUC		Crew: MT Kaill		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: H. Fogglin			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20 - 0.30	ES		0.30		 TOPSOIL: Grass overlies locally soft dark brown slightly sandy friable CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse Sandstone. Cobbles are angular of Sandstone. Frequent rootlets present		
		0.60 - 0.70	B				 Stiff to very stiff light brown mottled light grey slightly gravelly slightly sandy CLAY with a low cobble content. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse Sandstone. Cobbles are angular Sandstone.		
		0.70 - 0.80	D						
		0.70 - 0.80	ES						
		1.50 - 1.60	D						
		1.50 - 1.60	ES						
		1.60 - 1.70	B		1.70		 At 0.90m bgl: Sandstone laminations. Below 1.00m bgl: Medium cobble content. Gravel and cobbles includes siltstone. Occasional Sandstone laminations	1	
							End of Borehole at 1.70m	2	
								3	
								4	
Remarks: Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground. No Groundwater encountered. Bedrock encountered at 1.70m bgl.							Pit Dimensions Length: 1.70 Width: 0.45 Depth: 1.70		 CONCEPT LIFE SCIENCES DELIVERING SCIENCE
Stability: Stable									

				Trial Pit Log			Borehole No. TP104	
Project Name: Helme Lane, Meltham				Proj. ID: 106245		Easting: Northing:		Hole Type TP
Location: Meltham, Huddersfield				Plant: 5 Tonne Tracked Excavator		Level (m AOD): Final Depth (m): 1.75		Scale: 1:20
Client: ELLUC				Crew: MT Kaill		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: H. Fogglin
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 - 0.30	ES		0.30			TOPSOIL: Grass overlies dark grey slightly gravelly sandy friable CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to rounded, fine to coarse Sandstone. Cobbles are angular Sandstone.
		0.60 - 0.70	B					
		0.80 - 0.90	D		1.10		Stiff to very stiff orangeish brown slightly gravelly sandy CLAY with pockets of firm grey CLAY with a medium cobble content. Sand is fine to medium. Gravel is angular to subangular, fine to coarse Sandstone. Cobbles are angular to subangular Sandstone.	
		0.80 - 0.90	ES				At 1.50m bgl: Sandstone laminations.	
		1.40 - 1.50	D		1.75		End of Borehole at 1.75m	
		1.50	B					
1.60 - 1.70	ES							
Remarks: Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground. No Groundwater encountered. Bedrock encountered at 1.75m bgl.								Pit Dimensions Length: 1.60 Width: 0.45 Depth: 1.75
Stability: Stable								

   		Trial Pit Log			Borehole No. TP105 Sheet 1 of 1				
Project Name: Helme Lane, Meltham		Proj. ID: 106245		Easting: Northing:		Hole Type TP			
Location: Meltham, Huddersfield		Plant: 5 Tonne Tracked Excavator		Level (m AOD): Final Depth (m): 1.80		Scale: 1:20			
Client: ELLUC		Crew: MT Kaill		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: H. Fogglin			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.20	ES		0.40			TOPSOIL: Grass overlies dark greyish brown slightly gravelly sandy friable CLAY. Sand is fine to coarse. Gravel is angular to subangular, fine to coarse Sandstone. Frequent rootlets present.	1
		0.50 - 0.60	B					Stiff to very stiff light grey mottled orange sandy CLAY with a medium cobble content. Sand is fine to medium. Cobbles are angular Sandstone. Sandstone laminations throughout.	
		0.70 - 0.80	ES					Stiff to very stiff orangeish brown slightly gravelly very sandy CLAY with a moderate cobble content and low boulder content. Sand is fine to medium. Gravel is angular, medium to coarse Sandstone. Cobbles are angular Sandstone. Boulders are as cobbles. Sandstone laminations throughout.	
		0.80 - 0.90	D						
		1.50 - 1.60 1.50 - 1.60 1.60	B ES D		1.80		From 1.60m bgl: Light brown.	End of Borehole at 1.80m	2
							3		
									4

Remarks: Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground. No Groundwater encountered. Bedrock encountered at 1.80m bgl.		Pit Dimensions Length: 1.80 Width: 0.45 Depth: 1.80		 CONCEPT LIFE SCIENCES DELIVERING SCIENCE
Stability: Stable				

		  		Trial Pit Log			Borehole No. TP106	
Project Name: Helme Lane, Meltham		Proj. ID: 106245		Easting: Northing:		Hole Type TP		
Location: Meltham, Huddersfield		Plant: 5 Tonne Tracked Excavator		Level (m AOD): Final Depth (m): 2.00		Scale: 1:20		
Client: ELLUC		Crew: MT Kaill		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: H. Fogglin		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 - 0.30	ES		0.20		 TOPSOIL: Grass overlies dark greyish brown slightly gravelly sandy friable CLAY. Sand is fine to coarse. Gravel is angular to subangular, fine to coarse Sandstone and. Frequent rootlets present.  Firm to stiff light grey mottled orange sandy CLAY. Sand is fine to medium.	1
		0.50 - 0.60	ES					
		0.70 - 0.80	D					
		0.90 - 1.00	B					
		1.50 - 1.60 1.50 - 1.60	D ES		1.20		 Stiff to very stiff dark grey slightly sandy CLAY interbedded with brown slightly clayey slightly gravelly SAND with a low cobble content and sandstone laminations. Sand is fine to coarse. Gravel is angular to subangular, fine to coarse Sandstone. Cobbles are angular Sandstone.	2
		1.90 - 2.00	B					
				2.00		 End of Borehole at 2.00m	4	
Remarks: Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground. No Groundwater encountered. Bedrock encountered at 2.00m bgl.							Pit Dimensions Length: 1.90 Width: 0.45 Depth: 2.00	 CONCEPT LIFE SCIENCES DELIVERING SCIENCE
Stability: Stable								

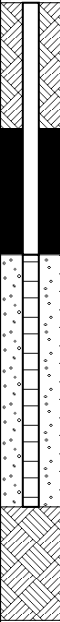
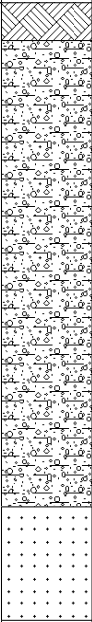
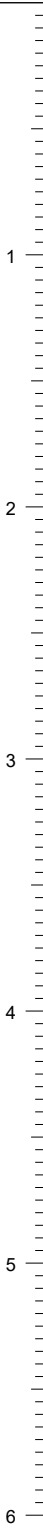
		  		Trial Pit Log			Borehole No. TP107		
Project Name: Helme Lane, Meltham				Proj. ID: 106245		Easting: Northing:		Hole Type TP	
Location: Meltham, Huddersfield				Plant: 5 Tonne Tracked Excavator		Level (m AOD): Final Depth (m): 2.00		Scale: 1:20	
Client: ELLUC				Crew: MT Kaill		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: H. Fogglin	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.20		 TOPSOIL: Grass overlies dark grey to black slightly gravelly sandy friable CLAY. Sand is fine to coarse. Gravel is angular to rounded, fine to coarse Sandstone. Frequent rootlets throughout.	1	
		0.50 - 0.60	ES		0.80	 Firm to stiff light grey mottled orange slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular, fine to coarse Sandstone.			
		0.60 - 0.70	B			 Stiff to very stiff dark grey sandy CLAY interbedded with dark orangeish brown sandy gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is angular to subangular, fine to coarse Sandstone. Cobbles are as gravel.			
		0.60 - 0.70	D						
		1.50 - 1.60	ES		2.00		End of Borehole at 2.00m	2	
		1.60 - 1.70	D						
		1.90 - 2.00	B						
									3
								4	

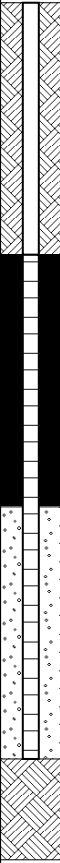
Remarks:
 Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground. No Groundwater encountered. Bedrock encountered at 2.00m bgl.

Stability: Stable

Pit Dimensions
 (m)
 Length: 2.00
 Width: 0.45
 Depth: 2.00

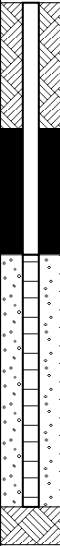
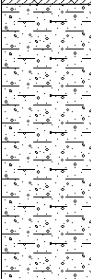

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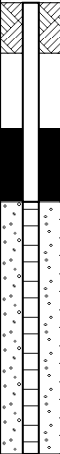
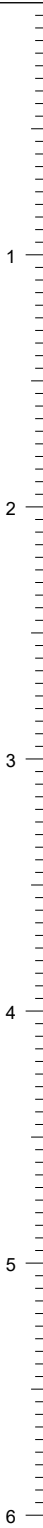
		  		Borehole Log			Borehole No. WS101 Sheet 1 of 1		
Project Name: Helme Lane, Meltham		Proj. ID: 106245		Easting: Northing:		Hole Type WS			
Location: Meltham, Huddersfield		Plant: Terrier Rig		Level (m AOD): Final Depth (m): 2.45		Scale: 1:30			
Client: ELLUC		Crew: Earth Engineering		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: C. Dowd			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.15			TOPSOIL: Grass overlies locally soft dark brown slightly sandy friable CLAY. Sand is fine to medium. Frequent rootlets present Stiff to very stiff orangeish brown slightly gravelly slightly sandy CLAY with a low cobble content. Sand is fine to medium. Gravel is sub-angular to sub-rounded, fine to coarse Sandstone. Cobbles are angular sandstone. <i>Between 0.90m and 1.50m bgl: very gravelly.</i> <i>Between 1.10m and 1.45m bgl: friable.</i>	
	0.50	ES							
	1.00	SPT	N=18 (4,4/5,4,5,4)						
	1.10 - 1.55	D							
	1.20	ES							
		2.00 - 2.45	D	N=50 (13,7/4,3,7,36)	2.00			2	
		2.00	SPT				Grey weathered SANDSTONE [HUDDERSFIELD WHITE ROCK]		
		2.45	SPT	0 (25 for 40mm/0 for 0mm)	2.45			End of Borehole at 2.45m	
Remarks: Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground and hand excavated for services to 1.10m bgl. No Groundwater encountered. Borehole terminated upon refusal at 2.45m bgl. Location installed with 50mm internal diameter HDPE gas and groundwater monitoring installation.									

		  		Borehole Log			Borehole No. WS102 Sheet 1 of 1		
Project Name: Helme Lane, Meltham		Proj. ID: 106245		Easting: Northing:		Hole Type WS			
Location: Meltham, Huddersfield		Plant: Terrier Rig		Level (m AOD): Final Depth (m): 3.40		Scale: 1:30			
Client: ELLUC		Crew: Earth Engineering		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: C. Dowd			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 TOPSOIL: Grass overlies locally soft dark brown slightly sandy friable CLAY. Sand is fine to medium. Frequent rootlets present		
		0.80	ES				 Stiff to very stiff orangeish grey slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is sub-angular to sub-rounded, fine to coarse coal and sandstone.	1	
		1.00 - 1.45 1.00	D SPT	N=8 (2,2/2,2,2,2)			 Below 1.60m bgl: Gravelly.		
		2.00 2.00 - 2.45 2.00	ES D SPT	N=35 (4,12/12,8,8,7)			 Below 2.20m bgl: Very sandy.	2	
		2.70	ES		2.55		 Grey weathered MUDSTONE [MARSDEN FORMATION]	3	
		3.00	SPT	N=50 (5,9/50 for 250mm)	3.40		 End of Borehole at 3.40m	4	
								5	
								6	

Remarks:
 Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground and hand excavated for services to 1.00m bgl. No Groundwater encountered. Borehole terminated upon refusal at 3.40m bgl. Location installed with 50mm internal diameter HDPE gas and groundwater monitoring installation.


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		  		Borehole Log			Borehole No. WS103 Sheet 1 of 1		
Project Name: Helme Lane, Meltham		Proj. ID: 106245		Easting: Northing:		Hole Type WS			
Location: Meltham, Huddersfield		Plant: Terrier Rig		Level (m AOD): Final Depth (m): 2.15		Scale: 1:30			
Client: ELLUC		Crew: Earth Engineering		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: C. Dowd			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 TOPSOIL: Grass overlies locally soft dark brown slightly sandy friable CLAY. Sand is fine to medium. Frequent rootlets present	1	
							 Stiff to very stiff orangeish grey mottled slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is sub-angular to sub-rounded, fine to medium Sandstone.		
		1.00 - 1.45	D			1.40		 Weathered orangeish grey MUDSTONE [MARSDEN FORMATION] <i>Below 1.20m bgl: Very sandy.</i>	2
		1.20	SPT	N=25 (1,2/5,4,4,12)					
		1.60	ES						
		2.00	SPT	50 (25 for 75mm/50 for 70mm)	2.15			End of Borehole at 2.15m	3
									4
									5
									6
Remarks: Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground and hand excavated for services to 1.00m bgl. No Groundwater encountered. Borehole terminated upon refusal at 2.15m bgl. Location installed with 50mm internal diameter HDPE gas and groundwater monitoring installation.									

		  		Borehole Log			Borehole No. WS104 Sheet 1 of 1		
Project Name: Helme Lane, Meltham		Proj. ID: 106245		Easting: Northing:		Hole Type WS			
Location: Meltham, Huddersfield		Plant: Terrier Rig		Level (m AOD): Final Depth (m): 1.79		Scale: 1:30			
Client: ELLUC		Crew: Earth Engineering		Start Date: 27/09/2018 End Date: 27/09/2018		REC Engineer: C. Dowd			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.30		 TOPSOIL: Grass overlies locally soft dark brown slightly sandy friable CLAY. Sand is fine to medium. Frequent rootlets present.		
						 Stiff to very stiff orangeish grey mottled sandy CLAY. Sand is fine to medium.			
	1.00 - 1.45 1.00	D SPT	N=10 (14,6/3,2,2,3)						
	1.30	ES							
		1.70 - 1.79 1.70	D SPT	50 (25 for 50mm/50 for 40mm)	1.79				
		End of Borehole at 1.79m							
Remarks: Location cleared for buried services using a Cable Avoidance Tool prior to breaking ground and hand excavated for services to 1.00m bgl. No Groundwater encountered. Borehole terminated upon refusal at 1.79m bgl. Location installed with 50mm internal diameter HDPE gas and groundwater monitoring installation.									
 CONCEPT LIFE SCIENCES DELIVERING SCIENCE									



APPENDIX V
IN-SITU TESTING RESULTS





APPENDIX VI
GEOTECHNICAL TESTING





LABORATORY REPORT



4043

Contract Number: PSL18/5245

Report Date: 06 November 2018

Client's Reference: 106245

Client Name: REC Manchester
Osprey House
Pacific Quay
Broadway
Manchester
M50 2UE

For the attention of: Phil Hill

Contract Title: Helme Lane

Date Received: 11/10/2018

Date Commenced: 11/10/2018

Date Completed: 6/11/2018

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

L Knight
(Senior Technician)

A Watkins
(Director)

S Eyre
(Senior Technician)

R Berriman
(Quality Manager)

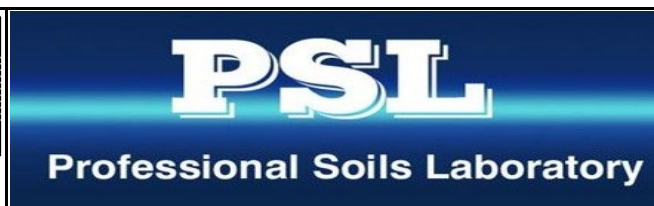
A Fry
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS101		D	1.10	1.55	Brown slightly gravelly sandy CLAY.
WS102		D	2.00	2.45	Brown sandy CLAY.
WS103		D	1.00	1.45	Brown mottled grey sandy very silty CLAY.
WS104		D	1.00	1.45	Brown mottled grey slightly sandy very silty CLAY.
WS105		D	1.00	1.45	Brown sandy CLAY.
TP101		B	1.60	1.70	Brown sandy very clayey GRAVEL.
TP102		B	0.60	0.70	Brown slightly gravelly sandy CLAY.
TP103		B	1.70	1.80	Brown sandy clayey GRAVEL.
TP104		B	1.50		Brown gravelly sandy CLAY.
TP105		B	1.50	1.60	Brown gravelly sandy CLAY.
TP106		B	1.90	2.00	Brown slightly gravelly sandy CLAY.
TP107		B	1.90	2.00	Brown gravelly sandy CLAY.
TP101		D	1.10	1.20	Brown gravelly very sandy CLAY.
TP106		D	0.70	0.80	Brown mottled grey slightly sandy CLAY.



Helme Lane

Contract No:
PSL18/5245
Client Ref:
106245

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WS101		D	1.10	1.55	14			39	19	20	97	Intermediate plasticity CI.
WS102		D	2.00	2.45	14			43	21	22	100	Intermediate plasticity CI.
WS103		D	1.00	1.45	13			38	20	18	100	Intermediate plasticity CI.
WS104		D	1.00	1.45	28			52	26	26	100	High plasticity CH.
WS105		D	1.00	1.45	18			46	22	24	100	Intermediate plasticity CI.
TP104		B	1.50		13			37	19	18	77	Intermediate plasticity CI.
TP105		B	1.50	1.60	18			39	19	20	72	Intermediate plasticity CI.
TP101		D	1.10	1.20	13			36	18	18	87	Intermediate plasticity CI.
TP106		D	0.70	0.80	31			59	26	33	100	High plasticity CH.

SYMBOLS : NP : Non Plastic

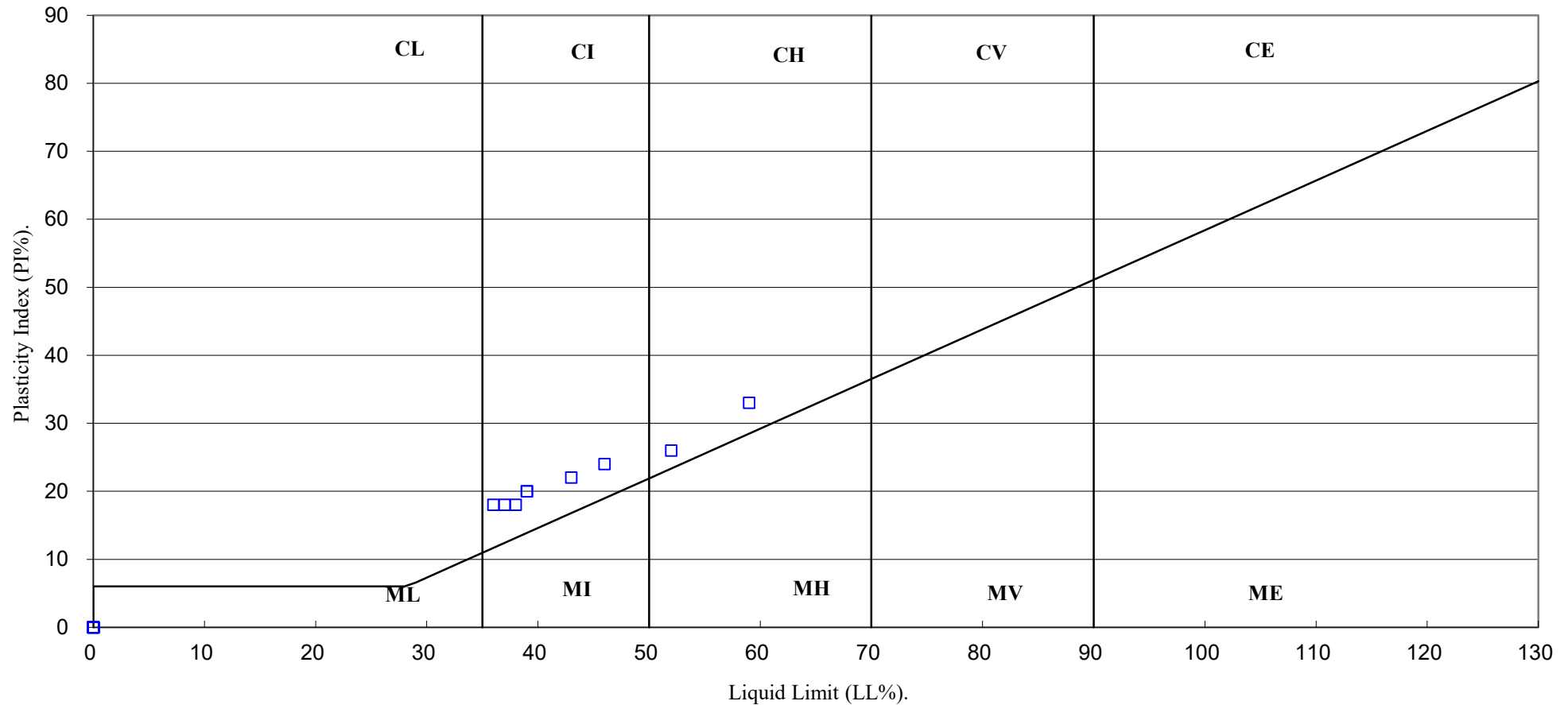
* : Liquid Limit and Plastic Limit Wet Sieved.



Helme Lane

Contract No:
PSL18/5245
Client Ref:
106245

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL

Professional Soils Laboratory

Helme Lane

Contract No:

PSL18/5245

Client Ref:

106245

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

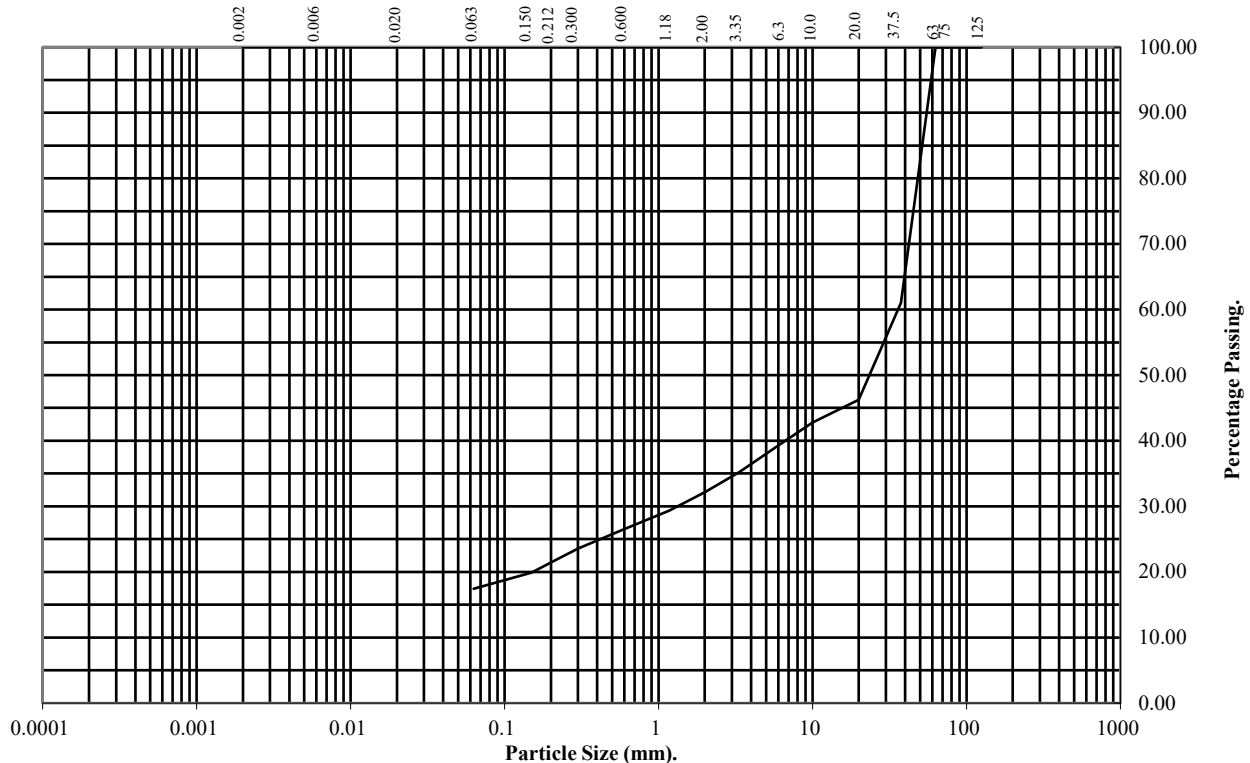
Hole Number: TP101

Top Depth (m): 1.60

Sample Number:

Base Depth(m): 1.70

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	61
20	46
10	43
6.3	40
3.35	35
2	32
1.18	29
0.6	27
0.3	24
0.212	22
0.15	20
0.063	17

Soil Fraction	Total Percentage
Cobbles	0
Gravel	68
Sand	15
Silt/Clay	17

Remarks:

See Summary of Soil Descriptions



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Professional Soils Laboratory

Helme Lane

Contract No:
PSL18/5245
Client Ref:
106245

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

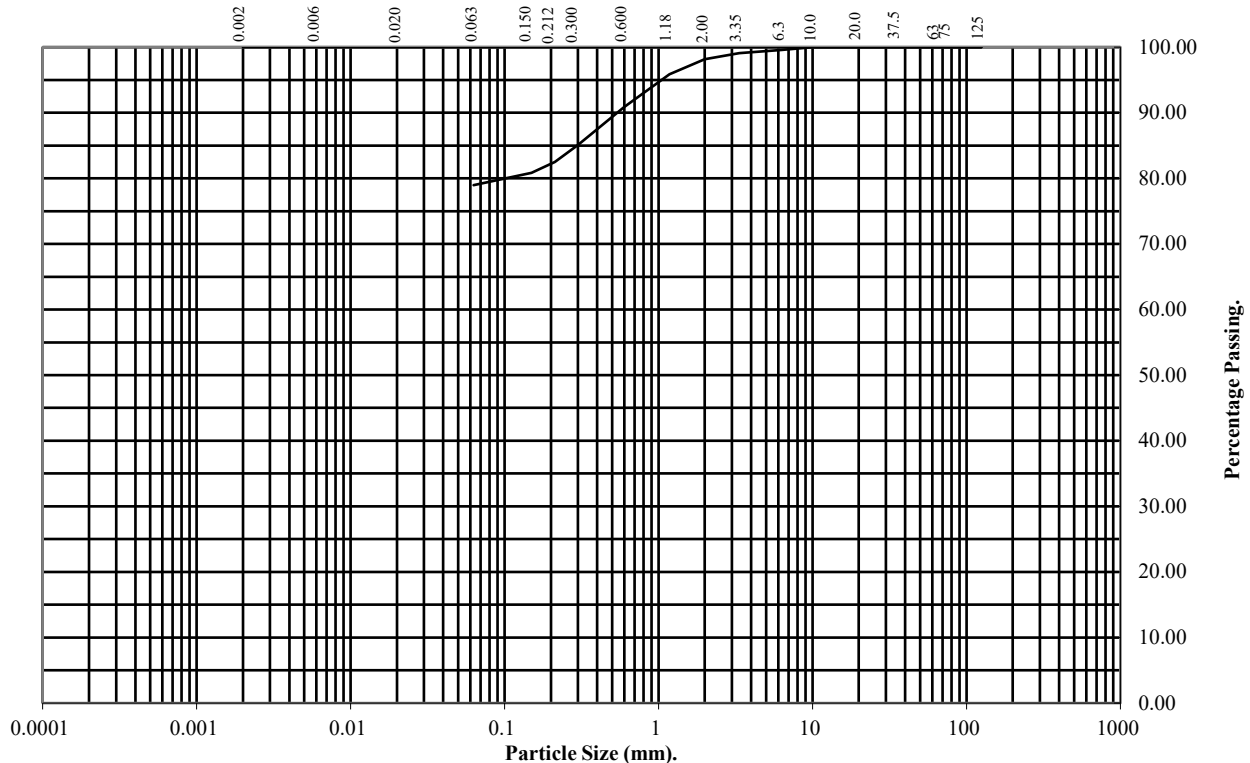
Hole Number: TP102

Top Depth (m): 0.60

Sample Number:

Base Depth(m): 0.70

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	98
1.18	96
0.6	91
0.3	85
0.212	82
0.15	81
0.063	79

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	19
Silt/Clay	79

Remarks:

See Summary of Soil Descriptions



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Contract No:
PSL18/5245
Client Ref:
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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

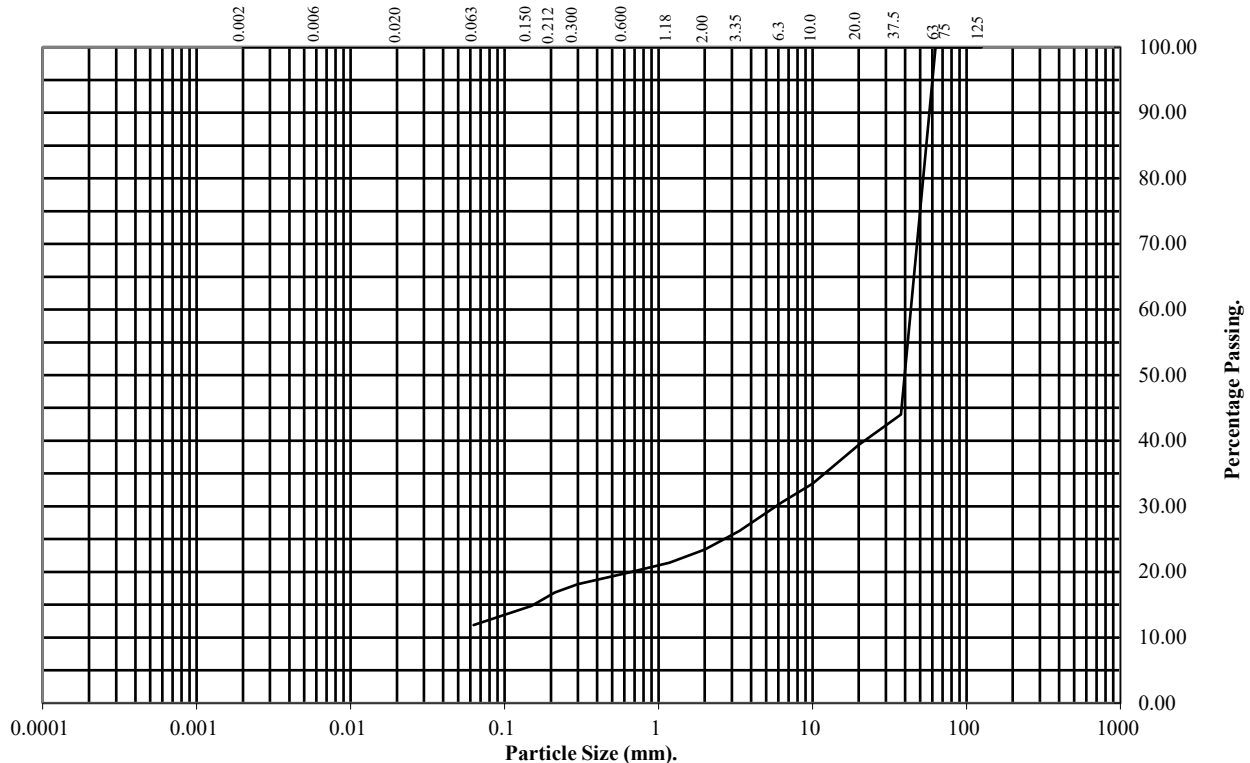
Hole Number: TP103

Top Depth (m): 1.70

Sample Number:

Base Depth(m): 1.80

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	44
20	39
10	33
6.3	31
3.35	26
2	23
1.18	21
0.6	20
0.3	18
0.212	17
0.15	15
0.063	12

Soil Fraction	Total Percentage
Cobbles	0
Gravel	77
Sand	11
Silt/Clay	12

Remarks:

See Summary of Soil Descriptions



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Contract No:
PSL18/5245
Client Ref:
106245

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

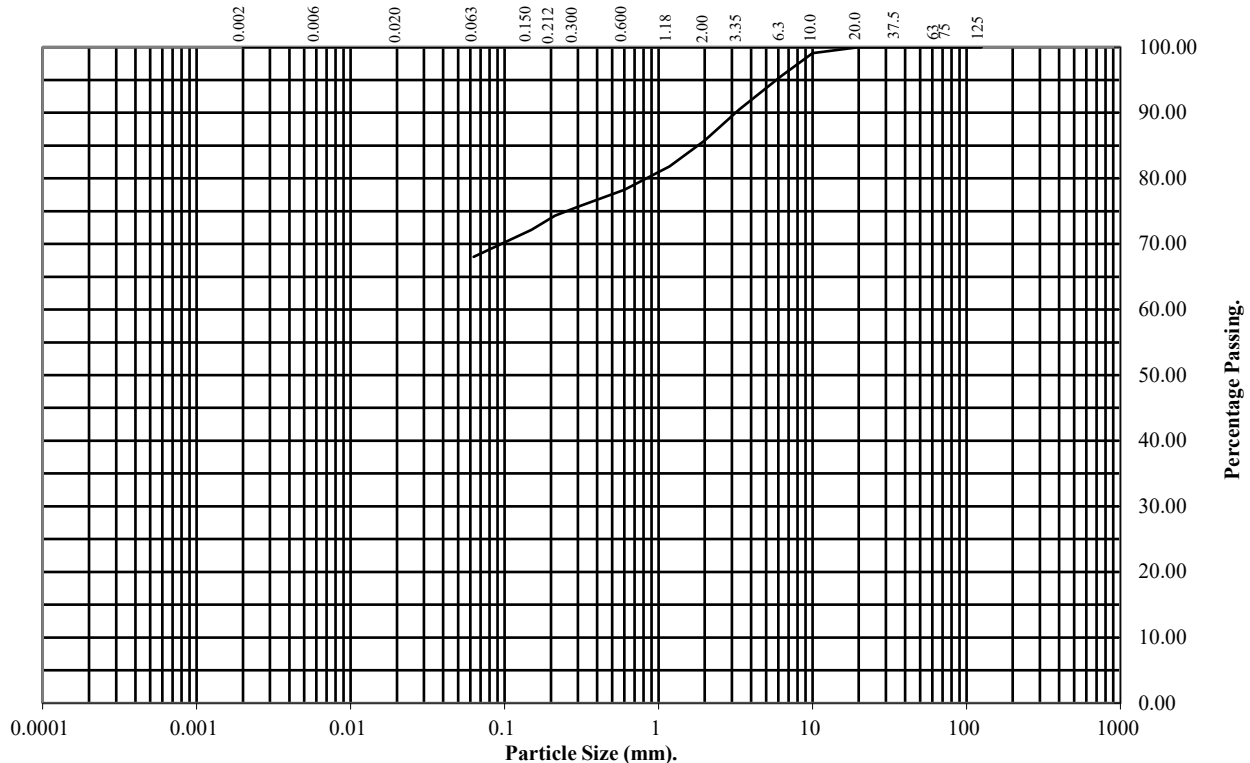
Hole Number: TP104

Top Depth (m): 1.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	96
3.35	91
2	86
1.18	82
0.6	78
0.3	76
0.212	74
0.15	72
0.063	68

Soil Fraction	Total Percentage
Cobbles	0
Gravel	14
Sand	18
Silt/Clay	68

Remarks:

See Summary of Soil Descriptions



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Helme Lane

Contract No:
PSL18/5245
Client Ref:
106245

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

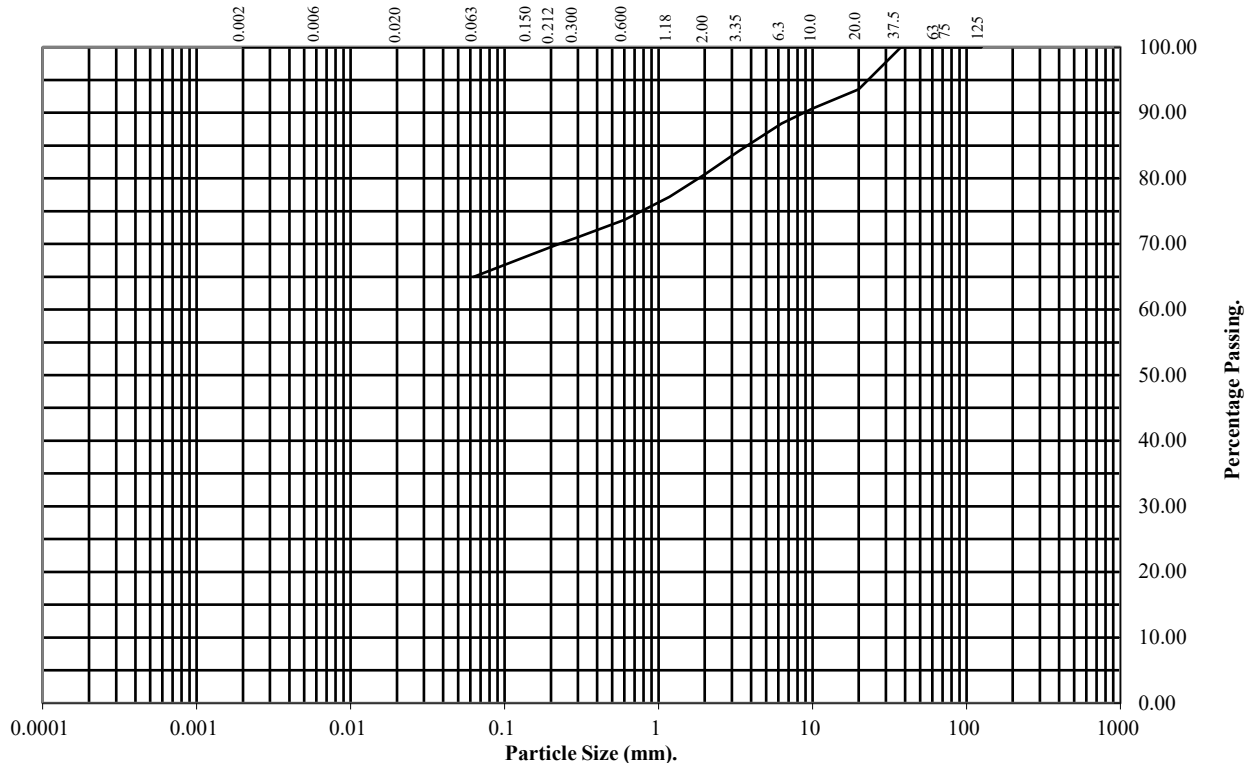
Hole Number: TP105

Top Depth (m): 1.50

Sample Number:

Base Depth(m): 1.60

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	91
6.3	88
3.35	84
2	81
1.18	77
0.6	74
0.3	71
0.212	70
0.15	68
0.063	65

Soil Fraction	Total Percentage
Cobbles	0
Gravel	19
Sand	16
Silt/Clay	65

Remarks:

See Summary of Soil Descriptions



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Helme Lane

Contract No:
PSL18/5245
Client Ref:
106245

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

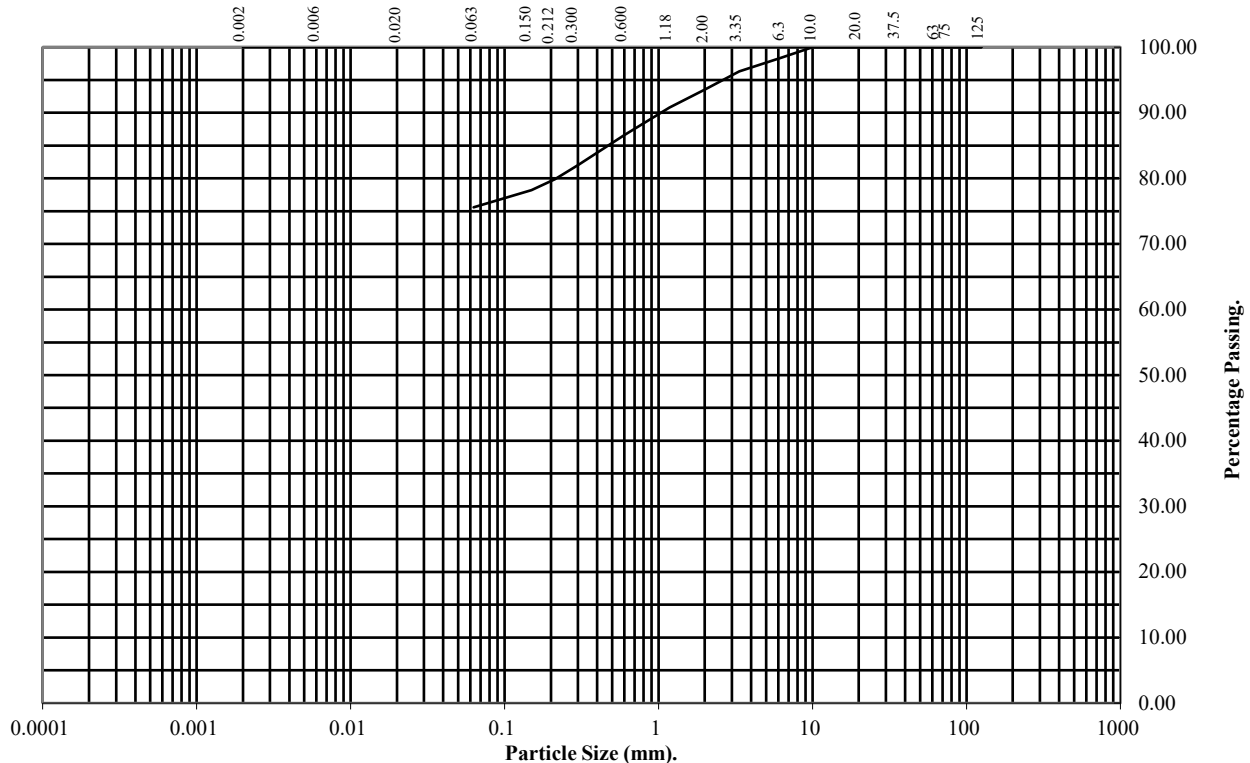
Hole Number: TP106

Top Depth (m): 1.90

Sample Number:

Base Depth(m): 2.00

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	98
3.35	96
2	94
1.18	91
0.6	87
0.3	82
0.212	80
0.15	78
0.063	76

Soil Fraction	Total Percentage
Cobbles	0
Gravel	6
Sand	18
Silt/Clay	76

Remarks:

See Summary of Soil Descriptions



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Contract No:
PSL18/5245
Client Ref:
106245

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

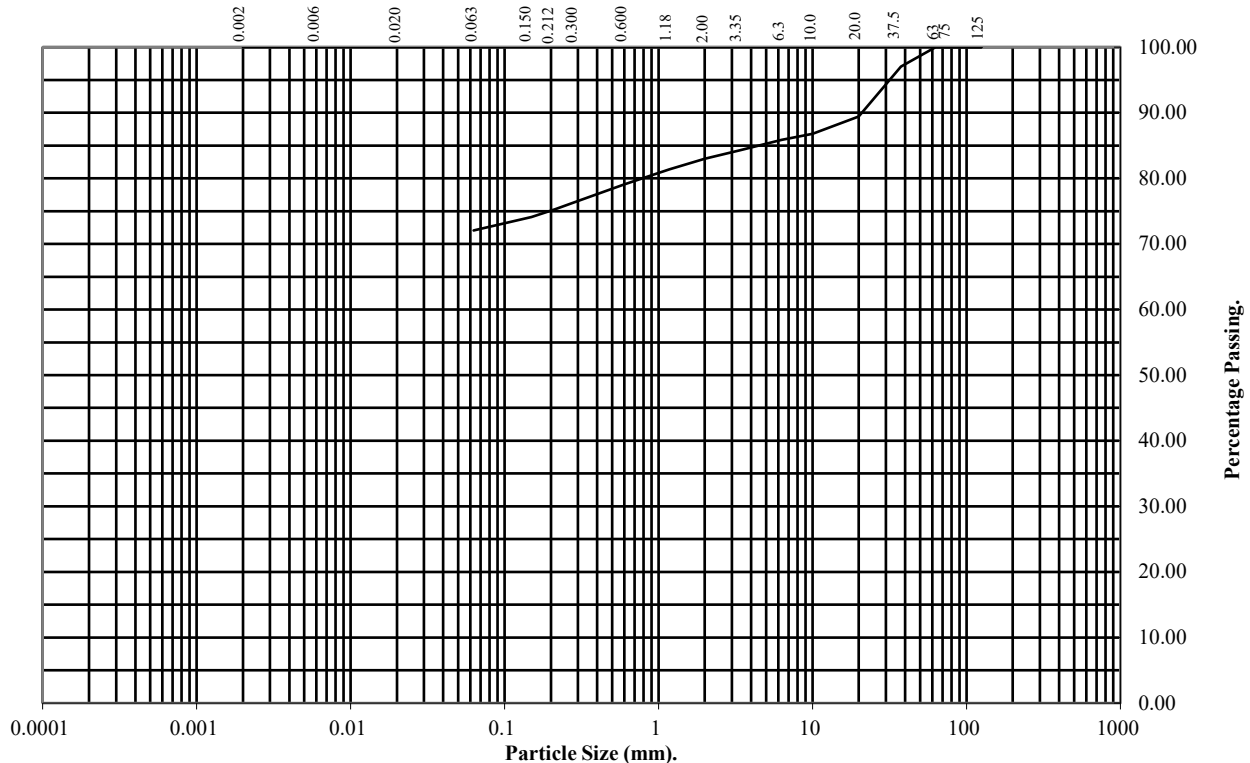
Hole Number: TP107

Top Depth (m): 1.90

Sample Number:

Base Depth(m): 2.00

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	97
20	89
10	87
6.3	86
3.35	84
2	83
1.18	81
0.6	79
0.3	77
0.212	75
0.15	74
0.063	72

Soil Fraction	Total Percentage
Cobbles	0
Gravel	17
Sand	11
Silt/Clay	72

Remarks:

See Summary of Soil Descriptions



PSL
Professional Soils Laboratory

Helme Lane

Contract No:
PSL18/5245
Client Ref:
106245



Phase II Geo-Environmental & Geotechnical
Assessment
Land Off Helme Lane
Meltham
November 2018
106245p1r0

CHEMICAL TESTING

APPENDIX VII

APPENDIX VII
CHEMICAL TESTING



Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 770881-1

Date of Report: 10-Oct-2018

Customer: Resource Environmental Consultants Ltd
Osprey House
Pacific Quay
Broadway
Salford
M50 2UE

Customer Contact: Mr Phil Hill

Customer Job Reference: 106245

Customer Purchase Order: PO005554

Customer Site Reference: Helme Lane

Date Job Received at Concept: 28-Sep-2018

Date Analysis Started: 01-Oct-2018

Date Analysis Completed: 10-Oct-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

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

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual



Report checked
and authorised by :
Chloe Kitto
Customer Service Advisor

Issued by :
Chloe Kitto
Customer Service Advisor



Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245									
Soil		Analysed as Soil							
MCERTS Preparation									
Concept Reference					770881 001	770881 002	770881 003	770881 004	770881 005
Customer Sample Reference					TP1	TP2	TP3	TP4	TP5
Depth					0.1	0.2	0.3	0.8	0.2
Bottom Depth					0.2	0.3	0.4	0.9	0.3
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Topsoil	Topsoil	Topsoil	Clay	Topsoil
Determinand		Method	Test Sample	LOD	Units				
Retained on 10mm sieve		T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1
Moisture @105C		T162	AR	0.1	%	25	27	26	18
								23	

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245									
Soil		Analysed as Soil							
MCERTS Preparation									
Concept Reference					770881 006	770881 007	770881 008	770881 009	770881 010
Customer Sample Reference					TP6	TP7	WS101	WS103	WS104
Depth					0.1	0.9	0.2	1.6	1.3
Bottom Depth					0.2				
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Clay	Clay	Clay	Sandy Soil	Clay
Determinand	Method	Test Sample	LOD	Units					
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1
Moisture @105C	T162	AR	0.1	%	25	30	23	7.3	22

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245 Soil Analysed as Soil MCERTS Preparation					
Concept Reference		770881 011			
Customer Sample Reference		WS105			
Depth		1.0			
Bottom Depth					
Date Sampled		27-SEP-2018			
Matrix Class		Sandy Soil			
Determinand	Method	Test Sample	LOD	Units	
Retained on 10mm sieve	T2	M40	0.1	%	<0.1
Moisture @105C	T162	AR	0.1	%	14

Concept Reference:	770881
Project Site:	Helme Lane
Customer Reference:	106245
Soil	Analysed as Soil
REC Ltd 002S	

Concept Reference					770881 001	770881 002	770881 003	770881 004	770881 005
Customer Sample Reference					TP1	TP2	TP3	TP4	TP5
Depth					0.1	0.2	0.3	0.8	0.2
Bottom Depth					0.2	0.3	0.4	0.9	0.3
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Topsoil	Topsoil	Topsoil	Clay	Topsoil
Determinand	Method	Test Sample	LOD	Units					
Arsenic	T6	M40	2	mg/kg	21	19	16	<2	8
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	24	42	29	25	23
Lead	T6	M40	1	mg/kg	110	110	100	19	51
Mercury	T6	M40	1	mg/kg	<1	<1	1	<1	<1
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Copper	T6	M40	1	mg/kg	34	46	36	22	22
Nickel	T6	M40	1	mg/kg	13	12	10	17	11
Zinc	T6	M40	1	mg/kg	64	69	65	38	51
pH	T7	A40			6.0	5.6	5.2	5.7	5.4
SO4(Total)	T6	A40	0.01	%	0.07	0.08	0.10	<0.01	0.05
SO4(2:1)	T6	AR	100	mg/l	<100	<100	<100	<100	<100
Chromium VI	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Barium	T6	A40	1	mg/kg	64	81	78	30	59
Beryllium	T6	A40	2	mg/kg	2	<2	<2	<2	<2
Boron (water-soluble)	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Cyanide(Total)	T921	M105	1	mg/kg	<1	<1	<1	<1	<1
Phenols(Mono)	T921	M105	1	mg/kg	<1	<1	<1	<1	<1
Vanadium	T6	M40	1	mg/kg	32	38	33	22	27

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245	
Soil REC Ltd 002S	Analysed as Soil

Concept Reference					770881 006	770881 007	770881 008	770881 009	770881 010
Customer Sample Reference					TP6	TP7	WS101	WS103	WS104
Depth					0.1	0.9	0.2	1.6	1.3
Bottom Depth					0.2				
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Clay	Clay	Clay	Sandy Soil	Clay
Determinand	Method	Test Sample	LOD	Units					
Arsenic	T6	M40	2	mg/kg	20	5	7	2	3
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	22	23	23	19	38
Lead	T6	M40	1	mg/kg	120	13	33	14	27
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Copper	T6	M40	1	mg/kg	31	27	25	19	46
Nickel	T6	M40	1	mg/kg	12	18	7	15	30
Zinc	T6	M40	1	mg/kg	77	44	38	38	85
pH	T7	A40			5.8	5.3	5.6	5.5	4.8
SO4(Total)	T6	A40	0.01	%	0.09	0.02	0.05	0.02	0.02
SO4(2:1)	T6	AR	100	mg/l	<100	<100	<100	<100	<100
Chromium VI	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Barium	T6	A40	1	mg/kg	82	40	42	31	57
Beryllium	T6	A40	2	mg/kg	<2	<2	<2	<2	3
Boron (water-soluble)	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Cyanide(Total)	T921	M105	1	mg/kg	<1	<1	<1	<1	<1
Phenols(Mono)	T921	M105	1	mg/kg	<1	<1	<1	<1	<1
Vanadium	T6	M40	1	mg/kg	33	23	31	18	34

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245 Soil Analysed as Soil PAH US EPA 16 (B and K split) and Phenol									
Concept Reference					770881 006	770881 007	770881 008	770881 009	770881 010
Customer Sample Reference					TP6	TP7	WS101	WS103	WS104
Depth					0.1	0.9	0.2	1.6	1.3
Bottom Depth					0.2				
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Clay	Clay	Clay	Sandy Soil	Clay
Determinand	Method	Test Sample	LOD	Units					
Naphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	0.3	<0.1	0.2	<0.1	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	0.7	<0.1	0.3	<0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	0.6	<0.1	0.2	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	0.4	<0.1	0.2	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	0.4	<0.1	0.2	<0.1	<0.1
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	0.3	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	0.3	<0.1	<0.1	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	0.3	<0.1	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	3.3	<0.1	1.0	<0.1	<0.1
Phenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245 Soil Analysed as Soil PAH US EPA 16 (B and K split) and Phenol					
Concept Reference					770881 011
Customer Sample Reference					WS105
Depth					1.0
Bottom Depth					
Date Sampled					27-SEP-2018
Matrix Class					Sandy Soil
Determinand	Method	Test Sample	LOD	Units	
Naphthalene	T207	M105	0.1	mg/kg	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	<0.1
Pyrene	T207	M105	0.1	mg/kg	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1
Chrysene	T207	M105	0.1	mg/kg	<0.1
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	<0.1
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1
PAH(total)	T207	M105	0.1	mg/kg	<0.1
Phenol	T207	M105	0.1	mg/kg	<0.1

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245 Soil Analysed as Soil REC Banded TPH									
Concept Reference					770881 001	770881 002	770881 003	770881 004	770881 005
Customer Sample Reference					TP1	TP2	TP3	TP4	TP5
Depth					0.1	0.2	0.3	0.8	0.2
Bottom Depth					0.2	0.3	0.4	0.9	0.3
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Topsoil	Topsoil	Topsoil	Clay	Topsoil
Determinand	Method	Test Sample	LOD	Units					
TPH (C5-C6)	T54	AR	0.10	mg/kg	<0.10	(100) <0.20	(100) <0.20	<0.10	<0.10
TPH (C6-C8)	T54	AR	0.10	mg/kg	<0.10	(100) <0.20	(100) <0.20	<0.10	<0.10
TPH (C8-C10)	T54	AR	0.10	mg/kg	<0.10	(100) <0.20	(100) <0.20	<0.10	<0.10
TPH (C35-C44)	T8	M105	1	mg/kg	(13) 4	(13) 5	(13) 11	(13) <1	(13) 3
TPH (C10-C12)	T206	M105	1	mg/kg	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
TPH (C12-C16)	T206	M105	1	mg/kg	(13) 1	(13) <1	(13) 3	(13) <1	(13) 1
TPH (C16-C21)	T206	M105	1	mg/kg	(13) 10	(13) 6	(13) 22	(13) 2	(13) 10
TPH (C21-C35)	T206	M105	1	mg/kg	(13) 37	(13) 42	(13) 88	(13) 4	(13) 40

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245 Soil Analysed as Soil REC Banded TPH									
Concept Reference					770881 006	770881 007	770881 008	770881 009	770881 010
Customer Sample Reference					TP6	TP7	WS101	WS103	WS104
Depth					0.1	0.9	0.2	1.6	1.3
Bottom Depth					0.2				
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Clay	Clay	Clay	Sandy Soil	Clay
Determinand	Method	Test Sample	LOD	Units					
TPH (C5-C6)	T54	AR	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
TPH (C6-C8)	T54	AR	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
TPH (C8-C10)	T54	AR	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
TPH (C35-C44)	T8	M105	1	mg/kg	(13) 4	(13) <1	(13) 40	(13) <1	(13) <1
TPH (C10-C12)	T206	M105	1	mg/kg	(13) 2	(13) <1	(13) <1	(13) <1	(13) <1
TPH (C12-C16)	T206	M105	1	mg/kg	(13) 6	(13) <1	(13) <1	(13) <1	(13) <1
TPH (C16-C21)	T206	M105	1	mg/kg	(13) 26	(13) 2	(13) 7	(13) 2	(13) 3
TPH (C21-C35)	T206	M105	1	mg/kg	(13) 54	(13) 3	(13) 58	(13) 3	(13) 7

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245 Soil Analysed as Soil REC Banded TPH					
Concept Reference					770881 011
Customer Sample Reference					WS105
Depth					1.0
Bottom Depth					
Date Sampled					27-SEP-2018
Matrix Class					Sandy Soil
Determinand	Method	Test Sample	LOD	Units	
TPH (C5-C6)	T54	AR	0.10	mg/kg	<0.10
TPH (C6-C8)	T54	AR	0.10	mg/kg	<0.10
TPH (C8-C10)	T54	AR	0.10	mg/kg	<0.10
TPH (C35-C44)	T8	M105	1	mg/kg	(13) <1
TPH (C10-C12)	T206	M105	1	mg/kg	(13) <1
TPH (C12-C16)	T206	M105	1	mg/kg	(13) <1
TPH (C16-C21)	T206	M105	1	mg/kg	(13) 2
TPH (C21-C35)	T206	M105	1	mg/kg	(13) 4

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245									
Soil		Analysed as Soil							
REC TOC and SOM									
Concept Reference				770881 001	770881 002	770881 003	770881 004	770881 005	
Customer Sample Reference				TP1	TP2	TP3	TP4	TP5	
Depth				0.1	0.2	0.3	0.8	0.2	
Bottom Depth				0.2	0.3	0.4	0.9	0.3	
Date Sampled				27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	
Matrix Class				Topsoil	Topsoil	Topsoil	Clay	Topsoil	
Determinand	Method	Test Sample	LOD	Units					
Soil Organic Matter	T287	A40	0.1	%	5.2	8.6	8.4	0.2	2.9
Total Organic Carbon	T21	A40	0.1	%	3.0	5.0	4.9	0.1	1.7

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245									
Soil		Analysed as Soil							
REC TOC and SOM									
Concept Reference					770881 006	770881 007	770881 008	770881 009	770881 010
Customer Sample Reference					TP6	TP7	WS101	WS103	WS104
Depth					0.1	0.9	0.2	1.6	1.3
Bottom Depth					0.2				
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Clay	Clay	Clay	Sandy Soil	Clay
Determinand	Method	Test Sample	LOD	Units					
Soil Organic Matter	T287	A40	0.1	%	8.7	0.5	2.8	0.4	0.7
Total Organic Carbon	T21	A40	0.1	%	5.0	0.3	1.6	0.2	0.4

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245 Soil Analysed as Soil REC TOC and SOM					
Concept Reference		770881 011			
Customer Sample Reference		WS105			
Depth		1.0			
Bottom Depth					
Date Sampled		27-SEP-2018			
Matrix Class		Sandy Soil			
Determinand	Method	Test Sample	LOD	Units	
Soil Organic Matter	T287	A40	0.1	%	1.1
Total Organic Carbon	T21	A40	0.1	%	0.6

Concept Reference: 770881 Project Site: Helme Lane Customer Reference: 106245									
Soil					Analysed as Soil				
Asbestos ID									
Concept Reference					770881 001	770881 002	770881 005	770881 006	770881 008
Customer Sample Reference					TP1	TP2	TP5	TP6	WS101
Depth					0.1	0.2	0.2	0.1	0.2
Bottom Depth					0.2	0.3	0.3	0.2	
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Matrix Class					Topsoil	Topsoil	Topsoil	Clay	Clay
Determinand	Method	Test Sample	LOD	Units					
Asbestos ID	T27	A40			N.D.	N.D.	N.D.	N.D.	N.D.

Index to symbols used in 770881-1

Value	Description
A40	Assisted dried < 40C
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
AR	As Received
N.D.	Not Detected
100	LOD determined by sample aliquot used for analysis
13	Results have been blank corrected.
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos testing was subcontracted to REC Asbestos.

Method Index

Value	Description
T207	GC/MS (MCERTS)
T921	Colorimetry (CF) (MCERT)
T6	ICP/OES
T27	PLM
T21	OX/IR
T7	Probe
T54	GC/MS (Headspace)
T2	Grav
T8	GC/FID
T162	Grav (1 Dec) (105 C)
T206	GC/FID (MCERTS)
T287	Calc TOC/0.58

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
TPH (C5-C6)	T54	AR	0.10	mg/kg	N	001-011
TPH (C6-C8)	T54	AR	0.10	mg/kg	N	001-011
TPH (C8-C10)	T54	AR	0.10	mg/kg	N	001-011
TPH (C35-C44)	T8	M105	1	mg/kg	N	001-011
TPH (C10-C12)	T206	M105	1	mg/kg	M	001-011
TPH (C12-C16)	T206	M105	1	mg/kg	M	001-011
TPH (C16-C21)	T206	M105	1	mg/kg	M	001-011
TPH (C21-C35)	T206	M105	1	mg/kg	M	001-011
Retained on 10mm sieve	T2	M40	0.1	%	N	001-011
Moisture @105C	T162	AR	0.1	%	N	001-011
Soil Organic Matter	T287	A40	0.1	%	N	001-011
Total Organic Carbon	T21	A40	0.1	%	N	001-011
Naphthalene	T207	M105	0.1	mg/kg	M	001-011
Acenaphthylene	T207	M105	0.1	mg/kg	U	001-011
Acenaphthene	T207	M105	0.1	mg/kg	M	001-011
Fluorene	T207	M105	0.1	mg/kg	M	001-011
Phenanthrene	T207	M105	0.1	mg/kg	M	001-011
Anthracene	T207	M105	0.1	mg/kg	U	001-011
Fluoranthene	T207	M105	0.1	mg/kg	M	001-011
Pyrene	T207	M105	0.1	mg/kg	M	001-011
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001-011
Chrysene	T207	M105	0.1	mg/kg	M	001-011
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001-011
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001-011
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001-011
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001-011
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001-011
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001-011

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
PAH(total)	T207	M105	0.1	mg/kg	U	001-011
Phenol	T207	M105	0.1	mg/kg	M	001-011
Asbestos ID	T27	A40			SU	001-002,005-006,008
Arsenic	T6	M40	2	mg/kg	M	001-011
Cadmium	T6	M40	1	mg/kg	M	001-011
Chromium	T6	M40	1	mg/kg	M	001-011
Lead	T6	M40	1	mg/kg	M	001-011
Mercury	T6	M40	1	mg/kg	M	001-011
Selenium	T6	M40	3	mg/kg	M	001-011
Copper	T6	M40	1	mg/kg	M	001-011
Nickel	T6	M40	1	mg/kg	M	001-011
Zinc	T6	M40	1	mg/kg	M	001-011
pH	T7	A40			M	001-011
SO4(Total)	T6	A40	0.01	%	N	001-011
SO4(2:1)	T6	AR	100	mg/l	N	001-011
Chromium VI	T6	A40	1	mg/kg	N	001-011
Barium	T6	A40	1	mg/kg	U	001-011
Beryllium	T6	A40	2	mg/kg	U	001-011
Boron (water-soluble)	T6	A40	1	mg/kg	N	001-011
Cyanide(Total)	T921	M105	1	mg/kg	M	001-011
Phenols(Mono)	T921	M105	1	mg/kg	M	001-011
Vanadium	T6	M40	1	mg/kg	M	001-011



Concept Life Sciences

Certificate of Analysis

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Report Number: 773923-1

Date of Report: 01-Nov-2018

Customer: Resource Environmental Consultants Ltd
Osprey House
Pacific Quay
Broadway
Salford
M50 2UE

Customer Contact: Mr Calum Dowd

Customer Job Reference: 106245

Customer Purchase Order: 005725

Customer Site Reference: Helme Lane

Date Job Received at Concept: 11-Oct-2018

Date Analysis Started: 12-Oct-2018

Date Analysis Completed: 24-Oct-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

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

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Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual



Report checked
and authorised by :
Aleksandra Pacula
Senior Customer Service
Advisor

Issued by :
Chloe Kitto
Customer Service Advisor



Soil	Analysed as Soil
Miscellaneous	

Concept Reference					773923 001	773923 002	773923 003	773923 004	773923 005
Customer Sample Reference					TP1	TP3	TP5	WS102	WS105
Depth					0.6	1.6	0.8	0.60	1.65
Bottom Depth					0.7	1.7	0.9		
Date Sampled					27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018	27-SEP-2018
Determinand	Method	Test Sample	LOD	Units					
SO4(2:1)	T112	A40	10	mg/l	<10	<10	<10	<10	<10
pH	T7	A40			6.1	5.9	5.1	5.2	4.9

Value	Description
A40	Assisted dried < 40C
U	Analysis is UKAS accredited

These samples have been analysed exceeding recommended holding times for pH. It is possible therefore that the results provided may be compromised.

Value	Description
T112	ICP/OES (SIM)(Water Extract)
T7	Probe

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
SO4(2:1)	T112	A40	10	mg/l	U	001-005
pH	T7	A40			U	001-005