



RIDGE

Property and Construction Consultants



Ground Condition Assessment
Land at Blendworth Crescent,
Havant

August 2015

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Ground Condition Assessment

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Section 1 – Introduction

1.1 Introduction

Ridge and Partners LLP (Ridge) was commissioned by Portsmouth City Council in May 2015 to undertake a Ground Condition Assessment of a plot of land at Blendworth Crescent, Havant, Hampshire.

The brief was to undertake a site investigation and assessment to identify any ground contamination issues and geotechnical conditions that may affect the proposed development. This Report provides an assessment of the identified and potential ground conditions of the site, with regard to the proposed works in accordance with the Model Procedures for the Management of Land Contamination (CLR 11), published by the Environment Agency. In addition, the geotechnical sections of this report provide a detailed assessment of the materials present beneath the site and present characteristic parameters that should be used in design of all geotechnical facets of the proposed development.

This Report is prepared in line with the agreed brief and is subject to the Report Conditions shown in Appendix 1.

1.2 Legal Context

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from land contamination. In accordance with the Act and the statutory guidance document 'The Contaminated Land (England) Regulations 2000', the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the Regulatory Authority, by reason of substances within or under the land, that:

- Significant harm is being caused, or there is a significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused."

Inherent in this definition is the requirement for contamination risk assessment to be undertaken on a site specific basis, as the potential for harm is determined by the site's end use and its specific environmental setting.

The guidance defines "risk" as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

1.3 Methodology

This Report has been prepared in accordance with published Environment Agency guidance ('Model Procedures for the Management of Land Contamination – Contaminated Land Report (CLR 11)'). CLR 11 provides the technical framework for structured decision making about land contamination and builds on previous work carried out under the Contaminated Land Research Programme (of the former Department of the Environment). CLR 11 has adopted and refined the well-recognised methodology and terminology that has been used in contaminated land risk assessment for a number of years.

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Pollutant Linkage Concept

In the context of land contamination, there are three essential elements to any risk:

- A **contaminant source** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters.
- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant–pathway–receptor is described as a pollutant linkage.

Conceptual Model

An important thread throughout the overall process of risk assessment is the need to formulate and develop a conceptual model for the site, which supports the identification and assessment of pollutant linkages. A conceptual model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

Risk Assessment

CLR 11 advocates a phased approach to risk assessment comprising the following in order, as necessary:

Preliminary Risk Assessment – a desk study consisting of a review of documentary, anecdotal and site walk over evidence.

Generic Quantitative Risk Assessment (GQRA) - comparison of contaminant concentrations obtained from site investigation with generic assessment criteria.

Detailed Quantitative Risk Assessment (DQRA) - comparison of contaminant concentrations obtained from site investigation with site-specific assessment criteria.

This document constitutes a Preliminary Risk Assessment, Generic Quantitative Risk Assessment and a Geotechnical Design Report.

1.4 Proposed Use

It is currently understood that the site is proposed for low rise residential development. A change in the site use from that currently proposed use may result in the need for re-assessment of risk criteria and the conclusions and recommendations resulting from the risk assessment could therefore significantly change.

1.5 Previous Reports Reviewed

An Environmental Desk Study was conducted for Portsmouth City Council by Omnia Environmental Consulting Ltd, in February of 2015; this Report was reviewed as part of this assessment.

1.6 Report Scope and Limitation

This Report is based upon a review of readily available historical and current information and the recent site investigation data detailed herein.

The Report presents an interpretation of the borehole and laboratory data provided by the Ridge site investigation undertaken between the 5th and 18th June 2015. In addition, this Report outlines the basic ground conditions encountered in the exploratory holes and the results of any monitoring of ground installations. This information has been collated, processed and used to provide an interpretation of the ground conditions, with recommendations on potential ground contamination risks for the proposed development.

The recommendations and opinions expressed in this Report are based on the strata observed in the exploratory holes, the results of the site and laboratory tests, and information obtained as part of the desk study or provided by others. Ridge takes no responsibility for conditions that have not been revealed by the exploratory holes, or which occur between them. Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative and liability cannot be accepted for its accuracy. Information provided from other sources is taken in good faith and Ridge cannot guarantee its accuracy.

The information contained in this Report is intended for the use of Portsmouth City Council. Ridge can take no responsibility for the use of this information by any other party or for uses other than that described in this Report.

Section 2 – Hazard Identification

2.1 Site Location and Description

The site is located to the south of Blendworth Crescent in a predominantly residential area of Havant. The site is irregular in plan shape tapering towards the east. The site comprises 1.13ha. of level grassland currently used as a recreation area; primarily dog walking and as an access route. The northern boundary of the site is denoted by the fences, mature trees and vegetation to the rear of residential properties along Blendworth Crescent. The southern site boundary is marked by a number of tall mature trees dotted along a hedge row concealing a fence line separating the site from Trosnant Junior School, immediately to the south. The western site limit is denoted by a line of vegetation, fence and trees, separating the site from the residential properties along Stockheath Lane.

2.2 Site History

According to the Ordnance Survey maps provided and reviewed from 1866 to 2014 (scales 1:2,500, 1:10,000, 1:1,250, 1:10,560) the site appears to have remained as undeveloped land until the late 1960's when the site is shown as a Playground, which appears to coincide with the current surfaced area. The site is shown to have been land, assumed to be agricultural, until the early 1950's, with a surface water feature running east west across the site, absent from mapping by the early 1960's.

The area surrounding the site remained undeveloped, excepting properties along Stockheath Lane until 1951, when the area now utilised as Trosnant Junior School is indicated as Allotment Gardens. The area saw development of properties along Blendworth Crescent, to the north and east of the site and structures associated with the school, to the south, by 1955. The school was redeveloped in the 1990's to early 2000's.

2.3 Documented Ground Conditions

Ground conditions recorded in readily available sources are summarised below.

Geology

Reference to the British Geological Survey (BGS) Map (Sheet 315, Southampton, Scale 1:50,000) indicates the site to directly overlie superficial geology of Head Deposits (clay, silt, sand and gravel and clayey gravel) and the London Clay Formation (clay, silt and sand). No Artificial or Made Ground deposits are recorded as present on the site, however the site is surrounded by developed properties and it is considered likely that some Made Ground may be present. It is also recognised that a former surface water feature running east-west across the site has been infilled with unknown material.

Hydrogeology

The Environment Agency Groundwater Vulnerability Map (Sheet 52, Southern Hampshire, Scale 1:100,000) indicates that the site is underlain by superficial Secondary Aquifer of undifferentiated layers, interpreted as Head Deposits. The site overlies bedrock Unproductive Strata, interpreted as the London Clay Formation.

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Secondary Aquifers with undifferentiated layers are cases where it has not been possible to attribute either A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

The site lies within a groundwater source protection zone (SPZ), recorded as 1C – Inner catchment within a confined aquifer, this is interpreted as the underlying deep Chalk Aquifer.

Hydrology

The nearest surface water feature to the site is a Tertiary River 125m to the south west of the site.

Radon

Radon is a naturally occurring radioactive gas which may be harmful to human health. Radon is generally released into the atmosphere in areas underlain by granite and limestone. Harmful concentrations of radon may build up if it becomes trapped in an enclosed space such as a building.

National Radiological Protection Board data presented within the Landmark Envirocheck Report indicates that the percentage of houses exceeding the Action Levels for Radon in this area is 1-3%. Therefore the British Geological Survey recommends that no radon protective measures are necessary in the construction of new dwellings or extensions.

2.4 Environmental Data Search

A search of an environmental database was undertaken together with information from various other organisations as part of the desk study and is summarised in **Table 2.1: Data search results** Table 2.1 and the following section. The following summary is generally limited to locations within 250m of the site boundaries unless it is considered that installations or activities beyond that range could potentially have an impact on the site or be affected by the redevelopment of the site.

Table 2.1 Data search results

Discharge consents	There are no recorded active discharge consents within 250m of the site.
Pollution incidents	There are no recorded pollution incidents to controlled waters within 250m of the site.
Water abstractions	There are no recorded water abstractions within 500m of the site.
Fuel stations	There are no recorded fuel stations within 250m of the site.
Landfill sites	There are no recorded landfill sites within 250m of the site.

The site is located in an area which may not be affected by coal mining.

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The following ground hazards were identified:

- Compressible ground stability hazards – Negligible hazard
- Collapsible ground stability hazards – Low hazard
- Ground dissolution stability hazards – Negligible hazard
- Landslide ground stability hazard – Very Low hazard
- Shrinking or swelling clay ground stability hazard – Low hazard
- Running sand ground stability hazards – Low hazard

2.5 Department of Environment – Industry Profiles

The Industry Profiles produced by the Department of the Environment do not cover the current or past uses of the site.

2.6 Preliminary Conceptual Site Model

Table 2.2: Pollutant linkage assessment

Source	Pathway	Receptor
Potential reduced quality Made Ground	Direct contact	Construction workers
	Ingestion	Future site users
	Inhalation	Future site users
	Vertical migration	Secondary A Aquifer
Potential ACM in Made Ground	Inhalation of fibres	Construction workers
		Future site users
Ground gas from natural strata	Vertical migration leading to accumulation and inhalation	Future site users

The preliminary risk assessment identified several potentially viable pollutant linkages that could present a significant risk, based on the proposed use. As such, an intrusive investigation was undertaken to further assess the potential risks.

Section 3 – Fieldwork Summary of Scope and Rationale

3.1 Rationale and Summary of Scope

Site investigation works were undertaken by Ridge between the 5th and 18th June 2015. The scope and rationale of the ground investigation are presented below.

- 5no. cable percussive boreholes (BH) to a maximum depth of 14.4mbgl.
- 10no. windowless sample boreholes (WS) to a maximum depth of 5.0mbgl.
- Collection of representative samples to undergo chemical and geotechnical laboratory testing as detailed in later sections of this Report.
- Installation of 6no. gas / water monitoring standpipes.
- 7no. TRRL probe locations to allow calculation of CBR values

It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site.

Table 3.1: Exploratory hole location rationale

Location	Rationale	Max Depth (mbgl)
BH1-5	5no. cable percussive boreholes positioned across the proposed development area to assess the nature and stratigraphy of the subsurface materials and allow collection of representative samples for geotechnical and environmental analyses and installation of monitoring wells.	14.4
WS1-10	10no. windowless sample boreholes positioned across the proposed development area to assess the nature and stratigraphy of the subsurface materials and allow collection of representative samples for chemical analysis	5.0

The layout of the exploratory positions is presented in Figure 2.

3.2 Environmental Sampling

Prior to the investigation it was determined that the primary receptors that would potentially be at risk on this site would be the future site users and construction workers with additional potential risk to the underlying Secondary Aquifer. It was therefore considered appropriate to target the near surface deposits, at a depth representative of the material that is likely to remain following site clearance for chemical analysis as this is the material most likely to be encountered by the receptor following the development of the site.

3.3 Monitoring

One groundwater level and ground gas monitoring round was undertaken on completion of the intrusive investigation works to provide an assessment of the ground gas / groundwater regime at the site. The results of the monitoring round are presented in Appendix 6.

3.4 Site Investigation Standards

Methods employed during the investigation were generally undertaken in accordance with BS10175, BS EN 1997-2 and BS5930.

Section 4 – Ground Conditions Encountered

4.1 Soil Conditions

Ground conditions encountered during the recent ground investigation were broadly consistent with those identified in the published literature and in summary comprised Topsoil / Made Ground; overlying clay, sand and gravel of the Head Deposits; in turn overlying clay of the London Clay Formation.

Variations in stratum thicknesses are summarised in Table 2.1 below, engineering logs are presented in Appendix 2.

Table 4.1: Summary of encountered ground conditions

Location	Topsoil/Made Ground		Head Deposits		London Clay Formation	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
BH1	GL	0.10	0.10	2.70	2.80	>7.20
BH2	GL	0.40	0.40	1.90	2.30	>10.70
BH3	GL	0.10	0.10	1.50	1.60	>12.55
BH4	GL	0.10	0.10	2.40	2.50	>11.90
BH5	GL	0.10	0.10	3.20	3.30	>6.70
WS1	GL	0.30	0.30	3.15	3.45	>1.55
WS2	GL	0.25	0.25	0.55	0.80	>4.20
WS3	GL	0.80	N/E	N/E	0.80	>4.20
WS4	GL	0.90	N/E	N/E	0.90	>3.50
WS5	GL	0.95	N/E	N/E	0.95	>3.05
WS6	GL	0.20	0.20	>2.00	NE	
WS7	GL	0.50	0.50	0.65	1.15	>2.85
WS8	GL	0.50	0.50	0.45	0.95	>3.05
WS9	GL	0.90	0.90	1.10	2.00	>1.00
WS10	GL	0.25	0.25	0.90	1.15	>2.85

Surfacing

The site comprises grassland with a surfaced disused play area in the centre of the site, and an asphalt pedestrian pathway leading from the site entrance in the north.

Topsoil / Made Ground

Topsoil was encountered in all locations and comprised 0.10 to 0.50m of soft to firm dark brown silty clay with frequent rootlets, locally sandy and gravelly.

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Made Ground was encountered in BH2 and WS3, 4, 5, 7 and 9 only and comprised soft to firm silty sandy gravelly clay with brick fragments from 0.1mbgl to a maximum depth of 0.95mbgl.

Head Deposits

Head Deposits were encountered immediately beneath the Topsoil / Made Ground at all exploratory hole locations except for WS3, 4 and 5 in the eastern half of the site. At all other locations the Head Deposits comprised between 0.45 and 3.20m of silty sandy gravelly clay.

London Clay Formation

The London Clay Formation was encountered in all locations, except WS6, and consisted of an upper layer of weathered material comprising firm brown occasionally mottled grey silty clay overlying unweathered firm to stiff grey clay.

The London Clay Formation persisted to the full depth of the ground investigation with a maximum thickness of >12.55m reported in BH3.

4.2 Obstructions

No obstructions were encountered during the intrusive investigations.

4.3 Groundwater Conditions

Water ingress was noted as seepage at 6.30mbgl in BH1, as seepage at 7.70mbgl and as a strike at 13.70mbgl rising to 4.50mbgl in BH3 and as seepage at 7.80mbgl in BH5. One round of groundwater and gas monitoring was undertaken subsequent to installation of groundwater and gas monitoring piezometers in BH2-7. Groundwater levels recorded during the monitoring are presented in Appendix 6 and were recorded at depths varying from 0.98mbgl to 1.36mbgl.

4.4 Visual/Olfactory Evidence of Contamination

No notable evidence of contamination was encountered.

Section 5 – Generic Risk Assessment

5.1 Contamination Assessment Methodology

In order to assess the human health and environmental risks posed by potential contaminants within the underlying soils and groundwater, Ridge undertook an initial screen of the laboratory results using generic assessment criteria. Generic assessment criteria (GAC) are conservative contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information.

Soils

In order to assess the soil analyses results with regard to potential human health risks, Ridge has adopted the LQM/CIEH Suitable 4 Use Levels (S4ULs), generic assessment criteria (GACs) derived in accordance with the UK framework set out in the most recent CLR (Contaminated Land Report) documents using the Contaminated Land Exposure Assessment (CLEA) Model.

S4ULs have been published for an extensive suite of contaminants, with assessment criteria derived for each contaminant for four different land use scenarios namely:

- Residential with homegrown produce;
- Residential without homegrown produce
- Allotments; and
- Commercial and industrial.

A full list of the GACs together with an indication of the method used for their derivation is provided in Appendix 3. GACs applicable to residential end use have been used for the assessment of the site. Contaminant concentrations below the GACs are considered not to warrant further risk assessment. However, concentrations of contaminants above the GACs may require further consideration through statistical analysis, if appropriate, or further detailed assessment using site specific data.

This document does not constitute a Site Assessment Report (SAR) as outlined in the UKWIR Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites (Ref: 10/WM/03/21, 2010). As such, the full generic suite of testing recommended in the UKWIR guidance may not have been undertaken for this site and may be required by some water companies. However, consideration has been given to the 'threshold' concentrations presented in Table 3.1 of the UKWIR guidance, where they are applicable to the analysis undertaken, to provide an indication of the potential risks to buried water supply pipes.

Assessment framework

In regards to human health, the CLEA model states that, 'the contamination is assumed to be at or within 1m of the surface' (CLR10 pg10). It is considered that at depths greater than 1m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. Therefore, for the purposes of statistical analysis, data from the top 1.0 to 1.5m is used for assessment of risks to human health via direct contact pathways in accordance with the CLEA model, dependant on proposed future site levels.

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Statistical analysis

The CLEA guidelines state that for each contaminant, the upper 95th percentile confidence limit on the mean measured concentration (95%UCL) should be calculated and this value should be compared to the GAC. Maximum value tests should also be performed in accordance with the method outlined in Annex 1 of CLR7.

The objective of these tests is to decide whether the maximum concentration observed should be treated as an outlier or whether it can reasonably be considered to come from the same underlying population as the other samples.

Annex 1 of CLR 7 describes a simplistic method for calculation of the 95%UCL value based on the arithmetic mean of the sample distribution, assuming the contaminant concentrations fall within a normal distribution. However, it is known that contaminant concentrations often tend towards other distribution forms.

Therefore, in order to calculate what are considered to be more representative 95%UCL values, the contaminant concentrations have first been assessed to determine if each contaminant distribution is closer to a normal or another distribution. If a dataset was found to be normally distributed, the arithmetic mean was used to calculate the 95%UCL using the 'One sample t-test' as described in CLR 7. If the distribution was determined to be significantly removed from normal, the one-sided Chebychev Theorem was used to calculate the 95%UCL. Constituent non-detects were assigned a value equal to the reported analytical laboratory limit of detection, considered reasonably conservative in accordance with CLR principles. Any identified outliers are excluded from the datasets used in calculation of the 95%UCL value, with justification.

Groundwater

Groundwater analyses, where undertaken, shall be assessed by direct comparison with the freshwater Environmental Quality Standards (EQS), or, in the absence of EQSs, UK or WHO Drinking Water Standards or other appropriate guidance values. For certain compounds, the EQS is quoted as a range of values based on the alkalinity of the water, where the measured concentration lies within this range, the results are interpreted qualitatively. The guideline values selected as appropriate GACs for each contaminant are presented in Appendix 3.

Leachate

Leachate analyses, where undertaken, shall be assessed in the same manner as the groundwater samples. The guideline values selected as appropriate GACs for each contaminant are presented in Appendix 3.

Ground Gas

The criteria used to assess the ground gas monitoring results, where monitored, have been taken from the following guidance documents:

- Assessing risks posed by ground gases to buildings, CIRIA Report C665, 2007
- Code of practice for the characterisation and remediation from ground gas in affected developments, British Standard BS 8576, 2013

The frequency and period of monitoring is assessed based on the gas generation potential of the source material and the sensitivity of the development, in accordance with Figure 6 of BS8576 and Table 5.5 of CIRIA C665. As BS8576 promotes a risk based approach to ground gas assessment, it recognises that ground gas monitoring might not be necessary if a viable pollutant linkages is not present, e.g. if a 'credible' source with significant ground gas generation potential and/or a 'credible' migration pathway are not present.

The typical monitoring recommendations present in BS8576 and CIRIA C665 vary between four sets of readings over a one month period for a commercial development and a very low generation potential source to 24 rounds over 24 months for a residential property and a very high generation potential source. However, these are recognised as typical recommendations that may require fewer or additional readings depending on site specific circumstances.

Where possible, monitoring rounds are undertaken during a range of atmospheric conditions to enable their influence on gas conditions to be assessed. As monitoring over the recommended periods is frequently impractical on development sites, the monitoring rounds undertaken are conducted during the worst case conditions (e.g. low and falling atmospheric pressure) during the time available, as far as reasonably practicable, in order to limit the level of uncertainty resulting from the reduced monitoring period. It may, however, be appropriate to raise the Characteristic Situation to account for uncertainties on a site by site basis.

The Characteristic Situation for a monitoring location is determined using the worst case gas screening value for methane or carbon dioxide from all of the monitoring rounds at that location. Following the precautionary principal, the most stringent of the Characteristic Situations for the monitoring locations within the Site is generally used to classify the Site as a whole.

5.2 Soil Assessment

General

A total of 20no. near surface soil samples collected during the site investigation were submitted to a UKAS accredited laboratory for analysis for a suite of heavy metals, phenols, speciated polycyclic aromatic hydrocarbons (PAHs), fractionated total petroleum hydrocarbons (TPH), BTEX compounds and several inorganic parameters. Due to the sites use as recreation ground potential for pesticides to be present was considered not to be significant and therefore pesticide analysis was not undertaken as part of the analysis suite. The results of the laboratory analyses are summarised in Appendix 4, in which they are compared to the relevant generic assessment criteria. A full set of all the laboratory test certificates is presented as Appendix 5.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect both commonly found contaminants and others indicated by research to have a significant risk of being present. It is, however, possible that others may exist for which analyses have not been carried out or which were outside the scope of completed exploratory holes.

The decision to recommend acceptability or a requirement for remediation is based on the evaluation of a number of factors which when combined present a statutory or non-statutory risk that may require remedial action.

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Heavy metals

The heavy metals included in the analysis of the samples from the site were identified at concentrations well below the relevant GACs, with the exception of beryllium at 1.0-1.2mbgl in WS4 exceeding the GAC value. There was no readily identifiable source of beryllium noted in the soil during the investigation and the material was not visually distinct from the material in the other boreholes across the site. Therefore heavy metals are generally not considered to present a significant source of contamination with regard to human health although beryllium should be assessed further using statistical analysis.

Petroleum hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations were recorded to be well below GACs in all the soil samples across the site with concentrations below the laboratory detection limits recorded in the majority of samples. Therefore TPH is not considered likely to represent a significant source of contamination with regard to human health across the site.

Concentrations of TPH C11-C40 fractions were not recorded to exceed the UKWIR 'threshold' values for mineral oil. TPH is therefore considered unlikely to represent a potentially significant source of contamination to proposed water supply pipes. However, the designers of the water supply pipes for this site should review the data in this report to inform their decision making process.

Polyaromatic hydrocarbons (PAHs)

Polyaromatic hydrocarbons (PAH) compounds were recorded to be well below the relevant GACs in all of the soil samples across the site with concentrations below the laboratory detection limits recorded in the majority of the samples. Therefore PAHs are not considered to represent a significant source of contamination with regard to human health across the site.

BTEX compounds and MTBE

BTEX compounds and MTBE were generally not identified at concentrations in excess of the laboratory detection limits and were well below the relevant GACs in all of the samples from across the site. Therefore BTEX compounds and MTBE are not considered to represent a significant source of contamination with regard to human health.

Concentrations of BTEX and MTBE were not recorded to exceed the UKWIR 'threshold' values. BTEX and MTBE are therefore not considered to represent a significant source of contamination to proposed water supply pipes.

Inorganics

The concentrations of free cyanide fell below laboratory detection limits in all of the soil samples analysed.

The pH of the soil samples analysed was within the 5-9 range.

No asbestos containing materials or fibres were identified in the samples analysed.

5.3 Statistical Analysis

A single concentration of beryllium was identified to exceed the generic assessment criterion on the site. It was therefore considered appropriate to further assess these contaminants using statistical analysis. All 20 samples were included in the sample population as all of the samples were from within the uppermost 1.5m of soil across the site and therefore in the region likely to be accessible to future site users.

The Maximum Value Test identified the elevated beryllium concentration as a statistical outlier. However, the impacted material was not distinct from the surrounding unimpacted material and no readily identifiable source has been identified for the impact. It is therefore considered appropriate in this case to consider the statistical outlier concentrations as part of the sample population for determining the 95% UCL on the mean measured concentrations as locating and removing the hotspot is unlikely to be viable.

An applicable 95% UCL of 1.14mg/kg was calculated for beryllium, which compares to a GAC of 1.7mg/kg. Therefore, as the 95% UCLs for beryllium falls below the relevant assessment criterion, beryllium is not considered to represent a significant source of contamination with regard to the proposed development.

5.4 Ground Gas Assessment

The intrusive investigation of the site identified Topsoil, Made Ground and Head Deposits overlying the London Clay Formation. No significant quantities of organic matter were observed within the natural soils during the investigation and the soil organic matter test data confirms the presence of moderately low organic content.

The presence and concentrations of ground gases in the installed monitoring wells were monitored in accordance with CIRIA C665 on the 8th of July 2015 to give a view of the ground gas regime at the site. The monitoring results are presented in Appendix 6.

Typical steady state flow rates monitored in wells were <0.1l/hr.

Recorded carbon dioxide concentrations were recorded to be up to 4.6% by volume in BH2, 2.1% by volume in BH1 and <0.1% by volume in the remaining wells. A maximum concentration of flammable gas as methane was recorded as 0.1% by volume. However, as the recorded groundwater levels during the monitoring round were at or around the top of the response zone in all of the wells, these recorded ground gas concentrations may not be accurate.

The Gas Screening Values (GSVs) in all locations fell well below the boundary between Characteristic 1 and 2 (NHBC Green and Amber 1).

Therefore, a classification of Characteristic Situation 1 is considered to be appropriate for this site, based on the data available, and no ground gas protection measures are recommended for the site.

Section 6 – Conceptual Site Model

6.1 Sources

No significant on or off site sources of contamination have been identified by this assessment.

6.2 Pathways and Receptors

As no significant sources of contamination have been identified, no viable pollutant linkages are considered to be present. As such, further discussion of pathways and receptors is not considered to be appropriate.

Section 7 – Geotechnical Assessment

7.1 Introduction

The geotechnical assessment and the subsequent foundation design recommendations will use the findings of the ground investigation and the results of the in-situ and geotechnical testing carried out in the boreholes and on representative samples of the material encountered.

7.2 Geotechnical Tests

A programme of geotechnical laboratory testing was carried out on representative samples collected from the strata encountered during the ground investigation.

Details of the specific procedure used in each case are shown below in Table 7.1 and the geotechnical test certificates are presented in Appendix 7.

Table 7.1: Summary of Geotechnical Testing

Test	Standard (BS1377:1990) unless otherwise indicated	No.
Classification Tests		
Atterberg Limits	Part 2, Clauses 4.3, 5.3 & 5.4	13
Shear Strength Tests		
Quick Undrained Triaxial	Part 7, Clause 8.4	11
Chemical Tests		
BRE SD1	Various	4
Sulphate Content 2:1 soil water extract	Part 3, Clause 5.3	4
pH value	Part 3, Clause 9.0	4

7.3 Geotechnical and Geological Parameters

This section discusses the key geotechnical characteristics of each encountered stratum as determined from field observations, in-situ and laboratory geotechnical testing.

Topsoil / Made Ground

Topsoil

Topsoil was encountered at all exploratory hole locations attaining thicknesses of 0.10 to 0.50m. The Topsoil comprised soft to firm dark brown clayey Sand / sandy Clay with occasional gravel and numerous rootlets.

Ground Condition Assessment

Made Ground

Made Ground was encountered in BH2 and WSs3, 4, 5, 7 and 9 and comprised soft to firm silty sandy gravelly clay with brick fragments. The Made Ground was encountered from 0.10mbgl and attained a maximum depth of 0.95mbgl (WS5).

No in-situ or geotechnical laboratory testing was carried out within the Topsoil / Made Ground as all foundations will be constructed beneath these superficial materials.

Head Deposits

Head Deposits (HD) were encountered immediately below the Topsoil / Made Ground at all exploratory locations with the exception of WSs3, 4 and 5. The HD, where encountered, comprised 0.45 to 3.20m of firm brown gravelly clay and brown silty fine sand.

In-situ testing

Standard penetration testing (SPT) was carried out throughout the HD. The distribution of SPT N and corrected N' values are shown in Table 7.2 and presented graphically in Figure 3.

Table 7.2: Distribution of SPT N Values in the Head Deposits

BH No.	Depth (mbgl)	SPT N Value	N'	Major Constituent	BH No.	Depth (mbgl)	SPT N Value	N'	Major Constituent
BH1	2.00	22	46	Gravelly Clay	WS6	1.00	11	30	Gravelly Clay
BH2	1.20	18	47	Gravelly Clay		2.00	10	21	
BH3	1.60	6	14	Sand		3.00	15	26	
BH4	1.20	7	18	Sand	WS9	1.00	29	>50	Gravelly Clay
BH5	1.20	5	13	Gravelly Clay					

**Values of N' derived in accordance with BS8002*

Careful inspection of the SPT results identifies no trend within the data set. There appears to be some variation between individual test results possibly due to the presence of gravel in some areas of the Head Deposits.

These differences and their geotechnical effects will be more fully considered in the following sections of this Report.

Classification Testing

Consistency Limits

Three Atterberg limits test were carried out on a representative samples of the HD. The results of these analyses are shown in Table 7.3.

Table 7.3: Results of the Atterberg Limits Analyses – Head Deposits

Location	Depth (mbgl)	Natural Moisture Content, w (%)	Liquid Limit w_L (%)	Plastic Limit w_p (%)	Plasticity Index I_p (%)	Corrected Plasticity Index (%)
BH1	1.20	16	45	20	25	10
BH4	2.00	30	78	70	40	30
BH5	1.20	33	76	29	47	47

The calculated plasticity indices of 25 to 47% are consistent with a medium to very high plasticity clay. After correction to account for the $>425\mu\text{m}$ content of the samples the corrected plasticity indices are indicative of a low to high volume change material. This variation in volume change potential confirms the wide variation in composition noted during the ground investigation.

The consistency index is the numerical difference between the liquid limit and the natural moisture content expressed as a percentage ratio of the plasticity index, and can be written as:

$$I_C = \frac{w_L - w}{I_p}$$

Calculations based on the results of the Atterberg limits tests (Table 7.3) give a range of consistency indices of 0.91 to 1.20 which is indicative of a stiff to very stiff consistency.

Shear Strength

Undrained Shear Strength

Two representative samples of the HD underwent laboratory quick undrained triaxial compression testing. The results of the laboratory testing are presented in Table 7.4; whilst the laboratory test certificates are located in Appendix 7.

Table 7.4: Results of the QU triaxial Compression Testing – Head Deposits

Location	Depth (mbgl)	Bulk Density (Mg/m^3)	Cell Pressure (kN/m^2)	Undrained Shear Strength c_u (kN/m^2)
BH1	1.20	2.21	25	44
BH4	2.00	1.98	45	54

The results of the QU triaxial testing give c_{uk} values of 44 and 54kN/m^2 which are consistent with a medium strength material.

This laboratory test results have been augmented with c_{uk} values derived from the widely accepted empirical relationship:

$$c_u = f_1 \times SPTN$$

Where f_1 is a correlation factor based on the I_p

Ground Condition Assessment

Using a correlation factor of 4.5, all the undrained shear strength data has been plotted and reveals reasonable agreement between the lab data and the results of the correlation with SPT N value (Figure 4). The results indicate a characteristic undrained shear strength of 45kN/m² is appropriate for the Head Deposits.

Drained (Effective) Shear Strength

The widely accepted relationship between drained shear strength and plasticity index for remoulded clays has been used to determine the effective shear strength parameters. In terms of effective stress, the shear strength of a fine-grained soil can be considered as frictional, such that $c'_k = 0\text{kN/m}^2$.

A characteristic plasticity index of 38% has been determined for the Head Deposits suggesting that a characteristic effective angle of shearing resistance (ϕ'_k) of 23° is appropriate for this material.

Other Geotechnical Parameters

Modulus of Deformation (E_k)

CIRIA R 143 presents a relationship between SPT N values and Modulus of Deformation for clay materials, where the undrained modulus (E_{uk}) is taken as the equivalent of the characteristic N' value and the drained modulus (E'_k) is taken as $0.75E_{uk}$. Given an N' value of 20 then the undrained and drained moduli for the fine-grained RTD are 20 and 15MN/m² respectively.

Coefficient of Volume Compressibility

The coefficient of volume compressibility (m_v) has been determined from the empirical relationship with the plasticity index (I_p), where:

$$m_v = \frac{1}{f_2 N}$$

Where f_2 is a correlation factor based on the characteristic I_p
and N is the characteristic SPT- N value.

The above relationship gives an m_{vk} of 0.13m²/MN which is indicative of a material of medium compressibility.

London Clay Formation

London Clay Formation (LCF) was encountered immediately below the HD and persisted to the full depth of the ground investigation. The LCF consisted of a superficial weathered material comprising firm brown silty clay overlying stiff grey silty clay.

The full thickness of the LCF was not encountered in any borehole although a maximum proven thickness of > 12.55m was encountered in BH3.

In-situ testing

Standard penetration testing (SPT) was carried out throughout the LCF. The distribution of SPT N and corrected N' values are shown in Table 7.5 and presented graphically in Figure 3.

Ground Condition Assessment

Table 7.5: Distribution of SPT N Values in the London Clay Formation

BH No.	Depth (mbgl)	SPT N Value	N'	Weathered/ Unweathered	BH No.	Depth (mbgl)	SPT N Value	N'	Weathered/ Unweathered
BH1	4.00	15	24	Weathered	WS2	4.00	16	26	Weathered
	6.50	19	22	Unweathered		5.00	18	24	
	9.50	24	24		WS3	1.00	6	17	Weathered
BH2	4.00	14	22	Weathered		2.00	10	21	
	6.50	19	22	Unweathered		3.00	14	25	
	9.50	23	23			4.00	17	26	
	12.50	>50	>50		5.00	22	30		
BH3	3.00	11	19	Weathered	WS4	1.00	7	19	Weathered
	5.00	14	19			2.00	10	21	
	8.00	21	21	Unweathered		3.00	13	23	
	11.00	28	28			4.00	13	19	
	13.70	21	21	Sand	WS5	1.00	7	19	Weathered
BH4	3.00	10	18	Weathered		2.00	9	19	
	5.00	16	22	Unweathered		3.00	10	18	
	8.00	25	25			4.00	20	32	
	11.00	26	26		WS7	1.00	4	11	Weathered
	14.00	>50	>50			2.00	10	21	
BH5	3.00	14	25	Weathered		3.00	13	23	
	5.00	16	22		4.00	15	24		
	8.00	18	18	Unweathered	WS8	1.00	8	22	Weathered
WS1	1.00	9	25	Weathered		2.00	12	25	
	2.00	9	19			3.00	16	28	
	3.00	12	21			4.00	15	24	
	4.00	18	27	WS9	2.00	17	36	Weathered	
	5.00	22	30		3.00	15	26		
WS2	1.00	5	14	Weathered	WS10	1.00	9	25	Weathered
	2.00	11	23			2.00	12	25	
	3.00	12	21			3.00	19	33	
							4.00	25	

*Values of N' derived in accordance with BS8002

Ground Condition Assessment

Careful inspection of the SPT results shows an easily identifiable trend in N value with depth from 9 at 1.00mbgl to 30 at 11.00mbgl. There appears to be no identifiable differences between the N values recorded in the weathered LCF and the LCF (Figure 3)

Further discussion of these results will be undertaken in subsequent sections of this Report.

Classification Testing

Consistency Limits

Eight Atterberg limits tests were carried out on a representative samples of the LCF. The results of these tests are shown in Table 7.6.

Table 7.6: Results of the Atterberg Limits Analyses – London Clay Formation

Location	Depth (mbgl)	Natural Moisture Content, w (%)	Liquid Limit w_L (%)	Plastic Limit w_P (%)	Plasticity Index I_P (%)	Corrected Plasticity Index (%)
BH1	3.00	31	82	28	54	54
	7.50	30	66	24	42	42
BH2	2.20	36	78	27	51	51
	5.00	33	81	29	52	52
BH3	2.00	32	75	30	45	45
	9.50	27	67	25	42	42
BH4	6.50	29	80	29	51	51
WS2	2.50	29	75	30	45	45

The natural moisture content of the LCF varied between 27 and 36%. When a simple assessment of desiccation using the $w < 0.4w_L$ criterion, three of the eight samples are shown to be slightly desiccated including two from within the top 3.00m of the LCF.

The calculated plasticity indices range between 42 and 54% which is consistent with a high to very high plasticity clay. No corrections to the plasticity indices were required as all the samples passed the 425 μ m sieve indicating the material to be of high volume change potential.

Calculations based on the results of the Atterberg limits tests (Table 7.6) give a range of consistency indices between 1.02 and 0.82 which are indicative of a stiff to very stiff consistency.

Shear Strength

Undrained Shear Strength

Seven representative samples of the LCF underwent laboratory quick undrained triaxial compression testing. The results of the laboratory testing are presented in Table 7.7; whilst the laboratory test certificates are located in Appendix 7.

Table 7.7: Results of the QU triaxial Compression Testing – London Clay Formation

Location	Depth (mbgl)	Bulk Density (Mg/m ³)	Cell Pressure (kN/m ²)	Undrained Shear Strength c_u (kN/m ²)
BH1	3.00	1.95	60	94
BH2	5.00	1.95	100	66
BH3	2.00	2.13	40	64
	9.50	2.05	190	93
BH4	6.50	2.02	125	91
BH5	2.50	1.95	50	54
WS2	2.50	1.59	55	78

The result of the QU triaxial testing give c_{uk} values of between 68 and 94kN/m² which are consistent with a medium to high strength material.

This laboratory test results have been augmented with c_{uk} values derived from empirical relationship with SPT N values and a correlation factor of 4.5.

All the undrained shear strength data has been plotted and reveals reasonable agreement between the lab data and the results of the correlation with SPT N value (Figure 4). The results indicate a characteristic undrained shear strength of 45kN/m² at 1.00mbgl increasing to 125kN/m² at 12.00mbgl is appropriate for the LCF including the weathered material.

Drained (Effective) Shear Strength

The widely accepted relationship between drained shear strength and plasticity index for remoulded clays has been used to determine the effective shear strength parameters. In terms of effective stress, the shear strength of a fine-grained soil can be considered as frictional, such that $c'_k = 0$ kN/m².

A characteristic plasticity index of 45% has been determined for the LCF suggesting that a characteristic effective angle of shearing resistance (ϕ'_k) of 22° is appropriate for this material.

Other Geotechnical Parameters

Modulus of Deformation (E_k)

Butler (1974) gives an E_{uk}/c_{uk} ratio of 400 for London Clay giving an undrained modulus of 18MN/m² at 1.00mbgl rising to 50MN/m² at 12.00mbgl. CIRIA R 143 suggests that the drained modulus (E'_k) should be taken as $0.75E_{uk}$. Therefore an E'_k of 14MN/m² at 1.00mbgl rising to 38MN/m² at 12.00mbgl is considered appropriate for the LCF.

Coefficient of Volume Compressibility

The coefficient of volume compressibility (m_v) has been determined from the empirical relationship with the plasticity index (I_p) giving an m_{vk} of 0.11m²/MN which is indicative of a material of medium compressibility.

Ground Condition Assessment

7.4 Aggressive Ground Soil Chemistry

Chemical testing was carried out on eight samples of the encountered materials in accordance with Box C10, BRE Special Digest 1. The results are summarised in Table 7.8 and 7.9.

Table 7.8: Summary of the Results of Chemical Testing for Concrete Classification

Test	BH1	BH2	BH3	BH4
	0.50	5.00	9.50	0.50
	HD	LCF	LCF	HD
pH	7.83	8.01	8.14	8.03
Soluble Sulphate (g/l)	0.30	0.32	0.54	0.44

Table 7.9: Summary of BRE SD1 Results

Test	BRE SD1			
	BH1	BH3	BH4	BH5
	1.20-1.65 (HD)	1.00 (HD)	2.00-2.45 (LCF)	2.85 (LCF)
pH	7.7	7.4	8.0	7.8
Total Sulphate (% SO ₄)	0.02	0.04	0.03	0.19
Total Sulphur (% S)	<0.01	0.05	0.02	0.04
Water Soluble Sulphate (g/l SO ₄)	0.05	0.05	0.04	0.49
Water Soluble Chloride (mg/kg)	<40	<40	<40	63
Water Soluble Nitrate (mg/kg)	<40	<40	<40	<40
Ammonium (mg/kg)	<0.1	<0.1	<0.1	<0.1

The amounts of oxidisable sulphides have been determined following the procedure documented in Paragraph C5.1.2 of BRE SD1. The results indicate that pyrite is unlikely to be present in significant amounts. However, it should be noted that the London Clay Formation is considered a pyritic stratum. Based on the maximum determined total potential sulphate content Table C2 of BRE SD1 gives a Design Sulphate Classification of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-1s assuming static groundwater conditions in London Clay Formation. However, based on the results of chemical tests in the London Clay Formation from adjacent sites it is recommended the founding stratum is considered as DS-3 and an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-2s is applied to the London Clay Formation.

7.5 Characteristic Geotechnical Parameters

Based on the laboratory test results, in-situ testing and subsequent analysis a range of characteristic geotechnical parameters, which should be used in all subsequent geotechnical and foundation design calculations are presented in Table 7.10.

Ground Condition Assessment

Table 7.10: Characteristic Geotechnical Parameters

Stratum	Parameter		Source	Value
Topsoil /Made Ground	All foundations to be constructed beneath Made Ground			
Head Deposits	Unit Weight γ_k (kN/m ³)		BS8002	19kN/m ³
	Undrained Shear Strength	c_{uk} (kN/m ²)	Laboratory QU Triaxial Testing	45kN/m ²
		ϕ_{uk} (°)		0°
	Drained Shear Strength	c'_k (kN/m ²)	Relationship with I_p	0kN/m ²
		ϕ'_k (°)		25°
	Modulus of Deformation	Undrained E_{uk} (MN/m ²)	CIRIA C R143	20MN/m ²
		Drained E'_k (MN/m ²)		15MN/m ²
	Modulus of Volume compressibility	m_v (m ² /MN)	Relationship with SPT and I_p	0.13m ² /MN
London Clay Formation	Unit Weight γ_k (kN/m ³)		Laboratory testing	19kN/m ³
	Undrained Shear Strength	c_{uk} (kN/m ²)	Laboratory QU Triaxial Testing	45kN/m ² at 1.00mbgl rising to 125kN/m ² at 12.00mbgl
		ϕ_{uk} (°)		0°
	Drained Shear Strength	c'_k (kN/m ²)	Relationship with I_p	0kN/m ²
		ϕ'_k (°)		22°
	Modulus of Deformation	Undrained E_{uk} (MN/m ²)	400 x c_{uk}	18MN/m ² at 1.00mbgl rising to 50MN/m ² at 12.00mbgl
	Modulus of Volume compressibility	m_v (m ² /MN)	Relationship with SPT and I_p	0.11m ² /MN

Section 8 – Foundation and Ground Engineering

8.1 Introduction

The geotechnical assessment below relates to the details of the proposed development. It is understood that the proposed development is to comprise a residential development. Although it is believed that the development will comprise low-rise properties consideration has been given to the presence of some multi-storey structures.

Five cable percussive boreholes (BH1-5) and ten windowless sample boreholes (WS1-10) were undertaken on the site. The ground conditions encountered comprised Topsoil / Made Ground overlying Head Deposits with London Clay Formation forming the basal unit in all exploratory holes with the exception of WS6 which terminated at 3.00mbgl. The Head Deposits showed a degree of variation in composition with some fine sand horizons being identified in the generally fine-grained stratum. For design purposes the Head Deposits will be considered fine-grained as this will offer the worst case foundation condition. The London Clay Formation comprised an upper weathered horizon to depths up to 6.20mbgl underlain by firm to stiff becoming stiff grey silty Clay.

Groundwater seepages were recorded at depths between 6.30 and 7.80mbgl in three of the cable percussive boreholes and one groundwater strike at 13.70 rising to 4.50mbgl was identified. One round of groundwater and monitoring has been undertaken at which time groundwater levels were recorded at depths varying from 0.98mbgl to 1.36mbgl.

Shallow Foundations

Depth of Foundations

All foundations must be constructed below the Made Ground / Topsoil within the natural strata. The minimum depth of foundation will be controlled by the volume change potential of the underlying strata. Atterberg limits testing of the underlying materials indicated both the Head Deposits and the London Clay Formation to be of high volume change potential.

NHBC Guidance offers two foundation depth scenarios dependant on the planting regimes adopted on the site (Table 9.1).

Table 9.1: Minimum Depth of Foundations for Medium Volume Change Soil (after NHBC)

Depth of Foundation	Description	No Tree Planting Zone (m)		
		High Water Demand	Moderate Water Demand	Low Water Demand
1.00m	No tree planting within Zone of Influence	1.25 x mature height	0.75 x mature height	0.50 x mature height
1.50m	Restricted tree planting within zone of influence	1.00 x mature height	0.50 x mature height	0.20 x mature height

Ground Condition Assessment

Therefore a minimum foundation depth of 1.00m with restrictions placed on planting is recommended across the site. Furthermore it should be noted that mature trees are present along the site boundaries and in adjacent gardens, in these areas foundations should not be placed within the zone of influence of the mature height of the existing tree or further foundation deepening in accordance with NHBC Guidance will be required.

Ultimate Limit State Bearing Resistance

Bearing resistance analysis was carried out in order to check the Ultimate Limit State (ULS) bearing resistance of the Head Deposits. The ground model and characteristic material properties used in the ULS analysis are presented in Table 9.2. The ground investigation shows that in some areas the foundations may be placed directly on the London Clay Formation; therefore the angle of friction of the Head Deposits has been reduced to 22° to allow for this situation.

Table 9.2: Ground Model used in the ULS Bearing Resistance Calculations

Ground Model	Stratum	Thickness		Shear Strength Parameters			
		From (mbgl)	To (mbgl)	Total		Effective	
				c_{uk} (kN/m ²)	ϕ_{uk} (°)	c'_k (kN/m ²)	ϕ'_k (°)
GM1	Topsoil / Made Ground	GL	0.30	Not used			
	Head Deposits	0.30	2.00	45	0	0	23*
	London Clay Formation	2.00	>12.00	45	0	0	22

*reduced to 22° in the ULS bearing resistance analysis

The UK has implemented Design Approach 1 (DA1) of BS EN1997-1:2004 (Eurocode 7: Geotechnical Design), which requires two design combinations to be satisfied:

Combination 1 (C1): A1 "+" M1 "+" R1

Combination 2 (C2): A2 "+" M2 "+" R1

Where A, M and R refer to groups of partial factors relating to actions, materials and resistance respectively.

Table 9.3: Partial Factors Applied to the Bearing Resistance Analysis

	Combination 1			Combination 2		
	A1	M1	R1	A2	M2	R2
Tangent of the Angle of Shearing Resistance ($\tan \phi$)		1.00			1.25	
Cohesion Intercept (c')		1.00			1.25	
Undrained Cohesion c_u		1.00			1.40	
Permanent Action	1.35					
Variable Action	1.50					
Resistance						1.00

Ground Condition Assessment

The summary of the bearing checks are presented in Table 9.4 and the geotechnical calculation sheets are located in Appendix 8.

Table 9.4: Summary of ULS Bearing Resistance Checks

GM	Foundation Type	Foundation Dimensions	Depth (mbgl)	DA1 Combination	Bearing Resistance (kN/m ²)	
					Drained	Undrained
1	Strip	0.75m wide	1.00	1	186	380
				2	120	275

These calculations indicate that combination 2 presents the most critical case. The results given represent the ultimate limit state that is the maximum load that can be supported by the soil without failure occurring within the soil mass.

The bearing resistances calculated indicate a ULS of 120kN/m² for a 0.75m wide strip foundation at a minimum depth of 1.00mbgl.

Serviceability Limit State

Eurocode 7 states that calculations of settlement must always be carried out on footings on soft clays - and should be carried out on footings on firm to stiff clays when the risk is anything other than negligible.

Verification of serviceability limit state (SLS) is demonstrated by satisfying the inequality:

$$s_{Ed} = s_0 \leq s_{Cd}$$

where s_{Ed} is the total settlement; and
 s_{Cd} is the limiting value of that settlement

Without site / structure specific data a limiting value of settlement (s_{Ed}) of 25mm is considered appropriate for the type of construction under consideration. Partial factors for serviceability limit state analyses have all been taken as 1.

The settlement analysis has been carried out using the Rockscience software programme Settle 3D. The results are presented in Appendix 8 and précised in Table 9.5.

Table 9.5: Results of Settlement Analyses

Foundation Type	Depth (m)	Applied Foundation Loading (kN/m ²)	Founding Stratum	Immediate Settlement (mm)	Consolidation Settlement (mm)	Total Settlement (mm)
Strip	1.00	120	Head Deposits / London Clay Formation	6	17	23

Ground Condition Assessment

The results of the settlement analyses show that if bearing pressures do not exceed 120kN/m² settlements will remain less 25mm.

The foundation design presented in the previous sections is considered appropriate for any low-rise dwellings. However, if multi storey blocks are to be constructed on the site the calculated bearing resistance may prove to be too restrictive.

If this proves to be the case it is recommended that a piled foundation is considered for these elements of the development.

8.2 Piled Foundations

The pile design has been carried out using the partial factors recommended in the UK National Annex to BSEN 1997.

Pile Calculations

Given the properties of the strata beneath the site, values for an axially loaded piles have been determined using the following relationships:

Characteristic Shaft Resistance – Head Deposits & London Clay Formation

$$R_{sk} = \frac{\alpha \times \bar{c}_{u,d} \times A_s}{\gamma_{rd}}$$

Characteristic End Bearing – London Clay Formation

$$R_{Bk} = \frac{N_c \times c_{u,d,B} \times A_B}{\gamma_{rd}}$$

Design Approach

The pile design has been carried out using the UK National Annex to EC7. The design approach and combination of partial factors and their values are presented in Table 9.6.

Table 9.6: Design Approach and Partial Factors used in Pile Design

CFA Pile								
Combination	Design Action Load	γ_G	Material Factors	All Partial Factors	Design Resistance	γ_b	γ_s	γ_{Rd}
1	A1	1.35	M1	1.00	R1	1.00	1.00	1.4
2	A2	1.00	M1	1.00	R4	2.00	1.60	1.4

Although higher carrying capacities are often achieved by driven piles, however, as the use of driven piles can cause environmental issues (noise and vibration) the initial axial resistance calculations have been carried out on augured piles.

Ground Condition Assessment

The ULS axial resistances of a 0.3, 0.4, and 0.5m diameter augured pile of varying length have been determined for the ground model presented in Table 9.2. The Geocentrix Repute Software programme has been used to calculate the axial resistances. The resultant calculation worksheets are presented in Appendix 8 and a précis of the results is shown in Table 9.7.

Table 9.7: Design Pile Resistances – Augured Pile

Pile Diameter (m)	Pile Length (m)	Combination	Design Pile Resistance (kN)			
			MG	Skin Friction (R_{sd})	End Bearing (R_{bd})	Design Axial Pile Resistance (kN)
0.30	5.00	C2	No input in Axial Resistance	68	13	81
	7.50			124	16	140
	10.00			200	19	219
0.40	5.00	C2	No input to Axial Resistance	91	22	113
	7.50			165	28	193
	10.00			254	34	288
0.50	5.00	C2	No input to Axial Resistance	118	35	153
	7.50			207	44	251
	10.00			317	54	371

The above pile axial resistances should be used as a guide only. It is recommended that if a piled foundation solution is the preferred option then the advice of an experienced piling contractor is sought.

When dimensioning a pile the applied load must be multiplied by the appropriate partial factor, γ_G (Table 9.6).

It must be remembered that the carrying capacity of a pile group is generally less than the sum of the individual piles. Therefore it is recommended that a pile group analysis is carried out once all the loads and serviceability limits are known.

8.3 Other Foundation Considerations

Excavation Stability

During the ground investigation groundwater seepages were reported in several of the cable percussive boreholes. However, all of these were below the proposed foundation depth. Return monitoring visits placed the groundwater at a minimum depth of 0.98mbgl although this would appear to impinge on the proposed depth of excavation it is unlikely that this will affect the excavations given the low permeability of the natural strata. Therefore it is considered probable that foundation excavations will remain stable in the short term.

It is recommended that foundation excavations are left open for the minimum time prior to the placement of the foundation concrete. The founding material in any foundation excavation that is left exposed to standing

water will undergo a degree of softening and the softened material will require excavation prior to the placement of foundation concrete. If it becomes apparent that excavations are to remain open for any length of time it is recommended that the foundation excavation is left short of the finished level to avoid deterioration of the founding stratum.

Floor Slabs

The ground investigation has shown that the volume change potential of both the Head Deposits and the London Clay Formation is high. Using a simple assessment to determine the onset of desiccation three of the eight samples tested indicated the ground to be desiccated. Therefore it is recommended that a suspended ground floor slab design is used on this site.

8.4 Other Geotechnical Considerations

Californian Bearing Ratio

Seven Californian bearing ratio (CBR) determinations were undertaken at locations across the site using a TRRL probe. The results varied widely across the site possibly as a result of the presence of gravel in the top 1.00m of the ground. The test certificates are presented in Appendix 9 and show that for preliminary design purposes a CBR of 7% is appropriate for depths of between 0.40 and 1.00m below existing ground level.

Chemical Attack on Buried Concrete

BRE testing of the London Clay Formation has showed it to be non-pyritic, conforming to a Design Sulphate classification of DS-1 and an ACEC of AC-1s. However experience of the London Clay Formation has shown it to be pyritic; therefore a more appropriate classification is considered to be DS-3 and AC-2s.

Section 9 – Conclusions and Recommendations

9.1 Contamination

No significant on or off site sources of contamination have been identified by this assessment. Therefore, no viable pollutant linkages are considered to be present.

General Notes

In order to mitigate the generic risks associated with development on potentially contaminated land the following mitigation measures are recommended:

- Preparation of a Discovery Strategy outlining the procedures to be followed in the event that unanticipated contamination is encountered during the development.
- Compliance with relevant Health and Safety procedures during construction works.
- Contractors on site should wear appropriate PPE to mitigate the risks from the chemical and physical impacts to the Made Ground at the site.
- The local authority should be informed if any sources of contamination are identified during the development that have not been assessed in this report. These sources should then be assessed and dealt with appropriately, with the agreement of the local authority.

These mitigation measures, as with any such mitigation or remedial measures, are subject to agreement with the regulatory authority, be it the Local Authority for human health related issues or the Environment Agency for environmental issues.

It is recommended that any removal and disposal of sub-soil arisings and/or groundwater from the site should be undertaken in a controlled manner to a licensed facility, with due regard to Duty of Care responsibilities. In addition, an appropriate degree of health and safety provision should be incorporated to protect both the site workers and the general public alike.

During any ground works, it is recommended that skin contact with soils is kept to a minimum in accordance with good working practice / specific control measures and the HSE guidance document 'Protection of Workers and the General Public During the Development of Contaminated Land', 1991.

9.2 Geotechnical

The ground investigation revealed the site to be underlain by Topsoil / Made Ground over Head Deposits in turn overlying London Clay Formation to the full depth of the investigation. The Head Deposits comprised a mixture of compositions including gravelly clay and fine sand; whilst the London Clay Formation consisted of silty clay.

Groundwater seepages were recorded during the ground investigation and subsequent monitoring visits indicated a minimum at rest groundwater level to be 0.98mbgl.

Ground Condition Assessment

Shallow Foundations

It is recommended that shallow foundations at a minimum depth of 1.00mbgl or below the any Made Ground, should thicker sequences be encountered, are adopted for this site. Foundation excavations should remain stable in the short term; however founding materials should not be left exposed for extended periods of time.

Ultimate bearing resistance calculations have been carried out for foundations constructed in either the London clay Formation or the Head Deposits and returned a ULS bearing resistance of 120kN/m².

In order to allow for any potential variation in founding material the characteristic angle of friction of the Head Deposit was reduced to that of the London Clay Formation so that the presented ULS bearing resistance is appropriate for both strata.

Serviceability limit state settlement analyses were carried out under a foundation loading of 120kN/m² on a strip foundation constructed within the Head Deposits. The results show that, with the foundation loading of 120kN/m², total settlement of less than 25mm should be expected.

Although the foundations may cross between two different strata, the similarity between the two material is such that differential settlement is not expected to present a significant problem.

Piled Foundations

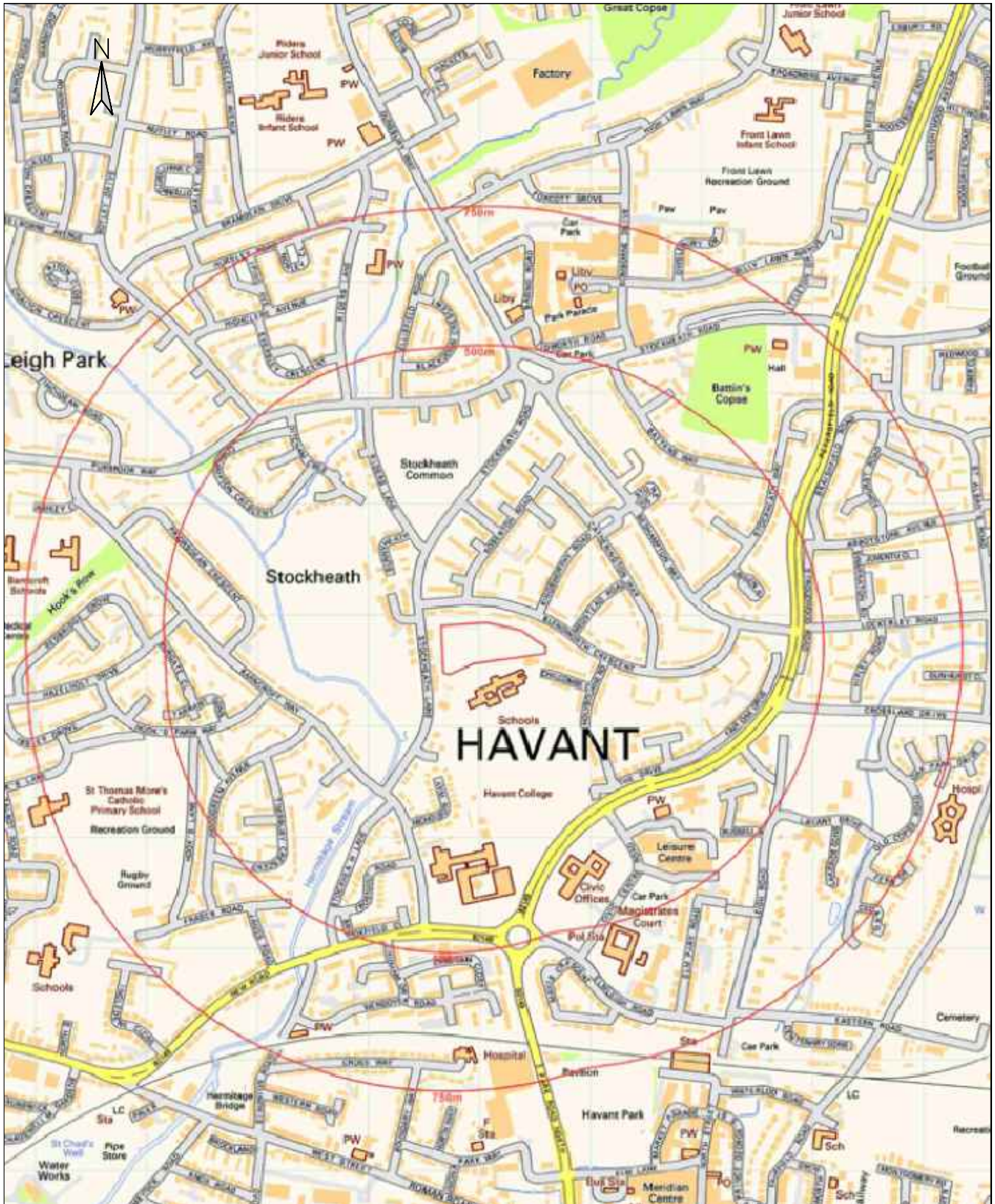
It is unclear at the time of reporting whether any multi-storey blocks are to form part of this development. If this is the case it is possible that the calculated bearing resistance may be too restrictive. Therefore, ULS axial pile resistances have been calculated for a range of diameters and lengths of augured pile. However, when sizing piles from these results all applied actions must be factored in accordance with the UK National Annex to Eurocode 7.

It should be noted that the carrying capacity of a pile group is usually less than the sum of the individual piles. Therefore it is recommended that a detailed pile group analysis is carried out when all loads and serviceability limits are known.

Other Geotechnical Considerations

Given the high volume change potential of the founding strum and the slight desiccation of this material a suspended floor slab solution is recommended for this site.

Figure 1 – Site Location Plan



-	20.07	PRELIMINARY	DAP	AP
REF	DATE	REVISION	DRAWN	CHECKED

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151238 - SITE LOCATION

SCALE
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DATE
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FIGURE 1

REV

-

Figure 2 – Investigation Location Plan



KEY:

-  BOREHOLE LOCATION
-  WINDOW SAMPLE LOCATION
-  TRL PROBE LOCATION

REF	20.07	PRELIMINARY	DAP	AP
DATE	REVISION		DRAWN	CHECKED

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FIGURE 2

REV

-

Figure 3 – SPT N v Depth

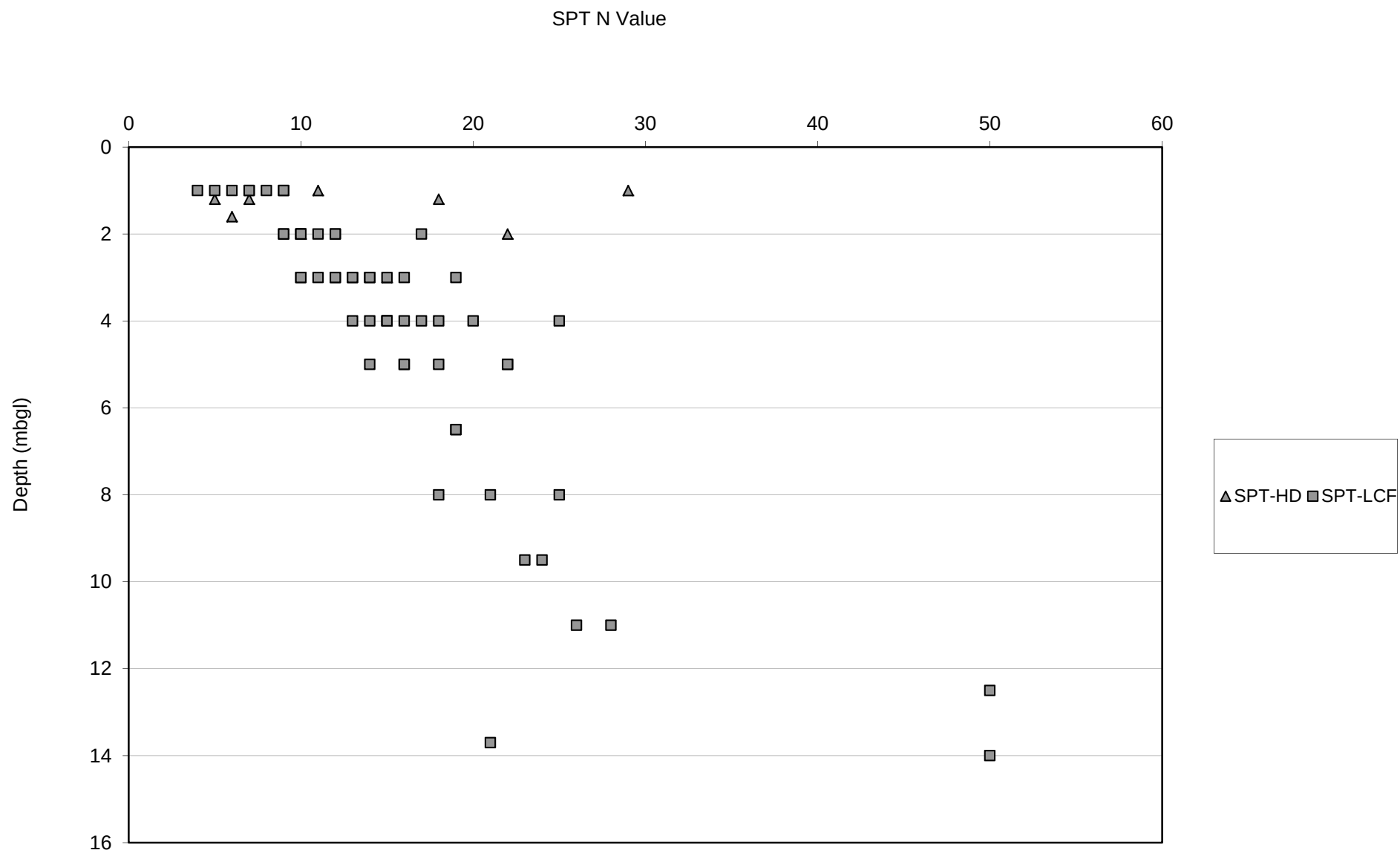
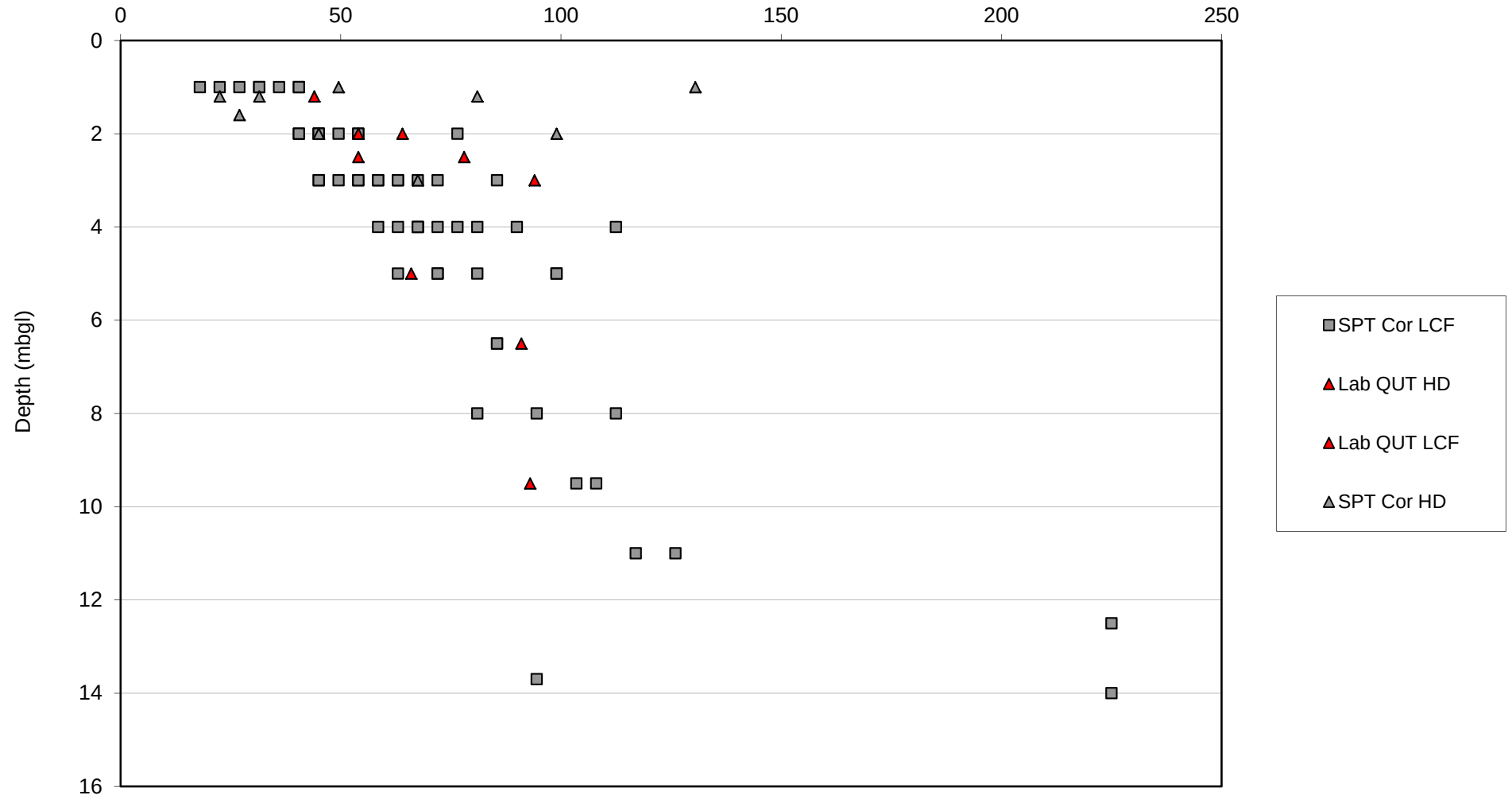


Figure 4 – Undrained Shear Strength v Depth

Undrained Shear Strength (kN/m²)



Appendix 1 – Report Conditions

Ground Condition Assessment

This report is produced solely for the benefit of **Portsmouth City Council** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

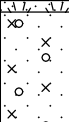
This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, study of readily accessible referenced historical records, information supplied by those parties noted in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented in good faith without exhaustive clarification. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to detailed activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, not revealed by this research cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question, as such bodies may have unpublished, often more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Ridge and Partners LLP. In time improved practices or amended legislation may necessitate a re-assessment.

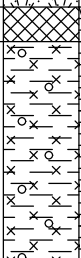
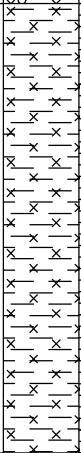
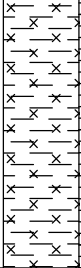
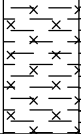
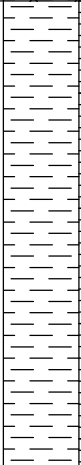
The report is necessarily limited to those aspects of land contamination specifically reported on and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents that may occur. The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists this can only practically be better assessed following extensive on and off site intrusive investigations and monitoring.

Appendix 2 – Engineering Logs

SAMPLES & TESTS			Water			Depth	STRATA	Geology	Instrument/ Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	(Thick- ness)	DESCRIPTION			
0.30	D1	40 blows			0.10	Soft brown slightly sandy CLAY with frequent rootlets				
0.30	ESA				(1.00)	Brown silty gravelly fine SAND. Gravel is of fine to medium angular flint				
0.50-0.70	B2									
1.10	D3								1.10	
1.20-1.65	U4								1.40	Soft to firm orange brown CLAY
1.65	D5								(1.40)	Firm brown gravelly CLAY. Gravel is of fine to medium angular flint
2.00-2.45	D6									
2.00	N22	2.80								
3.00-3.25	U7	35 blows			Firm to stiff grey brown CLAY					
3.40	D8									
4.00-4.45	D9					(2.90)				
4.00	N15									
5.00-5.45	U10	50 blows								
5.45	D11									
6.00	D12					(0.60) 6.30	Stiff grey CLAY			
6.50-6.95	D13							6.40	Soft grey clayey coarse sub rounded to rounded flint GRAVEL	
6.50	N19	Stiff grey CLAY								
7.50	D14									
8.00-8.30	U15		55 blows			(3.60)				
8.30	D16									
9.00	D17									
9.50-9.95	D18	N24								10.00
9.50										

BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No BH2
Job No 151238	Date 16-06-15 16-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 1 of 2

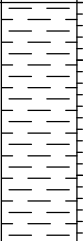
SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.30	D1	N18			0.10	Soft brown silty CLAY with frequent rootlets		
0.50-0.70	B2				0.40	Soft to firm brown silty gravelly CLAY. Gravel is of fine to coarse angular to sub rounded flint and brick fragments		
1.20	D3				(1.90)	Firm to stiff brown silty slightly gravelly CLAY. Gravel is of fine to coarse angular to sub rounded flint		
1.20								
2.20	D4	N5			2.30	Firm brown to grey silty CLAY		
2.20								
2.80	D5	45 blows						
3.00-3.45	U6							
3.45	D7							
4.00	D8	N14			(3.90)			
4.00								
5.00-5.45	U9	54 blows						
5.45	D10							
6.00	D11							
6.50	D12	N19			6.20	Stiff grey CLAY		
6.50								
7.50	D13							
8.00-8.30	U14	70 blows						
8.50	D15							
9.00	D16							
9.50	D17	N23			(6.50)			
9.50								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	

All dimensions in metres Scale 1:65.625	Client PCC	Method/ Plant Used	Logged By
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BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No BH2
Job No 151238	Date 16-06-15 16-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 2 of 2

SAMPLES & TESTS			Water			Depth (Thick- ness)	STRATA	Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend		DESCRIPTION		
10.50	D18	75 blows					Stiff grey CLAY <i>(continued)</i>		
11.00- 11.45	U19								
11.45	D20								
12.00	D21								
12.50	D22	N50/ 110 mm			12.70	Grey silty clayey medium to coarse sub angular to rounded flint GRAVEL and COBBLES			
12.50					13.00				
12.60- 13.00	B23								

[illegible]

BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No BH3
Job No 151238	Date 17-06-15 17-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill					
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)			DESCRIPTION				
0.30	D1	N6			0.10	Brown clayey SILT with frequent rootlets							
0.30	ESA				(0.70)	Soft to firm brown silty slightly gravelly CLAY. Gravel is of fine to coarse angular to sub angular flint							
0.50-0.70	B2				0.80	Grey brown clayey silty gravelly fine SAND							
1.00	D3				(0.80)	Firm orange brown silty CLAY							
1.20	B4			1.60	Firm to stiff brown to grey slightly silty CLAY								
2.00-2.20	U5	37 blows			(0.90)			Firm to stiff brown to grey slightly silty CLAY					
2.50	D6	N11			2.50	Firm to stiff brown to grey slightly silty CLAY							
3.00	U8				(3.50)	Firm to stiff brown to grey slightly silty CLAY							
4.00-4.45						Firm to stiff brown to grey slightly silty CLAY							
4.45				D9									Firm to stiff brown to grey slightly silty CLAY
5.00		D10				6.00	Firm to stiff brown to grey slightly silty CLAY						
5.00	N14			(1.70)	Stiff grey CLAY								
6.00		D11							Stiff grey CLAY				
6.50-6.95		U12							7.70			Stiff grey CLAY	
6.95		D13						(0.50)	Grey clayey fine to coarse angular to sub rounded flint GRAVEL				
7.50	D14			8.20	Stiff grey CLAY								
8.00	B15				Stiff grey CLAY								
8.00	N21				Stiff grey CLAY								
9.00		D16			Stiff grey CLAY								
9.50-9.95		U17			Stiff grey CLAY								
9.95		D18		Stiff grey CLAY									

[illegible]

Project Blendworth Crescent				BOREHOLE No BH3
Job No 151238	Date 17-06-15 17-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 2 of 2

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		
10.50	D19	N28			(5.40)	Stiff grey CLAY <i>(continued)</i>		
11.00	D20							
11.00								
12.00	D21	70 blows						
12.50-12.95	U22							
12.95	D23							
13.50	D24	N21			13.60			
13.70					13.70	Grey wet clayey medium to coarse sub rounded to rounded flint GRAVEL		
					14.15	Grey slightly silty fine SAND		

[illegible]

All dimensions in metres Scale 1:65.625	Client PCC	Method/ Plant Used	Logged By
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BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No BH4
Job No 151238	Date 17-06-15 18-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 1 of 2

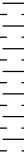
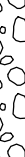
SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill		
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)			DESCRIPTION	
						0.10	Soft brown CLAY with frequent rootlets			
0.30	D1	N7				0.40	Light brown SAND and GRAVEL. Gravel is of fine to coarse sub angular flint			
0.30-0.30	ESA					(0.70)	Brown silty gravelly fine SAND. Gravel is of fine to medium angular to sub angular flint			
0.50-0.70	B2					1.10	Brown silty fine SAND			
1.20-1.65	D3	30 blows				(1.40)				
1.20										
2.00-2.45	U4					2.50				
2.45	D5	N10					Firm brown grey silty CLAY			
3.00-3.45	D6					(2.30)				
3.00										
4.00-4.50	U7	46 blows				4.80				
4.45	D8									
5.00-5.45	D9	N16					Firm to stiff grey CLAY			
5.00										
6.00	D10									
6.50-6.90	U11	55 blows				(3.90)				
6.90	D12									
7.50	D13	N25				8.70				
8.00-8.45	D14									
8.00										
8.70-9.00	B15	66 blows				(0.50)	Very stiff grey CLAY and claystone			
						9.20				
9.50-9.95	U16						Stiff grey CLAY			
9.95	D17									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625		Client PCC				Method/ Plant Used					Logged By

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BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No BH4	
Job No 151238	Date 17-06-15 18-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ DRILLING				Sheet 2 of 2	

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/Backfill
Depth	Type No	Test Result					DESCRIPTION		
10.50	D18	N26				(5.10)	Stiff grey CLAY (continued)		
11.00-11.45	D19								
11.00									
12.00	D20								
12.50-12.85	U21	70 blows							
12.85	D22								
13.50	D23								
14.00-14.40	D24	N50/235 mm				14.30			
14.00						14.40	Grey clayey medium to coarse sub rounded to rounded flint GRAVEL		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625						Client PCC			Method/ Plant Used		Logged By

BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No BH5
Job No 151238	Date 18-06-15 18-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.20	D1	N5				0.10	Soft brown silty CLAY with frequent rootlets		
0.30	ESA					0.40	Soft brown silty sandy gravelly CLAY. Gravel is of medium angular to sub angular flint		
0.50-0.70	B2					(0.70)	Soft to firm brown silty gravelly CLAY. Gravel is of fine to coarse sub angular flint		
						1.10			
1.20-1.65	D3	40 blows					Firm orange brown gravelly CLAY. Gravel is of medium sub angular flint		
1.20						(2.20)			
2.00-2.05	B4								
2.50-2.85	U5								
2.85	D6	N14							
3.00-3.45	D7					3.30			
3.00									
4.00-4.45	U8	44 blows					Firm brown grey CLAY		
4.45	D9					(2.50)			
5.00-5.45	D10								
5.00						5.80			
6.00	D11	50 blows					Stiff grey CLAY		
6.50-6.85	U12					(2.00)			
6.85	D13								
7.50	D14					7.80			
8.00-8.50	B15	N18				8.20	Very stiff grey CLAY and claystone		
8.00							Stiff grey CLAY		
9.00	D16					(1.80)			
9.50-9.95	U17					10.00			
9.95	D18	80 blows							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625			Client PCC			Method/ Plant Used					Logged By

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BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No WS1	
Job No 151238	Date 05-06-15 05-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ DRILLING				Sheet 1 of 1	

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/Backfill
Depth	Type No	Test Result					DESCRIPTION		
0.10-0.30	ES1	N9				0.30	Light brown silty slightly clayey gravelly fine SAND with frequent rootlets. Gravel is of fine to coarse angular to sub rounded flint		
0.50-1.00	ES2					(0.80)	Clayey silty sandy fine to coarse angular to sub rounded flint GRAVEL. Locally very clayey or very sandy.		
1.00						1.10	Firm to stiff light orange brown mottled light grey silty CLAY		
1.50-2.00	U3	N9							
2.00						(2.35)			
2.50-3.00	U4								
3.00		N12				3.45			
4.00		N18				(1.55)	Firm to stiff grey brown slightly silty CLAY		
5.00		N22				5.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625			Client PCC			Method/ Plant Used			Logged By		

SAMPLES & TESTS			Water			Depth (Thick- ness)	STRATA	Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend		DESCRIPTION		
0.25-0.50	ES1	N5				0.25	Light brown silty slightly clayey gravelly fine SAND with frequent rootlets		
0.80-1.00	ES2					(0.55) 0.80	Firm to stiff light brown to grey silty gravelly CLAY. Gravel is of fine to medium angular to sub angular flint		
1.00						(4.20)	Firm to stiff grey brown to light brown silty CLAY Several small black stained / mottled areas from 0.8-1.0m		
2.00		N11							
2.50-3.00	U3								
3.00		N12							
3.50-4.00	U4								
4.00-5.00	B5								
4.00		N16							
5.00		N18				5.00			
			</						

Project Blendworth Crescent				BOREHOLE No WS3
Job No 151238	Date 05-06-15 05-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 1 of 1

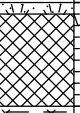
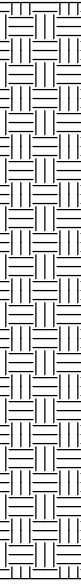
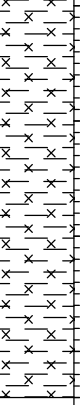
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All dimensions in metres Scale 1:65.625	Client PCC	Method/ Plant Used	Logged By
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Report ID: AGS4 UK BH || Project: BLENDWORTH CRESCENT.GPJ || Library: GINT STD AGS 4 0.GLB || Date: August 27, 2015

BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No WS4	
Job No 151238	Date 05-06-15 05-06-15	Ground Level (m)	Co-Ordinates ()	Sheet 1 of 1	
Contractor DJ DRILLING					

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/Backfill
Depth	Type No	Test Result					DESCRIPTION		
0.30-0.60	ES1	N7				0.10	Brown silty clayey fine SAND with frequent rootlets		
1.00-1.20	ES2					(0.80)	Firm light brown to grey silty gravelly CLAY. Gravel is of fine to coarse angular to sub rounded flint and brick fragments		
1.20-2.00	B3					0.90	Firm to stiff orange brown mottled grey to dark brown grey slightly silty CLAY		
2.00		N10				(3.50)			
3.00		N13				4.40			
4.00		N13				(0.60)	No recovery		
						5.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625						Client PCC			Method/ Plant Used		Logged By

BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No WS5
Job No 151238	Date 05-06-15 05-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 1 of 1

[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625			Client PCC				Method/ Plant Used				Logged By

Report ID: AGS4 UK BH || Project: BLENDWORTH CRESCENT.GPJ || Library: GINT STD AGS 4_0.GLB || Date: August 27, 2015

BOREHOLE LOG

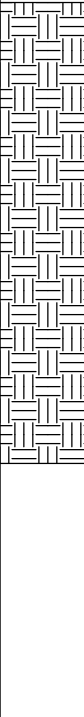
Project Blendworth Crescent				BOREHOLE No WS6
Job No 151238	Date 10-06-15 10-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		
0.10-0.30	ES1	N11				0.20	Brown silty slightly clayey fine SAND with frequent rootlets	
0.50-0.80	ES2					(0.65) 0.85	Firm to stiff orange brown silty slightly sandy gravelly CLAY. Gravel is of fine to coarse angular to sub angular flint	
1.00	B3					(2.15)	Firm light brown mottled grey silty CLAY. Locally pockets of fine to coarse angular to sub angular flint gravel. No recovery beyond 3m	
1.50-2.00								
2.00-3.00		B4						
2.00	N10				3.00			
3.00	N15							

[illegible]

BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No WS7
Job No 151238	Date 10-06-15 10-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ DRILLING				Sheet 1 of 1

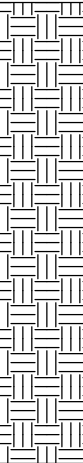
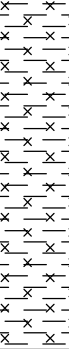
SAMPLES & TESTS			Water				STRATA	Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION		
0.30-0.50	ES1	N4			0.10	Brown silty slightly clayey fine SAND with frequent rootlets			
0.70-0.90	ES2				0.50	Brown silty sandy gravelly CLAY. Gravel is of fine to coarse angular to sub angular flint and brick fragments			
1.00	B3				(0.65)	Firm brown to grey brown silty gravelly CLAY. Gravel is of fine to coarse angular to sub rounded flint			
1.50-2.00					1.15	Firm to stiff brown to grey slightly silty CLAY			
2.00	B4	N10			(2.85)				
3.00-4.00									
3.00		N13							
4.00		N15							
					4.00				

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625			Client PCC				Method/ Plant Used				Logged By

Report ID: AGS4 UK BH || Project: BLENDWORTH CRESCENT.GPJ || Library: GINT STD AGS 4_0.GLB || Date: August 27, 2015

BOREHOLE LOG

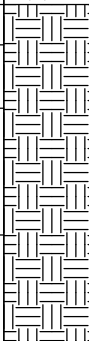
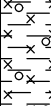
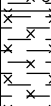
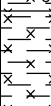
Project Blendworth Crescent				BOREHOLE No WS8	
Job No 151238	Date 10-06-15 10-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ DRILLING				Sheet 1 of 1	

SAMPLES & TESTS			Water				STRATA	Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION		
0.20-0.40	ES1	N8				(0.50) 0.50	Brown silty slightly clayey slightly gravelly fine SAND with frequent rootlets		
0.60-0.80	ES2					0.95	Light brown silty slightly sandy gravelly CLAY. Gravel is of fine to coarse angular to sub angular flint		
1.00-2.00 1.00	B3					(3.05) <			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625			Client PCC			Method/ Plant Used			Logged By		

BOREHOLE LOG

Project Blendworth Crescent				BOREHOLE No WS9	
Job No 151238	Date 10-06-15 10-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ DRILLING				Sheet 1 of 1	

SAMPLES & TESTS			Water				STRATA		Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION			
0.10-0.30	ES1	N29			0.35	Brown silty slightly gravelly fine SAND with frequent rootlets				
0.40-0.60	ES2				(0.55) 0.90	Firm light brown silty gravelly slightly cobbly CLAY. Gravel is of fine to coarse sub angular to sub rounded flint, brick and concrete.				
1.00					(1.10) 2.00	Firm to stiff brown silty gravelly CLAY. Gravel is of fine to coarse angular to sub angular flint				
2.00					(1.00) 3.00	Firm to stiff brown grey slightly silty CLAY				
2.50-3.00	U3	N15								
3.00										

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:65.625						Client PCC			Method/ Plant Used		Logged By

[illegible]

All dimensions in metres Scale 1:65.625	Client PCC	Method/ Plant Used	Logged By
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Appendix 3 – Generic Assessment Criteria

SOIL - HUMAN HEALTH SCREENING VALUES

Status	End Use	Issue No	Issue Date		
ISSUE	Residential with Homegrown Produce	1	June 2015		
Determinand	Units	SOIL ORGANIC MATTER			SOURCE
		1 %	2.5 %	6 %	
pH		<5, >9			
Asbestos	%	Presence			
HEAVY METALS / METALLOIDS					
Arsenic	mg/kg		37		S4UL
Cadmium	mg/kg		11		S4UL
Chromium (III)	mg/kg		910		S4UL
Chromium (VI)	mg/kg		6		S4UL
Lead	mg/kg		200		C4SL
Mercury (Elemental)	mg/kg		1.2		S4UL
Mercury (Inorganic)	mg/kg		40		S4UL
Mercury (Methyl)	mg/kg		11		S4UL
Nickel	mg/kg		180		S4UL
Selenium	mg/kg		250		S4UL
Beryllium	mg/kg		1.7		S4UL
Baron	mg/kg		290		S4UL
Vanadium	mg/kg		410		S4UL
Copper	mg/kg		2,400		S4UL
Zinc	mg/kg		3,700		S4UL
GENERAL INORGANICS					
Easily Liberatable Cyanide (free)	mg/kg		36		Acute effects infant 1 dose 3g soil
US EPA PRIORITY PAHs					
Acenaphthene	mg/kg	210	510	1100	S4UL
Acenaphthylene	mg/kg	170	420	920	S4UL
Anthracene	mg/kg	2,400	5,400	11,000	S4UL
Benzo(a)anthracene	mg/kg	72	11	13	S4UL
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	S4UL
Benzo(k)fluoranthene	mg/kg		93	100.0	S4UL
Benzo(g,h,i)perylene	mg/kg	320	340	350	S4UL
Benzo(a)pyrene	mg/kg	2.20	2.7	3	S4UL
Chrysene	mg/kg	15	22	27.0	S4UL
D-benzo(a,h)anthracene	mg/kg	0.24	0.28	0.30	S4UL
Fluoranthene	mg/kg	280	560	890	S4UL
Fluorene	mg/kg	170	400	860	S4UL
Indeno(1,2,3-cd)pyrene	mg/kg	27.0	36	41.0	S4UL
Naphthalene	mg/kg	2.3	5.6	13.0	S4UL
Phenanthrene	mg/kg	95	220	440	S4UL
Pyrene	mg/kg	620	1200	2000	S4UL
Total PAHs	mg/kg	No Sum	No Sum	No Sum	
Chlorinated Solvents/VOCs					
1,2-Dichloroethane (DCE)	mg/kg	0.0071	0.011	0.019	S4UL
1,1,1-Trichloroethane (111 TCA)	mg/kg	8.8	18	39	S4UL
1,1,1,2-Tetrachloroethane (1112 PCA)	mg/kg	1.2	2.8	6.40	S4UL
1,1,2,2-Tetrachloroethane (1122 PCA)	mg/kg	1.60	3.4	7.5	S4UL
Tetrachloroethane (PCE)	mg/kg	0.18	0.39	0.9	S4UL
Tetrachloroethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	S4UL
Trichloroethane (TCE)	mg/kg	0.016	0.034	0.075	S4UL
Trichloromethane (Chloroform)	mg/kg	0.91	1.7	3.4	S4UL
Vinyl Chloride	mg/kg	0.00064	0.00087	0.0014	S4UL
Chlorobenzene	mg/kg	0.46	1	2.4	S4UL
1,2-Dichlorobenzene	mg/kg	23	55	130	S4UL
1,3-Dichlorobenzene	mg/kg	0.4	1	2.3	S4UL
1,4-Dichlorobenzene	mg/kg	61	150	350	S4UL
1,2,3-Trichlorobenzene	mg/kg	1.5	3.6	8.6	S4UL
1,2,4-Trichlorobenzene	mg/kg	2.6	6.4	15	S4UL
1,3,5-Trichlorobenzene	mg/kg	0.33	0.81	1.9	S4UL
1,2,3,4-Tetrachlorobenzene	mg/kg	15	36	78	S4UL
1,2,3,5-Tetrachlorobenzene	mg/kg	0.66	1.6	3.7	S4UL
1,2,4,5-Tetrachlorobenzene	mg/kg	0.33	0.77	1.6	S4UL
Pentachlorobenzene	mg/kg	5.8	12	22	S4UL
Hexachlorobenzene	mg/kg	1.8	3.3	4.9	S4UL
Carbon Disulphide	mg/kg	0.14	0.29	0.62	S4UL
Hexachlorocycladiene	mg/kg	0.29	0.7	1.6	S4UL
Phenolics					
Phenol	mg/kg	280	550	1100	S4UL
Chlorophenols	mg/kg	0.87	2.00	4.50	S4UL
Pentachlorophenol	mg/kg	0.22	0.52	1.20	S4UL
Explosives					
2,4,6-Trinitrotoluene (TNT)	mg/kg	1.6	3.7	8.1	S4UL
RDX	mg/kg	120.0	250.0	540.0	S4UL
HMX	mg/kg	5.7	13.0	26.0	S4UL
Insecticides/Herbicides					
Aldrin	mg/kg	5.70	6.60	7.10	S4UL
Dieldrin	mg/kg	0.97	2.00	3.50	S4UL
Atrazine	mg/kg	3.30	7.60	17.40	S4UL
Dichlorvos	mg/kg	0.032	0.066	0.140	S4UL
Alpha-Endosulfan	mg/kg	7.4	18.0	41.0	S4UL
Beta-Endosulfan	mg/kg	7.0	17.0	39.0	S4UL
Alpha-Hexachlorocyclohexane	mg/kg	0.23	0.55	1.20	S4UL
Beta-Hexachlorocyclohexane	mg/kg	0.085	0.200	0.460	S4UL
Gamma-Hexachlorocyclohexanes (Lindane)	mg/kg	0.06	0.14	0.33	S4UL
TPH					
TPH Aliphatic >C5-6	mg/kg	42	78	160	S4UL
TPH Aliphatic >C6-8	mg/kg	100	230	530	S4UL
TPH Aliphatic >C8-10	mg/kg	27	65	150	S4UL
TPH Aliphatic >C10-12	mg/kg	130	330	760	S4UL
TPH Aliphatic >C12-16	mg/kg	1100	2,400	4,300	S4UL
TPH Aliphatic >C16-35	mg/kg	65,000	92,000	110,000	S4UL
TPH Aliphatic >C35-44	mg/kg	65,000	92,000	110,000	S4UL
TPH Aromatic >EC5-7 (Benzene)	mg/kg	70	140.00	300	S4UL
TPH Aromatic >EC7-8	mg/kg	130	290	660	S4UL
TPH Aromatic >EC8-10	mg/kg	34	83	190	S4UL
TPH Aromatic >EC10-12	mg/kg	74	180	390	S4UL
TPH Aromatic >EC12-16	mg/kg	140	330	660	S4UL
TPH Aromatic >EC16-21	mg/kg	260	540	930	S4UL
TPH Aromatic >EC21-35	mg/kg	1100	1,500	1,700	S4UL
TPH Aromatic >EC35-44	mg/kg	1100	1,500	1,700	S4UL
TPH Aliphatic & Aromatic >EC44-70	mg/kg	1,600	1,800	1,900	S4UL
Total TPH	mg/kg	No Sum	No Sum	No Sum	
BTEX					
Benzene	mg/kg	0.087	0.17	0.37	S4UL
Toluene	mg/kg	130	290	660	S4UL
Ethylbenzene	mg/kg	47	110	260	S4UL
m-Xylene	mg/kg	60	140	330	S4UL
p-Xylene	mg/kg	59	140	320	S4UL
o-Xylene	mg/kg	56	130	310	S4UL

NOTES

- 1) Compare individual samples values against Soil Screening Values (SSV). If exceedences are noted consider further in relation to averaging areas and statistical analysis.
- 2) These values are for initial screening for potential **risk to human health only**. They are **not remediation thresholds**. Screening for other receptors to be done separately as appropriate for the site, e.g. for water, ecology, building materials.
- 3) Screening criteria denoted with an asterisk (*) were capped at the lower vapour/aqueous saturation limits for Tier 1 human health risk assessment purposes and considered **conservative**. Where concentrations are recorded at levels greater than the SSV, free phase (NAPL) contamination may be present and should be considered qualitatively. Further information to support the interpretation of assessment criteria that exceed theoretical soil saturation limits is provided in Section 4.12 of the CLEA Software Handbook (SR4).
- 4) Screening criteria denoted with hash (#) were capped at 1000000mg/kg. It is noted that aesthetic (e.g. odour) and other site specific factors may also be relevant when providing advice relating to these compounds.
- 5) LQM/CIEH S4ULs November 2014 - Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3439. All rights reserved.
- 6) SSVs derived for certain constituents may be low in relation to standard laboratory Limits of Detection (LoD). It is the responsibility of the project engineer to check with the laboratory that appropriate detection limits can be achieved. As a target, an LoD would be no larger than 10% of the SSV, but this is not practicable for some constituents. Clearly an LoD greater than the SSV would prevent use of this SSV screening and/or be interpreted as if all samples exceeded the SSV.
- 7) **Human Health Soil Screening Values (SSV)** were calculated using a Soil Organic Matter (SOM) value of 1.0%, 2.5% and 6%. This is equivalent to an Fraction Organic Carbon (FOC) values of approx. 0.6%, 1.45% and 3.5% respectively (For reference FOC = 0.58*SOM). **Note that some soils have different SOM/FOC, which may give require more stringent SSVs for organic compounds. It is the responsibility of the project engineer to check the SOM with the site specific conditions.**
- 8) In general, SSVs above 100mg/kg are rounded down to 3 significant figures. Similarly, SSVs below 100mg/kg are rounded down to 2 significant figures

Appendix 4 – Soil Screening Summary

1. S4UL Majority
2. Lead C4SL
%SOM = FOC (100/0.58)
NA Not available
NAD No ACM Detected
LFS Loose Fibres in Soil
- Not analysed

Determinand	Units	TSV	Arithmetic Mean	Geometric Mean	No. of Samples	Standard Deviation	Coeff. Variability	Distribution	Applicable 95% UCL	95% UCL LogNormal	95% UCL Normal	Max	Min	Tcalc	Tcrit (5%)	Outlier?
Beryllium	mg/kg	1.7	1.1	1.0	20	0.2	0.21	NORMAL	1.1	1.1	1.1	2.0	1.0	4.25	2.56	Yes

95%UCL calculated dependent on type of distribution.

Maximum value test undertaken in accordance with CLR7 methodology. If Tcalc>Tcrit, maximum value in distribution is an outlier.

Appendix 5 – Chemical Analysis Results

FINAL ANALYTICAL TEST REPORT

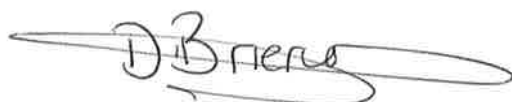
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Issue Number: 1

Date: 06 July, 2015

Client: Ridge and Partners Ltd
Partnership House
Moorside Road
Winchester
UK
SO23 7RX

Project Manager: Antony Platt
Project Name: Blendworth Crescent
Project Ref: Not specified
Order No: 994209
Date Samples Received: 09/06/15
Date Instructions Received: 22/06/15
Date Analysis Completed: 06/07/15

Prepared by:



Danielle Brierley
Administrative Assistant

Approved by:



Iain Haslock
Analytical Consultant

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/1	15/04104/2	15/04104/3	15/04104/4	15/04104/5	15/04104/6	15/04104/7	15/04104/8	Units	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS2	WS2	WS3	WS3	WS4	WS4		
Depth to Top	0.10	0.50	0.25	0.80	0.10	0.40	0.30	1.00		
Depth To Bottom	0.30	1.00	0.50	1.00	0.20	0.60	0.60	1.20		
Date Sampled	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6AE	5A	6A	6A	6AE	6A	6AE	6A		
% Stones >10mm _A [#]	7.5	23.0	5.6	4.6	13.7	12.3	11.9	7.5	% w/w	A-T-044
pH _D ^{M#}	7.15	8.25	8.40	8.31	7.70	8.07	8.29	7.99	pH	A-T-031s
Ammonium NH ₄ (exchangeable/water soluble) _D	5.46	0.88	3.12	2.48	14.5	5.19	3.44	0.37	mg/kg	A-T-033s
Sulphate (water sol 2:1) _D ^{M#}	<0.01	<0.01	<0.01	0.02	0.05	0.10	0.05	0.31	g/l	A-T-026s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	A-T-050s
Fraction of organic carbon _D [#]	0.0216	0.0030	0.0128	0.0122	0.0261	0.0134	0.0105	0.0020	N/A	A-T-032 FOC
Antimony _D	<5	<5	<5	<5	<5	<5	<5	<5	mg/kg	A-T-024s
Arsenic _D ^{M#}	8	12	7	7	10	9	9	7	mg/kg	A-T-024s
Barium _D	56	32	59	67	65	55	47	70	mg/kg	A-T-024s
Beryllium _D [#]	1	1	1	1	1	1	1	2	mg/kg	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	mg/kg	A-T-027s
Cadmium _D ^{M#}	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	A-T-024s
Copper _D ^{M#}	16	5	13	9	11	13	10	16	mg/kg	A-T-024s
Chromium _D ^{M#}	26	26	22	26	25	28	21	42	mg/kg	A-T-024s
Lead _D ^{M#}	43	11	42	28	33	34	21	16	mg/kg	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	mg/kg	A-T-024s
Molybdenum _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-024s
Nickel _D ^{M#}	12	10	11	11	13	18	16	32	mg/kg	A-T-024s
Selenium _D ^{M#}	<1	2	<1	<1	<1	<1	<1	<1	mg/kg	A-T-024s
Zinc _D ^{M#}	59	26	46	40	54	54	37	60	mg/kg	A-T-024s

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/1	15/04104/2	15/04104/3	15/04104/4	15/04104/5	15/04104/6	15/04104/7	15/04104/8	Units	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS2	WS2	WS3	WS3	WS4	WS4		
Depth to Top	0.10	0.50	0.25	0.80	0.10	0.40	0.30	1.00		
Depth To Bottom	0.30	1.00	0.50	1.00	0.20	0.60	0.60	1.20		
Date Sampled	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6AE	5A	6A	6A	6AE	6A	6AE	6A		
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	1.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Total Aliphatics _A	<0.1	2.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-022+23s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-022+23s
TPH (Ali & Aro) _A	<0.1	2.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-022+23s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/1	15/04104/2	15/04104/3	15/04104/4	15/04104/5	15/04104/6	15/04104/7	15/04104/8	Units	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS2	WS2	WS3	WS3	WS4	WS4		
Depth to Top	0.10	0.50	0.25	0.80	0.10	0.40	0.30	1.00		
Depth To Bottom	0.30	1.00	0.50	1.00	0.20	0.60	0.60	1.20		
Date Sampled	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6AE	5A	6A	6A	6AE	6A	6AE	6A		
Asbestos in Soil (inc. matrix)										
Asbestos in soil _A [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD		A-T-045
Asbestos Matrix (visual) _A	-	-	--	-	-	-	-	-		A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		Gravimetry

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/1	15/04104/2	15/04104/3	15/04104/4	15/04104/5	15/04104/6	15/04104/7	15/04104/8	Units	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS2	WS2	WS3	WS3	WS4	WS4		
Depth to Top	0.10	0.50	0.25	0.80	0.10	0.40	0.30	1.00		
Depth To Bottom	0.30	1.00	0.50	1.00	0.20	0.60	0.60	1.20		
Date Sampled	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15	05-Jun-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6AE	5A	6A	6A	6AE	6A	6AE	6A		
PAH-16MS (Ridge+Partners)										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Phenanthrene _A ^{M#}	0.04	<0.03	0.03	<0.03	0.07	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	A-T-019s
Fluoranthene _A ^{M#}	0.14	<0.08	0.10	<0.08	0.15	<0.08	<0.08	<0.08	mg/kg	A-T-019s
Pyrene _A ^{M#}	0.13	<0.07	0.09	<0.07	0.14	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.07	<0.04	<0.04	<0.04	0.07	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Chrysene _A ^{M#}	0.11	<0.06	<0.06	<0.06	0.10	<0.06	<0.06	<0.06	mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.14	<0.05	0.05	<0.05	0.11	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.10	<0.04	<0.04	<0.04	0.07	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.09	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	0.91	<0.08	0.27	<0.08	0.76	<0.08	<0.08	<0.08	mg/kg	A-T-019s

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/9	15/04104/10	15/04104/11	15/04104/12	15/04104/13	15/04104/14	15/04104/15	15/04104/16	Units	Method ref
Client Sample No										
Client Sample ID	WS5	WS5	WS6	WS6	WS7	WS7	WS8	WS8		
Depth to Top	0.10	0.50	0.10	0.50	0.30	0.70	0.20	0.60		
Depth To Bottom	0.30	0.70	0.30	0.80	0.50	0.90	0.40	0.80		
Date Sampled	05-Jun-15	05-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6AE	5AE	6E	6A	6AE	6A	6E	6A		
% Stones >10mm _A [#]	<0.1	4.6	3.5	4.6	22.7	29.0	3.3	6.4	% w/w	A-T-044
pH _D ^{M#}	6.23	8.92	7.20	7.76	8.18	7.93	6.89	8.28	pH	A-T-031s
Ammonium NH ₄ (exchangeable/water soluble) _D	31.7	6.74	30.2	2.02	3.02	5.24	5.82	5.00	mg/kg	A-T-033s
Sulphate (water sol 2:1) _D ^{M#}	0.05	0.07	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	g/l	A-T-026s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	A-T-050s
Fraction of organic carbon _D [#]	0.0426	0.0138	0.0530	0.0094	0.0073	0.0263	0.0022	0.0302	N/A	A-T-032 FOC
Antimony _D	<5	<5	<5	<5	<5	<5	<5	<5	mg/kg	A-T-024s
Arsenic _D ^{M#}	4	9	6	7	7	4	8	11	mg/kg	A-T-024s
Barium _D	68	62	67	52	56	40	48	47	mg/kg	A-T-024s
Beryllium _D [#]	1	1	1	1	1	1	1	1	mg/kg	A-T-024s
Boron (water soluble) _D ^{M#}	1.4	1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.0	mg/kg	A-T-027s
Cadmium _D ^{M#}	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	A-T-024s
Copper _D ^{M#}	16	16	14	13	10	13	13	8	mg/kg	A-T-024s
Chromium _D ^{M#}	27	28	24	20	20	18	23	25	mg/kg	A-T-024s
Lead _D ^{M#}	41	79	50	31	24	38	32	28	mg/kg	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	mg/kg	A-T-024s
Molybdenum _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-024s
Nickel _D ^{M#}	13	19	15	13	15	9	12	12	mg/kg	A-T-024s
Selenium _D ^{M#}	2	2	<1	<1	<1	<1	<1	<1	mg/kg	A-T-024s
Zinc _D ^{M#}	67	50	69	49	41	31	58	48	mg/kg	A-T-024s

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/9	15/04104/10	15/04104/11	15/04104/12	15/04104/13	15/04104/14	15/04104/15	15/04104/16	Units	Method ref
Client Sample No										
Client Sample ID	WS5	WS5	WS6	WS6	WS7	WS7	WS8	WS8		
Depth to Top	0.10	0.50	0.10	0.50	0.30	0.70	0.20	0.60		
Depth To Bottom	0.30	0.70	0.30	0.80	0.50	0.90	0.40	0.80		
Date Sampled	05-Jun-15	05-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6AE	5AE	6E	6A	6AE	6A	6E	6A		
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Total Aliphatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-022+23s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	2.5	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	0.4	<0.1	6.8	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	0.4	<0.1	9.3	<0.1	<0.1	<0.1	mg/kg	A-T-022+23s
TPH (Ali & Aro) _A	<0.1	<0.1	0.4	<0.1	9.3	<0.1	<0.1	<0.1	mg/kg	A-T-022+23s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/9	15/04104/10	15/04104/11	15/04104/12	15/04104/13	15/04104/14	15/04104/15	15/04104/16	Units	Method ref
Client Sample No										
Client Sample ID	WS5	WS5	WS6	WS6	WS7	WS7	WS8	WS8		
Depth to Top	0.10	0.50	0.10	0.50	0.30	0.70	0.20	0.60		
Depth To Bottom	0.30	0.70	0.30	0.80	0.50	0.90	0.40	0.80		
Date Sampled	05-Jun-15	05-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6AE	5AE	6E	6A	6AE	6A	6E	6A		
Asbestos in Soil (inc. matrix)										
Asbestos in soil _A [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD		A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		Gravimetry

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/9	15/04104/10	15/04104/11	15/04104/12	15/04104/13	15/04104/14	15/04104/15	15/04104/16	Units	Method ref
Client Sample No										
Client Sample ID	WS5	WS5	WS6	WS6	WS7	WS7	WS8	WS8		
Depth to Top	0.10	0.50	0.10	0.50	0.30	0.70	0.20	0.60		
Depth To Bottom	0.30	0.70	0.30	0.80	0.50	0.90	0.40	0.80		
Date Sampled	05-Jun-15	05-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6AE	5AE	6E	6A	6AE	6A	6E	6A		
PAH-16MS (Ridge+Partners)										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Phenanthrene _A ^{M#}	0.05	0.11	0.14	<0.03	0.15	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	0.02	<0.02	0.04	<0.02	<0.02	<0.02	mg/kg	A-T-019s
Fluoranthene _A ^{M#}	0.23	0.14	0.54	<0.08	0.40	<0.08	<0.08	<0.08	mg/kg	A-T-019s
Pyrene _A ^{M#}	0.21	0.12	0.54	<0.07	0.36	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.12	<0.04	0.38	<0.04	0.22	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Chrysene _A ^{M#}	0.16	<0.06	0.45	<0.06	0.24	<0.06	<0.06	<0.06	mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.19	<0.05	0.62	<0.05	0.26	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	0.20	<0.07	0.11	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.12	<0.04	0.48	<0.04	0.20	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.09	<0.03	0.36	<0.03	0.16	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	0.07	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.08	<0.05	0.35	<0.05	0.13	<0.05	<0.05	<0.05	mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	1.26	0.37	4.18	<0.08	2.27	<0.08	<0.08	<0.08	mg/kg	A-T-019s

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/17	15/04104/18	15/04104/19	15/04104/20					Units	Method ref
Client Sample No										
Client Sample ID	WS9	WS9	WS10	WS10						
Depth to Top	0.10	0.40	0.30	0.80						
Depth To Bottom	0.30	0.60	0.50	1.00						
Date Sampled	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15						
Sample Type	Soil	Soil	Soil	Soil						
Sample Matrix Code	6AE	6A	5AE	5E						
% Stones >10mm _A [#]	1.2	2.4	2.9	1.9					% w/w	A-T-044
pH _D ^{M#}	6.43	8.31	7.53	8.39					pH	A-T-031s
Ammonium NH ₄ (exchangeable/water soluble) _D	14.8	5.35	2.54	0.83					mg/kg	A-T-033s
Sulphate (water sol 2:1) _D ^{M#}	0.02	<0.01	<0.01	<0.01					g/l	A-T-026s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1					mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2					mg/kg	A-T-050s
Fraction of organic carbon _D [#]	0.0032	0.0047	0.0013	0.0119					N/A	A-T-032 FOC
Antimony _D	<5	<5	<5	<5					mg/kg	A-T-024s
Arsenic _D ^{M#}	6	7	6	7					mg/kg	A-T-024s
Barium _D	61	56	54	59					mg/kg	A-T-024s
Beryllium _D [#]	<1	1	1	1					mg/kg	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	1.2	<1.0	<1.0					mg/kg	A-T-027s
Cadmium _D ^{M#}	0.6	<0.5	<0.5	<0.5					mg/kg	A-T-024s
Copper _D ^{M#}	8	8	13	4					mg/kg	A-T-024s
Chromium _D ^{M#}	20	27	23	35					mg/kg	A-T-024s
Lead _D ^{M#}	37	30	27	14					mg/kg	A-T-024s
Mercury _D	<0.17	<0.17	0.33	<0.17					mg/kg	A-T-024s
Molybdenum _D ^{M#}	<1	<1	<1	<1					mg/kg	A-T-024s
Nickel _D ^{M#}	9	12	14	16					mg/kg	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1					mg/kg	A-T-024s
Zinc _D ^{M#}	61	46	50	47					mg/kg	A-T-024s

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/17	15/04104/18	15/04104/19	15/04104/20					Units	Method ref
Client Sample No										
Client Sample ID	WS9	WS9	WS10	WS10						
Depth to Top	0.10	0.40	0.30	0.80						
Depth To Bottom	0.30	0.60	0.50	1.00						
Date Sampled	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15						
Sample Type	Soil	Soil	Soil	Soil						
Sample Matrix Code	6AE	6A	5AE	5E						
TPH CWG										
Ali >C5-C6 _A [#]	0.01	<0.01	0.02	<0.01					mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
Ali >C8-C10 _A [#]	0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-023s
Total Aliphatics _A	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-022+23s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-022+23s
TPH (Ali & Aro) _A	<0.1	<0.1	<0.1	<0.1					mg/kg	A-T-022+23s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-022s

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/17	15/04104/18	15/04104/19	15/04104/20					Units	Method ref
Client Sample No										
Client Sample ID	WS9	WS9	WS10	WS10						
Depth to Top	0.10	0.40	0.30	0.80						
Depth To Bottom	0.30	0.60	0.50	1.00						
Date Sampled	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15						
Sample Type	Soil	Soil	Soil	Soil						
Sample Matrix Code	6AE	6A	5AE	5E						
Asbestos in Soil (inc. matrix)										
Asbestos in soil _A [#]	NAD	NAD	NAD	NAD						A-T-045
Asbestos Matrix (visual) _A	-	-	--	-						A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A						Gravimetry

Envirolab Job Number: 15/04104

Client Project Name: Blendworth Crescent

Client Project Ref: Not specified

Lab Sample ID	15/04104/17	15/04104/18	15/04104/19	15/04104/20					Units	Method ref
Client Sample No										
Client Sample ID	WS9	WS9	WS10	WS10						
Depth to Top	0.10	0.40	0.30	0.80						
Depth To Bottom	0.30	0.60	0.50	1.00						
Date Sampled	10-Jun-15	10-Jun-15	10-Jun-15	10-Jun-15						
Sample Type	Soil	Soil	Soil	Soil						
Sample Matrix Code	6AE	6A	5AE	5E						
PAH-16MS (Ridge+Partners)										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03					mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03					mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02					mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	<0.08					mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	<0.07					mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04					mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	<0.06					mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	<0.05					mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07					mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	<0.04					mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03					mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04					mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05					mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	<0.08	<0.08	<0.08	<0.08					mg/kg	A-T-019s

REPORT NOTES

Notes - Soil chemical analysis

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

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis. For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

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

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts.

Superscript "M" indicates method accredited to MCERTS.

If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.

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

TPH analysis of water by method A-T-007

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

Asbestos in soil

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if present as discrete fibres/fragments. Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed.

Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample. Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

Appendix 6 – Monitoring Records

GROUND GAS AND GROUNDWATER MONITORING RESULTS

SITE/REF:		Blendworth Crescent, Havant					General Site comments		www.ridge.co.uk			
DATE:		08/07/2015		1... of 1...								
OPERATOR(S):		DAP/AP										
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	PID (ppm)						
Before Monitoring		1012	<0.1	<0.1	20.5	-	EQUIPMENT					
After Monitoring		1012	<0.1	<0.1	20.5	-	Instrument / Model Type		Serial Number		Comments	
Atmospheric Pressure Trend:		Falling					GA2000 Gas Analyser		GA12820			
Ground Conditions:		Dry to Damp					Standard Dipmeter		79301			
Weather Conditions:		Patchy cloud to showers with gusty winds										

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			
BH1	11:25	<0.1	8.69	0.1	2.1	18.7	0.1	1	<1	<1	79.1	-	1	10	Head/LC	0.0001	0.0021
BH2	11:33	<0.1	8.69	<0.1	4.6	15.9	<0.1	<1	<1	<1	79.4	-	1	12.92	Head/LC	0.0001	0.0046
BH3	11:41	<0.1	8.69	<0.1	<0.1	20.6	<0.1	<1	1	<1	79.4	-	1	10.26	Head/LC	0.0001	0.0001
BH4	11:51	<0.1	8.69	<0.1	<0.1	20.7	<0.1	<1	<1	<1	79.3	-	1	13.43	Head/LC	0.0001	0.0001

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
BH1	1.06	10	-	-	-	-	-	-	-	-	-	
BH2	1.12	12.92	-	-	-	-	-	-	-	-	-	
BH3	0.98	10.26	-	-	-	-	-	-	-	-	-	
BH4	1.36	13.43	-	-	-	-	-	-	-	-	-	

Well volume (l) = $(3.14 \times (\text{hole diameter (m)}/2)^2 \times (\text{base dip (m)} - \text{standing water level (m)})) \times 1000$ (2l/m in 50mm well)

Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - millibars; l/hr - litres per hour; vv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

Appendix 7 – Geotechnical Test Certificates



Summary of Classification Test Results

Job No. 19131	Project Name Blendworth Crescent	Programme	
		Samples received	26/06/2015
Project No. -	Client Ridge and Partners	Schedule received	01/07/2015
		Project started	02/07/2015
		Testing Started	24/07/2015

Hole No.	Sample				Soil Description	NMC %	Passing 425µm %	LL %	PL %	PI %	Remarks
	Ref	Top	Base	Type							
BH1	4	1.20		U	Medium strength brown gravelly CLAY and black flecks (gravel is fmc and sub-angular to sub-rounded)	16	41	45	20	25	
BH1	7	3.00		U	High strength brown and blue grey mottled gravelly CLAY	31	100	82	28	54	
BH1	14	7.50		D	Grey slightly silty CLAY	30	100	66	24	42	
BH2	4	2.20		D	Brown and occasional blue grey slightly gravelly CLAY (gravel is fmc and sub-angular)	36	70	78	27	51	
BH2	9	5.00		U	Medium strength slightly fissured brown slightly mottled blue grey CLAY	33	100	81	29	52	
BH3	5	2.00		U	Medium strength slightly fissured brown slightly blue grey mottled CLAY	32	100	75	30	45	
BH3	17	9.50		U	High strength slightly fissured dark grey CLAY	27	100	67	25	42	
BH4	4	2.00		U	Medium strength slightly fissured brown and blue grey CLAY	30	99	70	40	30	
BH4	11	6.50		U	High strength slightly fissured dark grey CLAY	29	100	80	29	51	
BH5	3	1.20		D	Greyish brown slightly gravelly CLAY (gravel is fm and sub-rounded to sub-angular)	33	99	76	29	47	
WS2	3	2.50		U	High strength slightly fissured brown and blue grey mottled CLAY with occasional selenite crystals	29	100	75	30	45	

	Test Methods: BS1377: Part 2: 1990: Natural Moisture Content : clause 3.2 Atterberg Limits: clause 4.3 and 5.0	Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Tel: 01923 711 288 Email: James@k4soils.com	Checked and Approved Initials kp Date: 27/07/2015
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)		MSF-5-R1(a) -Rev. 0



Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results

Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No.	Project Name	Programme	
19131	Blendworth Crescent	Samples received	26/06/2015
		Schedule received	01/07/2015
Project No.	Client	Project started	02/07/2015
-	Ridge and Partners	Testing Started	15/07/2015

[illegible]

Test Report by K4 SOILS LABORATORY

Unit 8 Olds Close Olds Approach

Watford Herts WD18 9RU

Tel: 01923 711 288

Email: James@k4soils.com

Checked and
Approved

Initials K.P

Date: 27/07/2015

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Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R29 (Rev. 0)



Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

Job Ref	19131
Borehole/Pit No.	BH1
Sample No.	4
Depth	1.20 m
Sample Type	U
Samples received	26/06/2015
Schedules received	26/06/2015
Date of test	21/07/2015

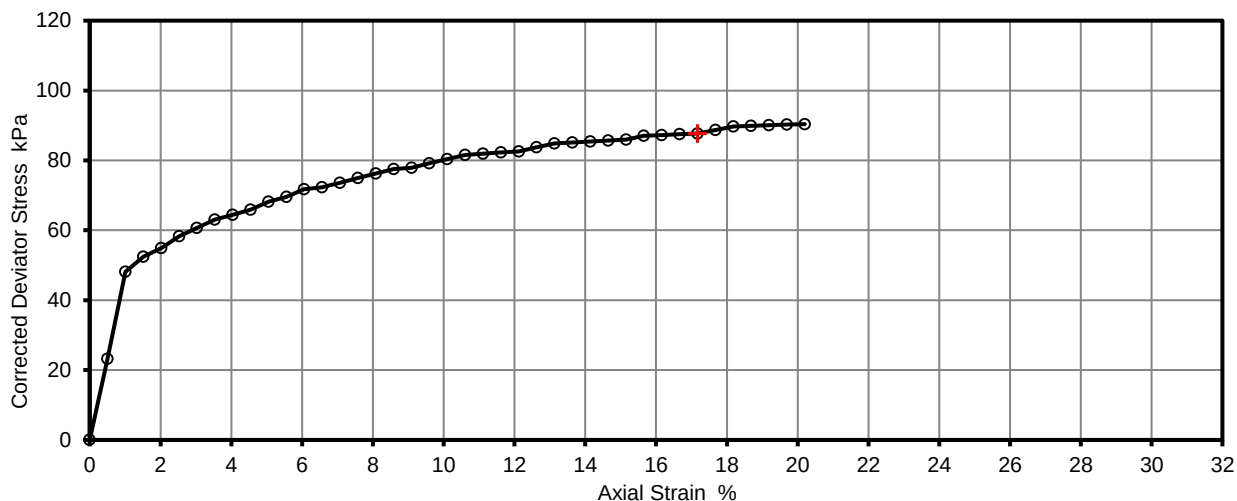
Site Name	Blendworth Crescent		
Project No.	-	Client	Ridge and Partners
Soil Description	Medium strength brown gravelly CLAY and black flecks (gravel is fmc and sub-angular to sub-rounded)		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Remarks

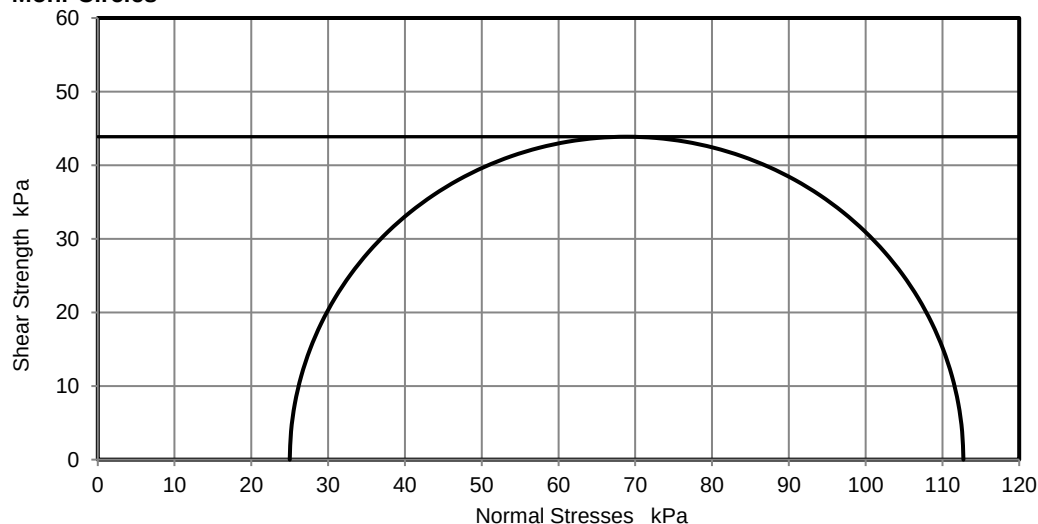
Position within sample

Test Number	1
Length	198.0 mm
Diameter	102.0 mm
Bulk Density	2.10 Mg/m3
Moisture Content	17 %
Dry Density	1.78 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	25 kPa
Axial Strain	17.2 %
Deviator Stress, ($\sigma_1 - \sigma_3$) f	88 kPa
Undrained Shear Strength, cu	44 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.



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Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Checked and Approved

Initials: kp

Date 27/07/2015

MSF-5 R7 (Rev.0)



Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

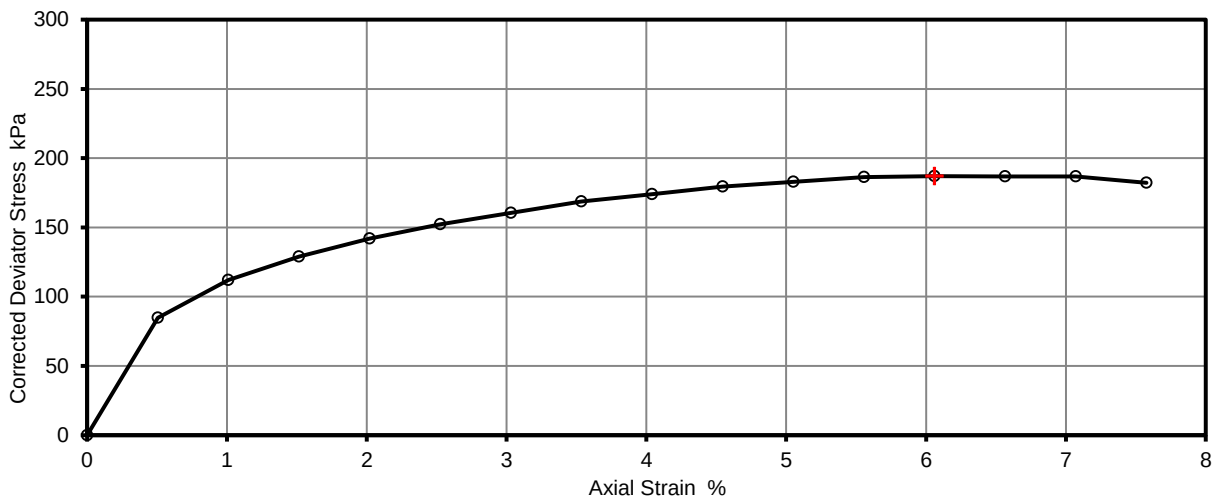
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	19131	
				Borehole/Pit No.	BH1	
Site Name	Blendworth Crescent			Sample No.	7	
Project No.	-	Client	Ridge and Partners	Depth	3.00	m
Soil Description	High strength brown and blue grey mottled gravelly CLAY			Sample Type	U	
				Samples received	26/06/2015	
				Schedules received	26/06/2015	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2015	

Remarks

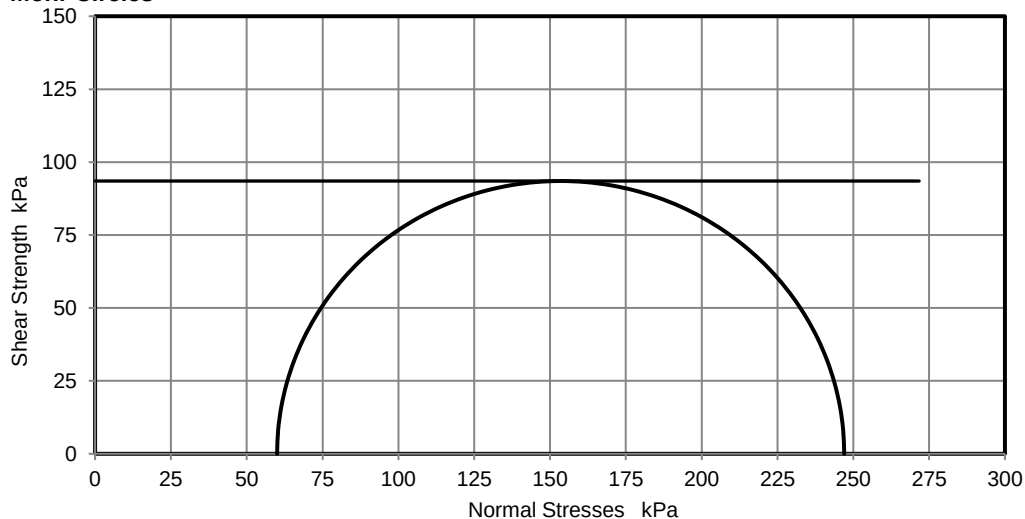
Position within sample

Test Number	1
Length	198.0 mm
Diameter	102.0 mm
Bulk Density	1.95 Mg/m3
Moisture Content	26 %
Dry Density	1.55 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	60 kPa
Axial Strain	6.1 %
Deviator Stress, ($\sigma_1 - \sigma_3$)f	187 kPa
Undrained Shear Strength, cu	94 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Brittle

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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2519

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Checked and Approved

Initials: kp

Date 27/07/2015

MSF-5 R7 (Rev.0)



Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

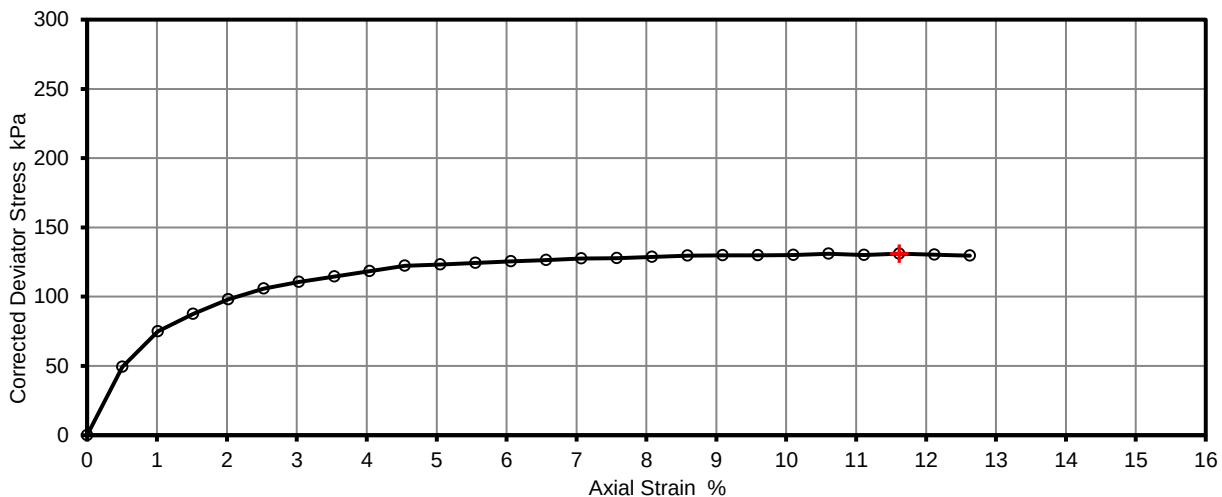
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	19131	
				Borehole/Pit No.	BH2	
Site Name	Blendworth Crescent			Sample No.	9	
Project No.	-	Client	Ridge and Partners	Depth	5.00	m
Soil Description	Medium strength slightly fissured brown slightly mottled blue grey CLAY			Sample Type	U	
				Samples received	26/06/2015	
				Schedules received	26/06/2015	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2015	

Remarks

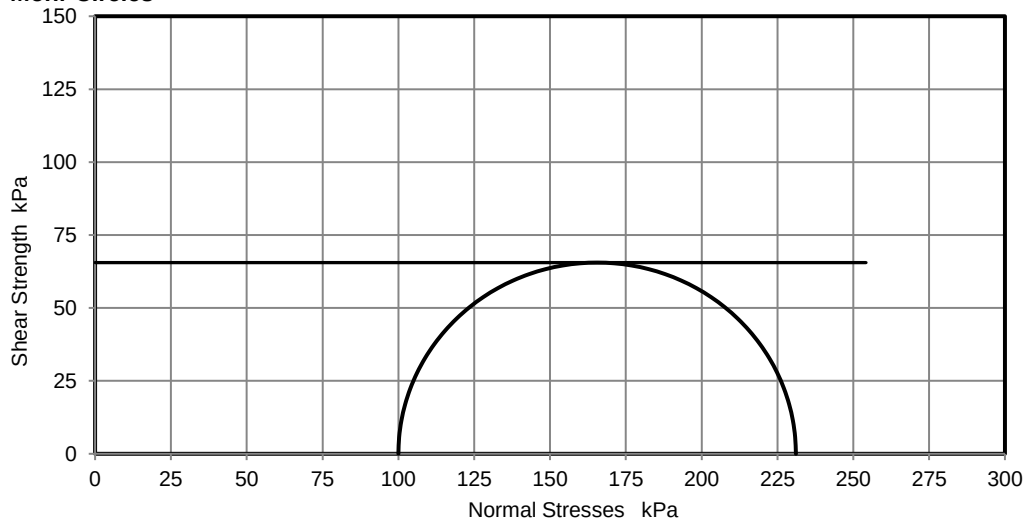
Position within sample

Test Number	1
Length	198.0 mm
Diameter	102.0 mm
Bulk Density	1.95 Mg/m3
Moisture Content	31 %
Dry Density	1.48 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	100 kPa
Axial Strain	11.6 %
Deviator Stress, ($\sigma_1 - \sigma_3$)f	131 kPa
Undrained Shear Strength, cu	66 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Compound

Deviator Stress v Axial Strain



Mohr Circles



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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

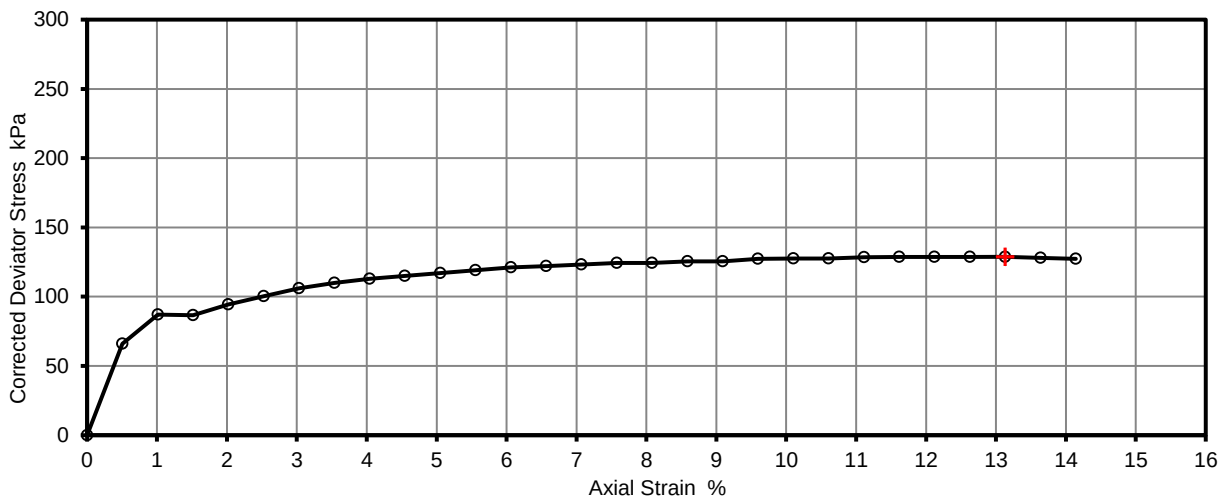
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	19131	
				Borehole/Pit No.	BH3	
Site Name	Blendworth Crescent			Sample No.	5	
Project No.	-	Client	Ridge and Partners	Depth	2.00	m
Soil Description	Medium strength slightly fissured brown slightly blue grey mottled CLAY			Sample Type	U	
				Samples received	08/07/2015	
				Schedules received	08/07/2015	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2015	

Remarks

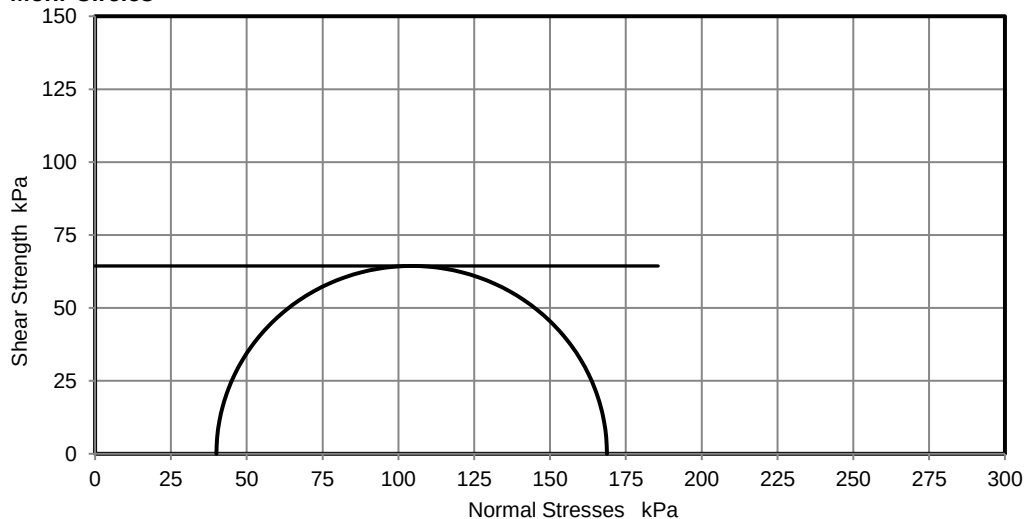
Position within sample

Test Number	1
Length	198.0 mm
Diameter	102.0 mm
Bulk Density	2.13 Mg/m3
Moisture Content	31 %
Dry Density	1.62 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	40 kPa
Axial Strain	13.1 %
Deviator Stress, ($\sigma_1 - \sigma_3$)f	129 kPa
Undrained Shear Strength, cu	64 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Compound

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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MSF-5 R7 (Rev.0)



Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

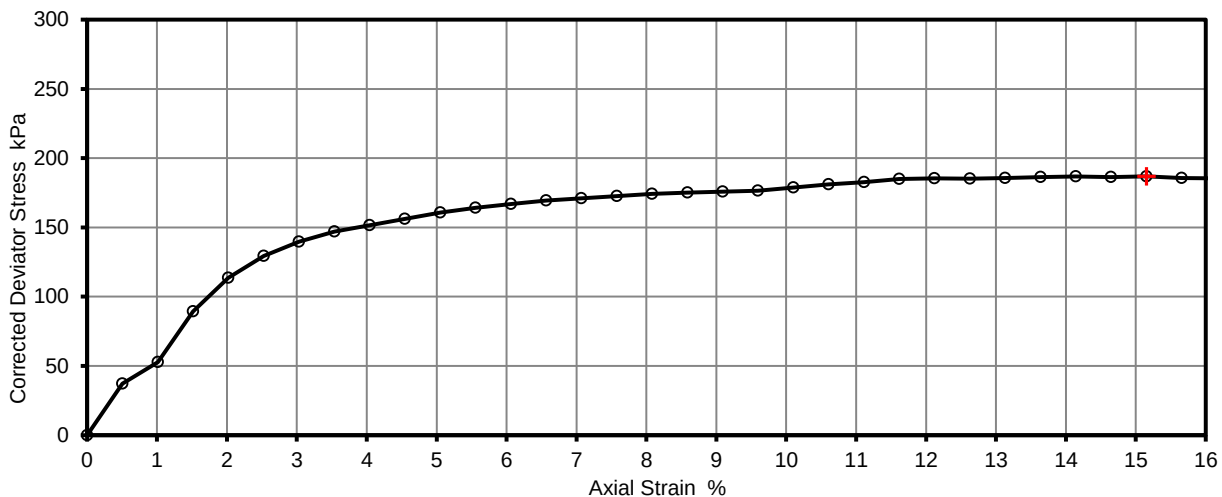
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	19131	
				Borehole/Pit No.	BH3	
Site Name	Blendworth Crescent			Sample No.	17	
Project No.	-	Client	Ridge and Partners	Depth	9.50	m
Soil Description	High strength slightly fissured dark grey CLAY			Sample Type	U	
				Samples received	26/06/2015	
				Schedules received	26/06/2015	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2015	

Remarks

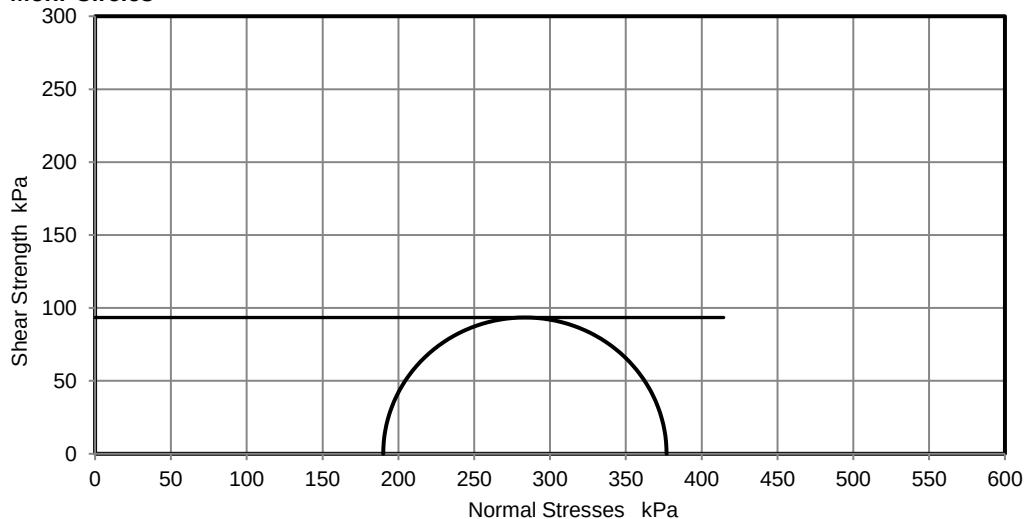
Position within sample

Test Number	1
Length	198.0 mm
Diameter	102.0 mm
Bulk Density	2.05 Mg/m3
Moisture Content	27 %
Dry Density	1.62 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	190 kPa
Axial Strain	15.2 %
Deviator Stress, ($\sigma_1 - \sigma_3$)f	187 kPa
Undrained Shear Strength, cu	93 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

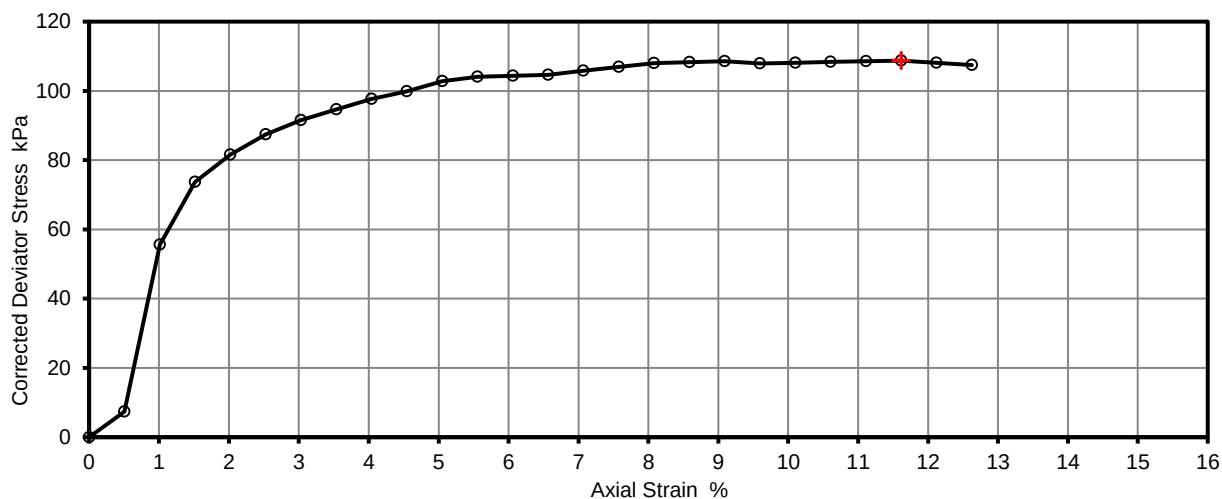
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	19131	
				Borehole/Pit No.	BH4	
Site Name	Blendworth Crescent			Sample No.	4	
Project No.	-	Client	Ridge and Partners	Depth	2.00	m
Soil Description	Medium strength slightly fissured brown and blue grey CLAY			Sample Type	U	
				Samples received	26/06/2015	
				Schedules received	26/06/2015	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2015	

Remarks

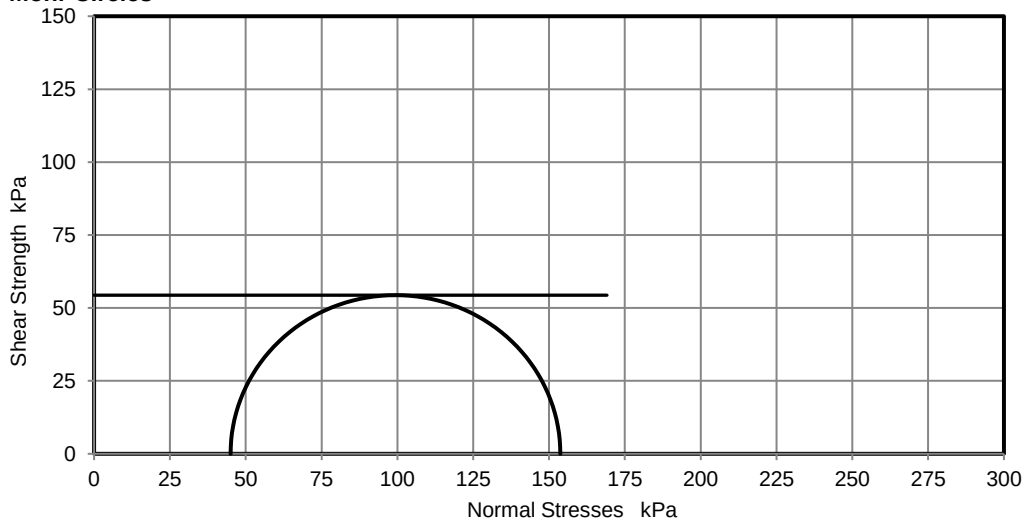
Position within sample

Test Number	1
Length	198.0 mm
Diameter	102.0 mm
Bulk Density	1.98 Mg/m3
Moisture Content	29 %
Dry Density	1.53 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	45 kPa
Axial Strain	11.6 %
Deviator Stress, ($\sigma_1 - \sigma_3$)f	109 kPa
Undrained Shear Strength, cu	54 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Compound

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

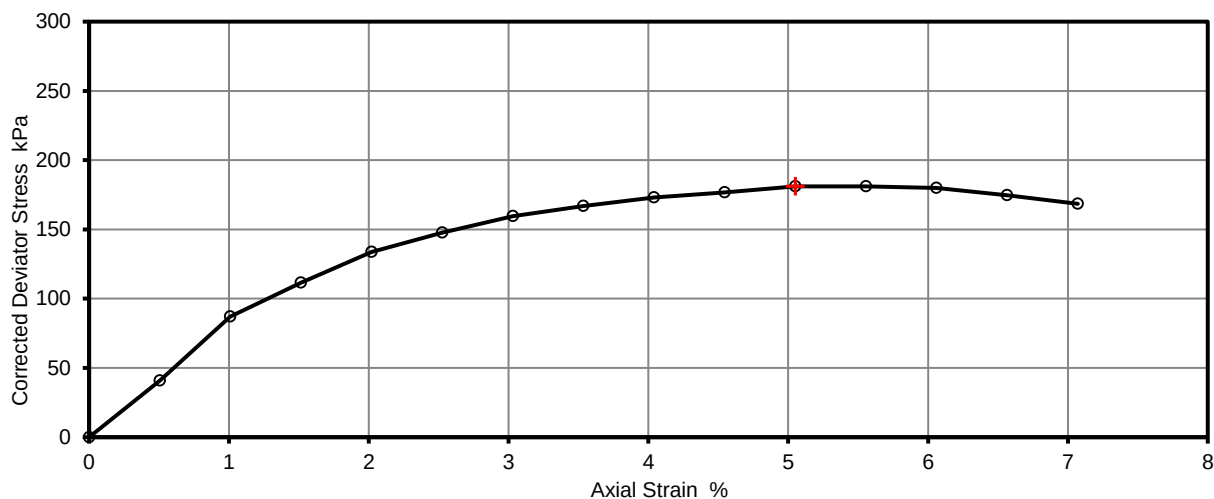
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	19131	
				Borehole/Pit No.	BH4	
Site Name	Blendworth Crescent			Sample No.	11	
Project No.	-	Client	Ridge and Partners	Depth	6.50	m
Soil Description	High strength slightly fissured dark grey CLAY			Sample Type	U	
				Samples received	26/06/2015	
				Schedules received	26/06/2015	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2015	

Remarks

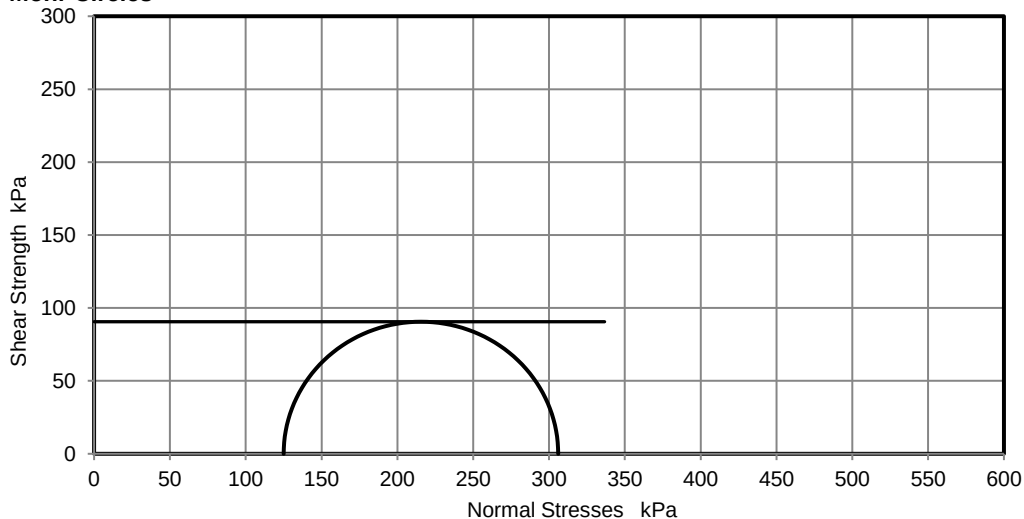
Position within sample

Test Number	1
Length	198.0 mm
Diameter	102.0 mm
Bulk Density	2.02 Mg/m3
Moisture Content	29 %
Dry Density	1.57 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	125 kPa
Axial Strain	5.1 %
Deviator Stress, ($\sigma_1 - \sigma_3$)f	181 kPa
Undrained Shear Strength, cu	91 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Brittle

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

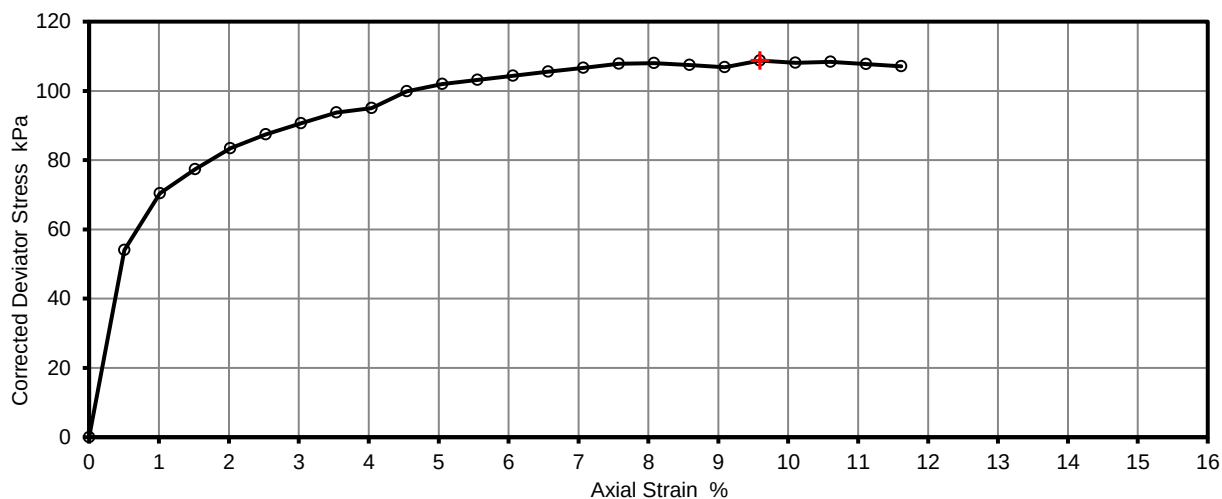
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	19131	
				Borehole/Pit No.	BH5	
Site Name	Blendworth Crescent			Sample No.	5	
Project No.	-	Client	Ridge and Partners	Depth	2.50	m
Soil Description	Medium strength slightly fissured brown and blue grey CLAY			Sample Type	U	
				Samples received	26/06/2015	
				Schedules received	26/06/2015	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2015	

Remarks

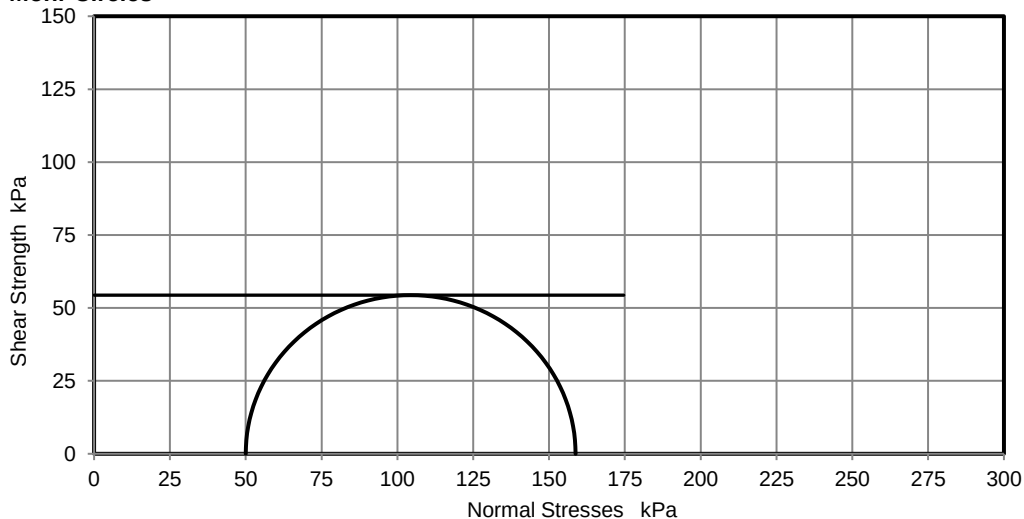
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	1.95	Mg/m3
Moisture Content	33	%
Dry Density	1.47	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	50	kPa
Axial Strain	9.6	%
Deviator Stress, ($\sigma_1 - \sigma_3$)f	109	kPa
Undrained Shear Strength, cu	54	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Compound	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

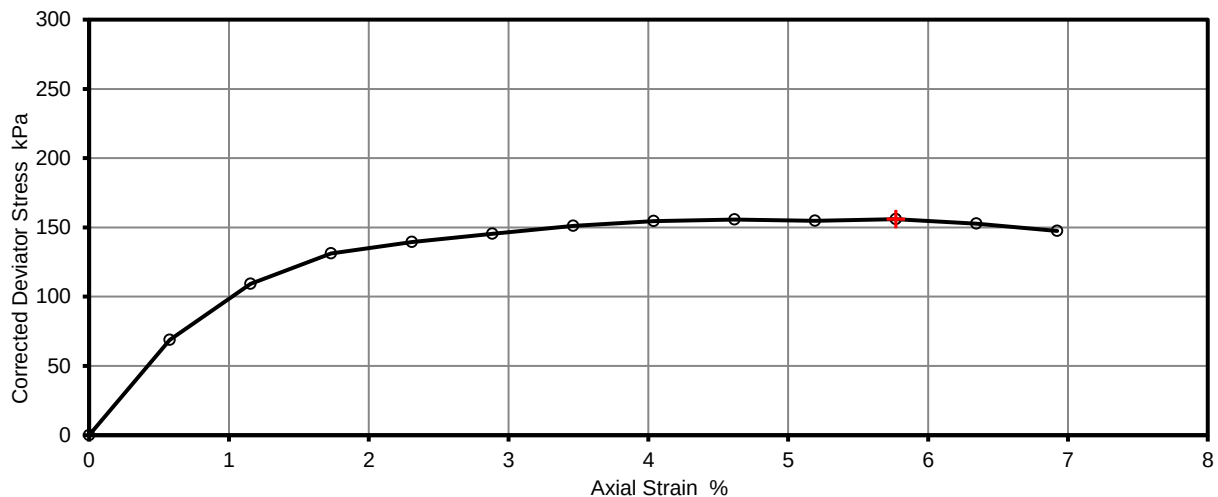
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	19131	
				Borehole/Pit No.	WS2	
Site Name	Blendworth Crescent			Sample No.	3	
Project No.	-	Client	Ridge and Partners	Depth	2.50	m
Soil Description	High strength slightly fissured brown and blue grey mottled CLAY with occasional selenite crystals			Sample Type	U	
				Samples received	26/06/2015	
				Schedules received	26/06/2015	
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2015	

Remarks

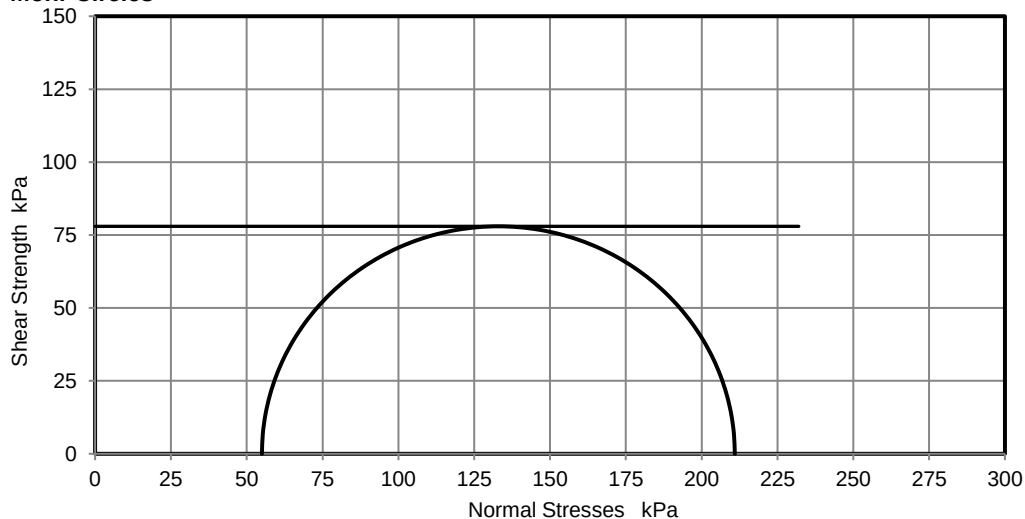
Position within sample

Test Number	1	
Length	130.0	mm
Diameter	65.0	mm
Bulk Density	1.59	Mg/m3
Moisture Content	29	%
Dry Density	1.24	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	55	kPa
Axial Strain	5.8	%
Deviator Stress, ($\sigma_1 - \sigma_3$)f	156	kPa
Undrained Shear Strength, cu	78	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure Summary of Results

Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test type.

Job No.	Project Name	Programme	
		Samples received	26/06/2015
19131	Blendworth Crescent	Schedule received	01/07/2015
Project No.	Client	Project started	02/07/2015
		-	Ridge and Partners

Hole No.	Sample				Soil Description	Test Type	Density		w %	Length mm	Diameter mm	σ_3 kPa	At failure				Remarks
	Ref	Top	Base	Type			bulk Mg/m ³	dry					Axial strain %	$\sigma_1 - \sigma_3$ kPa	C_u kPa	Mode	
BH1	4	1.20		U	Medium strength brown gravelly CLAY and black flecks (gravel is fmc and sub-angular to sub-rounded)	UU	2.10	1.78	17.5	198.0	102.0	25	17.2	88	44	P	
BH1	7	3.00		U	High strength brown and blue grey mottled gravelly CLAY	UU	1.95	1.55	25.6	198.0	102.0	60	6.1	187	94	B	
BH2	9	5.00		U	Medium strength slightly fissured brown slightly mottled blue grey CLAY	UU	1.95	1.48	31.2	198.0	102.0	100	11.6	131	66	C	
BH3	5	2.00		U	Medium strength slightly fissured brown slightly blue grey mottled CLAY	UU	2.13	1.62	31.5	198.0	102.0	40	13.1	129	64	C	
BH3	17	9.50		U	High strength slightly fissured dark grey CLAY	UU	2.05	1.62	26.8	198.0	102.0	190	15.2	187	93	P	
BH4	4	2.00		U	Medium strength slightly fissured brown and blue grey CLAY	UUR	1.98	1.53	29.4	198.0	102.0	45	11.6	109	54	C	
BH4	11	6.50		U	High strength slightly fissured dark grey CLAY		2.02	1.57	28.7	198.0	102.0	125	5.1	181	91	B	
BH5	5	2.50		U	Medium strength slightly fissured brown and blue grey CLAY	UU	1.95	1.47	32.5	198.0	102.0	50	9.6	109	54	C	
WS2	3	2.50		U	High strength slightly fissured brown and blue grey mottled CLAY with occasional selenite crystals	UU	1.59	1.24	28.7	130.0	65.0	55	5.8	156	78	B	

Legend	UU - single stage test (single and multiple specimens)	σ_3 Cell pressure	Mode of failure ;	B - Brittle
	UUM - Multistage test on a single specimen	$\sigma_1 - \sigma_3$ Maximum corrected deviator stress		P - Plastic
	suffix R - remoulded or recompacted	C_u Undrained shear strength, $\frac{1}{2}(\sigma_1 - \sigma_3)$		C - Compound

Tests performed at a nominal rate of strain of 2%/min unless annotated otherwise. See individual test reports for further details.

 2519	Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Tel: 01923 711 288 Email: james@k4soils.com	Checked and Approved Initials: kp Date: 27/07/2015
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)	MSF-5-R7b (Rev. 0)



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THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 15-02907

Issue: 1

Date of Issue: 20/07/2015

Contact: James Phaure

Customer Details: K4 Soils Laboratory Ltd
Unit 8
Watford
Hertfordshire

Quotation No: Q15-00248

Order No: 19131

Customer Reference: 19131

Date Received: 15/07/2015

Date Approved: 20/07/2015

Details: Blendworth

Approved by: 

Steve Knight, Business Development Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)



Sample Summary

Report No.: 15-02907

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
33785	BH1 1.20 - 1.65	Not Provided	15/07/2015	Silty clayey loam	a
33786	BH3 1.00	Not Provided	15/07/2015	Silty loam	a
33787	BH4 2.00 - 2.45	Not Provided	15/07/2015	Silty clayey loam	a
33788	BH5 2.85	Not Provided	15/07/2015	Silty clayey loam	a

Results Summary

Report No.: 15-02907

ELAB Reference	33785	33786	33787	33788
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	BH3	BH4	BH5
Sample Depth (m)	1.20 - 1.65	1.00	2.00 - 2.45	2.85
Sampling Date				

Determinand	Codes	Units	LOD				
Anions							
Water Soluble Chloride	M	mg/kg	40	< 40	< 40	< 40	63
Water Soluble Nitrate	M	mg/kg	40	< 40	< 40	< 40	< 40
Water Soluble Sulphate	M	g/l	0.02	0.05	0.05	0.04	0.49
Water Soluble Sulphate	M	mg/kg	40	60	72	63	787
Inorganics							
Ammonia as NH ₄	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Sulphur	N	%	0.01	< 0.01	0.05	0.02	0.04
Acid Soluble Sulphate (SO ₄)	U	%SO ₄	0.02	0.02	0.04	0.03	0.19
Miscellaneous							
Moisture Content	N	%	0.1	10.8	29.7	25.7	28.7
pH	M	units	0.1	7.7	7.4	8.0	7.8
Stones Content	N	%	0.1	43.5	28.5	21.7	18.9



Method Summary

Report No.: 15-02907

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	17/07/2015	113	Electromeric
Acid Soluble Sulphate	U	Air dried sample	20/07/2015	115	Ion Chromatography
Total organic carbon/Total sulphur	N	Air dried sample	20/07/2015	115	IR
Water soluble anions	M	Air dried sample	17/07/2015	172	Ion Chromatography

Tests marked N are not UKAS accredited

Report Information

Report No.: 15-02907

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

-
- | | |
|---|--|
| a | No date of sampling supplied |
| b | No time of sampling supplied (Waters Only) |
| c | Sample not received in appropriate containers |
| d | Sample not received in cooled condition |
| e | The container has been incorrectly filled |
| f | Sample age exceeds stability time (sampling to receipt) |
| g | Sample age exceeds stability time (sampling to analysis) |

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage

Appendix 8 – Geotechnical Calculations

Project	Blendworth Crescent				
	Shallow Foundation				
	Determination of Bearing Resistance	Calcs by	DF	Checked by	RP
	<u>Design Approach 1</u>			Ground Model 1 Strip Foundation	
	Combination 1 A1 + M1 + R1				
	<u>Material Properties and Resistance</u>				
	Partial factors set M1: $\gamma_{cu} = 1$ $\gamma_{\phi} = 1$ and $\gamma_c = 1$				
	$c_{ud} = \frac{c_{uk}}{\gamma_{cu}} = 45\text{kN/m}^2$				
	Design shearing resistance is $\phi_d = \tan^{-1}\left(\frac{\tan \phi_K}{\gamma_{\phi}}\right) = 22^{\circ}$				
	Design cohesion is $c'_d = \frac{c_k}{\gamma_c} = 0\text{kN/m}^2$				
	<u>Drained Bearing Capacity Factors</u>				
	For overburden $N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan\left(45 + \frac{\phi_d}{2}\right) \right)^2 \right] = 7.83$				
	For cohesion $N_c = [(N_q - 1) \times \cot(\phi_d)] = 16.9$				
	For self-weight $N_{\gamma} = [2(N_q - 1) \times \tan(\phi_d)] = 5.52$				
	<u>Depth and Shape Factors</u>				
	Solgado's depth factor for undrained loading: $d_c = 1 + 0.27\sqrt{\frac{d}{B}} = 1.31$				
	Ignore depth factors for drained loading				
	Solgado's shape factor for undrained loading: $s_c = 1 + 0.17\sqrt{\frac{d}{B}} = 1.19$				
	Shape factors are all 1.0 for drained loading and so can be ignored				
	<u>Undrained Bearing Resitance</u>				
	Total overburden at foundation base is $\sigma_{vk,b} = \gamma_k \times d = 19\text{kN/m}^2$				
	Partial factors set R1: $\gamma_{Rv} = 1$				
	Ultimate resistance is $q_{ult} = (\pi + 2) \times c_{ud} \times d_c \times s_c + \sigma_{vk,b} = 380\text{kN/m}^2$				
Design Resistance is $q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 380\text{kN/m}^2$					

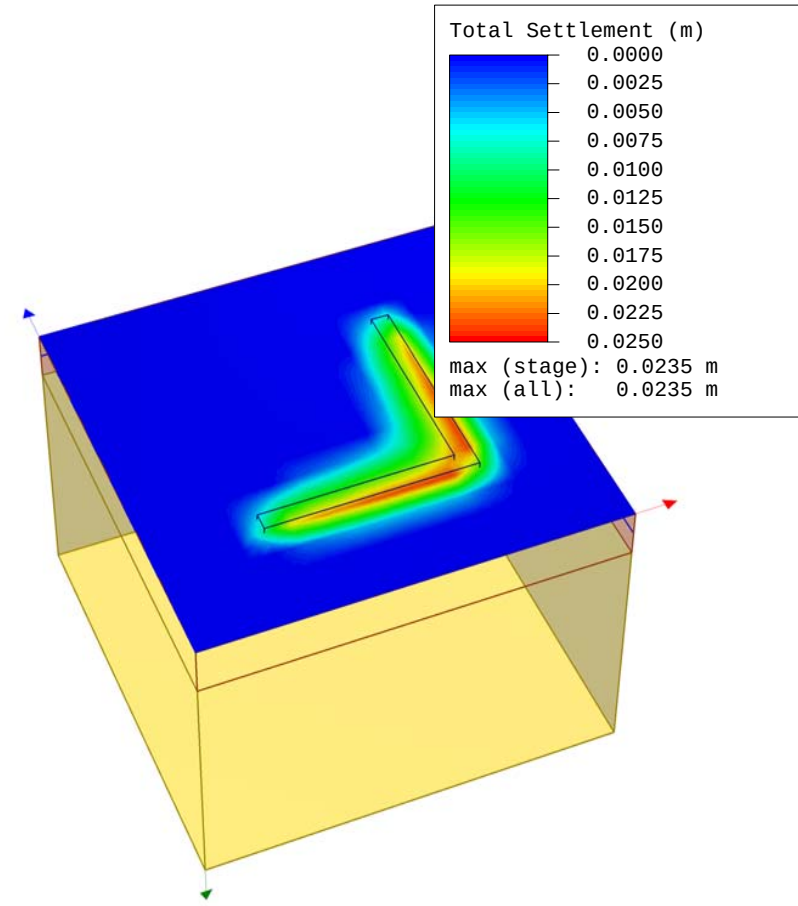
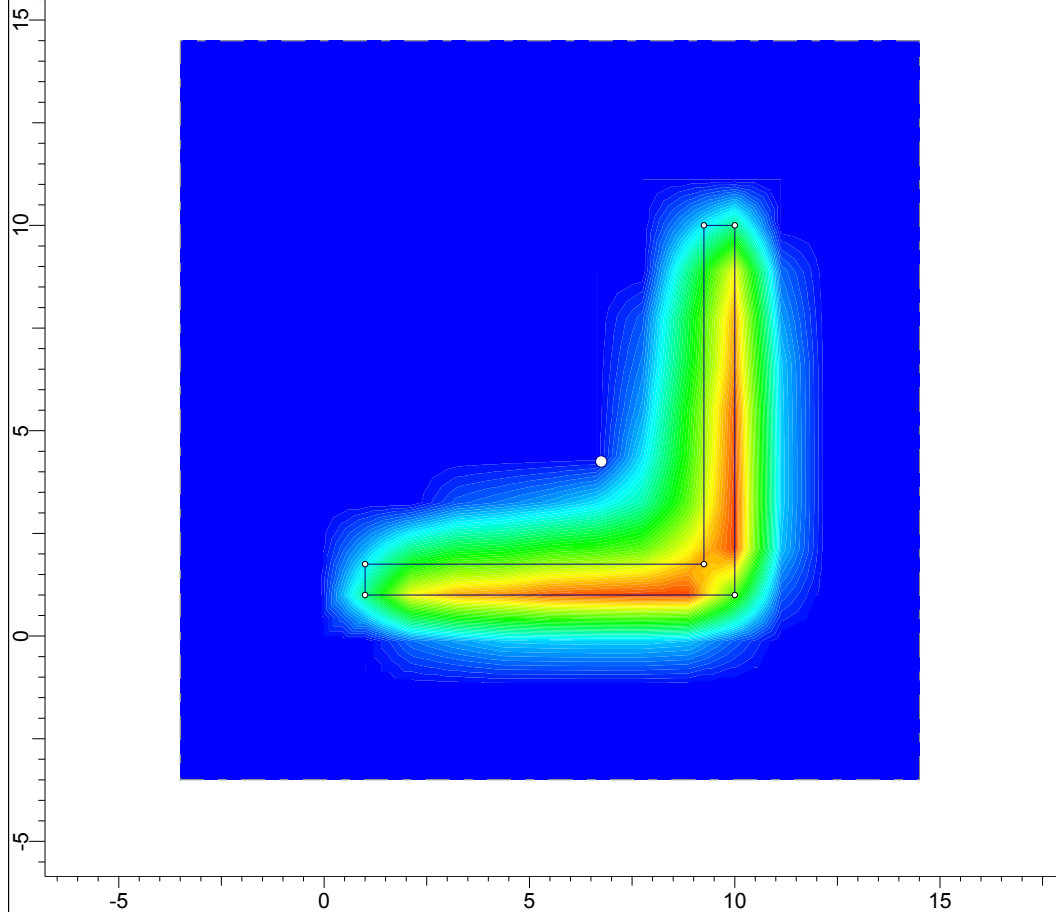
Project	Blendworth Crescent			
	Shallow Foundation			
	Determination of Bearing Resistance	Calcs by	DF	Checked by
	<u>Drained Bearing Resistance</u> Strip Foundation Effective overburden at foundation base is $\sigma'_{vk,b} = \sigma_{vk,b} - u_{k,b} = 19\text{kN/m}^2$ From overburden $q'_{ult_1} = N_q \times \sigma'_{wk,b} = 149\text{kN/m}^2$ From cohesion $q'_{ult_2} = N_C \times c'_d = 0\text{kN/m}^2$ From self-weight $q'_{ult_3} = \left[N_\gamma \times (\gamma_k - \gamma_w) \times \frac{B}{2} \right] = 39\text{kN/m}^2$ Total resistance is $q'_{ult} = \sum_{i=1}^3 q'_{ult_i} = 188\text{kN/m}^2$ Design resistance is $q'_{Rd} = \frac{q'_{ult}}{\gamma_{Rv}} = 188\text{kN/m}^2$ <u>Design Approach 1</u> Combination 2 A2 + M2 + R1 <u>Material Properties and Resistance</u> Partial factors set M2: $\gamma_{cu} = 1.4$ $\gamma_\phi = 1.25$ and $\gamma_c = 1.25$ Design undrained strength is $c_{ud} = \frac{c_{uk}}{\gamma_{cu}} = 32\text{kN/m}^2$ Design shearing resistance is $\phi_d = \tan^{-1} \left(\frac{\tan \phi_K}{\gamma_\phi} \right) = 18^\circ$ Design cohesion is $c'_d = \frac{c_k}{\gamma_c} = 0\text{kN/m}^2$ <u>Drained Bearing Capacity Factors</u> For overburden $N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] = 5.25$ For cohesion $N_c = [(N_q - 1) \times \cot(\phi_d)] = 13.1$ For self-weight $N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] = 2.76$			

Project	Blendworth Crescent																		
	Shallow Foundation																		
	Determination of Bearing Resistance	Calcs by	DF	Checked by															
	<u>Depth and Shape Factors</u> Strip Foundation																		
	Solgado's depth factor for undrained loading: $d_c = 1 + 0.27 \sqrt{\frac{d}{B}} = 1.31$																		
	Ignore depth factors for drained loading																		
	Solgado's shape factor for undrained loading: $s_c = 1 + 0.17 \sqrt{\frac{d}{B}} = 1.19$																		
	Shape factors are all 1.0 for drained loading and so can be ignored																		
	<u>Undrained Bearing Resitance</u>																		
	Total overburden at foundation base is $\sigma_{vk,b} = \gamma_k \times d = 19\text{kN/m}^2$																		
	Partial factors set R1: $\gamma_{Rv} = 1$																		
	Ultimate resistance is $q_{ult} = (\pi + 2) \times c_{ud} \times d_c \times s_c + \sigma_{vk,b} = 275\text{kN/m}^2$																		
	Design Resistance is $q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 275\text{kN/m}^2$																		
	<u>Drained Bearing Resistance</u>																		
	Effective overburden at foundation base is $\sigma'_{vk,b} = \sigma_{vk,b} - u_{k,b} = 19\text{kN/m}^2$																		
	From overburden $q'_{ult_1} = N_q \times \sigma'_{wk,b} = 100\text{kN/m}^2$																		
	From cohesion $q'_{ult_2} = N_C \times c'_d = 0\text{kN/m}^2$																		
	From self-weight $q'_{ult_3} = \left[N_\gamma \times (\gamma_k - \gamma_w) \times \frac{B}{2} \right] = 20\text{kN/m}^2$																		
	Total resistance is $q'_{ult} = \sum_{i=1}^3 q'_{ult_i} = 120\text{kN/m}^2$																		
	Design Resistance is $q'_{Rd} = \frac{q'_{ult}}{\gamma_{Rv}} = 120\text{kN/m}^2$																		
	<table><tr><td rowspan="3">Design Approach</td><td rowspan="3">Combination</td><td colspan="2">Design Resistance</td></tr><tr><td colspan="2">ULS (kN/m²)</td></tr><tr><td>undrained</td><td>drained</td></tr><tr><td rowspan="2">DA1</td><td>Combination 1</td><td>380</td><td>188</td></tr><tr><td>Combination 2</td><td>275</td><td>120</td></tr></table>				Design Approach	Combination	Design Resistance		ULS (kN/m ²)		undrained	drained	DA1	Combination 1	380	188	Combination 2	275	120
	Design Approach	Combination	Design Resistance																
			ULS (kN/m ²)																
			undrained	drained															
	DA1	Combination 1	380	188															
Combination 2		275	120																

Stage 1

Data Type: Total Settlement

Foundation Load = 120kPa
Head Deposit / London Clay Formation



Total Settlement (m)

0.0000
0.0025
0.0050
0.0075
0.0100
0.0125
0.0150
0.0175
0.0200
0.0225
0.0250

max (stage): 0.0235 m
max (all): 0.0235 m



SETTLE3D 2.019

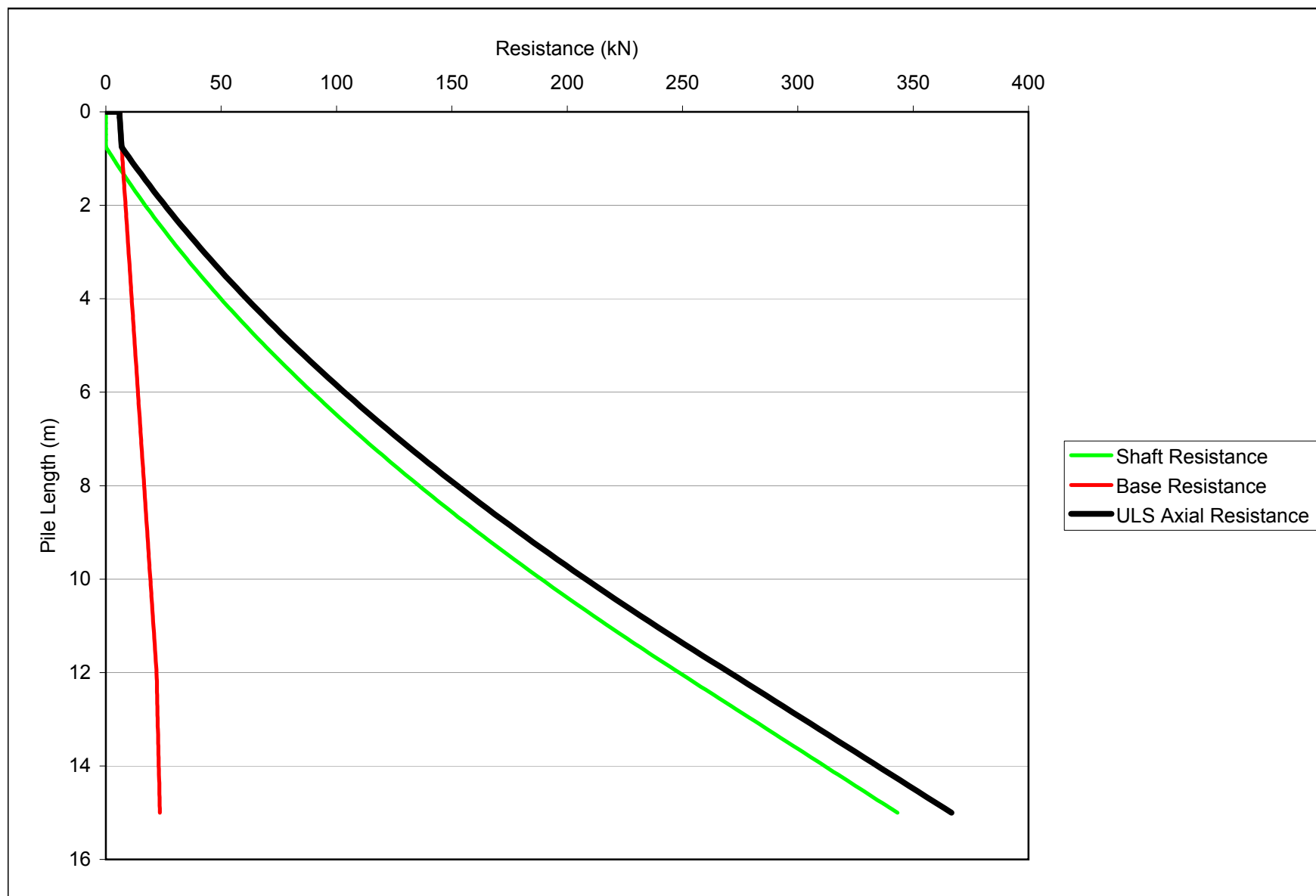
Project	Blendworth Crescent		
Analysis Description	Strip Foundation		
Drawn By	Dr David Fall	Company	Ridge
Date	26/08/2015	File Name	Strip Foundation Settlement.s3z

General	Actions		Material Properties			Calculation model		Effects of	Resistance			
	Design values		Design values					Design	Design values			
Depth (m)	F,d (kN)	W,d (kN)	phi,d (°)	c,d (kPa)	cu,d (kPa)	Skin friction (kPa)	Bearing pressure (kPa)	E,d (kN)	Rst,d (kN)	Rs,d (kN)	Rb,d (kN)	Rt,d (kN)
0	100	0	-	-	-	0	0	100	0	0	0	0
0	100	0	-	-	45	0	231.371669	100	0	0	5.84096414	5.84096414
0.12121212	100	0.21417509	-	-	45.8080808	0	237.829522	100.214175	0	0	6.00399224	6.00399224
0.24242424	100	0.42835018	-	-	46.6161616	0	244.287375	100.42835	0	0	6.16702035	6.16702035
0.36363636	100	0.64252526	-	-	47.4242424	0	250.745227	100.642525	0	0	6.33004846	6.33004846
0.48484848	100	0.85670035	-	-	48.2323232	0	257.20308	100.8567	0	0	6.49307657	6.49307657
0.60606061	100	1.07087544	-	-	49.040404	0	263.660933	101.070875	0	0	6.65610468	6.65610468
0.72727273	100	1.28505053	-	-	49.8484848	0	270.118785	101.285051	0	0	6.81913279	6.81913279
0.75	100	1.32520835	-	-	50	0	271.329633	101.325208	0	0	6.84970056	6.84970056
0.751	100	1.3269753	-	-	50.0066667	30.004	271.38291	101.326975	-0.00504966	0.00631208	6.85104554	6.85735762
0.84848485	100	1.49922561	-	-	50.6565657	30.3939394	276.576638	101.499226	-0.99597822	1.24497277	6.9821609	8.22713367
0.96969697	100	1.7134007	-	-	51.4646465	30.8787879	283.034491	101.713401	-2.24593893	2.80742366	7.14518901	9.95261267
1	100	1.76694447	-	-	51.6666667	31	284.648954	101.766944	-2.56152001	3.20190001	7.18594603	10.387846
1.09090909	100	1.92757579	-	-	52.2727273	31.3636364	289.492343	101.927576	-3.51568142	4.39460177	7.30821712	11.7028189
1.21212121	100	2.14175088	-	-	53.0808081	31.8484848	295.950196	102.141751	-4.80520567	6.00650709	7.47124522	13.4777523
1.33333333	100	2.35592596	-	-	53.8888889	32.3333333	302.408049	102.355926	-6.1145117	7.64313963	7.63427333	15.277413
1.45454545	100	2.57010105	-	-	54.6969697	32.8181818	308.865901	102.570101	-7.4435995	9.30449938	7.79730144	17.1018008
1.57575758	100	2.78427614	-	-	55.5050505	33.3030303	315.323754	102.784276	-8.79246908	10.9905863	7.96032955	18.9509159
1.6969697	100	2.99845123	-	-	56.3131313	33.7878788	321.781607	102.998451	-10.1611204	12.7014005	8.12335766	20.8247582
1.81818182	100	3.21262631	-	-	57.1212121	34.2727273	328.239459	103.212626	-11.5495535	14.4369419	8.28638577	22.7233277
1.93939394	100	3.4268014	-	-	57.9292929	34.7575758	334.697312	103.426801	-12.9577684	16.1972105	8.44941388	24.6466244
2.06060606	100	3.64097649	-	-	58.7373737	35.2424242	341.155164	103.640976	-14.3857651	17.9822064	8.61244199	26.5946483
2.18181818	100	3.85515158	-	-	59.5454545	35.7272727	347.613017	103.855152	-15.8335435	19.7919294	8.7754701	28.5673995
2.3030303	100	4.06932667	-	-	60.3535354	36.2121212	354.07087	104.069327	-17.3011037	21.6263797	8.9384982	30.5648779
2.42424242	100	4.28350175	-	-	61.1616162	36.6969697	360.528722	104.283502	-18.7884457	23.4855571	9.10152631	32.5870834
2.54545455	100	4.49767684	-	-	61.969697	37.1818182	366.986575	104.497677	-20.2955694	25.3694618	9.26455442	34.6340162
2.66666667	100	4.71185193	-	-	62.7777778	37.6666667	373.444428	104.711852	-21.822475	27.2780937	9.42758253	36.7056762
2.78787879	100	4.92602702	-	-	63.5858586	38.1515152	379.90228	104.926027	-23.3691623	29.2114528	9.59061064	38.8020635
2.90909091	100	5.1402021	-	-	64.3939394	38.6363636	386.360133	105.140202	-24.9356313	31.1695392	9.75363875	40.9231779

3.03030303	100	5.35437719	-	-	65.2020202	39.1212121	392.817986	105.354377	-26.5218822	33.1523527	9.91666686	43.0690196
3.15151515	100	5.56855228	-	-	66.010101	39.6060606	399.275838	105.568552	-28.1279148	35.1598935	10.079695	45.2395884
3.27272727	100	5.78272737	-	-	66.8181818	40.0909091	405.733691	105.782727	-29.7537292	37.1921614	10.2427231	47.4348845
3.39393939	100	5.99690245	-	-	67.6262626	40.5757576	412.191544	105.996902	-31.3993253	39.2491566	10.4057512	49.6549078
3.51515152	100	6.21107754	-	-	68.4343434	41.0606061	418.649396	106.211078	-33.0647032	41.330879	10.5687793	51.8996583
3.63636364	100	6.42525263	-	-	69.2424242	41.5454545	425.107249	106.425253	-34.7498629	43.4373287	10.7318074	54.1691361
3.75757576	100	6.63942772	-	-	70.0505051	42.030303	431.565102	106.639428	-36.4548044	45.5685055	10.8948355	56.463341
3.87878788	100	6.8536028	-	-	70.8585859	42.5151515	438.022954	106.853603	-38.1795276	47.7244095	11.0578636	58.7822732
4	100	7.06777789	-	-	71.6666667	43	444.480807	107.067778	-39.9240326	49.9050408	11.2208917	61.1259325
4.12121212	100	7.28195298	-	-	72.4747475	43.4848485	450.938659	107.281953	-41.6883194	52.1103993	11.3839198	63.4943191
4.24242424	100	7.49612807	-	-	73.2828283	43.969697	457.396512	107.496128	-43.472388	54.340485	11.5469479	65.8874329
4.36363636	100	7.71030316	-	-	74.0909091	44.4545455	463.854365	107.710303	-45.2762383	56.5952979	11.7099761	68.3052739
4.48484848	100	7.92447824	-	-	74.8989899	44.9393939	470.312217	107.924478	-47.0998704	58.874838	11.8730042	70.7478422
4.60606061	100	8.13865333	-	-	75.7070707	45.4242424	476.77007	108.138653	-48.9432843	61.1791053	12.0360323	73.2151376
4.72727273	100	8.35282842	-	-	76.5151515	45.9090909	483.227923	108.352828	-50.8064799	63.5080999	12.1990604	75.7071603
4.84848485	100	8.56700351	-	-	77.3232323	46.3939394	489.685775	108.567004	-52.6894573	65.8618217	12.3620885	78.2239102
4.96969697	100	8.78117859	-	-	78.1313131	46.8787879	496.143628	108.781179	-54.5922165	68.2402707	12.5251166	80.7653873
5.09090909	100	8.99535368	-	-	78.9393939	47.3636364	502.601481	108.995354	-56.5147575	70.6434469	12.6881447	83.3315916
5.21212121	100	9.20952877	-	-	79.7474747	47.8484848	509.059333	109.209529	-58.4570802	73.0713503	12.8511728	85.9225231
5.33333333	100	9.42370386	-	-	80.5555556	48.3333333	515.517186	109.423704	-60.4191847	75.5239809	13.0142009	88.5381818
5.45454545	100	9.63787894	-	-	81.3636364	48.8181818	521.975039	109.637879	-62.401071	78.0013387	13.177229	91.1785678
5.57575758	100	9.85205403	-	-	82.1717172	49.3030303	528.432891	109.852054	-64.402739	80.5034238	13.3402571	93.8436809
5.6969697	100	10.0662291	-	-	82.979798	49.7878788	534.890744	110.066229	-66.4241889	83.0302361	13.5032853	96.5335213
5.81818182	100	10.2804042	-	-	83.7878788	50.2727273	541.348597	110.280404	-68.4654204	85.5817756	13.6663134	99.2480889
5.93939394	100	10.4945793	-	-	84.5959596	50.7575758	547.806449	110.494579	-70.5264338	88.1580423	13.8293415	101.987384
6.06060606	100	10.7087544	-	-	85.4040404	51.2424242	554.264302	110.708754	-72.6072289	90.7590362	13.9923696	104.751406
6.18181818	100	10.9229295	-	-	86.2121212	51.7272727	560.722155	110.922929	-74.7078058	93.3847573	14.1553977	107.540155
6.3030303	100	11.1371046	-	-	87.020202	52.2121212	567.180007	111.137105	-76.8281645	96.0352057	14.3184258	110.353631
6.42424242	100	11.3512796	-	-	87.8282828	52.6969697	573.63786	111.35128	-78.968305	98.7103812	14.4814539	113.191835
6.54545455	100	11.5654547	-	-	88.6363636	53.1818182	580.095712	111.565455	-81.1282272	101.410284	14.644482	116.054766
6.66666667	100	11.7796298	-	-	89.4444444	53.6666667	586.553565	111.77963	-83.3079312	104.134914	14.8075101	118.942424
6.78787879	100	11.9938049	-	-	90.2525253	54.1515152	593.011418	111.993805	-85.507417	106.884271	14.9705382	121.854809
6.90909091	100	12.20798	-	-	91.0606061	54.6363636	599.46927	112.20798	-87.7266845	109.658356	15.1335663	124.791922
7.03030303	100	12.4221551	-	-	91.8686869	55.1212121	605.927123	112.422155	-89.9657338	112.457167	15.2965945	127.753762

7.15151515	100	12.6363302	-	-	92.6767677	55.6060606	612.384976	112.63633	-92.2245649	115.280706	15.4596226	130.740329
7.27272727	100	12.8505053	-	-	93.4848485	56.0909091	618.842828	112.850505	-94.5031777	118.128972	15.6226507	133.751623
7.39393939	100	13.0646803	-	-	94.2929293	56.5757576	625.300681	113.06468	-96.8015724	121.001965	15.7856788	136.787644
7.51515152	100	13.2788554	-	-	95.1010101	57.0606061	631.758534	113.278855	-99.1197488	123.899686	15.9487069	139.848393
7.63636364	100	13.4930305	-	-	95.9090909	57.5454545	638.216386	113.493031	-101.457707	126.822134	16.111735	142.933869
7.75757576	100	13.7072056	-	-	96.7171717	58.030303	644.674239	113.707206	-103.815447	129.769309	16.2747631	146.044072
7.87878788	100	13.9213807	-	-	97.5252525	58.5151515	651.132092	113.921381	-106.192969	132.741211	16.4377912	149.179002
8	100	14.1355558	-	-	98.3333333	59	657.589944	114.135556	-108.590272	135.73784	16.6008193	152.338659
8.12121212	100	14.3497309	-	-	99.1414141	59.4848485	664.047797	114.349731	-111.007357	138.759197	16.7638474	155.523044
8.24242424	100	14.563906	-	-	99.9494949	59.969697	670.50565	114.563906	-113.444224	141.80528	16.9268755	158.732156
8.36363636	100	14.778081	-	-	100.757576	60.4545455	676.963502	114.778081	-115.900873	144.876091	17.0899036	161.965995
8.48484848	100	14.9922561	-	-	101.565657	60.9393939	683.421355	114.992256	-118.377304	147.97163	17.2529318	165.224561
8.60606061	100	15.2064312	-	-	102.373737	61.4242424	689.879208	115.206431	-120.873516	151.091895	17.4159599	168.507855
8.72727273	100	15.4206063	-	-	103.181818	61.9090909	696.33706	115.420606	-123.38951	154.236888	17.578988	171.815876
8.84848485	100	15.6347814	-	-	103.989899	62.3939394	702.794913	115.634781	-125.925286	157.406608	17.7420161	175.148624
8.96969697	100	15.8489565	-	-	104.79798	62.8787879	709.252765	115.848956	-128.480844	160.601055	17.9050442	178.506099
9.09090909	100	16.0631316	-	-	105.606061	63.3636364	715.710618	116.063132	-131.056183	163.820229	18.0680723	181.888301
9.21212121	100	16.2773067	-	-	106.414141	63.8484848	722.168471	116.277307	-133.651304	167.06413	18.2311004	185.295231
9.33333333	100	16.4914817	-	-	107.222222	64.3333333	728.626323	116.491482	-136.266207	170.332759	18.3941285	188.726888
9.45454545	100	16.7056568	-	-	108.030303	64.8181818	735.084176	116.705657	-138.900892	173.626115	18.5571566	192.183272
9.57575758	100	16.9198319	-	-	108.838384	65.3030303	741.542029	116.919832	-141.555359	176.944198	18.7201847	195.664383
9.6969697	100	17.134007	-	-	109.646465	65.7878788	747.999881	117.134007	-144.229607	180.287009	18.8832128	199.170221
9.81818182	100	17.3481821	-	-	110.454545	66.2727273	754.457734	117.348182	-146.923637	183.654546	19.046241	202.700787
9.93939394	100	17.5623572	-	-	111.262626	66.7575758	760.915587	117.562357	-149.637449	187.046811	19.2092691	206.25608
10.0606061	100	17.7765323	-	-	112.070707	67.2424242	767.373439	117.776532	-152.371042	190.463803	19.3722972	209.8361
10.1818182	100	17.9907074	-	-	112.878788	67.7272727	773.831292	117.990707	-155.124418	193.905522	19.5353253	213.440848
10.3030303	100	18.2048825	-	-	113.686869	68.2121212	780.289145	118.204882	-157.897575	197.371969	19.6983534	217.070322
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10.5454545	100	18.6332326	-	-	115.30303	69.1818182	793.20485	118.633233	-163.503235	204.379043	20.0244096	224.403453
10.6666667	100	18.8474077	-	-	116.111111	69.6666667	799.662703	118.847408	-166.335737	207.919671	20.1874377	228.107109
10.7878788	100	19.0615828	-	-	116.919192	70.1515152	806.120555	119.061583	-169.188021	211.485027	20.3504658	231.835492
10.9090909	100	19.2757579	-	-	117.727273	70.6363636	812.578408	119.275758	-172.060087	215.075109	20.5134939	235.588603
11.030303	100	19.489933	-	-	118.535354	71.1212121	819.036261	119.489933	-174.951935	218.689919	20.676522	239.366441
11.1515152	100	19.7041081	-	-	119.343434	71.6060606	825.494113	119.704108	-177.863565	222.329456	20.8395502	243.169006

11.2727273	100	19.9182832	-	-	120.151515	72.0909091	831.951966	119.918283	-180.794976	225.99372	21.0025783	246.996298
11.3939394	100	20.1324582	-	-	120.959596	72.5757576	838.409818	120.132458	-183.746169	229.682711	21.1656064	250.848318
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11.6363636	100	20.5608084	-	-	122.575758	73.5454545	851.325524	120.560808	-189.707901	237.134876	21.4916626	258.626538
11.7575758	100	20.7749835	-	-	123.383838	74.030303	857.783376	120.774984	-192.718439	240.898049	21.6546907	262.552739
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12	100	21.2033337	-	-	125	75	870.699082	121.203334	-198.798861	248.498576	21.9807469	270.479323
12.1212121	100	21.4175088	-	-	125	75	873.002112	121.417509	-201.858854	252.323567	22.0388868	274.362454
12.2424242	100	21.6316839	-	-	125	75	875.305142	121.631684	-204.918847	256.148559	22.0970266	278.245585
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12.7272727	100	22.4883842	-	-	125	75	884.517264	122.488384	-217.158818	271.448523	22.3295861	293.778109
12.8484848	100	22.7025593	-	-	125	75	886.820294	122.702559	-220.218811	275.273514	22.387726	297.66124
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13.0909091	100	23.1309095	-	-	125	75	891.426354	123.130909	-226.338797	282.923496	22.5040057	305.427502
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13.3333333	100	23.5592596	-	-	125	75	896.032415	123.55926	-232.458782	290.573478	22.6202854	313.193763
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14.0606061	100	24.8443102	-	-	125	75	909.850597	124.84431	-250.818739	313.523424	22.9691246	336.492549
14.1818182	100	25.0584853	-	-	125	75	912.153627	125.058485	-253.878732	317.348415	23.0272645	340.37568
14.3030303	100	25.2726603	-	-	125	75	914.456657	125.27266	-256.938725	321.173406	23.0854043	344.258811
14.4242424	100	25.4868354	-	-	125	75	916.759688	125.486835	-259.998718	324.998398	23.1435442	348.141942
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14.6666667	100	25.9151856	-	-	125	75	921.365748	125.915186	-266.118704	332.64838	23.2598239	355.908204
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14.9090909	100	26.3435358	-	-	125	75	925.971809	126.343536	-272.238689	340.298362	23.3761037	363.674465
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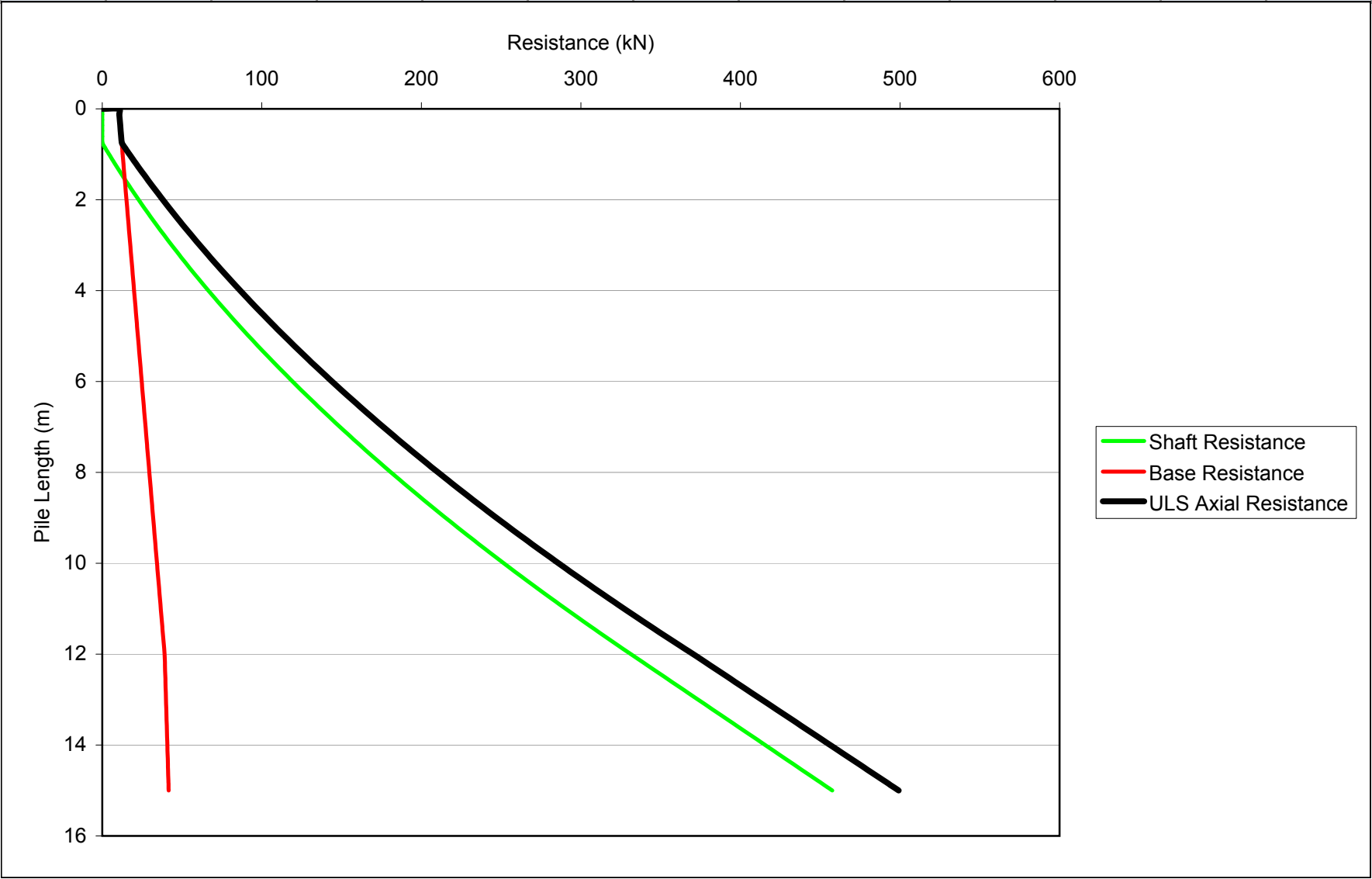
General	Actions		Material Properties			Calculation model		Effects of	Resistance			
	Design values		Design values					Design values	Design values			
Depth (m)	F,d (kN)	W,d (kN)	phi,d (°)	c,d (kPa)	cu,d (kPa)	Skin friction (kPa)	Bearing pressure (kPa)	E,d (kN)	Rst,d (kN)	Rs,d (kN)	Rb,d (kN)	Rt,d (kN)
0	100	0	-	-	-	0	0	100	0	0	0	0
0	100	0	-	-	45	0	231.3716694	100	0	0	10.38393624	10.38393624
0.121212121	100	0.380755711	-	-	45.80808081	0	237.8295221	100.3807557	0	0	10.67376399	10.67376399
0.242424242	100	0.761511423	-	-	46.61616162	0	244.2873747	100.7615114	0	0	10.96359174	10.96359174
0.363636364	100	1.142267134	-	-	47.42424242	0	250.7452274	101.1422671	0	0	11.25341949	11.25341949
0.484848485	100	1.523022845	-	-	48.23232323	0	257.20308	101.5230228	0	0	11.54324724	11.54324724
0.606060606	100	1.903778557	-	-	49.04040404	0	263.6609327	101.9037786	0	0	11.83307499	11.83307499
0.727272727	100	2.284534268	-	-	49.84848485	0	270.1187853	102.2845343	0	0	12.12290274	12.12290274
0.75	100	2.355925964	-	-	50	0	271.3296327	102.355926	0	0	12.17724544	12.17724544
0.751	100	2.359067199	-	-	50.00666667	30.004	271.38291	102.3590672	-0.00673288	0.008416102	12.17963652	12.18805262
0.848484848	100	2.66528998	-	-	50.65656566	30.39393939	276.576638	102.66529	-1.32797096	1.659963694	12.41273049	14.07269418
0.96969697	100	3.046045691	-	-	51.46464646	30.87878788	283.0344906	103.0460457	-2.99458524	3.74323155	12.70255823	16.44578978
1	100	3.141234619	-	-	51.66666667	31	284.6489538	103.1412346	-3.41536001	4.269200017	12.77501517	17.04421519
1.090909091	100	3.426801402	-	-	52.27272727	31.36363636	289.4923433	103.4268014	-4.68757522	5.859469025	12.99238598	18.85185501
1.212121212	100	3.807557114	-	-	53.08080808	31.84848485	295.9501959	103.8075571	-6.4069409	8.008676121	13.28221373	21.29088985
1.333333333	100	4.188312825	-	-	53.88888889	32.33333333	302.4080486	104.1883128	-8.15268227	10.19085284	13.57204148	23.76289432
1.454545455	100	4.569068536	-	-	54.6969697	32.81818182	308.8659012	104.5690685	-9.92479934	12.40599917	13.86186923	26.2678684
1.575757576	100	4.949824248	-	-	55.50505051	33.3030303	315.3237539	104.9498242	-11.7232921	14.65411513	14.15169698	28.80581211
1.696969697	100	5.330579959	-	-	56.31313131	33.78787879	321.7816065	105.33058	-13.5481606	16.9352007	14.44152473	31.37672543
1.818181818	100	5.711335671	-	-	57.12121212	34.27272727	328.2394592	105.7113357	-15.3994047	19.2492559	14.73135248	33.98060837
1.939393939	100	6.092091382	-	-	57.92929293	34.75757576	334.6973118	106.0920914	-17.2770246	21.59628071	15.02118023	36.61746094
2.060606061	100	6.472847093	-	-	58.73737374	35.24242424	341.1551645	106.4728471	-19.1810201	23.97627515	15.31100798	39.28728312
2.181818182	100	6.853602805	-	-	59.54545455	35.72727273	347.6130171	106.8536028	-21.1113914	26.3892392	15.60083573	41.99007493
2.303030303	100	7.234358516	-	-	60.35353535	36.21212121	354.0708697	107.2343585	-23.0681383	28.83517287	15.89066348	44.72583635
2.424242424	100	7.615114227	-	-	61.16161616	36.6969697	360.5287224	107.6151142	-25.0512609	31.31407617	16.18049122	47.49456739
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2.666666667	100	8.37662565	-	-	62.77777778	37.66666667	373.4444277	108.3766257	-29.0966333	36.37079162	16.76014672	53.13093834
2.787878788	100	8.757381362	-	-	63.58585859	38.15151515	379.9022803	108.7573814	-31.158883	38.94860377	17.04997447	55.99857824
2.909090909	100	9.138137073	-	-	64.39393939	38.63636364	386.360133	109.1381371	-33.2475084	41.55938554	17.33980222	58.89918776

3.03030303	100	9.518892784	-	-	65.2020202	39.12121212	392.8179856	109.5188928	-35.3625095	44.20313694	17.62962997	61.83276691
3.151515152	100	9.899648496	-	-	66.01010101	39.60606061	399.2758383	109.8996485	-37.5038864	46.87985795	17.91945772	64.79931567
3.272727273	100	10.28040421	-	-	66.81818182	40.09090909	405.7336909	110.2804042	-39.6716389	49.58954858	18.20928547	67.79883405
3.393939394	100	10.66115992	-	-	67.62626263	40.57575758	412.1915436	110.6611599	-41.8657671	52.33220884	18.49911322	70.83132205
3.515151515	100	11.04191563	-	-	68.43434343	41.06060606	418.6493962	111.0419156	-44.086271	55.10783871	18.78894097	73.89677968
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3.878787879	100	12.18418276	-	-	70.85858586	42.51515152	438.0229542	112.1841828	-50.9060368	63.63254605	19.65842421	83.29097026
4	100	12.56493848	-	-	71.66666667	43	444.4808068	112.5649385	-53.2320435	66.5400544	19.94825196	86.48830636
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4.242424242	100	13.3264499	-	-	73.28282828	43.96969697	457.3965121	113.3264499	-57.963184	72.45397997	20.52790746	92.98188743
4.363636364	100	13.70720561	-	-	74.09090909	44.45454545	463.8543648	113.7072056	-60.3683177	75.46039718	20.81773521	96.27813239
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4.727272727	100	14.84947274	-	-	76.51515152	45.90909091	483.2279227	114.8494727	-67.7419732	84.67746653	21.68721846	106.364685
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5.696969697	100	17.89551843	-	-	82.97979798	49.78787879	534.8907439	117.8955184	-88.5655851	110.7069814	24.00584045	134.7128219
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8.363636364	100	26.27214408	-	-	100.7575758	60.45454545	676.9635022	126.2721441	-154.534498	193.1681219	30.38205093	223.5501729
8.484848485	100	26.6528998	-	-	101.5656566	60.93939394	683.4213549	126.6528998	-157.836405	197.2955062	30.67187868	227.9673849
8.606060606	100	27.03365551	-	-	102.3737374	61.42424242	689.8792075	127.0336555	-161.164688	201.4558601	30.96170643	232.4175666
8.727272727	100	27.41441122	-	-	103.1818182	61.90909091	696.3370602	127.4144112	-164.519347	205.6491836	31.25153418	236.9007178
8.848484848	100	27.79516693	-	-	103.989899	62.39393939	702.7949128	127.7951669	-167.900381	209.8754768	31.54136193	241.4168387
8.96969697	100	28.17592264	-	-	104.7979798	62.87878788	709.2527655	128.1759226	-171.307792	214.1347396	31.83118968	245.9659292
9.090909091	100	28.55667835	-	-	105.6060606	63.36363636	715.7106181	128.5566784	-174.741578	218.4269719	32.12101743	250.5479894
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9.454545455	100	29.69894549	-	-	108.030303	64.81818182	735.0841761	129.6989455	-185.201189	231.5014868	32.99050068	264.4919875
9.575757576	100	30.0797012	-	-	108.8383838	65.3030303	741.5420287	130.0797012	-188.740478	235.9255977	33.28032842	269.2059261
9.696969697	100	30.46045691	-	-	109.6464646	65.78787879	747.9998814	130.4604569	-192.306143	240.3826782	33.57015617	273.9528344
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10.06060606	100	31.60272404	-	-	112.0707071	67.24242424	767.3734393	131.602724	-203.16139	253.9517374	34.43963942	288.3913768
10.18181818	100	31.98347976	-	-	112.8787879	67.72727273	773.831292	131.9834798	-206.832557	258.5406963	34.72946717	293.2701635
10.3030303	100	32.36423547	-	-	113.6868687	68.21212121	780.2891446	132.3642355	-210.5301	263.1626249	35.01929492	298.1819198
10.42424242	100	32.74499118	-	-	114.4949495	68.6969697	786.7469973	132.7449912	-214.254018	267.8175231	35.30912267	303.1266458
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11.03030303	100	34.64876974	-	-	118.5353535	71.12121212	819.0362605	134.6487697	-233.269247	291.5865584	36.75826141	328.3448199
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11.39393939	100	35.79103687	-	-	120.959596	72.57575758	838.4098185	135.7910369	-244.994892	306.2436151	37.62774466	343.8713597
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11.63636364	100	36.55254829	-	-	122.5757576	73.54545455	851.3255238	136.5525483	-252.943867	316.1798343	38.20740016	354.3872344
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12	100	37.69481543	-	-	125	75	870.6990817	137.6948154	-265.065148	331.3314352	39.07688341	370.4083186
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14.06060606	100	44.16766252	-	-	125	75	909.8505969	144.1676625	-334.424986	418.0312325	40.8339993	458.8652318
14.18181818	100	44.54841823	-	-	125	75	912.1536272	144.5484182	-338.504976	423.1312205	40.93735906	464.0685796
14.3030303	100	44.92917394	-	-	125	75	914.4566575	144.9291739	-342.584967	428.2312086	41.04071882	469.2719274
14.42424242	100	45.30992965	-	-	125	75	916.7596878	145.3099297	-346.664957	433.3311967	41.14407857	474.4752753
14.54545455	100	45.69068536	-	-	125	75	919.0627181	145.6906854	-350.744948	438.4311848	41.24743833	479.6786231
14.66666667	100	46.07144108	-	-	125	75	921.3657484	146.0714411	-354.824938	443.5311728	41.35079809	484.8819709
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15	100	47.11851928	-	-	125	75	927.6990817	147.1185193	-366.044912	457.55614	41.63503743	499.1911775
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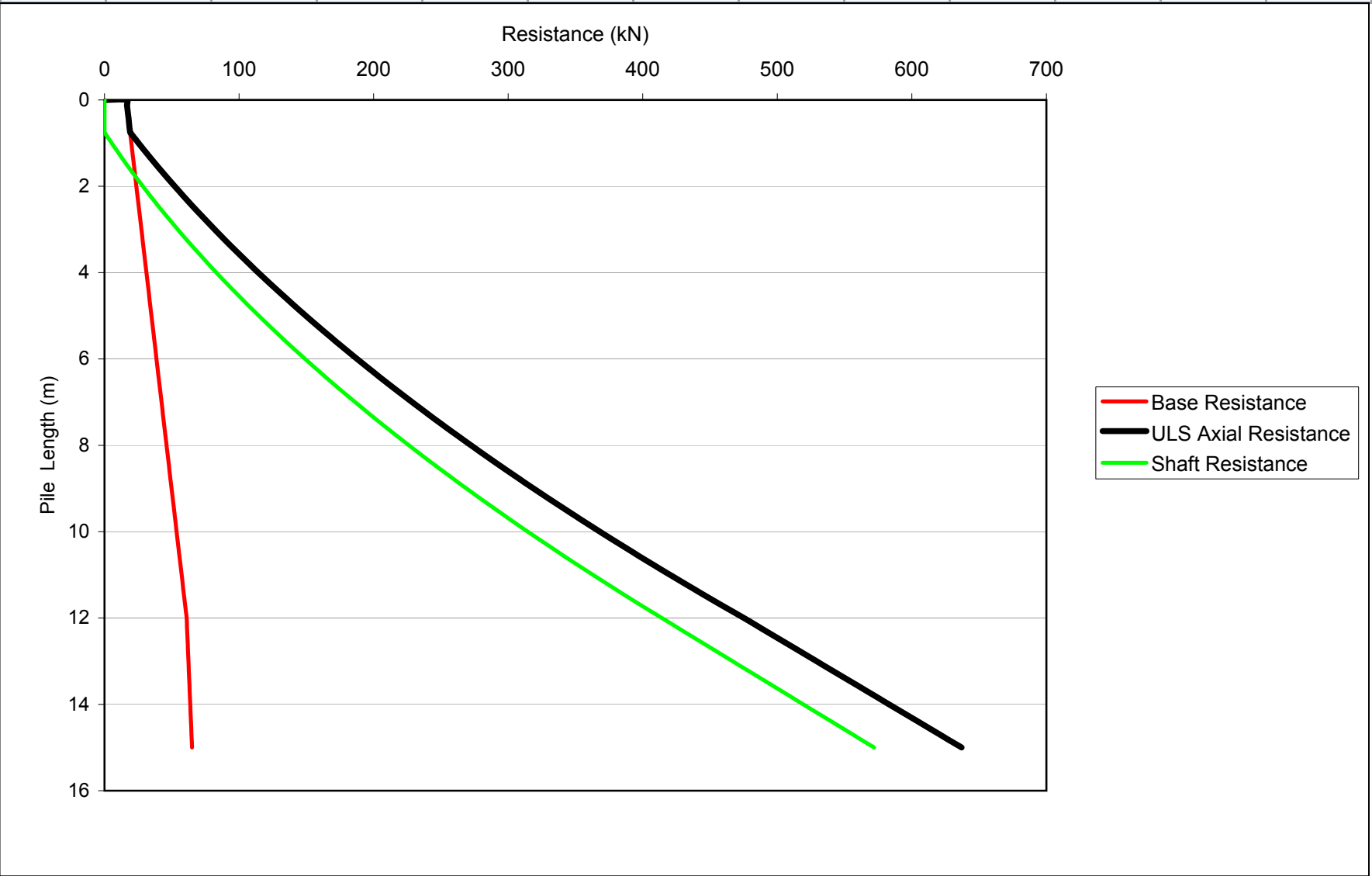
General	Actions		Material Properties			Calculation model		Effects of	Resistance			
	Design values		Design values					Design values	Design values			
Depth (m)	F,d (kN)	W,d (kN)	phi,d (°)	c,d (kPa)	cu,d (kPa)	Skin friction (kPa)	Bearing pressure (kPa)	E,d (kN)	Rst,d (kN)	Rs,d (kN)	Rb,d (kN)	Rt,d (kN)
0	100	0	-	-	-	0	0	100	0	0	0	0
0	100	0	-	-	45	0	231.3716694	100	0	0	16.22490038	16.22490038
0.121212121	100	0.594930799	-	-	45.80808081	0	237.8295221	100.5949308	0	0	16.67775623	16.67775623
0.242424242	100	1.189861598	-	-	46.61616162	0	244.2873747	101.1898616	0	0	17.13061209	17.13061209
0.363636364	100	1.784792397	-	-	47.42424242	0	250.7452274	101.7847924	0	0	17.58346795	17.58346795
0.484848485	100	2.379723196	-	-	48.23232323	0	257.20308	102.3797232	0	0	18.03632381	18.03632381
0.606060606	100	2.974653995	-	-	49.04040404	0	263.6609327	102.974654	0	0	18.48917967	18.48917967
0.727272727	100	3.569584794	-	-	49.84848485	0	270.1187853	103.5695848	0	0	18.94203552	18.94203552
0.75	100	3.681134319	-	-	50	0	271.3296327	103.6811343	0	0	19.026946	19.026946
0.751	100	3.686042498	-	-	50.00666667	30.004	271.38291	103.6860425	-0.0084161	0.010520128	19.03068206	19.04120219
0.848484848	100	4.164515593	-	-	50.65656566	30.39393939	276.576638	104.1645156	-1.65996369	2.074954618	19.39489138	21.469846
0.96969697	100	4.759446392	-	-	51.46464646	30.87878788	283.0344906	104.7594464	-3.74323155	4.679039437	19.84774724	24.52678668
1	100	4.908179092	-	-	51.66666667	31	284.6489538	104.9081791	-4.26920002	5.336500021	19.96096121	25.29746123
1.090909091	100	5.354377191	-	-	52.27272727	31.36363636	289.4923433	105.3543772	-5.85946903	7.324336282	20.3006031	27.62493938
1.212121212	100	5.94930799	-	-	53.08080808	31.84848485	295.9501959	105.949308	-8.00867612	10.01084515	20.75345896	30.76430411
1.333333333	100	6.544238789	-	-	53.88888889	32.33333333	302.4080486	106.5442388	-10.1908528	12.73856605	21.20631482	33.94488086
1.454545455	100	7.139169588	-	-	54.6969697	32.81818182	308.8659012	107.1391696	-12.4059992	15.50749896	21.65917067	37.16666964
1.575757576	100	7.734100387	-	-	55.50505051	33.3030303	315.3237539	107.7341004	-14.6541151	18.31764391	22.11202653	40.42967044
1.696969697	100	8.329031186	-	-	56.31313131	33.78787879	321.7816065	108.3290312	-16.9352007	21.16900088	22.56488239	43.73388327
1.818181818	100	8.923961985	-	-	57.12121212	34.27272727	328.2394592	108.923962	-19.2492559	24.06156987	23.01773825	47.07930812
1.939393939	100	9.518892784	-	-	57.92929293	34.75757576	334.6973118	109.5188928	-21.5962807	26.99535089	23.47059411	50.46594499
2.060606061	100	10.11382358	-	-	58.73737374	35.24242424	341.1551645	110.1138236	-23.9762751	29.97034393	23.92344996	53.8937939
2.181818182	100	10.70875438	-	-	59.54545455	35.72727273	347.6130171	110.7087544	-26.3892392	32.986549	24.37630582	57.36285482
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2.787878788	100	13.68340838	-	-	63.58585859	38.15151515	379.9022803	113.6834084	-38.9486038	48.68575471	26.64058511	75.32633982
2.909090909	100	14.27833918	-	-	64.39393939	38.63636364	386.360133	114.2783392	-41.5593855	51.94923193	27.09344097	79.0426729

3.03030303	100	14.87326998	-	-	65.2020202	39.12121212	392.8179856	114.87327	-44.2031369	55.25392117	27.54629683	82.800218
3.151515152	100	15.46820077	-	-	66.01010101	39.60606061	399.2758383	115.4682008	-46.879858	58.59982244	27.99915269	86.59897512
3.272727273	100	16.06313157	-	-	66.81818182	40.09090909	405.7336909	116.0631316	-49.5895486	61.98693573	28.45200854	90.43894427
3.393939394	100	16.65806237	-	-	67.62626263	40.57575758	412.1915436	116.6580624	-52.3322088	65.41526105	28.9048644	94.32012545
3.515151515	100	17.25299317	-	-	68.43434343	41.06060606	418.6493962	117.2529932	-55.1078387	68.88479839	29.35772026	98.24251865
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4	100	19.63271637	-	-	71.66666667	43	444.4808068	119.6327164	-66.5400544	83.175068	31.16914369	114.3442117
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4.242424242	100	20.82257797	-	-	73.28282828	43.96969697	457.3965121	120.822578	-72.45398	90.56747496	32.07485541	122.6423304
4.363636364	100	21.41750876	-	-	74.09090909	44.45454545	463.8543648	121.4175088	-75.4603972	94.32549647	32.52771127	126.8532077
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4.606060606	100	22.60737036	-	-	75.70707071	45.42424242	476.7700701	122.6073704	-81.5721405	101.9651756	33.43342298	135.3985986
4.727272727	100	23.20230116	-	-	76.51515152	45.90909091	483.2279227	123.2023012	-84.6774665	105.8468332	33.88627884	139.733112
4.848484848	100	23.79723196	-	-	77.32323232	46.39393939	489.6857754	123.797232	-87.8157622	109.7697028	34.3391347	144.1088375
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5.575757576	100	27.36681676	-	-	82.17171717	49.3030303	528.4328913	127.3668168	-107.337898	134.172373	37.05626985	171.2286428
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6.060606061	100	29.74653995	-	-	85.4040404	51.24242424	554.2643019	129.74654	-121.012048	151.2650603	38.86769328	190.1327536
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6.787878788	100	33.31612475	-	-	90.25252525	54.15151515	593.0114178	133.3161247	-142.512362	178.140452	41.58482843	219.7252804
6.909090909	100	33.91105554	-	-	91.06060606	54.63636364	599.4692704	133.9110555	-146.211141	182.763926	42.03768429	224.8016103

7.03030303	100	34.50598634	-	-	91.86868687	55.12121212	605.9271231	134.5059863	-149.94289	187.4286121	42.49054014	229.9191522
7.151515152	100	35.10091714	-	-	92.67676768	55.60606061	612.3849757	135.1009171	-153.707608	192.1345102	42.943396	235.0779062
7.272727273	100	35.69584794	-	-	93.48484848	56.09090909	618.8428284	135.6958479	-157.505296	196.8816203	43.39625186	240.2778721
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7.515151515	100	36.88570954	-	-	95.1010101	57.06060606	631.7585337	136.8857095	-165.199581	206.4994766	44.30196358	250.8014402
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7.878787879	100	38.67050194	-	-	97.52525253	58.51515152	651.1320916	138.6705019	-176.988281	221.2353512	45.66053115	266.8958824
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8.484848485	100	41.64515593	-	-	101.5656566	60.93939394	683.4213549	141.6451559	-197.295506	246.6193828	47.92481044	294.5441932
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11.03030303	100	54.13870271	-	-	118.5353535	71.12121212	819.0362605	154.1387027	-291.586558	364.4831981	57.43478346	421.9179815
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13.09090909	100	64.25252629	-	-	125	75	891.4263544	164.2525263	-377.231328	471.5391598	62.51112693	534.0502868
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13.81818182	100	67.82211109	-	-	125	75	905.2445362	167.8221111	-407.831256	509.7890704	63.48012466	573.2691951
13.93939394	100	68.41704189	-	-	125	75	907.5475665	168.4170419	-412.931244	516.1640555	63.64162428	579.8056798
14.06060606	100	69.01197269	-	-	125	75	909.8505969	169.0119727	-418.031232	522.5390406	63.8031239	586.3421645
14.18181818	100	69.60690349	-	-	125	75	912.1536272	169.6069035	-423.131221	528.9140257	63.96462353	592.8786492
14.3030303	100	70.20183428	-	-	125	75	914.4566575	170.2018343	-428.231209	535.2890108	64.12612315	599.4151339
14.42424242	100	70.79676508	-	-	125	75	916.7596878	170.7967651	-433.331197	541.6639959	64.28762277	605.9516186
14.54545455	100	71.39169588	-	-	125	75	919.0627181	171.3916959	-438.431185	548.0389809	64.44912239	612.4881033
14.66666667	100	71.98662668	-	-	125	75	921.3657484	171.9866267	-443.531173	554.413966	64.61062202	619.0245881
14.78787879	100	72.58155748	-	-	125	75	923.6687787	172.5815575	-448.631161	560.7889511	64.77212164	625.5610728
14.90909091	100	73.17648828	-	-	125	75	925.971809	173.1764883	-453.731149	567.1639362	64.93362126	632.0975575

15	100	73.62268638	-	-	125	75	927.6990817	173.6226864	-457.55614	571.945175	65.05474598	636.999921
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Appendix 9 – TRRL Probe Results

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Blendworth Crescent, Havant
Client: Portsmouth City Council

Ridge & Partners LLP
 Partnership House
 Moorside Road
 Winchester
 SO23 7RX

RIDGE

Project Number: 151239

Location ID: TRL1

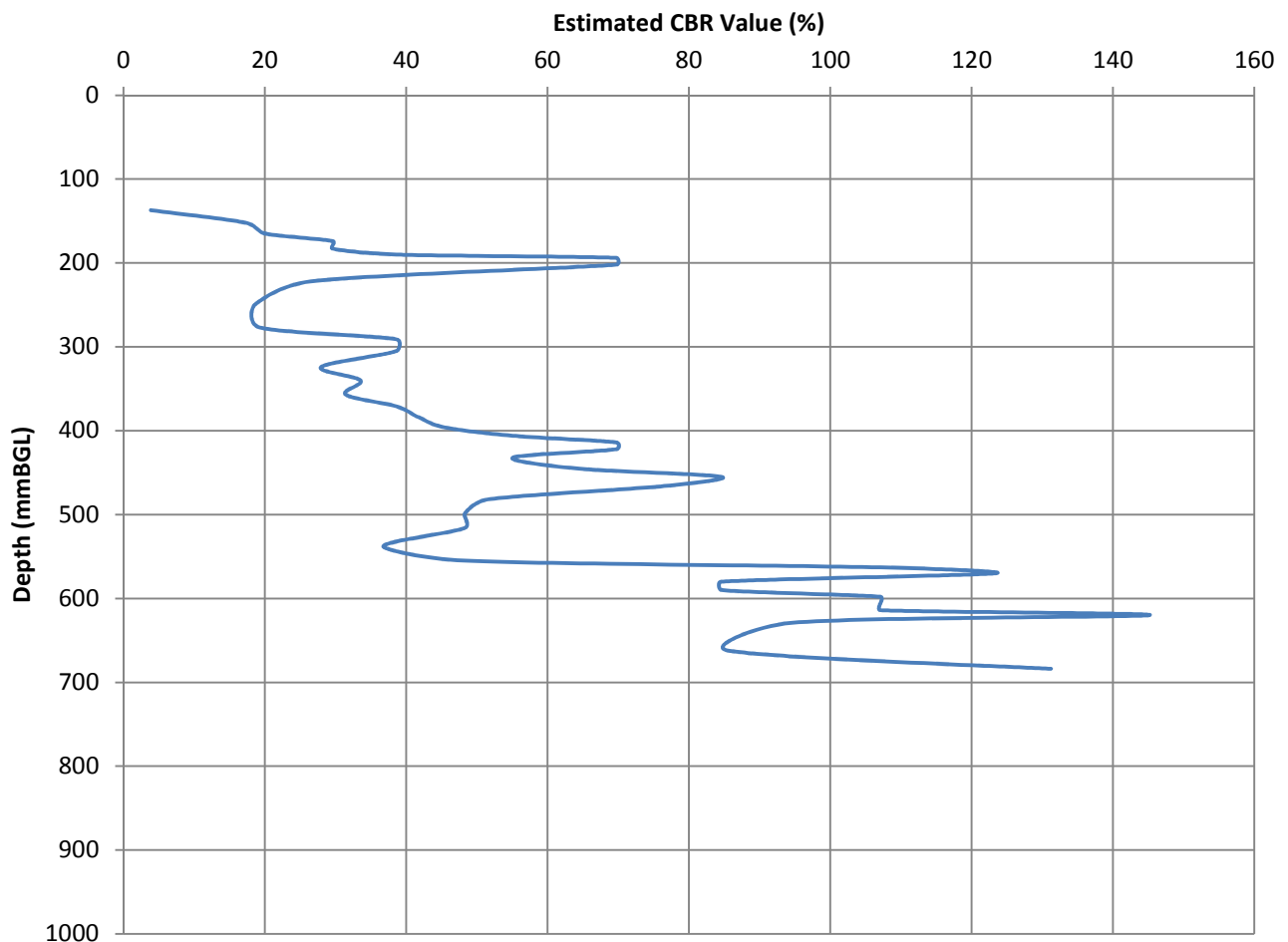
Date: 08/07/2015 **Engineer:** DAP

Easting: **Northing:**

Initial Depth (mmBGL): 75

Final Depth (mmBGL): 684

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
75	400	31	31	10.48	25.19
400	600	78	47	4.26	65.35
600	684	110	32	2.63	108.89

Comments:

Checked By:

Date:

Approved By:

Date:

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Blendworth Crescent, Havant
Client: Portsmouth City Council

Ridge & Partners LLP
 Partnership House
 Moorside Road
 Winchester
 SO23 7RX

RIDGE

Project Number: 151239

Location ID: TRL2

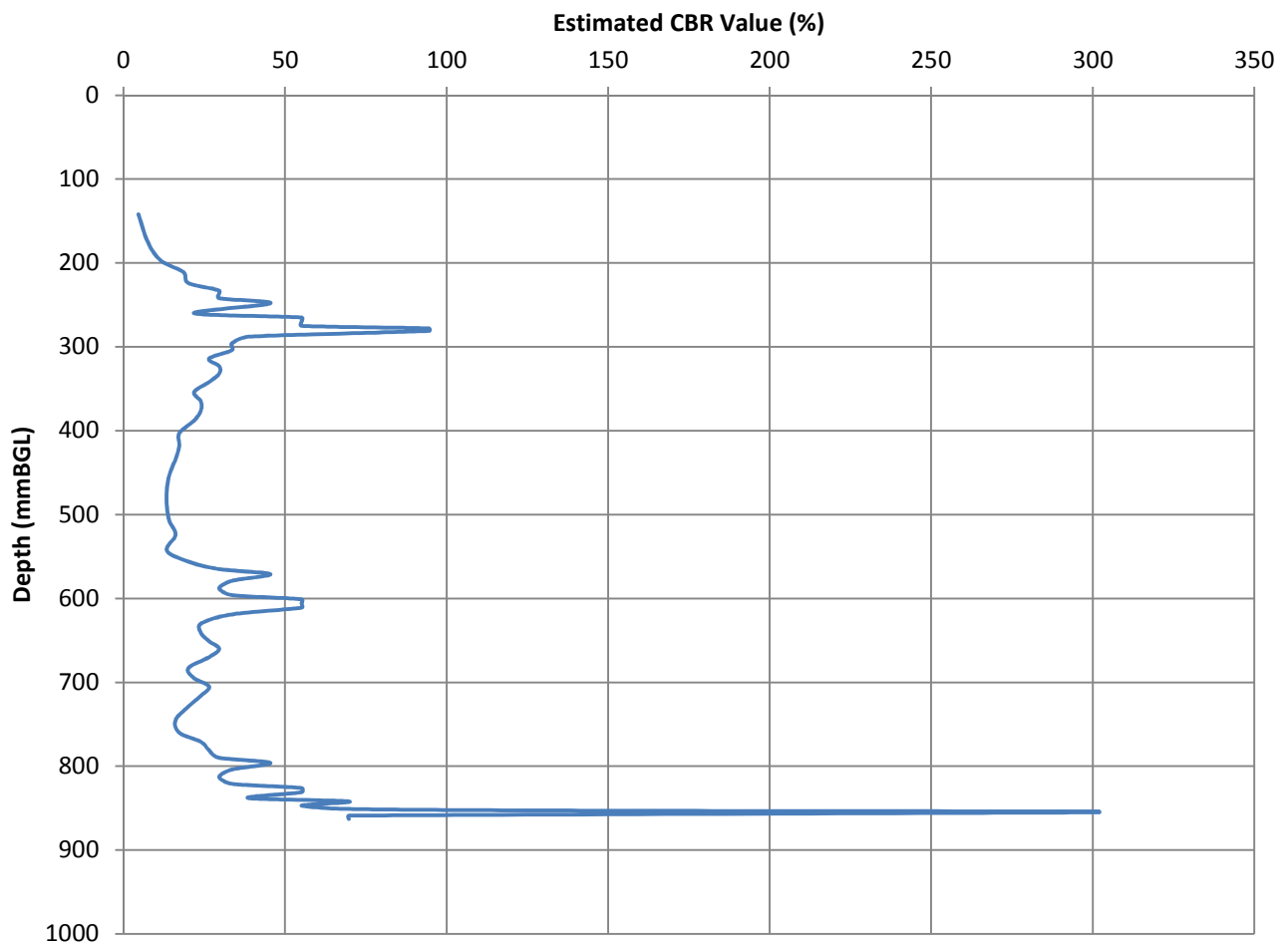
Date: 08/07/2015 **Engineer:** DAP

Easting: **Northing:**

Initial Depth (mmBGL): 90

Final Depth (mmBGL): 863

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
90	400	25	25	12.40	21.10
400	600	40	15	13.33	19.54
600	863	74	34	7.74	34.74

Comments:

Checked By:

Date:

Approved By:

Date:

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Blendworth Crescent, Havant
Client: Portsmouth City Council

Ridge & Partners LLP
 Partnership House
 Moorside Road
 Winchester
 SO23 7RX

RIDGE

Project Number: 151239

Location ID: TRL3

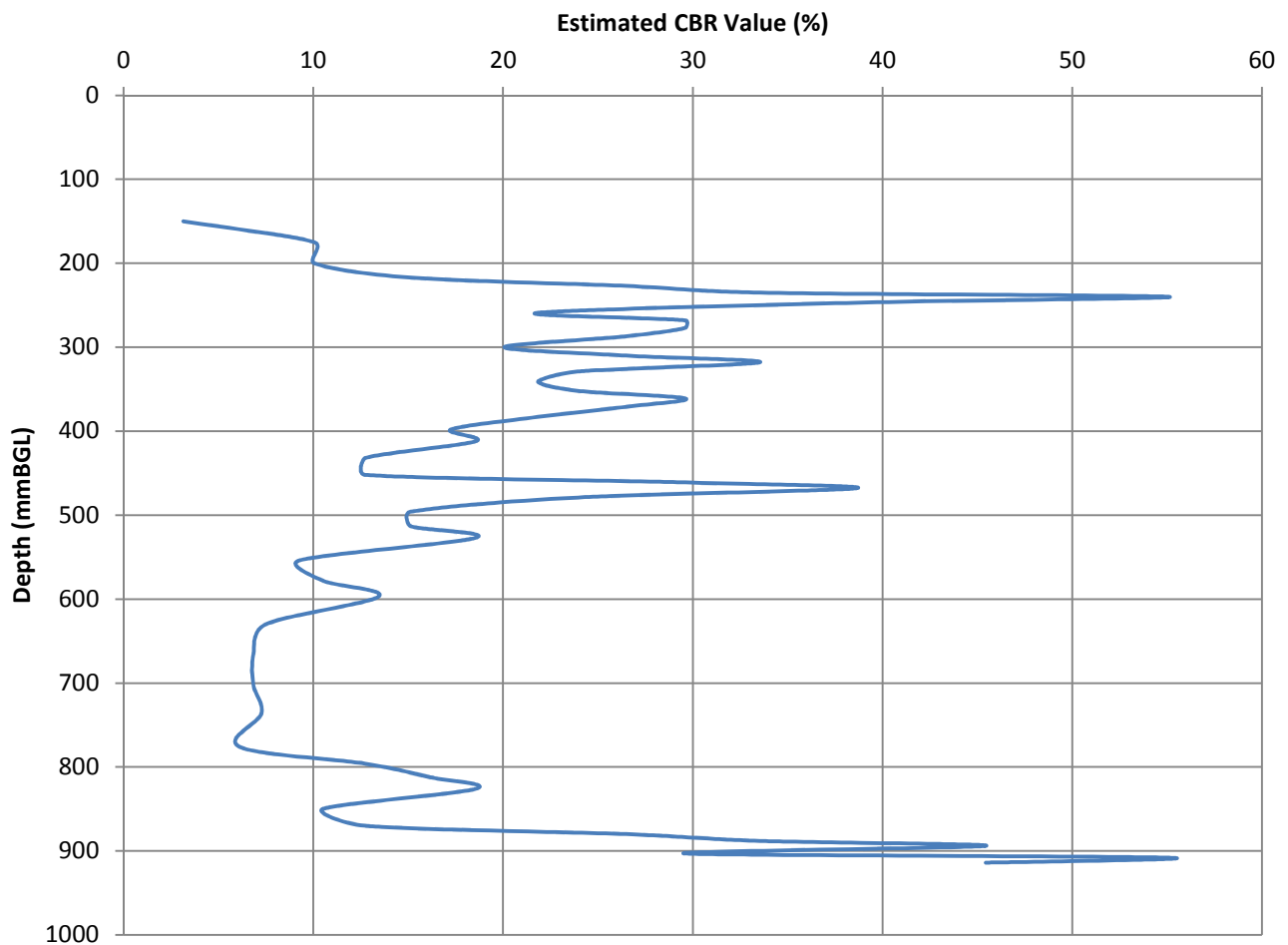
Date: 27/03/2015 **Engineer:** DAP

Easting: **Northing:**

Initial Depth (mmBGL): 75

Final Depth (mmBGL): 914

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
75	400	22	22	14.77	17.53
400	600	34	12	16.67	15.43
600	914	50	16	19.63	12.99

Comments:

Checked By:

Date:

Approved By:

Date:

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Blendworth Crescent, Havant
Client: Portsmouth City Council

Ridge & Partners LLP
 Partnership House
 Moorside Road
 Winchester
 SO23 7RX

RIDGE

Project Number: 151239

Location ID: TRL4

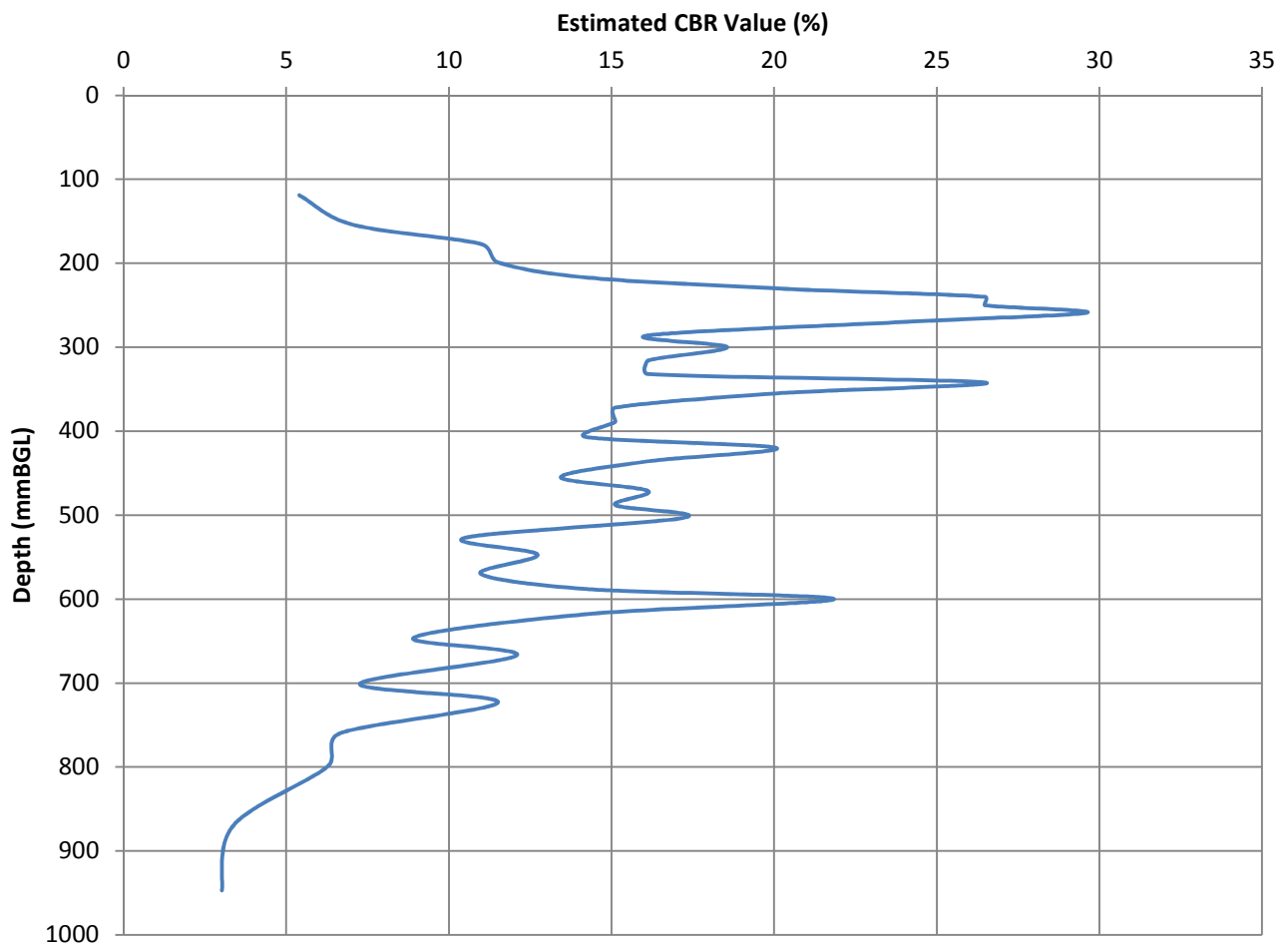
Date: 27/03/2015 **Engineer:** DAP

Easting: **Northing:**

Initial Depth (mmBGL): 74

Final Depth (mmBGL): 947

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
74	400	18	18	18.11	14.14
400	600	30	12	16.67	15.43
600	947	39	9	38.56	6.36

Comments:

Checked By:

Date:

Approved By:

Date:

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Blendworth Crescent, Havant
Client: Portsmouth City Council

Ridge & Partners LLP
 Partnership House
 Moorside Road
 Winchester
 SO23 7RX

RIDGE

Project Number: 151239

Location ID: TRL5

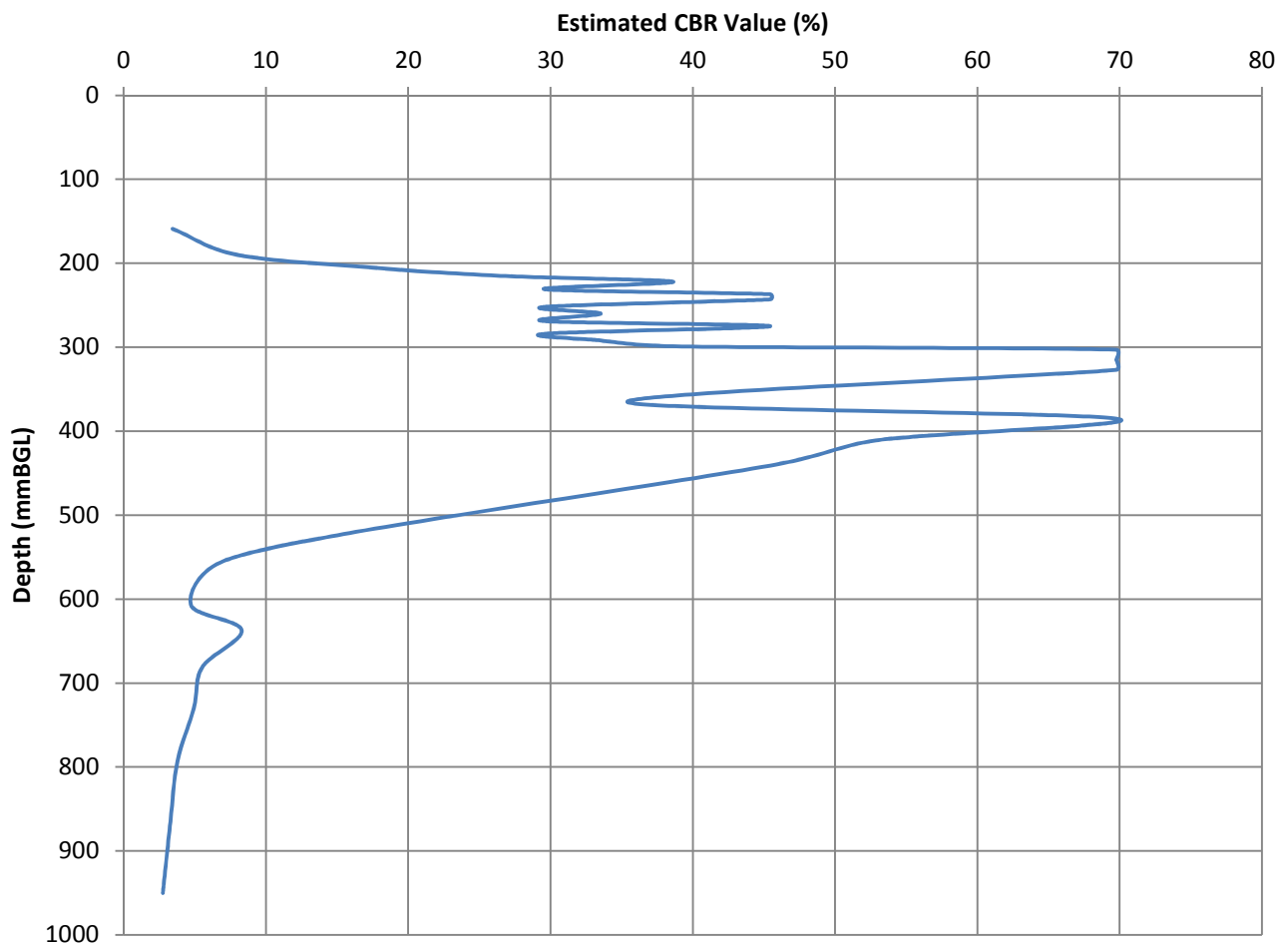
Date: 27/03/2015 **Engineer:** DAP

Easting: **Northing:**

Initial Depth (mmBGL): 90

Final Depth (mmBGL): 950

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
90	400	32	32	9.69	27.39
400	600	48	16	12.50	20.92
600	950	55	7	50.00	4.83

Comments:

Checked By:

Date:

Approved By:

Date:

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Blendworth Crescent, Havant
Client: Portsmouth City Council

Ridge & Partners LLP
 Partnership House
 Moorside Road
 Winchester
 SO23 7RX

RIDGE

Project Number: 151239

Location ID: TRL6

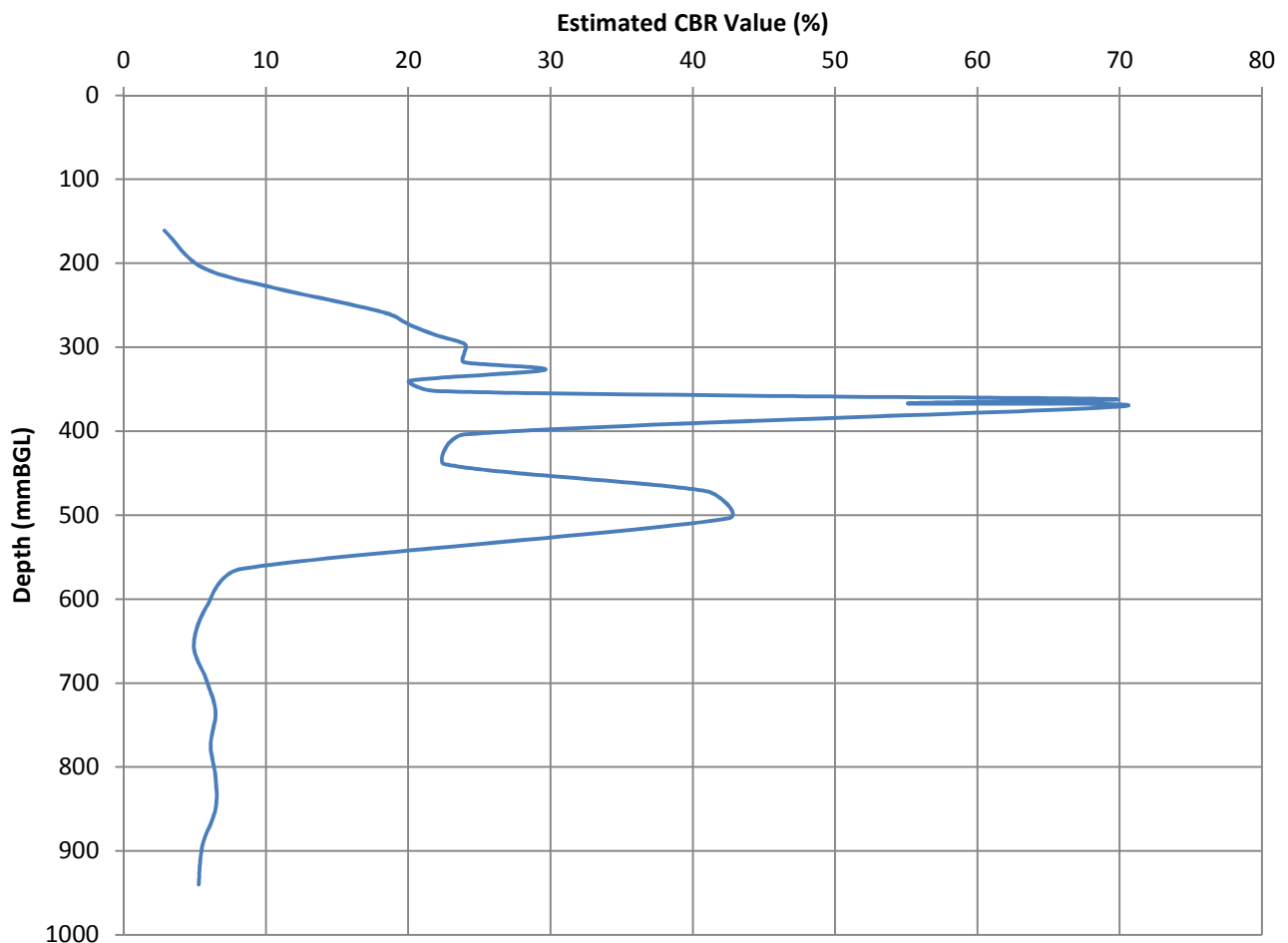
Date: 27/03/2015 **Engineer:** DAP

Easting: **Northing:**

Initial Depth (mmBGL): 79

Final Depth (mmBGL): 940

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
79	400	17	17	18.88	13.53
400	600	35	18	11.11	23.69
600	940	44	9	37.78	6.50

Comments:

Checked By:

Date:

Approved By:

Date:

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Blendworth Crescent, Havant
Client: Portsmouth City Council

Ridge & Partners LLP
 Partnership House
 Moorside Road
 Winchester
 SO23 7RX

RIDGE

Project Number: 151239

Location ID: TRL7

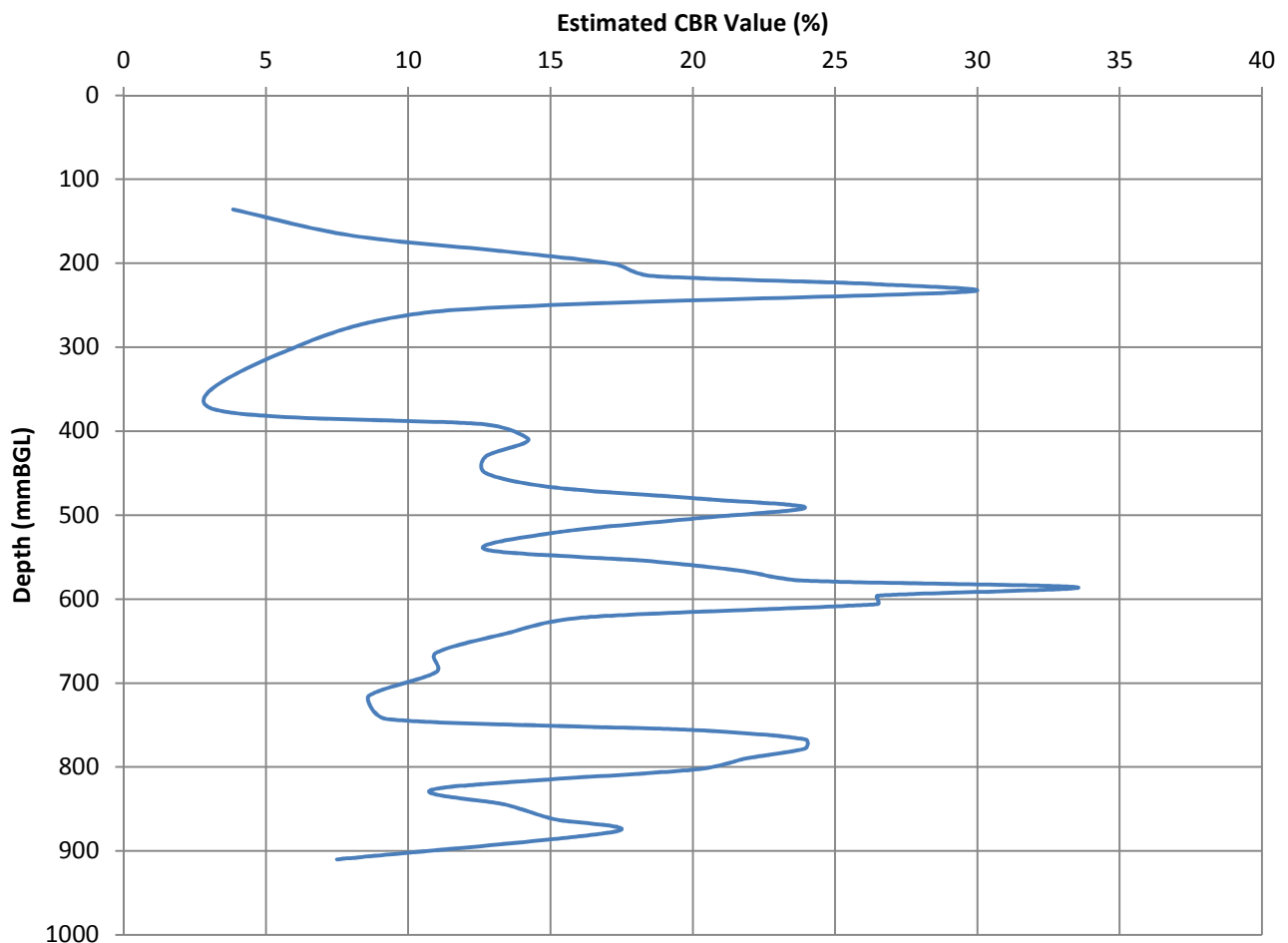
Date: 27/03/2015 **Engineer:** DAP

Easting: **Northing:**

Initial Depth (mmBGL): 74

Final Depth (mmBGL): 910

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
74	400	11	11	29.64	8.40
400	600	25	14	14.29	18.17
600	910	42	17	18.24	14.04

Comments:

Checked By:

Date:

Approved By:

Date: