Persimmon Homes Essex Northwest Haverhill Relief Road and Bridge

**Geotechnical Assessment** 



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## Contents

1	Executive Summary	1
2	Limitations and Exceptions	2
3	Introduction	3
3.1	General	3
3.2	Terms of Reference	3
3.3	Technical Approach	3
3.4	Proposed Development	3
4	The Site	4
4.1	Location and Description	4
4.2	Geology	4
4.3	Hydrogeology	4
4.4	Hydrology	5
5	Ground Investigation	6
5.1	Site Work	6
5.2	Investigation Rationale	6
5.3	Installations	7
5.4	In Situ Testing	7
5.5	Sampling	7
5.6	Post-Fieldwork Monitoring	7
5.7	Laboratory Analysis	7
6	Ground and Groundwater Conditions	8
6.1	General	8
6.2	Topsoil	8
6.3	Head Deposits	8
6.4	Lowestoft Formation (Diamicton)	8
6.5	Groundwater Conditions	8
7	Material Properties	10
7.1	General	10
7.2	Head Deposits	10
7.3	Lowestoft Formation	11
7.4	Summary	12
8	Geotechnical Assessment	15
8.1	General	15
8.2	Excavations	15

8.3	Bridge Foundations	15
8.4	Road Construction	16
8.5	Below Ground Concrete Design	16
9	Summary and Recommendations	18
9.1	Geotechnical	18
10	References	19

#### Figures

- Figure 2: SPT N Values vs Depth
- Figure 3: Shear Strength vs Depth

#### Drawings

775823-MLM-ZZ-XX-DR-J-0005 Exploratory Hole Location Plan

### Annen Exploratory Hole Logs

## $\Delta$ nnon In-situ CBR Results

Δnnon Geotechnical Test Results

## 1 Executive Summary

Details	Summary of Main Text		
Introduction	This report has been prepared on the instructions of Persimmon Homes Essex which proposes to construct a new relief road to the northwest of Haverhill, including a bridge across an existing ditch in the west of the site. It presents the results of a ground investigation and geotechnical assessment.		
Site description	The site currently comprises undeveloped agricultural land, crossed by a number of field boundaries and drainage ditches. There are a number of mature high water demand trees across the larger site area.		
Environmental Setting	Geological maps show the site to be underlain by Lowestoft Formation deposits, over Lewes Nodular and Seaford Chalk Formation deposits. The Lowestoft Formation is classified as unproductive strata, while the underlying chalk is a principal aquifer deposit. The northwest of the site is within a zone II (outer) groundwater protection zone.		
	There are a number of water bearing ditches crossing the site.		
	The site is bordered to the south by a new residential development, and to the north by agricultural land.		
Ground Investigation			
Ground Conditions Encountered	Topsoil (maximum proven depth 0.47m bgl) Head Deposits (maximum proven depth 2.40m bgl) Lowestoft Formation (Diamicton) (maximum proven depth 20.0m bgl)		
Groundwater	Groundwater was encountered across the larger site area at between 1.00m bgl and 4.50m bgl during a previous site investigation, and in the MLM supplementary investigation at 18.50m bgl.		
	During subsequent monitoring visits, groundwater was recorded at depths between 2.70m and 3.40m bgl.		
Geotechnical Assessment			
Excavations	Heavy duty excavation plant may be required to excavate to proposed construction depths.		
Bridge Foundations	The proposed bridge foundations should be suitable for the proposed development, as settlement is shown to be less than 25mm, and the proposed foundation depth is shown to be out of the zone of influence of trees at the site.		
Pavements	Design CBR of 4% on natural fine soils.		
Buried Concrete	Head Deposits: Design Sulphate Class – DS1 and ACEC Class – AC1 Lowestoft Formation: Design Sulphate Class – DS2 and ACEC Class – AC2		

## 2 Limitations and Exceptions

- 1 This report and its findings should be considered in relation to the terms and conditions proposed and scope of works agreed between MLM Consulting Engineers Ltd (MLM) and the client.
- 2 The Executive Summary, Conclusions and Recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon until considered in the context of the whole report and the development, if any, proposed.
- 3 The assessment and interpretation of contamination and associated risks are based on the scope of work agreed with the client and the report may not be sufficient to fully address contaminations or to allow detailed remediation design to proceed without further investigation and analysis.
- 4 Any assessments made in this report are based on the ground conditions as revealed by the exploratory holes and pits, together with the results of any field or laboratory testing undertaken and, where appropriate, other relevant data which may have been obtained for the sites including previous site investigation reports. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available.
- 5 Interpretations and recommendations contained in the report represent our professional opinions, which were arrived at in accordance with currently accepted industry practices at the time of reporting and based on current legislation in force at that time.
- 6 Where the data available from previous site investigation reports, supplied by the Client, have been used, it has been assumed that the information is correct. No responsibility can be accepted by MLM for inaccuracies within the data supplied.
- 7 Whilst the report may express an opinion of possible configuration of strata between or beyond exploratory hole or pit locations, or on the possible presence of features based on visual, verbal or published evidence, this is for guidance only and no liability can be accepted for the accuracy.
- 8 Comments on groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. It should be noted that groundwater levels can vary due to seasonal or other effects.
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- 10 This report is prepared and written in the context of the proposals stated in the introduction to this report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore, with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to us for re-assessment and, if necessary, re-appraisal.

### 3 Introduction

#### 3.1 General

This report has been prepared by MLM Consulting Engineers Ltd (MLM) on the instructions of Persimmon Homes Essex (Client), which is proposing to construct a new relief road to the northwest of Haverhill, which will include the construction of a bridge over an existing water-bearing ditch in the west of the site.

The objective of this report is to provide an assessment of ground conditions, and to provide recommendations and parameters for geotechnical design of the proposed bridge at the western end of the site and assessment of strength of the sub grade to the proposed road construction.

#### 3.2 Terms of Reference

The terms of reference for the work were set out in two MLM proposals, in reference to parameters for the bridge design in ref. 619132-MLM-ZZ-XX-CP-J-0001 dated 20 March 2018, and in reference to additional investigation to confirm the findings of the slope stability assessment, in the fee proposal ref. 619132-MLM-ZZ-XX-CP-J-0002, dated 21 March 2018.

#### 3.3 Technical Approach

The geoenvironmental and geotechnical work undertaken by MLM follows the Association of Geotechnical and Geoenvironmental Specialists (AGS) *Good Practice Guidelines for Site Investigations.* 

The process of contamination assessment adopted in this report generally follows the model procedures for the management of contaminated land described in the Environment Agency Contaminated Land Report 11. It also takes into account the guidance issued in the National Planning Policy Framework (NPPF).

The format of the report is in general accordance with the reporting requirements of BS5930:2015.

#### 3.4 Proposed Development

It is understood that the proposed development will comprise a relief road running along the northern boundary of a new development in northwest Haverhill. The design of the road is set out in MLM drawing ref. 612263/71 Rev 1.

For the proposed bridge, it is understood that a pad solution is being considered for the foundations.

### 4 The Site

#### 4.1 Location and Description

The site is located to the north of a proposed residential development, located approximately 1.4km to the north of Haverhill town centre.

The new relief road is orientated in a roughly east west direction, the eastern end of the road is at approximate National Grid Reference 567831, 246772 and joins the A143 (Haverhill Road); the western end is at grid reference 566157, 246910 and joins a roundabout on Hales Barn Road. The overall length of the proposed road is approximately 1.8km.

The relief road crosses over undeveloped agricultural land, divided up by a number of field boundaries, formed by hedgerows and drainage ditches. The biggest water-bearing ditch is adjacent to the existing roundabout to the west of the proposed road development.

Mature high and moderate water demand trees have been noted within the larger site area, including an ash and hawthorn tree in the area of the proposed new bridge.

The topography across the site varies from approximately 77m OD from the western end of the site, varying along the road alignment with approximate levels of 86m OD, 97m OD, 92m OD, 108m OD; and 102m OD at the eastern end of the site. Due to the variations in levels along the road, it will be formed at grade, in cut and on an embankment.

A location plan showing the road alignment is presented as Figure 1.

#### 4.2 Geology

The geological map of the area shows the site to be underlain by the Lowestoft Formation (Diamicton), over Lewes Nodular and Seaford Chalk Formation deposits.

#### 4.3 Hydrogeology

The Environment Agency website provides the following hydrogeological information:

#### Table 4.1 Aquifer Properties

Aspect	Designation	Description
Groundwater Source Protection Zone	SPZ2	Outer protection zone. Defined by a 400 day travel time from a point below the water table. This zone has a minimum radius of 250 or 500m around the source, depending on the size of the abstraction.
Eastern third of road		
Groundwater Source Protection Zone	No SPZ	The site is not within a catchment area where groundwater is discharged to a source.
Central and western site areas		

Aspect	Designation	Description
Aquifer Designation – Superficial Deposit	Secondary Aquifer (undifferentiated)	Permeable layers capable of supporting water supplies at a loca rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Lowestoft Formation		Assigned in cases where it has not been possible to attribute either category 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.
Aquifer Designation – Bedrock Deposit	Principal Aquifer	These are deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
Lewes Nodular and Seaford Chalk Formation		

#### 4.4 Hydrology

There are four drainage ditches crossing the path of the proposed relief road.

## 5 Ground Investigation

#### 5.1 Site Work

Site work combines information from a ground investigation undertaken by GEL (ref. 995,SI/SG,PD/09.12.14/V1, dated 9 December 2014) as well as information from a supplementary investigation undertaken by MLM in June 2018.

#### Table 5.1 Summary of Exploratory Holes (all phases)

Туре	Ref.	Depth Range (m bgl)
Cable percussion boreholes	BH5* CP101 to CP102	10.00 -20.00
Windowless sampler boreholes	WS1, WS4, WS6, WS7, WS18, WSF* WS101 to WS107	1.89 –5.00
Trial pits	TP5, TP7, TP17, TP17, TP24, TP31, TP32, TP33* TP101 to TP109	1.20 –3.00
In-situ CBR tests	CBR101 to CBR116	0.40m

\* Relevant holes from previous GEL investigation

The exploratory holes undertaken by MLM were set out by an MLM engineer targeting areas not previously investigated and at locations to maximise the available data, whilst operating within the constraints of the site.

All exploratory holes were logged by a geoenvironmental engineer in general accordance with BS5930:2015.

The exploratory hole logs are presented in Appendix A.

#### 5.2 Investigation Rationale

The rationale for the MLM investigation is presented in Tables 6.2:

#### Table 5.2 MLM Rationale for Geotechnical Sampling and Testing

Target/Area	Potential Geotechnical Feature	Exploratory Hole(s)
Areas of proposed cut	Ground conditions under proposed roadway	TP101 to TP109
Proposed bridge construction	Bridge foundation design	CP101, CP102, WS106 and WS107
Road sections to be constructed at existing site level	Strength of road formation	CBR101 – CBR116

Proposed cable percussive boreholes to the east of the existing ditch were replaced with windowless sampler boreholes due to access issues.

The locations of all the exploratory holes are presented on Drawing, 775823-MLM-ZZ-XX-DR-J-0005-S2-CO1.

#### 5.3 Installations

Groundwater monitoring standpipes were installed in CP102, WS7 and WS102.

Details of the installations are provided on the relevant borehole logs.

#### 5.4 In Situ Testing

Standard penetration tests (SPTs) were undertaken at regular intervals in the cable percussion and windowless sampler boreholes.

In situ CBR testing was undertaken in locations where the current elevations are approximately at formation.

SPT types and depths are recorded on the relevant exploratory hole records, with in-situ CBR testing results saved in Appendix B.

#### 5.5 Sampling

Geotechnical undisturbed samples were recovered from the cable percussion borehole in U100 tubes.

Continuous soil cores were recovered from the windowless sampler boreholes in clear PVC liners to prevent cross contamination and aid sample recovery.

Disturbed samples were recovered from all exploratory holes, in bulk bags and/or tubs depending on the soil types and proposed laboratory testing. In locations where cut is proposed, samples for lab-based CBRs were taken.

Sample types and depths are recorded on the relevant exploratory hole records.

#### 5.6 Post-Fieldwork Monitoring

Post-fieldwork monitoring of groundwater levels has been undertaken on one occasion following the site investigation.

#### 5.7 Laboratory Analysis

The following laboratory tests were scheduled on samples recovered by MLM from the exploratory holes. .

#### Table 5.3 Summary of Geotechnical Testing

Test	No.
Natural moisture content	46
Atterberg limits	37
Bulk density	9
Undrained triaxial shear strength	7
One dimensional oedometer consolidation	4
pH and sulphate	31

Geotechnical testing was undertaken by a UKAS-accredited laboratory to BS1377 and the results are presented in Appendix B.

## 6 Ground and Groundwater Conditions

#### 6.1 General

The following sections include data from the previous investigation by GEL dated 2014.

The following general strata sequence was encountered across the site. Interpolation between exploratory hole positions has been undertaken based on visual observations and laboratory testing.

#### Table 6.1 Generalised Strata Sequence

Stratum	Depth range (m bgl)		Proven Thickness range (m)	
	Тор	Base		
Topsoil	GL	0.10 - 0.60	0.10 - 0.60	
Head Deposits	0.25 - 0.60	1.30 - 2.40	1.10 – 2.15	
Lowestoft Formation*	0.10 - 2.40	1.20 - 20.00	0.10 – 17.60	

\* Base of stratum not proven in all holes

The findings of the ground investigations generally do not match the published geology for the area, with Head deposits encountered above the Lowestoft Formation across part of the site.

#### 6.2 Topsoil

For the purposes of this report topsoil is defined as a near surface soil which appears from visual inspection alone to be capable of supporting plant growth. The description of topsoil within this report does not imply compliance with BS3882.

Topsoil was recorded in all exploratory hole locations across the site, to depths of between 0.10m and 0.60m bgl. It generally comprised a clay soil, with varying amounts of silt, sand and gravel comprising flint, brick, charcoal, clinker and chalk.

#### 6.3 Head Deposits

Firm sandy gravelly clay deposits were encountered in two northwest-southeast bands across the site, and in the far west of the site, where deposits in part comprised silty gravelly sands. Significantly lower SPTs were encountered in the west of the site, in the location of the proposed road bridge. These have been recorded as being Head deposits. The gravel component comprised chalk, flint and occasional sandstone and mudstone, with occasional bands of sand. No exploratory holes were terminated in this strata.

#### 6.4 Lowestoft Formation (Diamicton)

Underlying the topsoil and/or Head deposits, a firm to stiff gravelly clay was recorded across the site, with the gravel component comprising flint, chalk and occasional limestone and fossils, which were considered to be representative of the Lowestoft Formation deposits. In CP01, in the west of the site, a silty gravelly sand with bands of sandy silty clay was encountered at depth. All exploratory holes were terminated within this strata.

#### 6.5 Groundwater Conditions

Groundwater was encountered during the initial ground investigation within TP7, WS18 and WSF at depths ranging from 1.0m to 1.8m bgl, within the granular Head deposits, and in the supplementary investigation in CP01, in the west of the site, at 18.50m bgl in the granular Lowestoft Formation deposits. It is considered to be perched groundwater, rather than being representative of the groundwater in the area.

There was only one well along the length of the roadway in the initial investigation, in WS7, where groundwater was encountered between 2.70m and 3.40m bgl during monitoring visits. In the wells installed during the supplementary investigation (CP102 and WS102), groundwater was encountered at 2.87m and 2.98m bgl during the one monitoring visit undertaken.

## 7 Material Properties

#### 7.1 General

The following sections include data from the previous investigation by GEL dated December 2014 (Ref: 995,SI/SG,PD/09.12.14/V1).

The following presents a summary of the properties of the soils encountered, based on field observations, in situ field testing and laboratory test results.

For the purposes of property designation, soils are divided into fine soils (clays and silts) and coarse soils (sands and gravels).

Soil plasticity class for fine soils is based on the classification system of BS5930, adopting modified plasticity index values (based on percentage passing 425µm sieve).

Volume change potential of fine soils on change of moisture content has been assessed using guidance provided in BRE Digest 240 - Part 1.

Equivalent approximate undrained shear strengths ( $c_u$ ) and equivalent approximate coefficients of volume compressibility ( $m_v$ ) have been calculated from recorded SPT N values, adopting  $f_1$  and  $f_2$  values respectively (based on CIRIA 143) appropriate to the recorded plasticity.

#### 7.2 Head Deposits

#### **Relief Road Construction**

Natural moisture contents in the fine fraction of these materials range from 19% to 24% in the three samples tested, with modified plasticity indices ranging from 21% and 31%. On this basis these soils are classified as of intermediate and high plasticity (CI/CH soils) and of medium swelling/shrinkage potential on change of moisture content.

In situ SPT N values within the fine fraction of these materials range from 6 to 14. Approximate undrained shear strengths based on these results range from 27kN/m<sup>2</sup> to 64kN/m<sup>2</sup>, adopting an f1 value of 4.6 (based on an 'average' plasticity of 27%). As shown on Figure 2 these values compare fairly well with the results of hand shear vane tests, which recorded undrained shear strengths of 36kN/m<sup>2</sup> to 70kN/m<sup>2</sup> on samples from 0.7m bgl to 1.5m bgl.

#### Proposed Bridge Location

A band of silty sandy gravel was encountered in one location in the area of the proposed bridge footings. A single in situ SPT N value of 10 was recorded in this stratum, showing the deposit to be between a loose and medium dense relative density. The angle of shearing resistance based on this is 30°.

Natural moisture contents in the fine fraction of these materials range from 17% to 21% in the three samples tested from this area of the site, with modified plasticity indices ranging from 10% and 23%. On this basis these soils are classified as of low to medium plasticity (CL/CI soils) and of low to medium swelling/shrinkage potential on change of moisture content.

In situ SPT N values within the fine fraction of these materials range from 3 to 8. Approximate undrained shear strengths based on these results range from 17kN/m<sup>2</sup> to 44kN/m<sup>2</sup>, adopting an f1 value of 5.5 (based on an 'average' plasticity of 19%).

Approximate coefficients of volume compressibility (mv) have been derived solely from the in situ SPTs in CP101, CP102 and WS106, where Head Deposits were encountered in the vicinity of the proposed bridge. Values in the fine fraction of these materials range from  $0.227m^2/MN$  to  $0.606m^2/MN$  adopting an f<sub>2</sub> value of 0.55 (based on the 'average' plasticity).

#### 7.3 Lowestoft Formation

#### **Relief Road Construction**

Recorded natural moisture contents in the fine fraction of these materials range from 15% to 29%, and plasticity indices from 14% to 32%. On this basis these soils are classified predominantly as of low to intermediate plasticity (CL/CI soils) and occasionally high plasticity (CH soils). The soils are classified as low to medium swelling/shrinkage potential on change of moisture content.

In situ SPT N values within the fine fraction of these materials range from 8 to 74, with SPT N values generally increasing with depth. Approximate undrained shear strengths based on these results range from 41kN/m<sup>2</sup> to 377kN/m<sup>2</sup>, adopting an f<sub>1</sub> value of 0.48 (based on an 'average' plasticity of 25%). Hand shear vane results from depths of 0.5m to 4.0m bgl generally recorded undrained shear strengths of 48kN/m<sup>2</sup> to 140kN/m<sup>2</sup>.

#### Proposed Bridge Location

Recorded natural moisture contents in the fine fraction of these materials range from 17% to 25%, and modified plasticity indices from 7% to 30%. On this basis these soils are classified as of low to intermediate plasticity (CL/CI) soils. The soils are classified as low to medium swelling/shrinkage potential on change of moisture content.

In situ SPT N values within the fine fraction of these materials range from 8 to 38, with SPT N values generally increasing with depth. As the proposed bridge footings will be at approximately 77.1m AOD, only SPT N values below this depth have been used in this assessment, and therefore values range from 13 to 38 have been adopted for this part of the site. Approximate undrained shear strengths based on these results range from 77kN/m<sup>2</sup> to 220kN/m<sup>2</sup>, adopting an f<sub>1</sub> value of 5.8 (based on an 'average' plasticity of 18%). As shown on Figure 2 these values are shown to be fairly conservative when compared with the results of the laboratory triaxial tests, where undrained shear strengths of 80kN/m<sup>2</sup> to 350kN/m<sup>2</sup> are recorded on samples from 1.2m bgl to 9.5m bgl.

Approximate coefficients of volume compressibility (mv), again only from CP101, CP102, WS106 and WS107 in close proximity to the proposed bridge have been calculated from the SPTs. Values in the fine fraction of these materials range from 0.045m<sup>2</sup>/MN to 0.13m<sup>2</sup>/MN adopting an f2 value of 0.59 (based on the 'average' plasticity).

#### 7.4 Summary

Based on the results of the in-situ testing and lab results, the following design parameters have been established:

Stratum	Parameter	Result range		Design Parameter/	Justification
		Minimum	Maximum	Range	
Head Deposits – Relief Road	In situ SPT value (N) (fine soils)	6	14	78.0m = 6 plus 2 per metre	Increasing with depth
Construction	Natural moisture content (%)	19	24	21	Average value
	Plasticity Index* (%)	23	31	27	Average value
	Undrained cohesion (c <sub>u</sub> ) (kN/m <sup>2</sup> ) (based on SPT N values and hand shear vane results)	27	64	40	Adopted value
	Weight density (kN/m <sup>3</sup> ) (fine soils)	-	-	20	Assumed value
	Water soluble sulphate content (mg/l)	20	40	40	Assumed based on maximum value recorded in Head Deposits on site
	pH value	7.3	7.8	7.3	Assumed based on maximum value recorded in Head Deposits on site
	Lab based CBRs	4.2	7.5	4.2	Minimum value

#### Table 7.1 Relief Road Construction

Stratum	Parameter	Result range		Design Parameter/	Justification	
		Minimum	Maximum	Range		
Lowestoft Formation	In situ SPT value (N) (fine soils)	8	74	79.0m = 8 plus 1.5 per metre	Increasing with depth	
(Diamicton) – Proposed roadway	Natural moisture content (%)	15	29	19	Average value	
	Plasticity Index* (%)	7	30	19	Average value	
	Undrained cohesion ( $c_u$ ) (kN/m <sup>2</sup> ) (based on SPT N values and hand shear vane results)	23	377	50	Adopted value for deposit	
	Weight density (kN/m <sup>3</sup> ) (fine soils)	-	-	20	Assumed value	
	Water soluble sulphate content (mg/l)	<10	1420	1420	Maximum value	
	pH value	6.9	7.8	6.9	Minimum value	
	In-situ and lab based CBRs	2.1	14	2.1	Minimum value	

\* modified

#### Table 7.2 Bridge Foundations

Stratum	Parameter	Result range		Design Parameter/	Justification
		Minimum Maximum		Range	
Head Deposits – Bridge structure	In situ SPT value (N) (fine soils)	3	8	3	Minimum value
	In site SPT value (N) (coarse soil)	10	10	10	Single recorded value
	Natural moisture content (%)	17	21	18	Average value
	Plasticity Index* (%)	10	23	19	Average value
	Undrained cohesion (c <sub>u</sub> ) (kN/m <sup>2</sup> ) (based on SPT N values, lab triaxial and hand shear vane results)	17	44	20	Conservative value adopted for deposit

Stratum	Parameter	Result range		Design Parameter/	Justification
		Minimum	Maximum	Range	
	Co-efficient of volume compressibility (mv) (m <sup>2</sup> /MN) (based on SPT N values)	0.227	0.606	0.455	Conservative value adopted for deposit
	Young's modulus (E') (kPa) (based on c <sub>u</sub> )	3570	9240	4200	Conservative value adopted for deposit
	Weight density (kN/m <sup>3</sup> ) (fine soils)	-	-	20	Assumed value
	Water soluble sulphate content (mg/l)	20	40	40	Maximum value
	pH value	7.3	7.8	7.3	Maximum value
Lowestoft	In situ SPT value (N) (fine soils)	13	35	13	Minimum value
Formation (Diamicton) –	Natural moisture content (%)	15	29	19	Average value
Bridge structure	Plasticity Index* (%)	7	30	18	Average value
	Undrained cohesion (c <sub>u</sub> ) (kN/m <sup>2</sup> ) (based on SPT N values and triaxial results)	75	224	85	Conservative value taken for whole deposit
	Co-efficient of volume compressibility (mv) (m²/MN) (based on SPT N values)	0.034	0.212	0.1	Conservative value taken for whole deposit
	Young's modulus (E') (kPa) (based on $c_u$ )	15750	47040	17850	Conservative value taken for whole deposit
	Weight density (kN/m <sup>3</sup> ) (fine soils)	-	-	20	Assumed value
	Water soluble sulphate content (mg/l)	<10	1420	1420	Maximum value
	pH value	6.9	7.8	6.9	Minimum value

\* modified

## 8 Geotechnical Assessment

#### 8.1 General

This geotechnical assessment is based on the parameters determined from the field work and laboratory analysis as described in section 8. It presents a geotechnical assessment of possible foundation solutions for the proposed bridge, and infrastructure design for the new relief road.

The road construction will include extensive earthworks activity, with cut and fill sections proposed along the length of the roadway. A separate slope stability assessment has been undertaken for the slopes forming the cut/fill road alignment (ref. 619132-MLM-ZZ-XX-RP-J-0001-S2-C02, October 2018).

#### 8.2 Excavations

Future road levels are proposed to be up to 4.2m below existing levels, and may require heavy-duty excavation plant to extend through the stiff clays at depth.

Instability of excavation faces was not noted during excavation of the trial pits, however random and sudden falls should be expected from the faces of near vertically sided excavations put down at the site. This situation is likely to be prevalent in the natural coarse soils and low strength natural fine soils.

Temporary trench support, or battering of excavation sides, is likely to be required for all excavations that are to be left open for any length of time, and will definitely be required where man entry is required.

Particular attention should be paid to excavation at, or close to, site boundaries, where collapse of excavation faces could have a disproportionate effect.

A risk assessment of the stability of any open excavation should be undertaken by a competent person and appropriate measures adopted to ensure safe working practise in and around open excavations. Further guidance on responsibilities and requirements for working near, and in, excavations can be obtained from the Construction Design and Management Regulations (2015).

During the investigations along the roadway, groundwater was generally not encountered within likely excavation depths, other than where seepages were encountered in the Head deposits in TP7, WS18 and WSF, at depths between 1.0m and 1.8m bgl. These locations are not located in areas where excavations are proposed, and therefore based on site observations, it is considered that sump pumping is likely to be sufficient to deal with anticipated flows.

Groundwater was not encountered in the boreholes in the area of the proposed bridge development, however groundwater was present during monitoring at 2.87m bgl in the borehole adjacent to the bridge, during a subsequent monitoring visit. Construction activities will need to account for water in the existing channel, as well as groundwater, with higher levels likely during wetter months. Dewatering requirements will be subject to actual groundwater and ditch water levels at the time of construction. Temporary works may require some form of dewatering scheme (eg cut off walls) to control groundwater ingress into open excavations.

Any water pumped from excavations is likely to need to be passed via settlement tanks before being discharged to the sewer; discharge consents will also be required.

#### 8.3 Bridge Foundations

The appropriate foundation solution adopted for the site will depend not only on ground conditions, but also on structural loading, load distribution and the limiting criteria for movement or settlement of the structure, which may have high specification finishes and unevenly distributed loadings so that settlement, and particularly differential settlement, will need to be maintained within tight tolerances.

The Head Deposits in the area of the proposed bridge are considered unsuitable in their present condition for use as founding soils, on the basis of their relatively low strength and high compressibility. These deposits should be fully penetrated by all new foundations.

The soils in this area of the site are of low to medium swelling/shrinkage potential on change of moisture content, and the moisture content testing does not show any evidence in of desiccation in these soils.

Trees are noted in the adjacent to the proposed bridge, with a 15m moderate water demand tree and a 7m high water demand tree located in the existing ditch. As bridge foundations are currently proposed at depths of approximately 2.80m below existing ground level, it is considered that, in accordance with NHBC standards, the foundations are outside the zone of influence of the trees to be removed.

Where trees are to be removed, the roots should be grubbed out and foundations extended to below the zone of disturbance created by this activity.

It is understood that the proposed bridge will be founded on two large strip foundations, 2m wide and 19.8m long; the long axis of the foundations running parallel to the ditch. The foundations will be founded at a depth of 2.8m bgl, into the Lowestoft Formation (Diamicton) deposits. The foundation excavations will be battered back, and once the foundations are constructed, the excavations will be backfilled with a 6N fill.

Settlement analysis has been carried out for the proposed foundations using the Oasys software PDISP, verison 19.2. For the settlement analysis, an initial worst case load scenario of 120kN/m<sup>2</sup> was used in the assessment. Based on the geotechnical testing undertaken, assuming a Young's Modulus (E') of 17850kN/m<sup>2</sup> for the underlying clay soils, settlement of 24.6mm is calculated using the Boussinesq method of calculating settlement. It is understood that this settlement is within the acceptability envelop of the proposed structure and no further refinement of the loadings is warranted.

The Lowestoft Formation is an over consolidated clay and can swell and soften readily when allowed access to free water. Groundwater monitoring indicates the presence of groundwater at the site, as well as the stream being present through the centre of the existing ditch. Therefore, care will be required to ensure that foundation excavations are kept as free of water as practicable and that concrete is poured as soon as practicable after excavation.

#### 8.4 Road Construction

Following site preparation/regrading the sub-grade will comprise Lowestoft Formation deposits across the majority of the site, with Head Deposits present in two bands across the site. In-situ CBRs were undertaken along the length of the proposed roadway, in locations where fill is not proposed. CBR values of between 3.5% and 14% were recorded, with natural moisture contents of between 9% and 25%. Typically, the higher the moisture content, the lower the CBR value and in the most part the majority of the CBR values ranged between 3.5% and 5.8%, with moisture contents in the range of 18% and 25%.

In comparison, assuming an average plasticity of 25%, in accordance with Table 5.1 of Interim Advice Note 73/06 Revision 1 (2009) an equilibrium subgrade CBR value of 3-4% is estimated assuming a thin construction.

Whilst higher CBR values have been recorded, these higher values are due to the lower moisture contents, and following wetting of these soils CBR values will significantly decrease. Based on the testing undertaken, and in line with published guidance, a design value of 4% is considered appropriate at the site.

#### 8.5 Below Ground Concrete Design

Based on the results of the pH and water soluble sulphate determinations on soil samples and in accordance with the categorisation system of BRE Special Digest 1, the soils below the site fall within the classes presented in Table 8.1 below.

#### Table 8.1 Summary of Concrete Design Class

Soil Type	Design Sulphate Class (DS)	Aggressive Chemical Environment for Concrete (ACEC)
Head Deposits	DS - 1	AC - 1
Lowestoft Formation	DS -2	AC - 2

## 9 Summary and Recommendations

The site is underlain by Head Deposits, in three areas of the site, over Lowestoft Formation deposits, which are present from the surface across the majority of the site area.

#### 9.1 Geotechnical

The proposed bridge will be founded on concrete strip foundations, 2.0m by 19.8m in size.

The foundations will be founded into the underlying Lowestoft Clays, from depths of 2.8m bgl.

Settlement analysis, assuming a worst-case load of 120kN/m<sup>2</sup>, has calculated less than 25mm settlement, which is understood to be in acceptable limits of the proposed structure.

The trees present in the area of the proposed bridge should not impact on the foundations, as at approximately 2.8m bgl the foundations are outside the zone of influence based on tree height and type.

Water was present in the well adjacent to the proposed bridge structure, and construction activities will need to take into account surface water, in the existing channel, and groundwater during the build phase. Some form of groundwater control may be required, eg cut off walls.

Based on the classification of the formation soils and in situ CBR testing an overall design CBR of 4% should be available, following proof rolling of the formation. Drainage control will be required on site.

The Head Deposits at the site fall within Design Sulphate Class DS-1with a corresponding ACEC Class of AC-1, whereas the Lowestoft Formation deposits are classified as DS-2 and AC-2.

## 10 References

- 1 Association of Geotechnical and Geoenvironmental Specialists (2004) A clients guide to site investigations.
- 2 Association of Geotechnical and Geoenvironmental Specialists (2006) AGS guidelines for good practise in site investigations.
- 3 Association of Geotechnical and Geoenvironmental Specialists (1999) Code of conduct for site investigations.
- 4 Association of Geotechnical and Geoenvironmental Specialists (2005) Management of risk associated with the preparation of ground reports.
- 5 Association of Geotechnical and Geoenvironmental Specialists (2005) Guidelines for the preparation of the ground report.
- 6 Association of Geotechnical and Geoenvironmental Specialists (2000) Guidelines for combined geoenvironmental and geotechnical investigations.
- 7 British Standards Institution (2011) Investigation of potentially contaminated sites code of practice. BS10175:2011.
- 8 British Standards Institution (2010) Code of practice for site investigation. BS5930:2015.
- 9 British Standards Institution (1990) Methods of test for civil engineering purposes. BS1377:1990.
- 10 British Standards Institution (2015) Specification for topsoil. BS3882:2015.
- 11 British Standards Institution (2015) Code of practice for the characterization and remediation from ground gas in affected developments. BS8485:2015.
- 12 British Geological Survey (2002) Sheet 205 Saffron Walden. 1:50,000 scale Geology Map, Solid and Drift Edition.
- 13 Building Research Establishment (1993) Building on shrinkable clay. BRE Digest 240 Part 1.
- 14 Building Research Establishment (1996) Desiccation in clay soils. BRE Digest 412.
- 15 Building Research Establishment (2005) Concrete in aggressive ground. BRE Special Digest 1.
- 16 CIRIA (1995) The standard penetration test (SPT). Methods and use. CIRIA Report C143.
- 17 Hatanaka M and Uchida A (1996) Empirical correlation between penetration resistance and effective friction of sandy soil. Soils and Foundations, Vol 36 (4), 1-9.
- 18 Hansen J and Brinch A (1961) General formula for bearing capacity. Danish Geotechnical Institute Bulletin No. 11.
- 19 Hansen J and Brinch A (1968) A revised extended formula for bearing capacity. Danish Geotechnical Institute Bulletin No. 28.
- 20 Hansen J and Brinch A (1978) A code of practise for foundation engineering. Danish Geotechnical Institute Bulletin No. 32.
- 21 Highways Agency (2009) Interim Advice Note 73/06 Revision 1 Design guidance for road pavement foundations.

## Figures

- Figure 1: Site Location Plan
- Figure 2: SPT N Values vs Depth
- Figure 3: Shear Strength vs Depth



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	PROJECT	ORIGINATOR	VOLUME/SYSTEM	LEVELS/LOCATIONS	TYPE	ROLE	NUMBER
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## Drawings

775823-MLM-ZZ-XX-DR-J-0005 Exploratory Hole Location Plan



_E(	GEND	
	CP1	CABLE PERCUSSION BOREHOLE LOCATION
ě	WS1	WINDOWLESS SAMPLER BOREHOLE LOCATION
4	WS1	CBR TEST LOCATION
	TP1	TRIAL PIT LOCATION
	DRAWING TI	TLE
	EXPL PLAN	ORATORY HOLE LOCATION - RELIEF ROAD & BRIDGE
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# $\Delta$ nnon Exploratory Hole Logs

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JT100	OPEN DRIVE THIN WALL TUBE SAMPLE			C STANDARD	PENETRATION TEST USING A SOLID CONE

WHERE A TEST HAS BEEN COMPLETED THE TYPE OF TEST AND THE N-VALUE WILL BE REPORTED.

WHERE THE FULL 300 mm PENETRATION OF THE MAIN DRIVE HAS NOT BEEN COMPLETED, THE NUMBER OF BLOWS (NOT AN N-VALUE) WILL BE REPORTED.

THE FIELD RECORDS COLUMN ON THE LOG WILL SHOW EACH SET OF BLOW COUNTS PER 75 mm OF PENETRATION INCLUDING SEATING BLOWS AND WILL ALSO INDICATE THE PARTIAL PENETRATION ACHIEVED (mm) FOR INCOMPLETE TESTS.



OPEN DRIVE TUBE SAMPLE (38 mm NOMINAL DIAMETER)

SMALL DISTURBED SAMPLE

BULK DISTURBED SAMPLE

ROTARY CORE SAMPLE

UNDISTURBED SAMPLE

ENVIRONMENTAL SAMPLE

STANDARD PENETRATION TEST

BLOCK SAMPLE

GAS SAMPLE

TUBE SAMPLE

WATER SAMPLE

PISTON SAMPLE (100 mm NOMINAL DIAMETER UNLESS NOTED OTHERWISE)

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<b>≉</b> MI	м	Project: Project ID: Location:	Nortl 7758 Have	nwest Hav 23 erhill	/erhi	ll Relief Road	Method: Start: Finish:	CP 07/06/2018 07/06/2018		CP101
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D2 : 0.70m			73.00	- - - -						
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04 : 2.70m	(C)		77.76	- 2.40 -						
J1 : 3.00m				- 						
05 : 3.50m				-						
1.00	N=17 (2,2/3,4,4,6) (C)		75.96	- - 4 - 4.20						
06 : 4.50m				- - -						
J2 : 5.00m				5						
D7 : 5.50m				- 6						
7.10	N=19 (2,2/4,4,5,6) (S)			- - - - - - - -						
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J3 : 9.10m				- 9 						
D9 : 9.60m				-  -  -  -  -						

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		Project Engineer	Hest	er Carter				246941.32N	Logged by:		
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U4 : 13.10m				13							
D11 : 13.60m				- - - - - - - 14							
15.00	N=22 (3.3/4,4,6,8) (S)			- - - - - - - - - - - - - - - - - - -							
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17.10 B3 : 17.20m	N=38 (4,4/7,8,9,14 (C)	)		- - 17 - - - -							
D13 : 18.30m			61.66	- 18 - 18 - 18.50							
19.00 B4 : 19.20m	50 (6,7/50 fo 87mm) (S)	r		- 19							
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D3 : 2.60m			11.02							
U1 : 2.90m										
D4 : 3.30m				- - - - -						
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U3 : 9.10m				9						
D8 : 9.60m										

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Notes:	tronatho	recorded		con Uand	Shoo	r \/ano			Dimer	nsions:
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Remark	(S	المط سنط	-	on'	oti				n	n
i. Irial	pit backfi	med with a	arisings up	on compl	etion.					
								m		
								Stability:		
								Plant Used:		
								Mechanical Ex	cavator	

R G		М.	Project: Project ID Location: Client: Project	No 2: 77! Ha Pe	rthwe: 5823 verhill rsimm	st Haverhill Relief Road on Homes Essex	Method: Start: Finish: Level (mOD): Co-ordinates:	TP 08/06/2018 08/06/2018 97.31 566511.60E -	1:25 Sheet	TP106
			Engineer	He	ster C	arter		246987.38N	Logge LE	d by:
	TEST/S/	AMPLING					STRATA			
Depth (m)	TEST/S/	AMPLING Strength Shear (kPa)	Level (mAOD) 96.81 95.51 94.31	Depth (m) 	redeut		STRATA			
				- - - - - - -						
Notes:									Dime	ensions:
Shear s Remark 1. Trial	trengths s oit backfi	recorded	using Pilic arisings up	con Hand on compl	Shear	r Vane		m Stability: Plant Used: Mechanical Ex	cavator	m

			Project:	No	rthwe	st Haverhill Relief Road	Method:	TP		
			Project ID	D: 77	5823		Start:	08/06/2018		TP107
			Location:	Ha	verhil		Finish:	08/06/2018		
		<b>VI.</b>	Client	De			Level (mOD):	97.57	1:25	
G	Froup		Dreiset	Pe	ISIIIII	ION HOMES ESSEX	Co-ordinates:	566558.01E -	Sheet	1 of 1
			Engineer:	: He	ster C	arter		247006.54N	Logge	ed by:
									LE	
	J 1ES1/5/	AMPLING					STRATA			
ш Ч	nple ef.	Strength	Level	Depth	end					
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Notes:					-				Dime	ensions:
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1. Trial	pit backfi	illed with a	arisings up	on comp	letion.					]
								m		
								Stability:		
								Plant Used:		
								Mechanical Ex	cavator	

			-							
			Project:	No	rthwe	st Haverhill Relief Road	Method:	TP		
			Project ID	D: 775	5823		Start:	08/06/2018		TP108
		-	Location:	Ha	verhil		Finish:	08/06/2018		
			Olivert	De			Level (mOD):	106.64	1:25	
	Froup		Client.	Pe	SIIIII	ION HOMES ESSEX	Co-ordinates:	567433.08E -	Sheet	1 of 1
			Project					246957 83N	Logge	d by:
			Engineer	: He	ster C	arter		240307.0014	LE	
INSITU	J TEST/S/	AMPLING					STRATA		-	
ĉ					-					
ц. Ч	nple ef.	Strength	Level	Depth	enc					
ept	San Ri	(kPa)	(mAOD)	(m)	Leg					
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Shears	aciiguis	lecolueu	aony Fill		Jiicd					
Remar	s									m
1. Trial	pit backf	illed with a	arisings up	on compl	etion.					
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								Stability:		
								Plant Used:		
								Mechanical Ex	cavator	

			Project:	No	rthwe	st Haverhill Relief Road	Method:	TP		
			Project ID	D: 77	5823		Start:	08/06/2018		TP109
			Location:	Ha	verhil		Finish:	08/06/2018		
	MLI	М.					Level (mOD):	108.00	1:25	
C	Froup		Client:	Pe	rsimm	on Homes Essex	Co-ordinatos:	567480 17E	Sheet	1 of 1
	noup		Project				Co-ordinates.	507400.17E -	Logge	d by:
			Engineer	: He	ster C	arter		246940.13N	LE	
INSITU	J TEST/S/	AMPLING					STRATA			
(n	Φ	Strongth			σ					
oth (	mpl Ref.	Shear		Depth	gen					
Dep	Sa	(kPa)	(IIIAOD)	(11)	Le					
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Shear s	strengths	recorded	using Pilio	con Hand	Shea	r Vane				
Remark	-		-							
1. Trial	oit backfi	illed with a	arisinas ur	on compl	etion					m
								m		
								Stability:		
								Plant Used:		
								Mechanical Ex	cavator	

ML Group	Μ.	Project: Project ID: Location: Client: Project	Pers	nwest Hav 23 erhill immon Ho	ome	ad Mernod Start: Finish: Level (r Co-ordi	mOD): inates:	07/06/2018 07/06/2018 85.60 566293.82E - 246938.54N	1:50 Sheet Logge	WS101
Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend				LE	
D1 : 0.20m			85.45	0.15 						
1.00 1.00 D2 : 1.00m D3 : 1.40m	N=13 (2,2/2,3,4,4) (C)	120	84.40	- - - - - - - - -						
2.00 2.00 D4 : 2.00m D5 : 2.40m	N=18 (3,4/4,4,5,5) (C)	103		- 2						
3.00 3.00 D6 : 3.00m D7 : 3.40m	N=22 (5,5/5,5,5,7) (C)	95		- - - - - - - - -						
4.00 4.00 D8 : 4.00m D9 : 4.50m	N=24 (5,5/5,5,7,7) (C)	93		- 4 - 4 						
5.00 5.00 D10 : 5.00m	N=49 (7,7/11,12,12 4) (C)	92	80.60	- 5 5.00 						

₩ MI	м	Project: Project ID: Location:	Norti 7758 Have	hwest Hav 323 erhill	/erhi	ll Relief Road	Method: Start: Finish:	WS 07/06/2018 07/06/2018		WS102
Group		Client: Project Engineer:	Pers Hest	immon Ho er Carter	omes	s Essex	Level (mOD): Co-ordinates:	91.23 566382.01E - 246963.64N	1:50 Sheet Logge LE	1 of 1 d by:
Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend					
D1 : 0.30m			91.13	0.10 						
1.00 1.00 D2 : 1.00m D3 : 1.10m	N=14 (2,3/3,4,3,4) (C)	125	90.33	- 0.90 - 1 						
2.00 2.00 D4 : 2.00m D5 : 2.20m	N=18 (3,3/4,3,5,6) (C)	107		- 2						
3.00 3.00 D6 : 3.00m D7 : 3.20m	N=38 (6,7/10,9,8,1 <sup>-</sup> (C)	93		- 3 						
4.00 4.00 D8 : 4.00m	N=50 (9,13/14,13,1 10) (C)	3, 91	87.23	- 4 4.00 - 5 - 5 - 6 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7						

攀		Project: Project ID: Location:	North 7758 Have	าwest Hav 23 erhill	erhi	ll Relief Road	Method: Start: Finish:	WS 07/06/2018 07/06/2018		WS103
<b>ML</b> Group	Μ.	Client: Project Engineer:	Pers Hest	immon Ho er Carter	mes	s Essex	Level (mOD): Co-ordinates:	96.54 566483.15E - 246975.46N	1:50 Sheet 1 Loggec LE	l of 1 l by:
Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend				-	
D1 : 0.30m			96.44	0.10						
1.00 1.00 D2 : 1.00m D3 : 1.40m	N=37 (2,2/18,7,6,6) (C)	128	95.24	- 1 - 1.30						
2.00 2.00 D4 : 2.00m D5 : 2.20m	N=18 (4,4/5,4,5,4) (C)	105		- 2						
3.00 3.00 D6 : 3.00m D7 : 3.20m	N=49 (8,12/12,12,1 12) (C)	96	93.54	- 3 3.00 						
4.00		94								

泰		Project: Project ID: Location:	Nortl 7758 Have	nwest Hav 823 erhill	verhi	ll Relief Road	Method: Start: Finish:	WS 08/06/2018 08/06/2018		WS104
ML	<b>M</b> .		_			_	Level (mOD):	97.52	1:50	
Group		Client:	Pers	immon Ho	me	SESSEX	Co-ordinates:	566569.38E -	Sheet 1	l of 1
		Engineer:	Hest	er Carter				247011.03N	Logged	i by:
Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend					
D1 : 0.10m			97.42	0.10						
D3 : 0.40m			97.12	- 0.40						
1.00 1.00 D2 : 1.00m	N=14 (3,3/3,3,4,4) (C)	128		- - - - - - - -						
2.00 2.00 D5 : 2.00m D4 : 2.10m	N=20 (3,3/5,4,5,6) (C)	106		- 2						
3.00 3.00 D7 : 3.00m D6 : 3.10m	N=29 (6,6/6,6,8,9) (C)	95	94.52	- - 3 3.00 - - -						
4.00 4.00 D8 : 4.00m	N=50 (9,10/11,12,1 14) (C)	93 3,	93.52	- - - - - - - -						
5.00		90								

泰	м	Project: Project ID: Location:	Norti 7758 Have	hwest Hav 323 erhill	/erhi	Il Relief Road	Method: Start: Finish:	WS 08/06/2018 08/06/2018		WS105
Group	IVI.	Client:	Pers	immon He	ome	s Essex	Level (mOD):	96.14	1:50 Shoot	1 of 1
Group		Project Engineer:	Hest	ter Carter			Co-ordinates:	566770.99E - 247131.17N	Logge	d by:
Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend					
D1 : 0.10m			96.04	_ 0.10	~~~					
			95.64	- 0.50						
1.00 1.00 D3 : 1.00m D2 : 1.40m	N=14 (1,3/4,3,3,4) (C)	125		- - 1 - - - - -						
2.00 2.00 D4 : 2.00m	N=19 (3,3/5,4,5,5) (C)	95		2						
D5 : 2.60m				-						
3.00 3.00 D6 : 3.00m D7 : 3.50m	N=30 (4,6/7,7,8,8) (C)	92		- 3 						
4.00 4.00 D8 : 4.00m	N=50 (11,12/12,12, ,13) (C)	90	92.14	- 4 4.00 - 5 - 6 - 7 - 7 - 8 - 9						

*		Project: Project ID: Location:	North 7758 Have	nwest Hav 323 erhill	/erhi	I Relief Road	Method: Start: Finish:	WS 08/06/2018 08/06/2018		WS106 (CP103)
Group	Μ.	Client: Project	Pers	immon Ho	ome	Essex	Level (mOD): Co-ordinates:	79.79 566196.71E - 246938 55N	1:50 Sheet Logge	1 of 1 ad by:
Depth	SPT	Engineer: Strength	Hest	er Carter	pu			240550.551¥	LE	
(m)	Results (Type)	Shear (kPa)	(mAOD)	(m)	Lege					
D1 : 0.20m			79.69	- 0.10 - - - -						
1.00 1.00 D2 : 1.20m	N=7 (1,1/1,2,2,2) (C)	124	78.49	- 1 - 1.30						
2.00 2.00 D3 : 2.00m D4 : 2.50m	N=13 (2,3/3,3,3,4) (C)	97	77.29	2						
3.00 3.00 D5 : 3.00m D6 : 3.20m	N=17 (3,4/4,4,4,5) (C)	93	76.59	- 3 - 3.20						
4.00 4.00 D7 : 4.00m D8 : 4.20m	N=21 (4,4/5,5,6,5) (C)	91		- 4						
5.00	N=32 (8,8/8,8,8,8) (C)	90	74.79	- 5 5.00						

Group	M.	Project: Project ID: Location: Client: Project Engineer:	North 7758 Have Persi Hest	iwest Hav 23 irhill immon Hc er Carter	verhil	ll Relief Road s Essex	Method: Start: Finish: Level (mOD): Co-ordinates:	WS 08/06/2018 08/06/2018 79.87 566193.54E - 246944.89N	1:50 Sheet Logge LE	WS107 (CP104)
Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend					
D1 : 0.20m			79.77	- 0.10 - - - -						
1.00 1.00 D2 : 1.00m D3 : 1.30m	N=8 (2,2/2,2,2,2) (C)	125	78.77	- - 1 - 1.10 -						
2.00 2.00 D4 : 2.00m D5 : 2.50m	N=10 (1,2/2,2,3,3) (C)	96	77.57	- 2 - 2.30						
3.00 3.00 D6 : 3.00m D7 : 3.20m	N=17 (3,3/4,3,5,5) (C)	92		- 3						
4.00 4.00 D8 : 4.00m D9 : 4.70m	N=20 (4,4/4,5,6,5) (C)	93		- 4						
5.00 5.00 D10 : 5.00m	N=35 (8,8/8,9,9,9) (C)	91	74.87	- 5 5.00 						

## Appendix B - In-situ CBR Results

				2466	64								
Soils	in Situ (	Jaino	rnia E	searin	ng r	Ratio ( C	вк)		CBR No.			CBR	101
Site Name	Northwest Haver	hill Relie	f Road,	CB9 91	٩J				Depth m	ו		0.4	0
Project No.	775823		Client			MLN	1		Date of 1	Fest		07/06/2	2018
Soil Description	E	Brown sli	ghtly gra	avelly s	lightl	y sandy silty	CLAY (	grave	I is fm and	l angular i	to sub-rou	nded)	
Test Method	BS1377 : Part 9 :	1990, c	lause 4.	3					CBR Tes	st Numbe	r	1	
Note: Test only applica	able when maximu	ım partic	le size k	beneath	the	plunger doe	s not exc	ceed.	20mm				
Rate if Strain	1.00 mm/n	nin			Tem	perature	Cloudy	20	0C				
Mass of Surcharge	4.6 kg 7.13 N/div				Con	ditions	Cioudy						
	<u></u>												
Readings	Force on Pl	unger					Force	e ve	rsus Pei	netratio	n Plot		
Penetration of Plunger	Dial Reading	Load	1	0.	.90 -								
mm		<b>kN</b>		0.	.80 -								*
0.00	19	0.00	-										
0.50	26	0.19		0.	.70 -	<b></b> .							
0.75	33	0.24	_										
1.00	39 44	0.28		0.	.60 -								
1.50	49	0.35											
1.75	53	0.38	- X	0.	.50 -			~	1				
2.00	57	0.41						7					
2.25	60	0.43	plie	0.	.40 -			÷					
2.50	64	0.46	Api				$\times$	i.					
2.75	67	0.48	ez	0.	.30 -			÷					
3.00	70	0.50	£					i.					
3.50	75	0.52		0.	.20 -			- <u>†</u> -					
3.75	79	0.56				¥		ł					
4.00	82	0.58		0.	.10 -			+					
4.25	85	0.61				/		-					
4.50	88	0.63		0.	.00 *			*	-	ļ ,	<u>с          </u>		
4.75	91	0.65			(	) 1	2		3	4 5	5 6	7	8
5.00	94	0.67							Penetra	tion mm			
5.25	97	0.69		_	×	Data	- <b>* - ·</b> 2 !	5mm	*-	• 5 0mm		- Correc	tion
5.75	100	0.73				Duta				0.01111		001100	
6.00	105	0.75		Rema	arks								
6.25	108	0.77			-								
6.50	110	0.78											
6.75	112	0.80											
7.00	114	0.81											
7.25	110	0.83											
1.50	115	0.00											
D Ka		-				0/	1						
Results	Cu	rve	( Pon	JBR Va	alues	, %	Moist	ure					
	app	lied	2.5mm	5n	nm	CBR Value	9 %	5111					
							,,,						
	N	0	35	2	4	35	18						
			2.0		-	0.0							
	<u> </u>						4						
GÎ.		Test R	eport b	y K4 S s Close		S LABORAT	ORY h				Che	ecked an	d Approved
			Watfo	rd Her	ts W	D18 9RU					Initials	5:	J.P
			Te	l: 0192	3 71	1 288 soils com					Date:		12/06/2018
2519 Approved	Signatories: K.Pha	aure (Te	ch.Mgr)	J.Phau	ure (L	.ab.Mgr)							MSF-5-R1

	In Citu	Calif	orni	a Bor	aring	Ratio ( (		Job Ref			24664		
Soils			Jilli		anny		( אם,		CBR No	).		CBR 102	2
Site Name	Northwest Haver	hill Rel	lief Ro	ad, CB	9 9NJ				Depth r	n		0.40	
Project No.	775823		Clie	nt		ML	М		Date of	Test		07/06/201	8
Soil Description		Bro	own sli	ghtly s	andy silf	ty CLAY with	n occasi	onal r	ootlets and	l fmc chall	k fragments	S	
Test Method	BS1377 : Part 9	: 1990,	claus	e 4.3					CBR Te	st Numbe	r	2	
Note: Test only applica	able when maximi	um part	ticle si	ze ben	eath the	e plunger do	es not e	xceed	20mm				
Rate if Strain	1.00 mm/i	min			Ter	nperature	Cloud	20	0C				
Mass of Surcharge	4.6 kg	,			Co	nditions	Cloud	у					
	7.13 N/UN												
Readings	Earas an B	lungor	. ]				Ford	ce ve	rsus Pe	netratio	on Plot		
Penetration of Plunger		Loa	ad		3.00								_
mm	Dial Reading	ki	N										*
0.00	0	0.0	00		2 50							****	
0.25	47	0.3	34 50		2.00	<b>*</b>							
0.75	90	0.6	64										
1.00	117	0.8	33		2.00								
1.25	139 157	0.9	99 12										
1.75	176	1.2	25	Ž		*		·-*					
2.00	195	39	т ре	1.50		*	∕ŗ						
2.25	207	1.4	48 50	oplie			<b>1</b>	1					
2.50	235	1.6	58	e Al	1.00								
3.00	247	1.7	76	Forc		<i>\</i>	~	i					
3.25	257	1.8	33										
3.75	265	1.8	39 97		0.50								
4.00	287	2.0	)5			¥		i					
4.25	294	2.1	10										
4.50	303 312	2.1	16		0.00	* ! 0 1	2	*	3	+ , 4 ;	<b>k</b>   5 6	7	<u>8</u>
5.00	323	2.3	30			•	_		Penetra	ation mm		-	-
5.25	330	2.3	35			Data -	<b>.</b>	) 5 m n		5 0mm		Corroctio	ND .
5.50	334	2.3	38 14		~	- Dala -	-#2		·*-	5.000		CONECTIO	// 1
6.00	349	2.4	19	R	emarks								
6.25	354	2.5	52	Γ									
6.50 6.75	360	2.5	50										
7.00	368	2.6	52										
7.25	373	2.6	66										
7.50	379	2.7	/0	L									]
Results	Cu	irve		CBF	R Values	s, %	Mois	sture	l				
	corre	ection	F	Penetra	ation		Con	ntent					
	app	blied	2.5n	nm	5mm		, o	%					
			40		10	10	1	0					
		10	12	-	12	12		0					
*		<b>.</b>			(1.00)	014000							
GLO		lest L	керо Jnit 8	rt by P Olds C	lose O	.5 LABORA Ids Approa	ch				Che	cked and A	Approved
- (≯≮) -			W	atford	Herts V	/D18 9RU					Initials	:	J.P
			Em	Tel: 0 ail: la:	1923 7' nes@k	11 288 4soils com					Date:		12/06/201
2519 Approved	Signatories: K.Ph	aure (T	Fech.N	/lgr) J.F	haure (	Lab.Mgr)							MSF-5-R

	In Site	u Calif	orni	a Ro	aring	Ratio ( (	BP )	Job Ref			24664		
Soils					anny			CBR N	0.	С	BR 103		
Site Name	Northwest Hav	verhill Re	lief Ro	oad, CE	9 9NJ			Depth	m		0.40		
Project No.	77582	3	Clie	ent		ML	М	Date o	f Test	07	/06/2018		
Soil Description	Brown slightly	/ gravelly	slight	ly sand	y silty C	LAY with oc angula	casional roo r to sub-rour	tlets and fn nded)	nc chalk frag	ments (grave	l is fmc and sub-		
Test Method	BS1377 : Part	9 : 1990	, clau	se 4.3				CBR T	est Number		3		
Note: Test only applica	able when maxi	imum par	ticle s	ize ben	eath the	e plunger doe	es not excee	ed 20mm					
Rate if Strain	1.00 mi	m/min			Те	mperature	20	0C					
Mass of Surcharge	4.6 kg				En Co	vironmental nditions	Cloudy						
Proving Ring Factor	7.13 N/	div											
Readings	1			r			Force v	versus P	enetratior	Plot			
Penetration of	Force or	Plunge	r		3 00								
Plunger	Dial Readin	g Lo	ad		0.00								
mm	0	k	<b>N</b>								**		
0.25	52	0.	37		2.50	*			-++	***			
0.50	86	0.	61										
0.75	<b>0.75</b> 120 0.86 <b>100</b> 148 106 200												
1.00	<b>1.00</b> 148 1.06 2.00 <b>1.17</b>												
1.25	164												
1.50	188	1.	34 52	7			Xi						
2.00	214	1.	53 67	Ϋ́	1.50								
2.25	249	1.	78	lied			×						
2.50	260	1.	85	dd≮			×   ¦						
2.75	270	1.	93	ce /	1.00	<u> </u>							
3.00	280	2.	00	For		/							
3.25	291	2.	07										
3.50	302	2.	15 23		0.50								
4.00	320	2.	28			*							
4.25	328	2.	34										
4.50	336	2.	40		0.00	₩	*		*				
4.75	341	2.	43			0 1	2	3	4 5	6	7 8		
5.00	348	2.	48					Penet	ration mm				
5.25	354	2.	52 56		<b></b> *-	– Data –	- <b>*</b> - • 2.5m	ım <b></b> *	<b>-</b> • 5.0mm	—— Со	rrection		
5.75	364	2.	60										
6.00	369	2.	63	F	Remarks	5							
6.25	375	2.	67	[ Γ									
6.50	381	2.	72										
6.75	385	2.	75										
7.00	388	2.	77 79										
7.50	395	2.	82										
	•												
Results	Г	Curve		СВ	R Value	s, %	Moisture						
Roound	сс	prrection		Penetra	ation		Content						
	á	applied	2.5	mm	5mm		le %						
		No	1	4	12	14	18						
	L												
<u>سمْ</u>	Test Report by K4 SOILS LABORATORY Checked and Approved												
		1	Unit 8	Olds (	Close O	lds Approa	ch						
(\\			N	atford	Herts V	VD18 9RU				Initials:	J.P		
				Tel· (	)1923 7	11 288				Date:	12/06/201		
U K A S TESTING			Em	nail: Ja	mes@k	4soils.com					12,00,201		
2519 Approved	Signatories: K.	Phaure (	Tech.l	Mgr) J.I	Phaure (	Lab.Mgr)					MSF-5-R		

	-								-			
		• •••				Job Ref		24664				
Soils	In Site	u Califo	ornia B	earing	Ratio ( C	BR)	CBR No	).		CBR 104		
Site Name	Northwest Hav	verhill Reli	ef Road,	CB9 9NJ			Depth r	n		0.40		
Project No.	77582	3	Client		ML	И	Date of	Test	0	07/06/2018		
Soil Description	Brown slightly	gravelly s	slightly sa	ndy silty C	LAY with occ angular	casional rootl to sub-rounc	ets and fmo led)	c chalk frag	ments (grav	el is fmc and sub-		
Test Method	BS1377 : Part	9 : 1990,	clause 4.	3			CBR Te	st Number		4		
Note: Test only applic	able when maxi	imum parti	icle size b	eneath the	e plunger doe	s not exceed	l 20mm					
Rate if Strain	1.00 mr	m/min		Те	mperature	20	0C					
Mass of Surcharge	4.6 kg			En		Cloudy						
Proving Ring Factor	7.13 N/	div			multions							
Readings						Force ve	ersus Pe	netratior	n Plot			
Penetration of	Force on	Plunger										
Plunger	Dial Booding	Loa	d	3.00								
mm	Liai keadin	y kN										
0.00	0	0.0	0	0.50						***		
0.25	42	0.3	0	2.50						**		
0.50	61	0.4	3									
0.75	<b>1.00</b> 95 0.68 2.00											
1.00	95	0.6	0	2.00								
1.50	136	0.0	7									
1.75	155	1.1	1				X					
2.00	172	1.2	3 7	1.50	*		×					
2.25	189	1.3	5 je									
2.50	203	1.4	5 dd									
2.75	216	1.5	4 g	1.00								
3.00	230	1.6	4 <sup>5</sup>			/						
3.25	242	1.7	3		X							
3.50	253	1.8	0	0.50								
3.75	260	1.8	5									
4.00	200	1.9	8									
4.50	286	2.0	4	0.00								
4.75	294	2.1	0	0.00	0 1	2	3	4 5	6	7 8		
5.00	302	2.1	5				Penetra	ation mm				
5.25	308	2.2	0		<b>D</b> .	0 5		5.0	0			
5.50	317	2.2	6	<b></b> *	– Data –	-* - · 2.5mr	n*-	•• 5.0mm	(	orrection		
5.75	325	2.3	2	- ·								
6.00	331	2.3	6	Remarks	3							
6 50	330	2.4	3	1								
6.75	347	2.4	7									
7.00	355	2.5	3	1								
7.25	360	2.5	7	1								
7.50	364	2.6	0									
	-	-				1	1					
Results		Curve	(	BR Value	s, %	Moisture						
			2.5mm	5mm	CBR Valu	e %						
		applied	2.011111	- Onnin		70						
		No	11	11	11	10						
						13						
							-					
		Test	Report by	/ K4 SOII		ORY			Check	ed and Approved		
		U	UIC & UIC Watto	s CIOSE () rd Herte V	ND18 9P1080	11			Initiale	IP		
(≯≮)-			mano						miliais.	5.1		
			Те	l: 01923 7	11 288				Date:	12/06/201		
U K A S TESTING			Email:	James@k	4soils.com							
2519 Approved	Signatories: K.	Phaure (T	ech.Mgr)	J.Phaure	(Lab.Mgr)					MSF-5-R		

				Deeri	Job Ref			24664				
Soils	1113		orna	a bearin	ng i	Ratio ( Ci	ык)	CBR No	).		CBR 105	
Site Name	Northwest H	laverhill Re	lief Roa	ad, CB9 91	۸J			Depth r	n		0.40	
Project No.	7758	823	Clier	nt		MLN	1	Date of	Test		07/06/2018	
Soil Description	Brown sligh	ntly gravelly	slightly	/ sandy sil	ty CL	AY with occa	asional rootle to sub-round	ets and fm ed)	c chalk frag	ments (gra	avel is fmc ar	าd sub-
Test Method	BS1377 : Pa	art 9 : 1990	, clause	e 4.3				CBR Te	st Number		5	
Note: Test only applica	able when ma	aximum pai	rticle siz	ze beneath	n the	plunger does	s not exceed	20mm				
Rate if Strain	1.00	mm/min			Ten	nperature	20	0C				
Mass of Surcharge	4.6	kg			Con	ironmental iditions	Cloudy					
Proving Ring Factor	7.13	N/div										
Readings	I						Force ve	ersus Pe	netratior	n Plot		
Penetration of	Force	on Plunge	r	2	50							
Plunger	Dial Read	ing Lo	ad	2	.50							
mm	0	<b>k</b>	N									
0.00	35	0.	25	2	00							
0.50	53	0.	38	2	- 00.					***		
0.75	0.75 70 0.50 1.00 88 0.63											
1.00	1.00         88         0.63           1.25         105         0.75											
1.25	103	0.	75 86	1	.50 -							
1.75	136	0.	97	Ŷ				<b>1</b>				
2.00	149	1.	06	т Ф	:	*		<b>`</b>				
2.25	160	1.	14	plie 1	00							
2.50	172	1.	23	Apl 1	.00 -							
2.75	181	1.	29	orce			×					
3.25	201	1.	43	ц		¥						
3.50	210	1.	50	0	.50 -			_				_
3.75	220	1.	57									
4.00	230	1.	64			¥						
4.25	237	1.	69 70									
4.50	243	1.	73 80	0	÷ 00.	* ! D 1	2	3	4 5	6	7	 8
5.00	252	1.	85			0 1	2	Penetra	ation mm	0	1	0
5.25	267	1.	90					i onotic				
5.50	273	1.	95	_	*	Data	<b>∗ -</b> • 2.5mm	n <b>*</b> -	••5.0mm		Correction	
5.75	278	1.	98	_								
6.00	284	2.	02	Rem	arks							7
6.50	209	2.	12									
6.75	304	2.	17									
7.00	309	2.	20									
7.25	312	2.	22									
7.50	317	Ζ.	26									
Poculte	Г	Curve		CBR Va	alues	%	Moisture					
Results		correction	F	Penetration	1		Content					
		applied	2.5m	nm 5r	nm	CBR Value	%					
		No	9.3	3 9	.3	9.3	20					
	Į											
~å~		Test	Repor	tby K4S	OIL	S LABORAT	ORY			Chec	ked and Ap	proved
			Unit 8 ( Wa	Olds Clos	e Ole ts W	ds Approach D18 9RU	ı			Initials:		J.P
				Tel: 0192	3 71	1 288				Date:	12	/06/2018
2519 Approved	Signatories:	K.Phaure (	Ema Tech.M	ail: James Igr) J.Phau	@ <b>k4</b> ure (L	soils.com .ab.Mgr)						MSF-5-R1

	In 6:4	Californ	ia Paari	n~ '	Datia ( C		Job Ref			24664
Soils		Jaillorn	ia Dearl	ng I	10 ( C	DR J	CBR	No.	(	CBR 106
Site Name	Northwest Haver	nill Relief R	oad, CB9 9	NJ			Dept	h m		0.40
Project No.	775823	Cli	ent		MLN	1	Date	of Test	0	7/06/2018
Soil Description	Brown slightly gr	avelly sligh	tly sandy si	lty CL	AY with occ. angular	asional roo to sub-rour	tlets and nded)	fmc chalk frag	ments (grave	el is fmc and sub-
Test Method	BS1377 : Part 9 :	1990, clau	ise 4.3				CBR	Test Number		6
Note: Test only applica	able when maximu	m particle	size beneati	h the	plunger doe	s not excee	ed 20mm			
Rate if Strain	1.00 mm/n	nin		Ten	nperature	20 Cloudy	0	С		
Mass of Surcharge	4.6 kg			Cor	ditions	Cloudy				
Proving Ring Factor	7.13 N/div									
Readings	I		T			Force v	ersus	Penetratior	n Plot	
Penetration of	Force on Pl	unger	1	.20						
Plunger	Dial Reading	Load	-							
mm 0.00	0	<b>kN</b>	4							
0.25	24	0.00	1 1	.00						
0.50	35	0.25	1							
0.75	44	0.31		;	<b>.</b>				***	
1.00	52	0.37	C	0.80						
1.25	58	0.41					×			
1.75	69	0.49	z							
2.00	74	74 0.53 79 0.56			<b></b>		$\frown$			
2.25	79	0.56	plied							
2.50	83	0.59	App							
2.75	88	0.63	e c	0.40						
3.00	92	0.66	Ū.							
3.25	96	0.68	-							
3.75	103	0.73	C	).20						
4.00	106	0.76								
4.25	109	0.78								
4.50	112	0.80	C	0.00				<u> </u>		
4.75	114	0.81	-		J 1	2	3	4 5	6	7 8
5.00	117	0.83	-				Pene	etration mm		
5.50	120	0.87		<b>-</b> ×	Data	- <b>* - ·</b> 2.5m	1m ––	<b>* - ·</b> 5.0mm	—— Co	orrection
5.75	125	0.89								
6.00	128	0.91	Rem	arks						
6.25	130	0.93	4							
6.50	133	0.95	+							
7.00	138	0.98	1							
7.25	140	1.00	1							
7.50	142	1.01								
Results	Cu	rve	CBR V	alues	, %	Moisture	•			
	corre	ction	Penetratio	n mm	CBR Value	Content	_			
	арр		Juini 51			70	-			
	N		15	12	45	24				
				T. <b>∠</b>	4.0	24				
*****		<b>T</b> . ( )					_			
Câo		Test Rep	ort by K4 S B Olds Clos	SOIL: Se Ol	s LABORAT	UKY			Checke	ed and Approved
		V	Vatford Hei	rts W	D18 9RU	•			Initials:	J.P
·(≯≮)=									1	
			Tel: 0192	23 71	1 288				Date:	12/06/201
TESTING	0	Er	nail: James	s@k4	soils.com					
2519 Approved	Signatories: K.Pha	aure (Tech	.Mgr) J.Pha	ure (L	.ab.Mgr)				1	MSF-5-R

4	In Situ (	Californ	ia Reariu	Job Ref		24664							
Soils		Janion					CBR No		C	3BR 107			
Site Name	Northwest Haverh	nill Relief R	oad, CB9 9I	NJ			Depth n	n		0.40			
Project No.	775823	Cli	ent		MLN	1	Date of <sup>-</sup>	Test	07	7/06/2018			
Soil Description	Brown slightly gra	avelly sligh	tly sandy sil	ty CLAY wi ar	th occ ngular	asional rooth to sub-round	ets and fmc led)	c chalk fragn	nents (grave	is fmc and sub-			
Test Method	BS1377 : Part 9 :	1990, clau	ise 4.3				CBR Tes	st Number		7			
Note: Test only applica	able when maximu	m particle	size beneath	n the plunge	er doe:	s not exceed	l 20mm						
Rate if Strain	1.00 mm/m	nin		Temperat	ure	20 Claudu	0C						
Mass of Surcharge	4.6 kg			Conditions	entai S	Cloudy							
Proving Ring Factor	7.13 N/div												
Readings	1		т			Force ve	ersus Pe	netration	Plot				
Penetration of	Force on Pl	unger	1	40									
Plunger	Dial Reading	Load	-										
mm	-	<u>kN</u>	4							***			
0.00	24	0.00	1	.20						*			
0.50	35	0.25	1										
0.75	<b>0.75</b> 45 0.32 1.00 <b>*</b>												
1.00	$\begin{array}{c c c c c c c c c c c c c c c c c c c $												
1.25	61	0.43	1										
1.50	68	0.48	0	.80									
2.00	74 80	0.53	Σ				$\checkmark$						
2.25	86	0.61	0 lied	60		X							
2.50	92	0.66	dd{	.00									
2.75	98	0.70	ee /			×							
3.00	<b>3.00</b> 104 0.74 E 0.40												
3.25	3.25 109 0.78												
3.50	114	0.81		~ /									
4.00	113	0.88	0	.20 7									
4.25	129	0.92	1										
4.50	134	0.96	0	.00 🖌	_	*	1	*					
4.75	139	0.99		0	1	2	3	4 5	6	7 8			
5.00	143	1.02	4				Penetra	ition mm					
5.25	146	1.04				<b>* - ·</b> 2.5mr	n <b>*-</b>	- 5.0mm	Cc	prrection			
5.30	150	1.07		Duta		2.0111		0.011111					
6.00	159	1.13	Rem	arks									
6.25	163	1.16	1										
6.50	167	1.19	]										
6.75	169	1.20	4										
7.00	172	1.23	4										
7.50	173	1.25	4										
			J <u>L</u>										
Results	Cur	ve	CBR Va	alues. %		Moisture	I						
neouno	correc	ction	Penetration			Content							
	appl	lied 2.5	5 Sr	nm CBR	Value	%							
	N	o 5	5.0 5	5.1 <b>;</b>	5.1	21							
*													
		Unit S	BOIds Clos	e Olds Ani	oraci				Checke	a and Approved			
		V	Vatford Her	ts WD18 9	RU	-			Initials:	J.P			
-(≯≮)=													
			Tel: 0192	23 711 288					Date:	12/06/2018			
TESTING	Oleverte 16 Di	Er	nail: James	@k4soils.	com								
2519 Approved	Signatories: K.Pha	aure (Tech	Mgr) J.Phau	ure (Lab.Mo	gr)				<u> </u>	MSF-5-R1			

						Job Ref				24664			
Soils		Califor		earin	y katio	(0	ык)		CBR No			CBR	. 108
Site Name	Northwest Haver	hill Relief	Road, C	B9 9N.					Depth n	n		0.4	40
Project No.	775823	С	lient			MLN	1		Date of	Test		07/06	/2018
Soil Description	Brown slightly gr	avelly slig	htly san	ıdy silty	CLAY with ang	n occ jular	asional roc to sub-rou	otlets nded	and fmo )	c chalk fra	agments (g	gravel is	fmc and sub-
Test Method	BS1377 : Part 9	: 1990, cla	use 4.3						CBR Te	st Numbe	er	8	3
Note: Test only applica	able when maximu	ım particle	size be	eneath t	he plunger	doe	s not exce	ed 20	)mm				
Rate if Strain	1.00 mm/r	min		Т	emperatu	re	20	0	0C				
Mass of Surcharge	4.6 kg			E	Invironmer	ntal	Cloudy						
Proving Ring Factor	7.13 N/div			, c	Jonunions								
Readings			_				Force	vers	us Pe	netratio	on Plot		
Penetration of	Force on P	lunger		4 4	0								
Plunger	Dial Reading	Load	4	1.4									
mm	g	kN	4										
0.00	0	0.00	_	1.2	0	+							
0.23	29 41	0.21	-										
0.75	52	0.37		1.0	o <b>*</b> -								
1.00	<b>1.00</b> 61 0.43 <b>125</b> 70 0.50												
1.25	70	0.50							A A A A A A A A A A A A A A A A A A A				
1.50	77	0.55		0.8	0	+			<u>/</u>				
2.00	84 90	0.60	- X		*	·	·						
2.25	95	0.68	lied	0.6	o								
2.50	100	0.71	App	0.0	°		$\checkmark$	:					
2.75	106	0.76	ce ∕					!					
3.00	112	0.80	For	0.4	0	<u>A</u>		 					
3.25	117	0.83	_										
3.50	121	0.86	-	0.0									
4.00	123	0.89	-	0.2	• 17								
4.25	133	0.95						i					
4.50	138	0.98		0.0	o #	_	,	k			* !		ļļ
4.75	142	1.01			0	1	2	3	5	4	5 6		7 8
5.00	146	1.04							Penetra	tion mm			
5.25	149	1.06	-	—×	— Data		<b>* - ·</b> 2.5n	nm	*-	•• 5.0mm	ı —	– Corre	ection
5.75	152	1.10	-		Dutu		2.011			0.01111	•	00110	otion
6.00	157	1.12		Remar	ks								
6.25	159	1.13											
6.50	162	1.16											
6.75	165	1.18	4										
7.00	168	1.20	-										
7.50	170	1.21											
<u></u>	•												
Results	Cu	rve	C	BR Valı	ies. %		Moisture	e					
noouno	corre	ection	Penet	tration	CDD	V	Conten	t					
	арр	olied 2	.5mm	5mr	n CBR	value	%						
	Ν	10	5.4	5.2	5.	.4	21						
		Tost Ro	port by	K4 S0		RAT	ORY				L Ch	ockod o	nd Approved
		Unit	8 Olds	Close	Olds App	roach	1					ескей а	
			Watfor	d Herts	WD18 9R	U					Initial	s:	J.P
T(₽¶)=													
			Tel:	01923	711 288						Date:		12/06/2018
TESTING	Pignotorios K DL		mail: J	ames@	k4soils.c	om					_ <b> </b>		
2519 Approved	Signatories: K.Ph	aure (Tecl	h.Mgr) J	.Phaure	e (∟ab.Mgr	)							MSF-5-R1

	In Citu		ie Deeri				Job Ref			2466	<b>;</b> 4		
Soils	in Situ	Californ	lia Beari	ng r	Ratio ( C	вк)	CBR No			CBR 1	109		
Site Name	Northwest Haver	hill Relief F	Road, CB9 9	NJ			Depth n	า		0.40	)		
Project No.	775823	CI	ient		MLN	1	Date of	Fest		08/06/2	2018		
Soil Description	Brown slightly gr	avelly slig	ntly sandy si	lty CL	AY with occa angular	asional rootl to sub-round	ets and fmo led)	chalk frag	gments (g	ravel is fr	nc and sub-		
Test Method	BS1377 : Part 9	: 1990, cla	use 4.3				CBR Te	st Number		9			
Note: Test only applica	able when maximu	ım particle	size beneat	h the	plunger does	s not exceed	1 20mm						
Rate if Strain	1.00 mm/r	min		Terr	nperature	21	0C						
Mass of Surcharge	4.6 kg			Env	ironmental	Cloudy							
Proving Ring Factor	7.13 N/div			Con	aitions								
Readings						Force ve	ersus Pe	netratio	n Plot				
Penetration of	Force on P	lunger	]										
Plunger	Dial Peading	Load	2	2.50 -									
mm		kN	]										
0.00	0	0.00	1										
0.25	30	0.21	2	2.00 -									
0.50	45	0.32	4								**		
0.75	57	0.41	-							**			
1.00	75	0.47	4										
1.50	86	0.61	1	1.50	<del></del>			┼╌╌╌┾					
1.75	96	0.68	N N N										
2.00	105	0.75	g					1					
2.25	114	0.81	plie	00 -									
2.50	126	0.90	A P	;	<b>e</b>		*						
2.75	137	0.98	- Drce										
3.25	153	1.00	ш										
3.50	160	1.14	(	0.50 -									
3.75	170	1.21	1										
4.00	179	1.28	4		×								
4.25	185	1.32											
4.50	192	1.37	- (	4 00.( )	<b>κ</b> ; Γ 1	2	3	; <b>≭</b> 4 5	6	7			
5.00	207	1.42	4			2	Penetra	tion mm	0		0		
5.25	217	1.55	1				i chetta						
5.50	225	1.60	1 -	-*	Data	<b>∗ -</b> • 2.5mr	n <b>*-</b>	• 5.0mm		- Correc	tion		
5.75	232	1.65											
6.00	238	1.70	Rem	narks									
6.25	243	1.73	4										
6.75	257	1.83	4										
7.00	263	1.88	1										
7.25	268	1.91	1										
7.50	273	1.95											
							_						
Results	Cu	rve	CBR V	alues	, %	Moisture							
	corre	ection	Penetratio	n	CBR Value	Content							
	app	olied Z.	c mmc	mm		%							
		1		7 4	7.4	40							
	N	U	0.0	1.4	7.4	18							
	<u> </u>						J						
CÎ.	Test Report by K4 SOILS LABORATORY Checked and Approved												
		Unit	8 Olds Clos Natford He	se Olo rts W	as Approach D18 9RU	1			Initials	5:	J.P		
-(≯≮)-													
			Tel: 019	23 71	1 288				Date:		12/06/2018		
TESTING 2519 Approved	Signatorias: K Dh	E aure (Toob	Mar)   Pho	s@k4	soils.com						MQE-E-P1		
ZUTU Approved	orginatories: K.Ph	aure (rech	.iviyi) J.PHa	ure (L	.av.iviyi)						IVIOF-D-K1		

R	In Situ (	Californ	ia Roari	na Potic			Job R	ef		24664
Soils		Samorn				ык )	CBR	No.		CBR 110
Site Name	Northwest Haver	hill Relief F	load, CB9 9I	NJ			Depth	m		0.40
Project No.	775823	Cl	ent		MLN	1	Date	of Test	(	)8/06/2018
Soil Description	Brown slightly gr	avelly sligh	itly sandy sil	ty CLAY wi ar	th occ igular	asional roo to sub-rour	tlets and f nded)	mc chalk fraç	gments (grav	el is fmc and sub-
Test Method	BS1377 : Part 9 :	1990, clau	ıse 4.3				CBR	Test Number		10
Note: Test only applica	able when maximu	ım particle	size beneatł	n the plunge	er does	s not excee	ed 20mm			
Rate if Strain	1.00 mm/n	nin		Temperate	ure	21	00	C		
Mass of Surcharge	4.6 kg			Environme	ental	Cloudy				
Proving Ring Factor	7.13 N/div			Conditions	,					
Readings	-		-			Force v	versus F	Penetratio	n Plot	
Penetration of	Force on Pl	unger		60						
Plunger	Dial Reading	Load	-	.00						
mm	<u> </u>	<b>kN</b>		40						***
0.00	0 21	0.00	-	.40					×	**
0.50	33	0.24	1	20						
0.75	43	0.31		.20 *				*		
1.00	51	0.36	4.							
1.25	59	0.42	1	.00						
1.50		0.47	z							
2.00	82	0.58	- <u>→</u> 0	.80	_		$\mathbf{X}$			<u> </u>
2.25	89	0.63	oliec	*		·				
2.50	96	0.68	] dd 0	.60						
2.75	104	0.74	ce							
3.00	111	0.79	Ē	40	×	×				
3.25	118	0.84	-	.40	X					
3.75	123	0.89	+		<b>^</b>	i				
4.00	138	0.98	0	.20						
4.25	144	1.03	1							
4.50	150	1.07	0	.00 🖌	_	*				
4.75	157	1.12	4	0	1	2	3	4 5	6	7 8
5.00	162	1.16	4				Pene	tration mm		
5.25	100	1.10	+ _			<b>* - ·</b> 2.5m	ım <b>– –</b> »	<b>←−</b> ∙5.0mm	C	orrection
5.75	178	1.24	1							
6.00	179	1.28	Rem	arks						
6.25	184	1.31	]							
6.50	188	1.34	4							
6.75	193	1.38	4							
7.00	200	1.40	4							
7.50	203	1.45	1							
			4 <b>L</b>							
Results	Cu	rve	CBR Va	alues. %		Moisture				
noouno	corre	ction	Penetration		) / a l	Content				
	арр	lied 2.	5mm 5r	nm CBR	value	%				
	N	lo é	5.2 5	5.8 <b>!</b>	5.8	20				
cio		Test Rep	ort by K4 S	OILS LAB	ORAT	ORY			Check	ed and Approved
		Unit	Natford Her	e Olds App ts WD18 9	broach RU	ו			Initials:	J.P
			Tel: 0192	3 711 288					Date:	12/06/2018
U K A S TESTING		E	nail: James	@k4soils.	com					, 00, 2010
2519 Approved	Signatories: K.Pha	aure (Tech	.Mgr) J.Phau	ure (Lab.Mg	ır)					MSF-5-R1

4	In Situ (	Californ	ia Boariı	ng Ratio		R )	Job Ref			24664	
Soils		Camorn				51()	CBR No			CBR 111	
Site Name	Northwest Haver	hill Relief R	oad, CB9 91	NJ			Depth n	n		0.40	
Project No.	775823	Cli	ent		MLM		Date of	Test		08/06/2018	
Soil Description	Brown slightly gr	avelly sligh	tly sandy sil	ty CLAY with ang	occa ular te	isional root o sub-round	lets and fmo ded)	c chalk frag	gments (gra	vel is fmc and	sub-
Test Method	BS1377 : Part 9 :	: 1990, clau	se 4.3				CBR Te	st Number		11	
Note: Test only applica	able when maximu	ım particle .	size beneath	n the plunger	does	not excee	d 20mm				
Rate if Strain	1.00 mm/n	nin		Temperatur	e	21	0C				
Mass of Surcharge	4.6 kg			Environmen	tal	Cloudy					
Proving Ring Factor	7.13 N/div			Contaitionio							
Readings		n Plot									
Penetration of	Force on Pl	lunger	2	.00							1
Plunger	Dial Reading	Load	{ _							×	
mm	0	<b>kN</b>	1	.80						*	1
0.25	27	0.00	1 ,	60							
0.50	44	0.31	1 '	.00 <b>x</b>							1
0.75	58	0.41	1	.40							4
1.00	71	0.51	ļ					$\downarrow$			
1.25	83	0.59	1	.20							4
1.50	98	0.00	z				$\mathbf{X}$				
2.00	118	0.84	± 1	.00 *			, 				1
2.25	130	0.93	oliec								
2.50	142	1.01	dd 0	.80							1
2.75	151	1.08	e e	c0		×					
3.00	159	1.13	Ū Ū	.60	$\boldsymbol{V}$	i					1
3.25	166 172	1.18	0	40	1						1
3.75	172	1.23	Ť			- I i					
4.00	187	1.33	0	.20	_	i					4
4.25	195	1.39	1								
4.50	202	1.44	0	.00 🖌	-	*		*			4
4.75	209	1.49	4	0	1	2	3	4 5	6	7	8
5.00	214	1.53	+				Penetra	ition mm			
5.50	221	1.62	1 _	<b>→</b> Data	>	<b>* - ·</b> 2.5mi	m*-	•• 5.0mm	(	Correction	
5.75	233	1.66	1								
6.00	239	1.70	Rem	arks							_
6.25	242	1.73	↓								
6.50	246	1.75	4								
6.75	251	1.79	4								
7.25	261	1.86	1								
7.50	265	1.89	1 🗋								
Results	Cu	rve	CBR Va	alues, %		Moisture	1				
	corre	ection	Penetration		/alue	Content 0/	4				
	app		omm or	nm		%	4				
			, ,   _	_	,	10	1				
	N			.υ 7.	'	19					
							J				
. 1000 Å. 1000.		Test Ren	ort bv K4 S		RATO	DRY			Chec	ked and Appr	oved
		Unit 8	3 Olds Clos Vatford Her	e Olds Appr ts WD18 9R	oach U				Initials:		J.P
			Tel: 0192	23 711 288					Date:	12/0	6/2018
2519 Approved	Email: James@k4soils.com  Sector Signatories: K Phaure (Tech Mgr), J Phaure (Lab Mgr)  MSE-5-R										

	In Situ		24664									
Soils		Camorn		ny nauo			CBR	No.		CBR 112		
Site Name	Northwest Haver	hill Relief R	oad, CB9 9I	NJ			Depth	n m		0.40		
Project No.	775823	Cli	ent		MLN	1	Date	of Test	(	08/06/2018		
Soil Description	Brown slightly gr	avelly sligh	tly sandy sil	ty CLAY wit an	h occ gular	asional roo to sub-roun	tlets and ded)	fmc chalk frag	gments (grav	vel is fmc and sub-		
Test Method	BS1377 : Part 9 :	: 1990, clau	ise 4.3				CBR	Test Number		12		
Note: Test only applica	able when maximu	ım particle	size beneatł	n the plunge	r doe	s not excee	d 20mm					
Rate if Strain	1.00 mm/r	nin		Temperatu	ire	21 Cloudy	0	С				
Mass of Surcharge	4.6 kg			Conditions	ental	Cloudy						
Proving Ring Factor	7.13 N/div											
Readings	1		Т			Force v	ersus I	Penetratio	n Plot			
Penetration of	Force on P	lunger	1	20	-							
Plunger	Dial Reading	Load	4 '									
mm		<b>kN</b>	4							***		
0.00	15	0.00	1	.00				_		**		
0.50	27	0.19	1						Jan Market			
0.75	37	0.26	]	*		·	+					
1.00	47	0.34	0	.80 -								
1.25	56 65	0.40	-									
1.75	72	0.40	z									
2.00	77	0.55	- ¥ 0	.60 *			,					
2.25	81	0.58	plie									
2.50	85	0.61	Api			X						
2.75	92	0.66	0 <u>1</u> 2	.40	-/*							
3.00	95 100	0.68	- й -		X							
3.50	104	0.74			×							
3.75	108	0.77	0	.20								
4.00	111	0.79		<b>/</b>								
4.25	113	0.81										
4.50	116	0.83	0	.00 *	1		3	4 5	6			
4.75	120	0.88	-	0	1	2	Pene	tration mm	0	7 0		
5.25	128	0.00	-				i ene					
5.50	131	0.93	1 –	<mark>-∗</mark> Data		<b>-* - ·</b> 2.5m	m:	<b>* - ·</b> 5.0mm	(	Correction		
5.75	134	0.96	1									
6.00	136	0.97	Rem	arks						1		
6.25 6.50	139	0.99	+									
6.75	145	1.03	1 1									
7.00	148	1.06	1									
7.25	150	1.07	]									
7.50	152	1.08										
Roculte		rve	CBR Va	alues %		Moieturo	7					
NESUIS	corre	ection	Penetratior	1 <u>~</u>		Content						
	арр	lied 2.	5mm 5r	nm CBR	valu	%	1					
	Ν	lo 4	1.6 4	.4 <b>4</b>	.6	21						
Test Report by K4 SOILS LABORATORY Checked and Approved												
		Unit	8 Olds Clos	e Olds App	roac	n						
$(\mathbf{k}_{\mathbf{k}})$		١	Vatford Her	ts WD18 9F	ิรบ				Initials:	J.P		
			Tel: 0102	3 711 200					Date	12/06/20/		
	KAS         Date:         12/06/2018           KAS         Email: James@k4soils.com         Date:         12/06/2018											
2519 Approved	Signatories: K.Ph	aure (Tech	.Mgr) J.Phau	ure (Lab.Mg	r)					MSF-5-F		

	In Situ	Califor	nia Pos		Datia ( 4			Job Ref			24664	
Soils		Callfor	ilia Beal	ing	Ratio ( 1	свк)		CBR No			CBR 113	
Site Name	Northwest Haver	hill Relief	Road, CB9	9NJ				Depth n	n		0.40	
Project No.	775823	C	lient		ML	_M		Date of <sup>-</sup>	Test	C	8/06/2018	
Soil Description	Brown slightly gr	avelly slig	htly sandy	silty Cl	AY with oc angula	ccasiona ar to sub	al rootle -round	ets and fmo	chalk frag	ments (grav	el is fmc and	sub-
Test Method	BS1377 : Part 9	: 1990, cla	ause 4.3					CBR Tes	st Number		13	
Note: Test only applica	able when maximu	ım particle	e size benea	ath the	plunger do	bes not e	exceed	20mm				
Rate if Strain	1.00 mm/r	nin		Ter	nperature		21	0C				
Mass of Surcharge	4.6 kg			En\ Cor	ironmental	Cloud	dy					
Proving Ring Factor	0.43 N/div			CO	IUILIONS							
Readings			<b></b>			For	ce ve	ersus Pe	netratior	n Plot		
Penetration of	Force on P	lunger		1 00	_							_
Plunger	Dial Reading	Load	4	1.00								
mm		kN	4	0.90	┝──┤							-
0.00	0	0.00	_									
0.25	98 237	0.04	-	0.80							<u>^</u>	1
0.75	403	0.17	-	0.70	<b>*</b>				<b>-</b> *	**		
1.00	530	0.23	1	0.70					Law I			1
1.25	637	0.27	4	0.60								4
1.50	745 845	0.32	z									
2.00	934	0.30		0.50	<b>*</b>			×	+ +			{
2.25	1022	0.44	oliec									
2.50	1114	0.48	App	0.40								1
2.75	1196	0.51	Lce	0 30		<u> </u>	i					
3.25	1262	0.54	Ľ	0.00		*						
3.50	1380	0.59		0.20	<u> </u>			_				{
3.75	1446	0.62										
4.00	1501	0.65	4	0.10								1
4.25	1548	0.67		0.00			ļį					
4.75	1639	0.00	-	0.00	0 1		2	3	4 5	6	7 8	8
5.00	1672	0.72						Penetra	tion mm			
5.25	1718	0.74			Data		0 E m n	~ …	E Omm	C	orrection	
5.50	1769	0.76		<b></b> ×	- Dala -	*	2.51111		• 5.0000	<u> </u>	orrection	
6.00	1812	0.78		marks								
6.25	1884	0.81	1 Ё									
6.50	1921	0.83										
6.75	1958	0.84	-↓ ↓									
7.00	1988 2017	0.85										
7.50	2050	0.88										
	•	•										
Results	Cu	rve	CBR	Values	s, %	Мо	isture					
	corre	ection	Penetrati	on	CBR Va	Co	ntent					
	app	olied 2	.5mm	5mm	CDIX Val	luc	%					
	Ν	10	3.6	3.6	3.6		24					
<u></u>		Test Re	port by K4	SOIL	S LABORA	ATORY				Check	ed and Appro	oved
		Uni	8 Olds Clo Watford H	ose Ol erts W	ds Approa /D18 9RU	ich				Initials:		J.P
			Tel: 01	923 71	1 288					Date:	12/0	6/2018
2519 Approved	Signatories: K.Ph	aure (Tec	<b>-mail: Jam</b> h.Mgr) J.Ph	es@k4 aure (l	soils.com Lab.Mgr)	1					N	/ISF-5-R1

	In Si	tu Calif	orni	a Roari	ing	Ratio ( C	BR \	Job Re	əf		24664	
Soils					ing			CBR N	lo.		CBR 114	_
Site Name	Northwest H	averhill Re	lief Ro	ad, CB9 9	)NJ			Depth	m		0.40	
Project No.	7758	23	Clie	nt		MLN	1	Date o	f Test		08/06/2018	
Soil Description	Brown sligh	tly gravelly	slightl	y sandy s	ilty Cl	AY with occ. angular	asional root to sub-round	ets and fr ded)	nc chalk frag	jments (gra	vel is fmc and su	b-
Test Method	BS1377 : Pa	art 9 : 1990	, claus	se 4.3				CBR T	est Number		14	
Note: Test only applica	able when ma	ximum pai	rticle si	ize beneai	th the	plunger doe	s not exceed	d 20mm				
Rate if Strain	1.00 r	nm/min			Ter	nperature	21	00	,			
Mass of Surcharge	4.6	kg			En\ Cor	rironmental	Cloudy					
Proving Ring Factor	7.13	N/div			001							
Readings							Force v	ersus P	enetratio	n <b>Plo</b> t		
Penetration of	Force	on Plunge	r		0 50							
Plunger	Dial Readi		ad		∠.ວ∪							
mm		<u> </u>	N									
0.00	0	0.	00									
0.25	22 42	0.	10 30	:	2.00				+ +			
0.75	42 58	0.	30 41								***	
1.00	73	0.	52									
1.25	84	0.	60		4 50	*			*			
1.50	100	0.	71		1.50							
1.75	116	0.	83	Υ Υ					*			
2.00	128	0.	91 00	eq				$\times$				
2.20	140	1.	00	ppli	1.00	*	·					
2.75	161	1.	15	e A								
3.00	171	1.	22	orc								
3.25	177	1.	26	ш								
3.50	184	1.	31		0.50	╞╌╱╀						
3.75	191	1.	36									
4.00	200	1.	43 49									
4.25	207	1.	40 53		0 00		- I 					
4.75	213	1.	58		0.00	0 1	2	3	4 5	6	7 8	
5.00	227	1.	62					Penet	ration mm			
5.25	232	1.	65			<b>-</b> .						
5.50	238	1.	70	-	<b>-</b> ×	-Data	- <b>* - ·</b> 2.5mi	n <b>*</b>	• <b>-</b> •5.0mm	(	Correction	
5.75	245	1.	75	_								
6.00	250	1.	78	Ren	narks							
0.∠⊃ 6.50	254 258	1.	०। 84									
6.75	263	1.	88									
7.00	268	1.	91									
7.25	272	1.	94									
7.50	276	1.	97									
D14 -	F	0		000 1	(ol	0/	NA - ' - '	7				
Results		Curve		CBR V	alues	5, %	Content					
		applied	2.5r	nm 5	imm	CBR Valu	9 %	-				
	F	• • • • •					1	1				
		No	8.	1	8.1	8.1	18					
	L											
		Tac	Reno	rt by KA	SOII		ORY			Chaol	ked and Approve	24
		163	Unit 8	Olds Clo	se Ol	ds Approac	h			Cneci	ren ann Abbron	eu
			W	atford He	rts W	/D18 9RU				Initials:	J.P	,
				<b></b>	oc -	4 000					40/00/	
UKAS			E	Tel: 019	23 71	1 288				Date:	12/06/2	201
2519 Approved	Signatories: I	K.Phaure (	⊏m Tech.N	An. Jame Agr) J.Pha	awre (l	Lab.Mgr)					MSF	-5-R

		Californ		24664							
Soils		Janiorn	ia Dearli	iy f	( C	DK)		CBR No.			CBR 115
Site Name	Northwest Haver	nill Relief R	oad, CB9 9I	٩J				Depth m	ו		0.40
Project No.	775823	Clie	ent		MLM	Л		Date of T	Fest	(	08/06/2018
Soil Description	Brown slightly gr	avelly sligh	tly sandy sil	ty CL	AY with occ angular	asiona to sub	al rootle -rounde	ts and fmc ed)	chalk frag	ments (grav	vel is fmc and sub-
Test Method	BS1377 : Part 9 :	1990, clau	se 4.3					CBR Tes	st Number		15
Note: Test only applica	able when maximu	m particle s	size beneath	n the j	olunger doe	s not e	exceed	20mm			
Rate if Strain	1.00 mm/n	nin		Tem	perature	Clause	21	0C			
Mass of Surcharge	4.6 kg			Con	ditions	Ciouc	ıy				
Proving Ring Factor	7.13 N/div										
Readings			7			For	ce ve	rsus Per	netratio	n Plot	
Penetration of	Force on Pl	unger	1	20 -				-			
Plunger	Dial Reading	Load									
mm	0	<b>kN</b>	ł								
0.00	20	0.00	1	.00 -							····*
0.50	35	0.25	t							Jan Harrison	
0.75	46	0.33	1	,	•			.+		-	
1.00	55	0.39	0	.80 -							
1.25	62	0.44									
1.50	69 75	0.49	z	,	•		*	1			
2.00	81	0.58	_ <u></u> _ 0	.60 -	·		А́-				
2.25	85	0.61	lied								
2.50	90	0.64	App								
2.75	94	0.67	ė 0	.40 -	-						
3.00	97	0.69	For		*						
3.25	100	0.71									
3.50	104	0.74	0	.20 -				_			
4.00	110	0.78			*						
4.25	112	0.80	İ		/		i				
4.50	115	0.82	0	.00 🕯			*	_	<u>  *</u>		ĮĮ
4.75	118	0.84	-	C	) 1	2	2	3 4	4 5	6	7 8
5.00	120	0.86	-					Penetra	tion mm		
5.25	122	0.87	- 1	- <b>×</b>	Data -	-* - • 2	2.5mm	*-	• 5.0mm	C	Correction
5.75	128	0.91	ł			-					
6.00	130	0.93	Rem	arks							
6.25	133	0.95	I [								
6.50	135	0.96									
6.75	137	0.98									
7.00	139	1 01	<b>∤</b>								
7.50	143	1.02	†								
			. L								<b>.</b>
Results	Cu	rve	CBR Va	alues.	%	Moi	sture				
	corre	ction	Penetration	) 1		Co	ntent				
	арр	lied 2.5	mm 5r	nm	COR Valu	C I	%				
	N	o 4	.9 4	.3	4.9		25				
<u>سمْ</u>		Test Rep	ort by K4 S	OILS	LABORA	ORY				Check	ed and Approved
		Unit 8	Olds Clos	e Old	ls Approac	h					
$(\mathbf{k}_{t})$		v	atford Her	ts WI	D18 9RU					Initials:	J.P
			Tel: 0400	2 74	1 200					Data	10/06/00
UKAS	Tel: 01923 711 288 Date: 12/06/2018										
2519 Approved	Signatories: K.Pha	aure (Tech.	Mgr) J.Phau	ure (L	ab.Mgr)						MSF-5-
			,	- \-	3.1						

	In 6:4	Californ	ia Paari	n~ '	Patia ( C		Job Re	ef		24664		
Soils		Jaillorn	na Dearl	ng I	naliu ( C	DR J	CBR N	lo.	C	CBR 116		
Site Name	Northwest Haver	nill Relief R	load, CB9 9	NJ			Depth	m		0.40		
Project No.	775823	Cli	ent		MLM	1	Date o	of Test	08	3/06/2018		
Soil Description	Brown slightly gr	avelly sligh	itly sandy sil	lty CL	AY with occ. angular	asional roc to sub-rour	otlets and fr nded)	mc chalk fragr	nents (grave	el is fmc and sub-		
Test Method	BS1377 : Part 9 :	1990, clau	ise 4.3				CBR T	est Number		16		
Note: Test only applica	able when maximu	m particle	size beneatl	h the	plunger doe	s not excee	ed 20mm					
Rate if Strain	1.00 mm/n	nin		Ten	nperature	21 Cloudy	00	;				
Mass of Surcharge	4.6 kg			Con	ditions	Cloudy						
Proving Ring Factor	7.13 N/div											
Readings	1		Т			Force v	/ersus P	enetration	Plot			
Penetration of	Force on Pl	unger	1	.20 -	·							
Plunger	Dial Reading	Load	-									
0.00	0	к <b>N</b> 0.00	1							<sub></sub>		
0.25	19	0.14	1	.00 -						***		
0.50	29	0.21	]						A A A A A A A A A A A A A A A A A A A			
0.75	37	0.26	-	:	*				~			
1.00	44 51	0.31	0	.80 -								
1.50	58	0.41	1					*				
1.75	62	0.44	ΣΥ ο	0.60								
2.00	68	0.48	eq	.00	*							
2.25	74 79	0.53	ppli			$\mathbf{X}$						
2.75	84	0.60	- ₹ 0	.40 -								
3.00	89	0.63	orc									
3.25	93	0.66	] -									
3.50	97 102	0.69	c c	).20 -								
4.00	102	0.75	+		<b>  ∤</b>							
4.25	109	0.78	1		/							
4.50	112	0.80	C	0.00	<u> </u>			*				
4.75	115	0.82	4	(	0 1	2	3	4 5 .:	6	7 8		
5.00	119 122	0.85	+				Penet	ration mm				
5.50	125	0.89	1 –	<del></del>	- Data	<b>-* - ·</b> 2.5m	nm <b></b> *	5.0mm	<u> </u>	prrection		
5.75	128	0.91	1									
6.00	131	0.93	Rem	arks								
6.25	133 135	0.95	4									
6.75	138	0.98	1									
7.00	140	1.00	1									
7.25	143	1.02	4									
1.50	145	1.03										
Results	Cu	rve	CBR V	alues	, %	Moisture	e					
	corre	ction	Penetration	n		Content						
	арр	lied 2.	5mm 5i	mm		%						
						Ĩ						
	N	0 4	4.3 4	1.2	4.3	22						
	L				1							
Test Report by K4 SOILS LABORATORY Checked and Approve Unit 8 Olds Close Olds Approach												
		Unit	Vatford Her	ts W	us Approaci D18 9RU	1			Initials	J.P		
·(≯≮)-		-										
			Tel: 0192	23 71	1 288				Date:	12/06/201		
2519 Approved	Signatories: K Ph	Ei aure (Tech	mail: James	s@k4 ure /I	ab.Mar)					MSF-5-R		
	e.g. a.onoo. I.i He			⊶. ∪ (L								

## Appendix C - Geotechnical Test Results



## **TEST REPORT**

ISSUED BY SOIL PROPERTY TESTING LTD DATE ISSUED: 10/07/2018



Contract		Northwest Haverhi	ll Relief R	Road							
Serial No	).	\$33252									
Client:	MLM Cor 7200 Cam Cambridg CB5 9TL	nsulting Engineers Lt Ibridge Research Park e	d	Soil Property Testing La 15, 16, 18 Halcyon Court, St Margaret's Way, Stukeley Meadows, Huntingdon, Cambridgeshire, PE29 6DG							
Samples	Submitted MLM Cor Labelled: Northwe	<b>d By:</b> nsulting Engineers Lt st Haverhill Relief Ro	Approved Signator	<ul> <li>J.C. Garner B.Eng (Hons) FGS Technical Director</li> <li>S.P. Townend FGS Quality Manager</li> <li>W. Johnstone Materials Lab Manager</li> <li>D. Sabnis</li> <li>Operations Manager</li> </ul>							
Date R	eceived:	15/06/2018	Sample	s Tested Between:	15/06/2018 and 10/07/2018						
Remarks	: For the a Your Refe	ttention of Hester Ca erence No: 775951	arter								
Notes:	1 2	All remaining samples of unless we are notified t (a) UKAS - United Kin (b) Opinions and inte	or remnants to the contr ngdom Accr erpretations	s from this contract will b rary. reditation Service s expressed herein are ou	e disposed of after 21 days from today, utside the scope of UKAS accreditation						
	3	Tests marked "NOT UKA Schedule for this testing This test report may no issuing laboratory.	AS ACCREDI g laboratory t be reprod	TED" in this test report a y. luced other than in full ex	re not included in the UKAS Accreditation						



## TEST REPORT ISSUED BY SOIL PROPERTY TESTING LTD DATE ISSUED: 10/07/2018



Contra	act		Northwest Haverhill Relief Road																				
Serial	No.		S33252	)														Т	arg	et I	Dat	е	10/07/2018
Sched	uled I	Зу	MLM C	ons	ulti	ng	Eng	ine	ers	Lto	ł												
								S	CH	ED	ULI	ΕO	FL	AB	OR.	ATC	DR۱	Y TE	EST	S			
Sched	ule Re	emarks																					
Bore Hole No.	Туре	Sample Ref.	Top Depth												Sample Remarks								
CP01	D	1	0.30	1																			
CP01	D	2	0.70		1	1	1																
CP01	D	4	2.70	1	1	1	1																
CP01	U	1	3.00	1				1	1														
CP01	D	5	3.50	 	1	1	1																
CP01	U	2	5.00			-		1															
CP01	D	7	5.50		1	1	1																
CP01	U	3	9.10					1															
CP01	D	9	9.60		1	1	1																
CP01	D	10	12.20	1																			
CP01	U	4	13.10					1	1														
CP01	D	11	13.60		1	1	1																
CP01	D	4	19.20	1	1	1	1																
CP02	D	3	2.60		1	1	1																
CP02	U	1	2.90					1	1														
CP02	D	4	3.30	1	1	1	1																
CP02	U	2	5.00					1	1														
CP02	D	6	5.50	1	1	1	1																
CP02	D	7	7.90		1	1	1	1															
CP02	U	3	9.10	1	1	1	1	1															
TP101	B	10	12.30	<u> </u>	1		1			1													
TP102	В	1	3.00		1					1													
TP103	В	1	3.00		1					1													
TP104	В	1	3.00		1					1													
TP105	В	1	3.00		1					1													
TP106	В	1	3.00		1					1													
TP107	B	1	1.70		1	-				1				-	-			$\left  - \right $					
TP108	B R	1	1.70		1					1					-								
WS101	D	2	1.00	1		-								-	+								
WS101	D	3	1.40		1	1	1																
WS101	D	8	4.00	1																			




Contra	act		Northv	vest	: Ha	aver	hill	Re	lief	Ro	ad												
Serial	No.		S33252	)														Т	arg	jet l	Dat	е	10/07/2018
Sched	uled I	Ву	MLM C	ons	ulti	ng	Eng	ine	ers	Ltd	1												
								S	СН	ED	ULI	ΞO	F L <i>i</i>	ABO	) DR	ATC	٦R	Y TI	EST	S			
Sched	ule R	emarks																					
Bore Hole No.	Туре	Sample Ref.	Top Depth	/c	ulprat.	e cont	onter	Nation 1		and the second s	S. A.	alle Deter	ninati	J BE									Sample Remarks
WS101	D	9	4.50		1	1	1																
WS102	D	5	2.20	1	1	1	1																
WS102	D	7	3.20		1	1	1																
WS103	D	4	2.00		1	1	1																
WS103	D	7	3.20	1	1	1	1																
WS104	D	5	2.00		1	1	1																
WS105	D	3	1.00	1																			
WS105	D	2	1.40		1	1	1																
WS106	D	2	1.20		1	1	1																
WS106	D	4	2.50		1	1	1																
WS106	D	5	3.00	1																			
WS107	D	3	1.30	1	1	1																	
WS107	D	9	4.70		1	1	1																
		Totals		15	34	25	24	7	4	9													End of Schedule





Contract		Nort	hwest Hav	erhill Rel	ief Road			
Serial No		S332	52					
			DE	TERMIN	ATION C	OF DENS	ITY AND WATER CONTENT	
Borehole	Depth	5	Sample	Water	Bulk	Dry	Description	Domorizo
/Pit No.	(m)	Туре	Reference	(%)	(Mg/m3)	(Mg/m3)	Description	Remarks
TP101	1.8	В	1	16.1	1.94	1.67	Very stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP102	3	В	1	18.5	2.06	1.74	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP103	3	В	1	17.2	2.10	1.79	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional grey and orange mottling. Gravel is fine to coarse chalk and rare flint.	
TP104	3	В	1	19.9	2.04	1.70	Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP105	3	В	1	18.3	2.06	1.74	Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP106	3	В	1	18.9	2.09	1.76	Very stiff dark olive slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP107	1.7	В	1	17.9	2.07	1.76	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling and rare orange staining. Gravel is fine to coarse chalk and rare flint.	
TP108	1.7	В	1	16.9	2.08	1.78	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling and rare orange staining. Gravel is fine to coarse chalk and rare flint.	
Method of Pr Method of Te Type of Samp Comments:	eparation: est: ble Key:		BS EN ISO 178 U = Undisturb	392-1: 2014 & aed, B = Bulk,	& BS EN ISO 1 D = Disturbe	7892-2: 201 d, J - Jar, W :	4 = Water, SPT = Split Spoon Sample, C = Core Cutte	
Remarks to li	nclude:		Sample distur	bance, loss o rature if not	of moisture, v 105-110°C.	ariation fron	n test procedure, location and origin of test specir	nen within original sample. Oven





Contract		Nort	hwest Hav	erhill Rel	ief Road			
Serial No	)	S332	.52					
			DF	TERMIN	IATION C	DF DENS	TY AND WATER CONTENT	
Borehole /Pit No.	Depth (m)	S Type	Sample Reference	Water Content	Bulk Density (Ma/m3)	Dry Density (Ma/m3)	Description	Remarks
TP109	1.7	В	1	19.1	2.05	1.72	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
Method of Pr Method of Te Type of Samı Comments:	reparation: est: ple Key:		BS EN ISO 178 U = Undisturt	392-1: 2014 { bed, B = Bulk,	≩ BS EN ISO 1 D = Disturbe	7892-2: 201 :d, J - Jar, W	4 = Water, SPT = Split Spoon Sample, C = Core Cutte	9L
Remarks to I <sup>,</sup>	nclude:		Sample distur	rbance, loss c	of moisture, v	variation fron	n test procedure, location and origin of test specir	men within original sample. Oven





Contract	t	Nort	thwest H	laverhil	I Relie	f Road	1							
Serial No	0.	S332	252		. <u> </u>		·							
	SUMM	- ARY C	)F WATE		TENT, I		) LIMIT	, PLAS	TIC LIN	/IT, PL/	ASTICIT		DEX AND LIQUIDITY INDEX	
Borehole /Pit No.	Depth (m)	Туре	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasti- city Index (%)	Liquid- ity Index (%)	SA Method	MPLE PRE Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	N Curing Time (hrs)	Description	CLASS
CP01	0.70	D	2	16.6	28	14	14	0.18	Wet Sieved	19 (M)	N/R*	24	Firm yellowish brown slightly gravelly slightly sandy silty CLAY with occasional recently active roots. Gravel is fine to coarse angular to subangular flint.	CL
CP01	2.70	D	4	19.1	34	16	18	0.17	Wet Sieved	13 (M)	N/R*	24	Stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling. Gravel is fine to medium chalk.	CL
CP01	4.50	D	6	18.9	31	15	16	0.25	Wet Sieved	15 (M)	N/R*	24	Stiff grey slightly gravelly slightly sandy silty calcareous CLAY with occasional orange staining. Gravel is fine to coarse chalk.	CL
CP01	5.50	D	7	19.0	33	16	17	0.17	Wet Sieved	12 (M)	N/R*	25	Stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
CP01	9.60	D	9	20.0	33	16	17	0.23	Wet Sieved	17 (M)	N/R*	24	Stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
CP01	13.60	D	11	17.0	34	16	18	0.05	Wet Sieved	8 (M)	N/R*	24	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
CP01	19.20	В	4	21.9	20	13	7	1.27	Wet Sieved	2 (M)	N/R*	24	Dark brownish grey sandy silty calcareous CLAY/very clayey fine and medium SAND with rare fine and medium chalk gravel	CL
CP02	1.90	D	2	16.9	33	16	17	0.05	Wet Sieved	43 (M)	N/R*	24	Firm brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with rare recently active roots. Gravel is fine to medium chalk and rare flint.	CL
Method Of Method of <sup>–</sup> Type of Sam Comments: Remarks to	Preparation Test: nple Key:	.:	BS EN ISO: BS EN ISO: U = Undistu *Corrected corrected v Sample dis	17892-1: 2 17892-1: 2 Jrbed, B = Water con water cont turbance,	2014 & B 2014 & B Bulk, D = ntent assi- tent is no loss of w	S 1377: P S 1377: P Disturbe ume mate t reporte vater, vari	'art 2:199 'art 2:199 yd, J = Jar, erial grea d due to i iation froi	0:4.2 0:3.2, 4.4 W = Wat ter than ( material t m test prc	I, 5.3, 5.4 ter, SPT = 0.425mm ype. pcedure, i	Split Spo is non-po location a	ion Sampl orous. See and origin	le, C = C e BS137 of test	Core Cutter 77: Part 2: 1990 Clause 3 Note 1. Where specimen within original sample, oven c	N/R, drying





Contract	t	Nort	hwest H	laverhil	Il Relie	f Road	1							
Serial No	0.	S332	252											
	SUMM	ARY C	)F WATE	RCON	TENT, I	LIQUIE	) LIMIT	, PLAS	TIC LIN	ЛIT, PL	ASTICIT	ry ini	DEX AND LIQUIDITY INDEX	
Borehole /Pit No.	Depth (m)	Туре	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasti- city Index (%)	Liquid- ity Index (%)	SA Method	MPLE PRE Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	N Curing Time (hrs)	Description	CLASS
CP02	2.60	D	3	17.9	34	16	18	0.11	Wet Sieved	9 (M)	N/R*	24	Stiff brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with occasional light grey mottling. Gravel is fine to medium chalk.	CL
CP02	3.30	D	4	19.6	33	15	18	0.26	Wet Sieved	15 (M)	N/R*	77	Stiff olive yellow slightly gravelly slightly sandy silty calcareous CLAY with occasional light grey mottling, and rare decayed roots. Gravel is fine to coarse chalk.	CL
CP02	5.50	D	6	20.8	32	15	17	0.34	Wet Sieved	44 (M)	N/R*	77	Stiff light olive brown slightly gravelly sandy silty calcareous CLAY. Gravel is fine to coarse chalk.	CL
CP02	7.90	D	7	19.3	31	15	16	0.27	Wet Sieved	14 (M)	N/R*	76	Stiff dark olive grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
CP02	12.30	D	10	16.8	33	15	18	0.10	Wet Sieved	11 (M)	N/R*	28	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
WS101	1.40	D	3	17.3	51	19	32	-0.05	Wet Sieved	6 (M)	N/R*	28	Very stiff olive brown slightly gravelly slightly sandy calcareous CLAY with occasional dark grey mottling. Gravel is fine to medium chalk and rare flint.	СН
WS101	4.50	D	9	17.4	40	18	22	-0.03	Wet Sieved	10 (M)	N/R*	72	Very stiff greyish brown slightly gravelly slightly sandy silty calcareous CLAY with occasional orangish brown mottling. Gravel is fine to medium chalk and rare flint.	CI
WS102	2.20	D	5	16.1	47	19	28	-0.10	Wet Sieved	33 (M)	N/R*	28	Very stiff dark olive slightly gravelly slightly sandy silty CLAY with occasional dark grey mottling. Gravel is fine to coarse chalk.	CI
Method Of Method of <sup>-</sup> Type of Sam Comments: Remarks to	Preparation Test: nple Key:	1:	BS EN ISO: BS EN ISO: U = Undistu *Corrected corrected v Sample dis	17892-1: 2 17892-1: 2 Jrbed, B = I water con water cont turbance,	2014 & B 2014 & B Bulk, D = ntent ass tent is no loss of w	S 1377: P S 1377: P Disturbe ume mat t reporte vater, vari	'art 2:199 'art 2:199 ≥d, J = Jar, erial grea ed due to i iation froi	0:4.2 0:3.2, 4.4 W = Wat ter than ( material t m test prc	I, 5.3, 5.4 ter, SPT = 0.425mm ype. pcedure, l	ן Split Spo ו is non-p location a	ion Sampl orous. See and origin	le, C = C e BS137 of test	Core Cutter 77: Part 2: 1990 Clause 3 Note 1. Where specimen within original sample, oven d	N/R, drying





Contract	t	Nort	thwest H	laverhil	I Relie	f Road	1							
Serial No	Э.	S332	252	. <u> </u>	. <u> </u>		·		. <u> </u>					
	SUMM	ARY C	)F WATE		TENT, I		LIMIT	, PLAS	TIC LIN	/IT, PL/	ASTICIT	Y IN[	DEX AND LIQUIDITY INDEX	
Borehole /Pit No.	Depth (m)	Туре	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasti- city Index (%)	Liquid- ity Index (%)	SAI Method	MPLE PRE Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	N Curing Time (hrs)	Description	CLASS
WS102	3.20	D	7	14.9	46	16	30	-0.04	Wet Sieved	38 (M)	N/R*	72	Very stiff dark olive slightly gravelly sandy silty calcareous CLAY with occasional dark grey mottling, and rare selenite crystals. Gravel is fine to coarse chalk.	CI
WS103	2.00	D	4	18.8	43	15	28	0.14	Wet Sieved	22 (M)	N/R*	71	Very stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with rare bluish grey veins, and decayed roots. Gravel is fine to medium chalk.	CI
WS103	3.20	D	7	18.4	44	18	26	0.01	Wet Sieved	8 (M)	N/R*	145	Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling, and rare decayed roots. Gravel is fine to medium chalk.	CI
WS104	2.00	D	5	18.4	47	16	31	0.08	Wet Sieved	33 (M)	N/R*	71	Very stiff dark olive slightly gravelly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to medium chalk.	CI
WS105	1.40	D	2	17.6	48	19	29	-0.05	Wet Sieved	8 (M)	N/R*	72	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling, and rare recently active and decayed roots. Gravel is fine to medium chalk.	CI
WS106	1.20	D	2	21.4	43	18	25	0.14	Wet Sieved	10 (M)	N/R*	144	Very stiff olive yellow slightly gravelly slightly sandy silty calcareous CLAY with rare recently active and decayed roots. Gravel is fine to medium chalk.	CI
WS106	2.50	D	4	20.5	41	16	25	0.18	Wet Sieved	14 (M)	N/R*	71	Very stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling, and rare recently active roots. Gravel is fine to medium chalk.	CI
WS107	1.30	D	3	24.9	49	19	30	0.20	From Natural	<1% (A)	N/R*	71	Firm brown slightly gravelly slightly sandy silty calcareous CLAY with rare recently active roots. Gravel is fine to medium and flint.	CI
Method Of I Method of T Type of Sam Comments: Remarks to	Preparation Fest: uple Key: Include:		BS EN ISO: BS EN ISO: U = Undistu *Corrected corrected v Sample dis	17892-1: : 17892-1: : urbed, B = I water con water cont iturbance,	2014 & B 2014 & B Bulk, D = ntent assi- tent is no loss of w	S 1377: P S 1377: P Disturbe ume mate t reporter ater, vari	art 2:199 art 2:199 d, J = Jar, erial grea d due to r ation fror	0:4.2 0:3.2, 4.4 W = Wat ter than ( material t m test pro	-, 5.3, 5.4 :er, SPT = ).425mm ype. pcedure, I	Split Spo i is non-po location a	on Sampl orous. Se∉ and origin	e, C = C e BS137 of test	ore Cutter 7: Part 2: 1990 Clause 3 Note 1. Where specimen within original sample, oven c	N/R, drying





Contract	t	Nort	hwest H	laverhil	II Relie	ef Road	1							
Serial No	0.	S332	252				. <u> </u>	. <u> </u>			. <u> </u>			
	SUMM	ARY C	)F WATE		TENT, I		) LIMIT	, PLAS	TIC LIN	/IIT, PL/	ASTICI	 [Y IN[	DEX AND LIQUIDITY INDEX	
Borehole /Pit No.	Depth (m)	Туре	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasti- city Index (%)	Liquid- ity Index (%)	SAI Method	MPLE PRE Ret'd 0.425mm (%)	PARATIO Corr'd W/C <0.425mm	Curing Time (hrs)	Description	CLASS
WS107	4.70	D	9	17.7	32	16	16	0.11	Wet Sieved	13 (M)	N/R*	72	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
Method Of Method of Type of Sam Comments: Remarks to	Preparation Test: nple Key:	.:	BS EN ISO: BS EN ISO: U = Undistu *Corrected corrected v Sample dis	17892-1: 2 17892-1: 2 17bed, B = water con water cont turbance,	2014 & B 2014 & B Bulk, D = ntent ass tent is no loss of w	S 1377: P S 1377: P Disturbe ume mat t reporte vater, vari	art 2:199 art 2:199 d, J = Jar, erial grea d due to i ation froi	0:4.2 0:3.2, 4.4 W = Wat ter than ( material t m test pro	4, 5.3, 5.4 ter, SPT = 0.425mm type. pcedure,	Split Spo i is non-po location a	on Sampl prous. See and origin	le, C = C e BS137 of test	ore Cutter 7: Part 2: 1990 Clause 3 Note 1. Where specimen within original sample, oven (	N/R, drying











Contract		North	west Have	rhill Relie	ef Road					
Serial No.		S3325	2							
		DET	ERMINATI DEF	ON OF W	ATER CC	ONTENT, L STICITY IN	IQUID LIMIT DEX AND LIC	AND PLASTIC LIM	IT AND	
Borehole / Pit No.	Depti m	n S Type	Sample	Water Content		-	Description			Remarks
CP01	0.70	D	2	16.6	Firm yellow occasional r subangular	ish brown sligh ecently active r flint.	tly gravelly slightly s oots. Gravel is fine	andy silty CLAY with to coarse angular to		
			Р	REPARATIO	ЛС			Liquid Limit		28 %
Method o	f prepa	aration	l		Wet s	ieved over	0.425mm siev	e Plastic Limit		14 %
Sample re		14 %								
Corrected	water	conte	nt for mate	rial passing	g 0.425mi	m N	Not reported	Liquidity Index		0.18
Sample re	tained	2mm	sieve	(Measu	ured)		2 %	NHBC Modified (I	'p)	11 %
Curing tim	e		24	hrs	Clay C	content r	Not analysed	Derived Activity		Not analysed
C=CLAY Plasticity % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL	CI 	CH 	CV CV MV 70 80 Plast	CE ME 90 100 110 city Chart BS5930: 2015: Fi	120	Low Medium High NHBC Volume Change Potential
Method of Method of Type of Sar Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISO: BS EN ISO: U=Undisturk Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 ped, B=Bulk ter content r ter content a ge Potential: ed Plasticity I	2014 & BS 2014 & BS , D=Distur not reported ssume mat NHBC Stan ndex I'p = Ip	5 1377: Part 5 1377: Part bed, J=Jar, W d due to mate erial greater t dards Chapte o x (% less tha	t 2: 1990: 4.2 t 2: 1990: 3.2, /=Water, SPT=S rial type. than 0.425mm nc r 4.2 Unmodified n 425microns/10	4.4, 5.3, 5.4 plit Spoon Sample, C= n-porous. See BS1377: F Plasticity Index 0)	Core Cut Part2: 199	ter 0 Clause 3 Note 1





Contract		North	west Have	rhill Relie	ef Road							
Serial No.		S3325	2									
		DET	ERMINATI DEF	ON OF W RIVATION	ATER CC OF PLAS	NTENT, LI STICITY INI	QUID LIMIT A	AND PLASTIC LIM JIDITY INDEX	IT AND			
Borehole / Pit No.	Deptl m	n S Type	Sample Reference	Water Content (W) %			Description			Remarks		
CP01	2.70	D	4	19.1	Stiff light oli CLAY with o medium cha	ve brown slight ccasional light l ilk.	ly gravelly slightly sa bluish grey mottling.	ndy silty calcareous Gravel is fine to				
			P	REPARATIO	ON			Liquid Limit		34 %		
Method of	fprep	aration			Wet si	eved over	0.425mm sieve	Plastic Limit		16 %		
Sample retained 0.425mm sieve     (Measured)     13 %     Plasticity Index       Corrected water content for material passing 0.425mm     National data water     Liquidity Index												
Corrected	water	conte	nt for mate	rial passing	g 0.425mr	n N	lot reported	Liquidity Index		0.17		
Sample re	tained	2mm	sieve	(Measu	ired)		11 %	NHBC Modified (	l'p)	<mark>16</mark> %		
Curing tim	е		24	hrs	Clay C	ontent	lot analysed	Derived Activity		Not analysed		
C=CLAY Plasticity   % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL ML 30	CI MI 40	CH 	CV CV N/V 70 80 Plastic	CE CE ME 90 100 110 ity Chart BS5930: 2015: F	120 igure 8	Low   Medium   High     NHBC Volume Change Potential		
Method of Method of Type of San Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISO: BS EN ISO: U=Undisturk Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 bed, B=Bulk, ter content n ter content a ge Potential: ed Plasticity II	2014 & BS 2014 & BS , D=Disturk not reported ssume mat NHBC Stan ndex I'p = Ip	5 1377: Part 5 1377: Part Ded, J=Jar, W I due to mate erial greater t dards Chapter o x (% less tha	2: 1990: 4.2 2: 1990: 3.2, 4 /=Water, SPT=Sp rial type. han 0.425mm nor 4.2 Unmodified F n 425microns/100	4.4, 5.3, 5.4 Ilit Spoon Sample, C= 1-porous. See BS1377: I Plasticity Index )	∈Core Cut Part2: 199	tter 90 Clause 3 Note 1		





Contract		North	west Have	rhill Relie	ef Road							
Serial No.		S3325	2									
		DET	ERMINAT	ON OF W	ATER CO OF PLAS	NTENT, LI TICITY INI	QUID LIN DEX AND	/IT A LIQU	ND PLASTIC LIMIT A	ND		
Borehole / Pit No.	Depth m		Sample Reference	Water Content (W) %			Descriptio	on		Remarks		
CP01	4.50	D	6	18.9	Stiff grey slig occasional o	htly gravelly sl range staining.	ightly sandy si Gravel is fine	ilty calc to coar	areous CLAY with rse chalk.			
			P	REPARATI	ON				Liquid Limit	31 %		
Method of	f prepa	aratior	I		Wet si	eved over	0.425mm	sieve	Plastic Limit	15 %		
Sample retained 0.425mm sieve (Measured) 15 % Plasticity Index												
Corrected	0.25											
Sample re	14 %											
Curing tim	ie		24	hrs	Clay C	ontent	lot analysed		Derived Activity	Not analysed		
C=CLAY Plasticity   % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL × ML 20 30	CI MI 40 5	CH 	C \	V V V O Plastici	CE ME 90 100 110 120 ty Chart BS5930: 2015: Figure 8	Liding Triange Potential		
Method of Method of Type of San Comments:	Prepar Test: nple Ke	ation: y:	BS EN ISO: BS EN ISO: U=Undisturl Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 Ded, B=Bulk ter content r ter content a ge Potential: ed Plasticity I	2014 & BS 2014 & BS , D=Disturk not reported assume mate NHBC Stand ndex I'p = Ip	1377: Part 1377: Part ped, J=Jar, W due to mate erial greater t dards Chapter x (% less tha	2: 1990: 4 2: 1990: 5 2: 1990: 5 2: 1990: 5 2: 2: 1990: 5 2: 2: 2: 2: 2: 2: 2: 2: 2: 2: 2: 2: 2: 2	4.2 3.2, 4 PT=Sp m non ified P is/100)	.4, 5.3, 5.4 lit Spoon Sample, C=Core -porous. See BS1377: Part2: lasticity Index )	Cutter 1990 Clause 3 Note 1		





Contract		North	west Hav	verhill Reli€	ef Road							
Serial No.		S3325	52									
		DET	ERMINA D	TION OF W ERIVATION	ater CC	ONTENT, LI STICITY IN	IQUID DEX A	LIMIT A	ND PLASTIC LIN	1IT AND	)	
Borehole / Pit No.	Deptr m	ז אַ Type	Sample	Water Content			Descr	ription			Remarks	
CP01	5.50	D	7	19.0	Stiff dark gr Gravel is fin	ey slightly grave to medium ch	elly slight nalk.	lly sandy silty	/ calcareous CLAY.			
		_		PREPARATI	ON				Liquid Limit			33 %
Method o	f prep;	aratior	1		Wet s	ieved over	0.425r	nm sieve	Plastic Limit			16 %
Sample re		17 %										
Corrected	(	).17										
Sample retained 2mm sieve   (Measured)   10 %   NHBC Modified (I'p)												15 %
Curing time25 hrsClay ContentNot analysedDerived Activity												lysed
C=CLAY Plasticity   % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL	CI MI 40	CH 60	70	CV MV 80 Plastici	CE CE ME 90 100 110 ty Chart BS5930: 2015: F	120 igure 8	Liquid Lin	% NHBC Volume Change Potential
IVI=SIL1MLMLMIMHMVME0102030405060708090100110120Plasticity Chart BS5930: 2015: Figure 8Method of Preparation:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2Method of Test:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4Type of Sample Key:U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core CutterCorrected water content not reported due to material type.Corrected water content not reported due to material type.Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)												





Contract		North	west Hav	/erhill Reli€	ef Road								
Serial No.		S3325	2										
		DET	ERMINA DI	TION OF W ERIVATION	ATER CC	ONTENT, LI STICITY IN	IQUID DEX A	D LIMIT A	ND PLASTIC LI JIDITY INDEX	MIT AND	)		
Borehole / Pit No.	Depth m		Sample	Water Content			Descr	ription			Remark	S	
CP01	9.60	D	9	20.0	Stiff dark gr Gravel is fin	ey slightly grave to medium ch	elly slight nalk.	tly sandy silty	r calcareous CLAY.				
			ľ	PREPARATI	ON				Liquid Limit	•		<mark>33</mark> %	
Method of	fprepa	aratior	1		Wet s	ieved over	0.425r	mm sieve	Plastic Limit			<mark>16</mark> %	
Sample re <sup>-</sup>		17 %											
Corrected		0.23											
Sample retained 2mm sieve (Measured) 14 % NHBC Modified (I'p)												14 %	
Curing time24 hrsClay ContentNot analysedDerived Activity												alysed	
C=CLAY Plasticity I % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL	CI MI 40	CH 60	70	CV MV 80 Plasticit	CE ME 90 100 110 ty Chart BS5930: 2015	D 120	Liquid L	NHBC Volume Change Potential %	
Method of I Method of <sup>-</sup> Type of San Comments:	Method of Preparation:MCMIMHMVMEMethod of Preparation:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2Method of Test:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core CutterComments:Corrected water content not reported due to material type. Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)												





Contract		North	west Hav	erhill Relie	ef Road					
Serial No.		S3325	2							
		DET	ERMINAT DE	ION OF W	ATER CO	ONTENT, L STICITY IN	IQUID LIN DEX AND	/IT A LIQU	ND PLASTIC LIMIT AN	ND
Borehole / Pit No.	Depth m	n S Type	Sample Reference	Water Content (W) %	_		Descriptio	on		Remarks
CP01	13.60	D	11	17.0	Very stiff da Gravel is fir	ark grey slightly ie to medium cl	gravelly slightl halk.	ly sand	y silty calcareous CLAY.	
			F	PREPARATI	ON				Liquid Limit	34 %
Method of	f prepa	aration	l		Wet s	ieved over	0.425mm	sieve	Plastic Limit	16 %
Sample retained 0.425mm sieve(Measured)8 %Plasticity Index										18 %
Corrected water content for material passing 0.425mm Not reported Liquidity Index										0.05
Sample retained 2mm sieve(Measured)6 %NHBC Modified (I'p)										17 %
Curing time       24 hrs       Clay Content       Not analysed       Derived Activity										Not analysed
C=CLAY Plasticity I % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL	CI MI 40	CH MH 50 60	C\	V V Plastici	CE ME 90 100 110 120 ty Chart BS5930: 2015: Figure 8	Low   Medium     High     NHBC Volume Change Potential
Method of Method of Type of San Comments:	Prepara Test: nple Ke	ation: y:	BS EN ISO BS EN ISO U=Undistur Corrected w Corrected w Volume Cha Note: Modif	: 17892-1: 2 : 17892-1: 2 : bed, B=Bulk ater content r ater content a nge Potential: ied Plasticity I	2014 & B: 2014 & B: , D=Distur not reporte assume mat NHBC Star ndex I'p = I	S 1377: Par S 1377: Par bed, J=Jar, V d due to mate terial greater f idards Chapte p x (% less tha	t 2: 1990: 4 t 2: 1990: 3 V=Water, SF erial type. than 0.425mr r 4.2 Unmodi in 425micron	4.2 3.2, 4 PT=Sp m non ified P s/100)	4, 5.3, 5.4 lit Spoon Sample, C=Core -porous. See BS1377: Part2: lasticity Index )	Cutter 1990 Clause 3 Note 1





Contract		North	west Have	rhill Relie	ef Road						
Serial No.		S3325	2								
		DET	ERMINATI DEF	ON OF W	ATER CC	ONTENT, L STICITY IN	IQUID LIMIT DEX AND LIC	AND PLASTIC LIM	IT AND		
Borehole / Pit No.	Deptl m	n S Type	Sample Reference	Water Content (W) %			Description			Remarks	
CP01	19.20	) B	4	21.9	Dark brown medium SAI	ish grey sandy s ND with rare fir	silty calcareous CLA ne and medium cha	Y/very clayey fine and Ik gravel			
			Р	REPARATIO	ON			Liquid Limit		20 %	
Method of	fprepa	aration			Wet si	ieved over	0.425mm siev	e Plastic Limit		13 %	
Sample re	tained	0.425	mm sieve	(Measu	ured)		2 %	Plasticity Index		7 %	
Corrected water content for material passing 0.425mmNot reportedLiquidity Index1.27											
Sample re	tained	2mm	sieve	(Measu	ured)		<1 %	NHBC Modified (I	l'p)	7 %	
Curing time       24 hrs       Clay Content       Not analysed       Derived Activity       Not analysed											
C=CLAY Plasticity % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL ML 0 30	CI MI 40	CH 	CV CV MV 70 80 Plast	CE ME 90 100 110	120	Low Medium High NHBC Volume Change Potential	
Method of Method of Type of Sar Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISO: BS EN ISO: U=Undisturk Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 bed, B=Bulk ter content r ter content a ge Potential: ed Plasticity I	2014 & BS 2014 & BS , D=Disturk not reported assume mat NHBC Stan ndex I'p = Ip	5 1377: Par 5 1377: Par bed, J=Jar, W d due to mate erial greater t dards Chapte b x (% less tha	t 2: 1990: 4.2 t 2: 1990: 3.2, /=Water, SPT=S rial type. than 0.425mm no r 4.2 Unmodified n 425microns/10	4.4, 5.3, 5.4 plit Spoon Sample, C= on-porous. See BS1377: F Plasticity Index 0)	Core Cut Part2: 199	tter 10 Clause 3 Note 1	





Contract   Northwest Haverhill Relief Road     Serial No.   \$33252										
Serial No.		S3325	2							
		DET	ERMINAT	ION OF W	ATER CO	NTENT, LI TICITY INI		AND PLASTIC LIMI	T AND	
Borehole / Pit No.	Depth m	Type	Sample	Water Content			Description		Remarks	
CP02	1.90	D	2	16.9	Firm browni: CLAY with ra rare flint.	sh yellow sligh re recently act	ly gravelly slightly sa ive roots. Gravel is fi	andy silty calcareous ne to medium chalk and		
			F	REPARATIO	ON			Liquid Limit	3	3 %
Method of	fprepa	aration	l		Wet si	eved over	0.425mm sieve	Plastic Limit	1	<mark>6</mark> %
Sample re	tained	0.425	mm sieve	(Measu	ured)		43 %	Plasticity Index	1	7 %
Corrected water content for material passing 0.425mm Not reported Liquidity Index										5
Sample retained 2mm sieve(Measured)34 %NHBC Modified (I'p)										
Curing time       24 hrs       Clay Content       Not analysed       Derived Activity										ed
Curing time   24 hrs   Clay Content   Not analysed   Derived Activity   Not analysed     C=CLAY   0   0   CL   CL<									120 NHBC Volume Change Potential	, ,
Method of Method of Type of San Comments:	Prepar Test: nple Ke	ation: :y:	BS EN ISO: BS EN ISO: U=Undistur Corrected w Corrected w Volume Char Note: Modifi	17892-1: 2 17892-1: 2 bed, B=Bulk ater content r ater content a nge Potential: ed Plasticity I	2014 & BS 2014 & BS , D=Disturb not reported issume mate NHBC Stand ndex I'p = Ip	1377: Part 1377: Part ped, J=Jar, W due to mate erial greater t dards Chapter x (% less tha	2: 1990: 4.2 2: 1990: 3.2, 4 =Water, SPT=Sp rial type. han 0.425mm nor 4.2 Unmodified F n 425microns/100	1.4, 5.3, 5.4 Ilit Spoon Sample, C=( 1-porous. See BS1377: Pa Plasticity Index )	Core Cutter art2: 1990 Clause 3 Note	e 1





Contract		North	west Hav	erhill Relie	ef Road							
Serial No.		S3325	2							_	_	_
		DET	ERMINAT DE	TON OF W	ATER CO	<u></u> ONTENT, L STICITY IN	iquid Dex A	D LIMIT A	ND PLASTIC LIN	1IT AND	)	
Borehole / Pit No.	Depth		Sample	Water Content			Desci	ription			Remark	S
CP02	2.60	D	3	17.9	Stiff browni CLAY with c chalk.	ish yellow slight occasional light	tly gravel grey mot	lly slightly sar ttling. Gravel	ndy silty calcareous is fine to medium			
			[	PREPARATI	ON				Liquid Limit			<mark>34</mark> %
Method of	f prepa	aration			Wet s	ieved over	0.425r	mm sieve	Plastic Limit			16 %
Sample re	tained	0.425	mm sieve	(Meası	ured)			<mark>9</mark> %	Plasticity Index			18 %
Corrected	water	conte	nt for mate	erial passing	g 0.425m	m I	Not repo	orted	Liquidity Index			0.11
Sample retained 2mm sieve(Measured)8 %NHBC Modified (I'p)16 %											16 %	
Curing time       24 hrs       Clay Content       Not analysed       Derived Activity       Not analysed											alysed	
Curing time   24 hrs   Clay Content   Not analysed   Derived Activity   Not analysed     C=CLAY   70   CL   CL   CL   CH   CV   CE     Plasticity Index %   40   30   20   0   0   0   0     M=SILT   0   10   20   30   40   50   60   70   80   90   100   110   120   Liquid Lim									itime Change Potential %			
Method of Method of Type of San Comments:	Prepara Test: nple Ke :	ation: y:	BS EN ISO BS EN ISO U=Undistur Corrected w Corrected w Volume Cha Note: Modif	: 17892-1: 2 : 17892-1: 2 rbed, B=Bulk vater content r vater content a inge Potential: fied Plasticity I	2014 & B 2014 & B 2014 & B D=Distur not reporte assume mat NHBC Star NHBC Star	S 1377: Par S 1377: Par bed, J=Jar, V d due to mate terial greater ndards Chapte p x (% less tha	t 2: 19 t 2: 19 V=Wate erial type than 0.4 er 4.2 Ur an 425m	290: 4.2 290: 3.2, 4 er, SPT=Spl e. 125mm non- nmodified P hicrons/100)	4, 5.3, 5.4 lit Spoon Sample, C -porous. See BS1377: lasticity Index	=Core Cu Part2: 194	tter 90 Clause 3	Note 1





Contract		North	west Have	rhill Relie	ef Road					
Serial No.		S3325	2							
		DET	ERMINATI DEF	ON OF W RIVATION	ATER CC	ONTENT, LI STICITY INI	IQUID LIMIT A	AND PLASTIC LIM UIDITY INDEX	IT AND	
Borehole / Pit No.	Depth m	n S Type	Sample Reference	Water Content (W) %			Description			Remarks
CP02	3.30	D	4	19.6	Stiff olive ye with occasio fine to coars	ellow slightly gra onal light grey n se chalk.	avelly slightly sandy nottling, and rare de	silty calcareous CLAY cayed roots. Gravel is		
			P	REPARATIO	ON			Liquid Limit		33 %
Method o	fprepa	aration			Wet s	ieved over	0.425mm siev	e Plastic Limit		15 %
Sample re	tained	0.425	mm sieve	(Measu	ired)		15 %	Plasticity Index		18 %
Corrected water content for material passing 0.425mm Not reported Liquidity Index 0.26										
Sample retained 2mm sieve(Measured)13 %NHBC Modified (I'p)15 %										
Curing time       77 hrs       Clay Content       Not analysed       Derived Activity       Not analysed										
Curing time   77 hrs   Clay Content   Not analysed   Derived Activity   Not analysed     C=CLAY   70   CL   C										Low   Medium   High     NHBC Volume Change Potential
Method of Method of Type of Sar Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISO: BS EN ISO: U=Undisturk Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 bed, B=Bulk, ter content n ter content a ge Potential: ed Plasticity II	2014 & BS 2014 & BS , D=Disturl not reported ssume mat NHBC Stan ndex I'p = Ip	5 1377: Part 5 1377: Part bed, J=Jar, W d due to mate erial greater t dards Chapter o x (% less tha	t 2: 1990: 4.2 t 2: 1990: 3.2, /=Water, SPT=Sp rial type. than 0.425mm not r 4.2 Unmodified n 425microns/100	4.4, 5.3, 5.4 blit Spoon Sample, C= n-porous. See BS1377: I Plasticity Index ))	=Core Cut Part2: 199	tter 90 Clause 3 Note 1





Contract		North	west Hav	/erhill Reli€	ef Road							
Serial No.		S3325	2							_	_	_
		DET	ERMINA Di	TION OF W	ATER CO	ONTENT,	LIQUI NDEX	d limit a And liqu	ND PLASTIC LIN	/IT AND	)	
Borehole / Pit No.	Depth m		Sample	Water Content			Desc	cription			Remark	S
CP02	5.50	D	6	20.8	Stiff light o Gravel is fi	olive brown sli ine to coarse (	ightly grav chalk.	elly sandy silty	r calcareous CLAY.			
				PREPARATI	ON				Liquid Limit	•		<mark>32</mark> %
Method of	f prepa	aration	1		Wet	sieved ove	er 0.425	āmm sieve	Plastic Limit			15 %
Sample re <sup>-</sup>	tained	0.425	mm sieve	(Meası	ured)			44 %	Plasticity Index			17 %
Corrected	water	conte	nt for mat	erial passing	y 0.425m	าท	Not rep	oorted	Liquidity Index			0.34
Sample retained 2mm sieve(Measured)10 %NHBC Modified (I'p)10 %												
Curing time77 hrsClay ContentNot analysedDerived ActivityNot analysed											alysed	
Curing time       77 hrs       Clay Content       Not analysed       Derived Activity       Not analysed         C=CLAY       70       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       60       70       60       70       70       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10<									iti NHBC Volume Change Potential %			
Method of I Method of <sup>7</sup> Type of San Comments:	Prepara Test: nple Ke :	ation: y:	BS EN ISO BS EN ISO U=Undistu Corrected v Corrected v Volume Cha Note: Modi	7: 17892-1: 2 7: 17892-1: 2 1rbed, B=Bulk vater content r vater content a ange Potential: fied Plasticity I	2014 & B 2014 & B , D=Distur 10t reporte 3ssume ma NHBC Sta ndex l'p =	IS 1377: P IS 1377: P rbed, J=Jar ed due to m aterial greate ndards Chap Ip x (% less	art 2: 1 art 2: 1 , W=Wa aterial tyj er than 0. oter 4.2 U than 425i	990: 4.2 990: 3.2, 4 ter, SPT=Spl pe. .425mm non- Jnmodified P microns/100)	. 4, 5.3, 5.4 lit Spoon Sample, C -porous. See BS1377: lasticity Index	=Core Cu Part2: 194	tter 90 Clause 3	Note 1





Contract		North	west Hav	/erhill Reli€	ef Road							
Serial No.		S3325	2									
		DET	ERMINA Di	TION OF W ERIVATION	'ATER CC I OF PLA!	ONTENT, LI STICITY IN	iquid Dex A	LIMIT A	ND PLASTIC LIN JIDITY INDEX	IIT AND	)	
Borehole / Pit No.	Depth m		Sample Referenc	Water Content			Descr	iption			Remarks	
CP02	7.90	D	7	19.3	Stiff dark ol Gravel is fin	ive grey slightly ie to medium ch	gravelly : nalk.	slightly sand	y silty calcareous CLAY.			
		- <b></b>		PREPARATI	ON				Liquid Limit		3	31 %
Method of	f prepa	aratior	1		Wet s	ieved over	0.425n	nm sieve	Plastic Limit		1	5 %
Sample re <sup>-</sup>	tained	0.425	mm sieve	(Meası	ured)			14 %	Plasticity Index		1	<mark>6</mark> %
Corrected	water	conte	nt for mat	erial passing	g 0.425m	m N	lot repo	rted	Liquidity Index		0.2	27
Sample retained 2mm sieve(Measured)13 %NHBC Modified (I'p)14 %											4 %	
Curing time       76 hrs       Clay Content       Not analysed       Derived Activity       Not analysed											Not analyse	ed
C=CLAY Plasticity I % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL	CI MI 40	CH 60	70	CV MV 80 Plastici	CE ME 90 100 110 ty Chart BS5930: 2015: F	120 igure 8	Low Medium High Medium Aigh Medium Aigh Medium Aigh Medium Aigh Aigh Aigh Aigh Aigh Aigh Aigh Aigh	t %
Method of I Method of <sup>7</sup> Type of San Comments:	Prepara Test: nple Ke :	ation: y:	BS EN ISC BS EN ISC U=Undistu Corrected v Corrected v Volume Cha Note: Modi	7: 17892-1: 2 7: 17892-1: 2 1rbed, B=Bulk vater content r vater content a ange Potential: fied Plasticity I	2014 & BS 2014 & BS , D=Disturl not reporter assume mat NHBC Star Index I'p = I	5 1377: Part 5 1377: Part bed, J=Jar, W d due to mate terial greater t idards Chapte p x (% less tha	t 2: 199 t 2: 199 rial type han 0.4: r 4.2 Uni n 425mi	90: 4.2 90: 3.2, 4 er, SPT=Spl e. 25mm non- modified Pl icrons/100)	.4, 5.3, 5.4 it Spoon Sample, C porous. See BS1377: lasticity Index	=Core Cu Part2: 199	tter 90 Clause 3 Not	e 1





Contract		North	west Have	erhill Relie	ef Road					
Serial No.		S3325	2							
		DET	ERMINAT DE	ION OF W RIVATION	ATER CC	ONTENT, L STICITY IN	iquid lin Dex and	/IT A LIQL	ND PLASTIC LIMIT AN	ND
Borehole / Pit No.	Depth m	n S Type	Sample Reference	Water Content (W) %			Descripti	on		Remarks
CP02	12.30	D	10	16.8	Very stiff da Gravel is fin	irk grey slightly e to medium cl	gravelly slight halk.	ly sand	y silty calcareous CLAY.	
			F	REPARATI	ON				Liquid Limit	33 %
Method o	f prepa	aration	l		Wet s	ieved over	0.425mm	sieve	Plastic Limit	15 %
Sample retained 0.425mm sieve(Measured)11 %Plasticity Index										18 %
Corrected water content for material passing 0.425mm Not reported Liquidity Index										0.10
Sample retained 2mm sieve(Measured)9 %NHBC Modified (I'p)										16 %
Curing time       28 hrs       Clay Content       Not analysed       Derived Activity										Not analysed
C=CLAY Plasticity % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL	CI MI 40	CH MH 50 60	C'	V V V O Plastici	CE ME 90 100 110 120 ty Chart BS5930: 2015: Figure 8	Low Medium High NHBC Volume Change Potential
Method of Method of Type of Sar Comments:	Prepara Test: nple Ke	ation: y:	BS EN ISO: BS EN ISO: U=Undistur Corrected w Corrected w Volume Char Note: Modifi	17892-1: 2 17892-1: 2 bed, B=Bulk ater content r ater content a nge Potential: ed Plasticity I	2014 & BS 2014 & BS , D=Disturl not reported assume mat NHBC Stan ndex I'p = Ip	5 1377: Par 5 1377: Par bed, J=Jar, V d due to mate erial greater f dards Chapte o x (% less tha	t 2: 1990: t 2: 1990: V=Water, SI erial type. than 0.425m r 4.2 Unmod in 425micror	4.2 3.2, 4 PT=Sp m non ified P ns/100)	4, 5.3, 5.4 lit Spoon Sample, C=Core -porous. See BS1377: Part2: lasticity Index	Cutter 1990 Clause 3 Note 1





Contract   Northwest Haverhill Relief Road     Serial No.   \$33252										
Serial No.		S3325	2							
		DET	ERMINA DI	FION OF W	ATER CO OF PLAS	NTENT, L		AND PLASTIC LIM	IIT AND	
Borehole / Pit No.	Deptl m	n S Type	Sample	Water Content			Description			Remarks
WS101	1.40	D	3	17.3	Very stiff oliv with occasio rare flint.	ve brown slight nal dark grey r	ly gravelly slightly nottling. Gravel is	r sandy calcareous CLAY fine to medium chalk and		
				PREPARATIO	ЛС			Liquid Limit		51 %
Method of	fprep	aration	l		Wet si	eved over	0.425mm sie	ve Plastic Limit		19 %
Sample retained 0.425mm sieve(Measured)6 %Plasticity Index										32 %
Corrected water content for material passing 0.425mm Not reported Liquidity Index										-0.05
Sample retained 2mm sieve(Measured)4 %NHBC Modified (I'p)										30 %
Curing time       28 hrs       Clay Content       Not analysed       Derived Activity										Not analysed
Curing time   28 hrs   Clay Content   Not analysed   Derived Activity   Not analysed     C=CLAY   70   0   0   0   0   0   0   0     Plasticity Index %   40   30   0   0   0   0   0   0   0     M=SILT   0   10   20   30   40   50   60   70   80   90   100   110   120   Liquid Lit									Low Medium High NHBC Volume Change Potential	
Method of Method of Type of San Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISC BS EN ISC U=Undistu Corrected w Corrected w Volume Cha Note: Modif	17892-1: 2 17892-1: 2 rbed, B=Bulk vater content r vater content a inge Potential: fied Plasticity I	2014 & BS 2014 & BS , D=Disturk not reported assume mate NHBC Stand ndex I'p = Ip	1377: Par 1377: Par ped, J=Jar, W due to mate erial greater t dards Chapte x (% less tha	t 2: 1990: 4.2 t 2: 1990: 3.2 /=Water, SPT= rial type. han 0.425mm r r 4.2 Unmodifie n 425microns/1	2, 4.4, 5.3, 5.4 Split Spoon Sample, C= ion-porous. See BS1377: d Plasticity Index 00)	=Core Cut Part2: 199	tter 0 Clause 3 Note 1





Contract		North	west Have	erhill Relie	ef Road					
Serial No.		S3325	2							
		DET	ERMINAT Dei	ION OF W RIVATION	ATER CO OF PLA	ONTENT, LI STICITY INI	QUID LIMIT . DEX AND LIQ	AND PLASTIC LIM UIDITY INDEX	IT AND	
Borehole / Pit No.	Depth m	n S Type	Sample Reference	Water Content (W) %			Description			Remarks
WS101	4.50	D	9	17.4	Very stiff gr CLAY with o medium ch	reyish brown slig occasional orang alk and rare flin	ghtly gravelly slightl jish brown mottling t.	y sandy silty calcareous Gravel is fine to		
			Р	REPARATIO	ON			Liquid Limit		40 %
Method of	fprepa	aration			Wet s	ieved over	0.425mm siev	e Plastic Limit		18 %
Sample re <sup>-</sup>	tained	0.425	mm sieve	(Measu	ired)		10 %	Plasticity Index		22 %
Corrected water content for material passing 0.425mm Not reported Liquidity Index -0.03										
Sample retained 2mm sieve(Measured)8 %NHBC Modified (I'p)20 %										
Curing time72 hrsClay ContentNot analysedDerived ActivityNot analysed										
Curing time   72 hrs   Clay Content   Not analysed   Derived Activity   Not analysed     C=CLAY   70   CL   C										Low Medium High NHBC Volume Change Potential
Method of Method of Type of San Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISO: BS EN ISO: U=Undistur Corrected wa Corrected wa Volume Char Note: Modifi	17892-1: 2 17892-1: 2 Ded, B=Bulk, Iter content n Iter content a ge Potential: ed Plasticity II	2014 & B 2014 & B 0 D=Distur not reporte ssume mai NHBC Star ndex I'p = I	S 1377: Part S 1377: Part bed, J=Jar, W d due to mate terial greater t idards Chapter p x (% less tha	t 2: 1990: 4.2 t 2: 1990: 3.2, /=Water, SPT=S rial type. han 0.425mm no r 4.2 Unmodified n 425microns/10	4.4, 5.3, 5.4 blit Spoon Sample, C= n-porous. See BS1377: F Plasticity Index ))	Core Cut Part2: 199	tter 10 Clause 3 Note 1





Contract		North	west Have	erhill Relie	ef Road						
Serial No.		S3325	2								
		DET	ERMINAT	ON OF W	ATER CO	NTENT, LI	QUID LIMIT A	ND PLASTIC LIN	IIT AND	)	
Borehole / Pit No.	Deptł m	n S Type	Sample Reference	Water Content (W) %			Description			Remarks	5
WS102	2.20	D	5	16.1	Very stiff dar occasional da	k olive slightly g ark grey mottlir	gravelly slightly sand ng. Gravel is fine to c	y silty CLAY with oarse chalk.	1nr chalk c test as unr	cobble not inc representative	luded in e.
			Р	REPARATIO	ON			Liquid Limit			47 %
Method o	f prepa	aration			Wet sie	eved over (	).425mm sieve	Plastic Limit			19 %
Sample re	tained	0.425	mm sieve	(Measu	ired)		<mark>33</mark> %	Plasticity Index			<mark>28</mark> %
Corrected	water	conte	nt for mate	rial passing	g 0.425mm	ר N	ot reported	Liquidity Index		-	0.10
Sample re	tained	2mm s	sieve	(Measu	ired)		15 %	NHBC Modified	(l'p)		19 %
Curing tim	ie		28	hrs	Clay Co	ontent N	ot analysed	Derived Activity		Not ana	alysed
C=CLAY Plasticity % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL ML 20 30	CI × MI 40 5	CH 	CV CV MV 70 80 Plastici	CE ME 90 100 110 ty Chart BS5930: 2015: 1	120 Figure 8	Lidnin High	NHBC Volume Change Potential %
Method of Method of Type of Sar Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISO: BS EN ISO: U=Undisturl Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 Ded, B=Bulk, ter content n ter content a ge Potential: ed Plasticity II	2014 & BS 2014 & BS 5 D=Disturb 100 reported 100 ssume mate 100 NHBC Stand 100 ndex l'p = lp	1377: Part 1377: Part ed, J=Jar, W due to mater rial greater th ards Chapter x (% less thar	2: 1990: 4.2 2: 1990: 3.2, 4 =Water, SPT=Sp ial type. nan 0.425mm non 4.2 Unmodified P n 425microns/100	4, 5.3, 5.4 lit Spoon Sample, C -porous. See BS1377: lasticity Index	=Core Cu Part2: 194	tter 90 Clause 3 I	Note 1





Contract		North	west Have	erhill Relie	ef Road					
Serial No.		S3325	2							
		DET	ERMINAT DEI	ON OF W	ATER CO OF PLAS	NTENT, LI TICITY INI	QUID LIMIT A	ND PLASTIC LIN JIDITY INDEX	1IT AND	
Borehole / Pit No.	Depth m		Sample	Water Content			Description			Remarks
WS102	3.20	D	7	14.9	Very stiff dar occasional da to coarse cha	k olive slightly ark grey mottli alk.	gravelly sandy silty c ng, and rare selenite	alcareous CLAY with crystals. Gravel is fine	Specimen ( presence c	dried at 80°C due to the f selenite.
			Р	REPARATIO	ЛС			Liquid Limit		46 %
Method of	fprepa	aration			Wet sid	eved over	0.425mm sieve	Plastic Limit		16 %
Sample re	tained	0.425	mm sieve	(Measu	ured)		38 %	Plasticity Index		30 %
Corrected water content for material passing 0.425mm     Not reported     Liquidity Index     -0.04										
Sample re <sup>.</sup>	tained	2mm	sieve	(Measu	ured)		5 %	NHBC Modified (	(l'p)	19 %
Curing time       72 hrs       Clay Content       Not analysed       Derived Activity       Not analysed										
C=CLAY Plasticity I % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL ML 20 30	CI × MI 40 5	CH 	CV CV MV 70 80 Plastic	CE CE ME 90 100 110 ty Chart BS5930: 2015: F	120	Low Medium High NHBC Volume Change Potential
Method of Method of Type of San Comments:	Prepara Test: nple Ke	ation: y:	BS EN ISO: BS EN ISO: U=Undisturl Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 Ded, B=Bulk ter content r ter content a ge Potential: ed Plasticity I	2014 & BS 2014 & BS , D=Disturb not reported assume mate NHBC Stand ndex I'p = Ip	1377: Part 1377: Part ed, J=Jar, W due to mate trial greater t lards Chapter x (% less tha	2: 1990: 4.2 2: 1990: 3.2, 4 /=Water, SPT=Sp rial type. han 0.425mm non 4.2 Unmodified P n 425microns/100	I.4, 5.3, 5.4 lit Spoon Sample, C I-porous. See BS1377: lasticity Index	=Core Cu Part2: 199	tter 90 Clause 3 Note 1





Contract Northwest Haverhill Relief Road												
Serial No.		S3325	2									
		DET	ERMINA DI	TION OF W ERIVATION	ATER CC	ONTENT, L STICITY IN	iquid Dex A	LIMIT A	ND PLASTIC LIN JIDITY INDEX	1IT AND	)	
Borehole / Pit No.	Depth m		Sample	Water Content			Descr	iption			Remarks	5
WS103	2.00	D	4	18.8	Very stiff lig calcareous ( is fine to me	ht olive brown CLAY with rare l edium chalk.	slightly g oluish gre	ravelly slight ey veins, and	ly sandy silty decayed roots. Gravel			
		•		PREPARATI	ON				Liquid Limit			43 %
Method of preparationWet sieved over 0.425mm sievePlastic Limit15											15 %	
Sample re	tained	0.425	mm sieve	(Meası	ured)			22 %	Plasticity Index			<mark>28</mark> %
Corrected	water	conte	nt for mat	erial passing	g 0.425mr	m M	lot repo	rted	Liquidity Index			0.14
Sample re	tained	2mm	sieve	(Meası	ured)			1 %	NHBC Modified (	(l'p)		22 %
Curing tim	ne		7	1 hrs	Clay C	ontent	Not analy	ysed	Derived Activity		Not and	alysed
C=CLAY Plasticity   % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL	CI × MI 40	CH 60	70	CV MV 80 Plastici	CE ME 90 100 110 ty Chart BS5930: 2015: F	120	Low Medium High	in MBC Volume Change Potential %
Method of Preparation:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2Method of Test:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4Type of Sample Key:U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core CutterComments:Corrected water content not reported due to material type. Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)												





Contract Northwest Haverhill Relief Road												
Serial No.		S3325	2									
		DET	ERMINAT DE	TON OF W	ATER CC	ONTENT, LI STICITY IN	QUID Dex a	LIMIT A	ND PLASTIC LIN	/IT AND	)	
Borehole / Pit No.	Depth m		Sample	Water Content			Descr	iption			Remarks	;
WS103	3.20	D	7	18.4	Very stiff da calcareous ( roots. Grave	ark olive brown CLAY with occas el is fine to med	slightly g sional blu ium chal	ravelly slight ish grey mot k.	ly sandy silty tling, and rare decayed			
		<u> </u>	[	PREPARATI	ON				Liquid Limit	•		44 %
Method of preparation Wet sieved over 0.425mm sieve Plastic Limit											18 %	
Sample retained 0.425mm sieve (Measured) 8 % Plasticity Index											<mark>26</mark> %	
Corrected	water	conter	nt for mate	erial passing	g 0.425m	m N	lot repo	rted	Liquidity Index			0.01
Sample re <sup>.</sup>	tained	2mm :	sieve	(Measu	ured)			<mark>6</mark> %	NHBC Modified	(l'p)		24 %
Curing tim		145	5 hrs	Clay C	ay Content Not analysed Derived Activity					Not ana	llysed	
C=CLAY Plasticity I % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL	CI × MI 40	CH 60	70	CV MV 80 Plastici	CE CE ME 90 100 110 ty Chart BS5930: 2015: 1	120 Figure 8	Lidnin High	NHBC Volume Change Potential %
Method of Preparation:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2Method of Test:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4Type of Sample Key:U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core CutterComments:Corrected water content not reported due to material type. Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)												





Contract	Contract Northwest Haverhill Relief Road										
Serial No.		S3325	2								
		DET	ERMINAT DE	TON OF W	ATER CO	ONTENT, L STICITY IN	iquid Dex A	LIMIT A	ND PLASTIC LII JIDITY INDEX	MIT AND	)
Borehole / Pit No.	Depth m	n S Type	Sample Reference	Water Content (W) %			Descr	ription			Remarks
WS104	2.00	D	5	18.4	Very stiff da occasional l	ark olive slightly bluish grey mot	gravelly tling. Gra	sandy silty c avel is fine to	alcareous CLAY with medium chalk.		
PREPARATION Liquid Limit											47 %
Method of preparation Wet sieved over 0.425mm sieve Plastic Limit										16 %	
Sample retained 0.425mm sieve (Measured) 33 % Plasticity Index											31 %
Corrected	water	conte	nt for mate	erial passing	g 0.425m	m r	Not repo	orted	Liquidity Index		0.08
Sample re <sup>-</sup>	tained	2mm	sieve	(Measu	ured)			2 %	NHBC Modified	(l'p)	21 %
Curing tim	е		71	hrs	Clay C	Content	Not anal	ysed	Derived Activity	Not analysed	
C=CLAY Plasticity I % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL ML 20 30	CI	CH MH 50 60	70	CV NV 80 Plastici	CE ME 90 100 110 ty Chart BS5930: 2015:	120 Figure 8	Low   Medium   High     NHBC Volume Change Potential
Invietnod of Preparation:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2Method of Test:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4Type of Sample Key:U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core CutterComments:Corrected water content not reported due to material type. Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)									utter 90 Clause 3 Note 1		





Contract Northwest Haverhill Relief Road												
Serial No.		S3325	2									
		DET	ERMINAT DEI	ON OF W	ATER CC	NTENT, L	IQUID LIMI DEX AND L	t a Iqu	ND PLASTIC LIMI IIDITY INDEX	IT AND	)	
Borehole / Pit No.	Depth m	n S Type	Sample Reference	Water Content (W) %			Descriptior	ו			Remarks	
WS105	1.40	D	2	17.6	Very stiff oli CLAY with o decayed roc	ve brown sligh ccasional bluish ots. Gravel is fin	tly gravelly sligh n grey mottling, a e to medium cha	tly sai and ra alk.	ndy silty calcareous are recently active and			
PREPARATION Liquid Limit											48	8 %
Method of preparation Wet sieved over 0.425mm sieve Plastic Limit											19	9%
Sample re	tained	0.425	mm sieve	(Measu	ured)		8 %	, D	Plasticity Index		29	9%
Corrected	water	conte	nt for mate	rial passing	g 0.425mi	n r	lot reported		Liquidity Index		-0.05	5
Sample re	tained	2mm	sieve	(Measu	ured)		6 %	, D	NHBC Modified (I	'p)	27	7 %
Curing tim	Curing time 72 hrs Clay Content Not analysed Derived							Derived Activity		Not analysed	d	
C=CLAY Plasticity % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL ML 20 30	CI MI 40	CH 60 60	CV	asticit	CE ME 90 100 110 y Chart BS5930: 2015: Fig	120 gure 8	Low Medium High NHBC Volume Change Potential	%
Method of Method of Type of Sar Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISO: BS EN ISO: U=Undisturl Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 Ded, B=Bulk, ter content n ter content a ge Potential: ed Plasticity II	2014 & BS 2014 & BS , D=Disturk not reported ssume mat NHBC Stan ndex l'p = lp	5 1377: Part 5 1377: Part bed, J=Jar, W I due to mate erial greater t dards Chapte b x (% less tha	t 2: 1990: 4. t 2: 1990: 3. /=Water, SPT rial type. han 0.425mm r 4.2 Unmodifie n 425microns/	2 2, 4 =Spl non- ed Pl 100)	.4, 5.3, 5.4 it Spoon Sample, C= porous. See BS1377: P asticity Index	Core Cu Part2: 199	tter 90 Clause 3 Note	1





Contract Northwest Haverhill Relief Road										
Serial No.		S3325	2							
		DET	ERMINAT DEI	ON OF W	ATER CO OF PLAS	NTENT, LI	QUID LIMIT	AND PLASTIC LIM UIDITY INDEX	IT AND	
Borehole / Pit No.	Depth m	n S Type	Sample Reference	Water Content (W) %			Description			Remarks
WS106	1.20	D	2	21.4	Very stiff oliv CLAY with ra medium cha	ve yellow slight are recently act ılk.	ly gravelly slightly s ive and decayed roo	andy silty calcareous ots. Gravel is fine to		
PREPARATION Liquid Limit										
Method of	fprepa	aration			Wet si	eved over (	0.425mm siev	e Plastic Limit		18 %
Sample re	tained	0.425	mm sieve	(Measu	ired)		10 %	Plasticity Index		25 %
Corrected	water	conte	nt for mate	rial passing	g 0.425mr	n N	lot reported	Liquidity Index		0.14
Sample re	tained	2mm	sieve	(Measu	ired)		8 %	NHBC Modified (	l'p)	23 %
Curing tim	е		144	hrs	Clay C	ontent	lot analysed	Derived Activity		Not analysed
C=CLAY Plasticity   % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL ML 20 30	CI × MI 40 5	CH MH 50 60	CV CV N/V 70 80 Plasti	CE ME 90 100 110 city Chart BS5930: 2015: F	120 igure 8	Low Medium High NHBC Volume Change Potential
Method of Method of Type of San Comments:	Prepara Test: nple Ke	ation: y:	BS EN ISO: BS EN ISO: U=Undisturl Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 Ded, B=Bulk, ter content n ter content a ge Potential: ed Plasticity II	2014 & BS 2014 & BS , D=Disturk not reported ssume mate NHBC Stand ndex I'p = Ip	5 1377: Part 5 1377: Part bed, J=Jar, W I due to mate erial greater t dards Chapter o x (% less that	2: 1990: 4.2 2: 1990: 3.2, /=Water, SPT=S rial type. han 0.425mm no 4.2 Unmodified n 425microns/10	4.4, 5.3, 5.4 plit Spoon Sample, C= n-porous. See BS1377:   Plasticity Index 0)	=Core Cu Part2: 199	tter 90 Clause 3 Note 1





Contract Northwest Haverhill Relief Road											
Serial No.		S3325	2								
		DET	ERMINAT DEI	ON OF W RIVATION	ATER CO OF PLA	ONTENT, L STICITY IN	IQUID LIMIT . DEX AND LIQ	AND PLASTIC LIM UIDITY INDEX	IT AND	)	
Borehole / Pit No.	Deptl m	n S Type	Sample Reference	Water Content (W) %			Description			Remarks	
WS106	2.50	D	4	20.5	Very stiff liq calcareous recently ac	ght olive brown CLAY with occas tive roots. Grave	slightly gravelly sligl sional light bluish gr el is fine to medium	ntly sandy silty ey mottling, and rare chalk.			
PREPARATION Liquid Limit											6
Method o	fprep	aration			Wet s	ieved over	0.425mm siev	e Plastic Limit		16 %	6
Sample re	tained	0.425	mm sieve	(Measu	ired)		14 %	Plasticity Index		25 %	6
Corrected	water	conte	nt for mate	rial passing	g 0.425m	m N	Not reported	Liquidity Index		0.18	
Sample re	tained	2mm	sieve	(Measu	ired)		12 %	NHBC Modified (	l'p)	22 %	6
Curing time 71 hrs Clay Content Not a							Not analysed	Derived Activity		Not analysed	
C=CLAY Plasticity 1 % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10 2	CL ML 0 30	CI × MI 40	CH 60	CV CV MV 70 80 Plasti	CE ME 90 100 110	120 igure 8	Low Medium High NHBC Volume Change Potential %	
Method of Method of Type of San Comments:	Prepar Test: nple Ke	ation: ey:	BS EN ISO: BS EN ISO: U=Undisturl Corrected wa Corrected wa Volume Chan Note: Modifie	17892-1: 2 17892-1: 2 bed, B=Bulk, ter content n ter content a ge Potential: ed Plasticity II	2014 & B 2014 & B , D=Distur not reporte ssume ma NHBC Star ndex I'p = I	S 1377: Par S 1377: Par bed, J=Jar, W d due to mate terial greater t ndards Chapte p x (% less tha	t 2: 1990: 4.2 t 2: 1990: 3.2, /=Water, SPT=S rial type. than 0.425mm no r 4.2 Unmodified n 425microns/10	4.4, 5.3, 5.4 Dlit Spoon Sample, C= n-porous. See BS1377:   Plasticity Index D)	=Core Cu Part2: 199	tter 90 Clause 3 Note 1	





Contract Northwest Haverhill Relief Road													
Serial No.	Sa	3325	2										
		DET	ERMINA D	TION OF W ERIVATION	ATER CO	ONTENT, L STICITY IN	iquid lin Dex and	- ЛІТ А LIQL	ND PLASTIC LIMI IIDITY INDEX	T AND	)		
Borehole / Pit No.	pth n_7	s Гуре	Sample R <u>eferenc</u>	Water Content e (W) %			Descripti	on			Remarks		
WS107 1.	30	D	3	24.9	Firm brown rare recent	i slightly gravell ly active roots.	y slightly sand Gravel is fine t	y silty ca o mediu	alcareous CLAY with um and flint.				
PREPARATION Liquid Limit 49 %											<mark>9</mark> %		
Method of pr	epara	ation		Fron	n natural,	/gravel picl	ked out by	hand	Plastic Limit		1	<mark>9</mark> %	
Sample retain	ed 0	.425ı	mm sieve	(Assun	ned)			%	Plasticity Index		3	0 %	
Corrected wa	ter co	ontei	nt for ma	terial passing	g 0.425m	m	Not reported		Liquidity Index		0.2	0	
Sample retain	ed 2	mm	sieve	(Approxi	imate)		<1	%	NHBC Modified (I'	p)	n/a		
Curing time		7	1 hrs	Clay C	Content	Not analysed		Derived Activity		Not analyse	ed		
C=CLAY Plasticity Inde % (Ip) M=SILT	71 61 51 31 21 11		10	CL	CI MI 40	CH MH 50 60	C'	V V V 0 Plasticit	CE CE ME 90 100 110 ty Chart BS5930: 2015: Fig	120 ure 8	Low Medium High NHBC Volume Change Potential	, t %	
Method of Prep Method of Test Type of Sample Comments:	oarati : Key:	on:	BS EN ISC BS EN ISC U=Undistu Corrected v	D: 17892-1: 2 D: 17892-1: 2 Irbed, B=Bulk water content r	2014 & B 2014 & B , D=Distur not reporte	S 1377: Par S 1377: Par bed, J=Jar, V d due to mate	t 2: 1990: t 2: 1990: V=Water, SI erial type.	4.2 3.2, 4 PT=Spl	.4, 5.3, 5.4 lit Spoon Sample, C=C	Core Cu	tter		





Contract Northwest Haverhill Relief Road												
Serial No.		S3325	2									
		DET	ERMINA D	TION OF W	ATER CO	<u></u> SNTENT, L STICITY IN	iquid Dex A	) LIMIT A	ND PLASTIC LIN	IIT AND	)	
Borehole / Pit No.	Depth m		Sample Referenc	Water Content			Desci	ription			Remarks	8
WS107	4.70	D	9	17.7	Very stiff da Gravel is fir	ark grey slightly ne to medium cl	gravelly halk.	slightly sandy	y silty calcareous CLAY.			
PREPARATION Liquid Limit												32 %
Method of preparation Wet sieved over 0.425mm sieve Plastic Limit												<mark>16</mark> %
Sample re <sup>-</sup>	tained	0.425	mm sieve	(Meası	ured)			13 %	Plasticity Index			16 %
Corrected	water	conte	nt for ma	terial passing	g 0.425m	im f	Not repo	orted	Liquidity Index			0.11
Sample re <sup>-</sup>	tained	2mm	sieve	(Meası	ured)			10 %	NHBC Modified	(l'p)		14 %
Curing tim	ie		7	'2 hrs	Clay (	Content	Not anal	lysed	Derived Activity		Not and	alysed
C=CLAY Plasticity I % (Ip) M=SILT	Index	70 60 50 40 30 20 10 0 0	10	CL	CI MI 40	CH	70	CV MV 80 Plastici	CE ME 90 100 110 ty Chart BS5930: 2015: 1	120 Figure 8	High Lidnin Teature	minimic change Potential %
Method of Preparation:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2Method of Test:BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4Type of Sample Key:U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core CutterComments:Corrected water content not reported due to material type. Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)												





Contrac	t	North	nwest Hav	erhill R	elief Ro	ad														
Serial N	0.	S3325	52																	
	DETERM	1INAT	ION OF D CON	DENSITY /IPRESS	, WAT	ER CON	NTENT A	ND UN URMEN	draine It of p	ED SHEA	AR STR ESSUR	ENGTH IN TRIAXIAL								
Borehole /Pit No.	Depth (m)	Туре	Reference	Water Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Lateral Pressure (kPa)	Deviator Stress (kPa)	Shear Stress (kPa)	Mohrs Ana Cu (kPa)	s Circle Iysis Ø degrees	Description								
							60	306	153			Very stiff (Very high strength) light								
CP01	3.00	U	1	18.9	2.08	1.75	123	321	161	140	3.8	yellowish brown slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to								
							181	322	161			rounded chalk.								
							99	359	180			Very stiff (Very high strength) grey								
CP01	5.00	U	2	18.1	2.15	1.82	203	375	188	163	3.5	slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse								
							301	386	193			white subangular to rounded chaik.								
							185	448	224			Very stiff (Very high strength) mottled								
CP01	9.10	U	3	17.2	2.15	1.83	370	474	237	202	3.4	slightly sandy silty calcareous CLAY. Gravel is fine to coarse white								
							553	496	248			subangular to rounded chalk.								
							265	424	212			Very stiff (Very high strength) mottled								
CP01	13.10	U	4	17.6	2.13	1.81	533	470	235	180	4.0	slightly sandy silty calcareous CLAY. Gravel is fine to coarse white								
							796	506	253			subangular to rounded chalk.								
							60	425	213			Very stiff (Very high strength) brownish								
CP02	2.90	U	1	17.7	2.12	1.80	124	451	226	176 8.5	176 8.5	176 8.5	176 8.5	<b>5</b> 176 8.5	176 8.5	176 8.5	176 8.5	176 8.5		silty calcareous CLAY with frequent grey mottling. Gravel is fine to coarse white
							178	468	234			subangular to rounded chalk.								
							102	348	174			Very stiff (Very high strength) mottled light olive brown and grey slightly								
CP02	5.00	U	2	19.4	2.09	1.75	205	368	184	153	4.4	gravelly slightly sandy silty calcareous CLAY with rare orange staining. Gravel								
							306	381	191			is fine to coarse white subangular to rounded chalk.								
							187	532	266			Very stiff (Very high strength) grey								
CP02	9.10	U	3	16.9	2.14	1.83	373	568	284	234	4.2	slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse								
							555	589	295			white subangular to rounded chalk.								
Method of Method of Type of San	Preparation Test: nple Key:	:	BS 1377: Par BS 1377: Par Strenth U = Undistur	t 1: 1990: 7 t 2: 1990:3 bed, B = Bu	7.4.2 & 8, 1 Determin Jlk, D = Dis	Part 2: 199 ation of M sturbed, J =	0: 7.2, Part oisture Con Jar, W = W	7: 1990: 8.3 tent, Part2: ater, SPT = 3	3 1990:7 De Split Spoor	terminatio Sample, C	n of Densi C = Core Cu	ty, Part 7: 1990: 8 Undrained Shear Itter								
Comments: Remarks to	Include:		Sample distu	irbance, los	ss of moist	ure, variat ∩°⊂	ion from tes	st procedure	e, location	and origin	of test spe	cimen within original sample, oven								
















Contract		Northwest Haverhill Relief Road									
Serial No.		\$33252									
DETER	MINATIO	N OF UND	RAINED SHI	EAR STREN OF	igth in Pore pi	TRIAXI. RESSUR	AL COMPRE: E	SSION WIT	HOUT ME	ASUREMENT	
Borehole /Pit No.	Depth (m)	(m) Type Reference Description							Remarks		
CP01	9.10	U	Ve 3 gra wł	Very stiff (Very high strength) mottled grey and dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.					Coarse gravel noted within specimen after test.		
Initial S	pecimen	Height		Diameter		ght	Water Conte	ent Bulk	Density	Dry Density	
	Depth of	(mm) 199.5		(mm) 102.3		))	(%)	(N	/lg/m³)	(Mg/m³) 1.83	
	Specimen (m) 9.20					24	17.2	:	2.15		
TEST INFO	ORMATION	N Ra	ate of Strain	2.0	% per M	in	Rubber Men	nbrane Thic	kness	0.6 mm	
4 3 2 1		5	10 Strain (%)	15	20	800 700 500 400 300 100 0		400 é Total Stres	000 800 SS (kPa)	1000	
Specimer	n at failure	Measured Cel Pressure, σ3	ll Strain at Failu (%)	re Stress Rubber	Corrections	(kPa)	Corrected Max. Deviator Stress,	Shear Stress Cu ⅔(σ1-σ3)f	u, Mohr Cu	s Circle Analysis PHI	
		(kPa)	(70)	Membra	ne		(σ1-σ3)f (kPa)	(kPa)	(kPa)	(degrees)	
		185 370 553	14.9 17.5 20.1	1.8 2.0 2.3		/ 10.7 17.6	448 474 496	224 237 248	202	3.4	
Method of Pi Method of Te Type of Samp Comments: Remarks to li	reparation: est: ple Key: nclude:	BS 1377: Part 1 BS 1377: Part 7 U = Undisturbe Tested in Vertic UKAS Calibratic Sample disturb temperature if	: 1990 7: 1990: 8 Definitiv ed, B = Bulk, D = D cal Condition on - loads from 0. vance, loss of mois not 105-110°C	ve Method, 199 isturbed, J = Jar 2 to 10kN sture, variation	0: 9 Multi-si ; W = Water form test pr	age loading , SPT = Split ocedure, lo	) : Spoon Sample, C cation and origin c	= Core Cutter of test specimen	within original	sample, oven drying	





Contract		Northwest Haverhill Relief Road									
Serial No.		S33252									
DETER	MINATIO	N OF UNDR	AINED SHE	AR STREN OF	NGTH PORE	IN TRIAXI PRESSURI	AL COMPRE E	ssion w	ITHOUT MI	EASUREMENT	
Borehole /Pit No.	Depth (m)	Type R	eference	erence Description Rer							
CP01	13.10	U	Ver 4 gra whi	y stiff (Very hi velly slightly sa te subangular	gh streng andy silty to round	gth) mottled grey and dark grey slightly / calcareous CLAY. Gravel is fine to coarse ded chalk.			Coarse gravel noted within specimen after test.		
Initial Specimen		Height		Diameter		Neight	Water Content		Ilk Density	Dry Density	
	Depth of Top of	(mm)		(mm)		(g)	(%)		(Mg/m³)	(Mg/m³)	
	Specimen (m) 13.19	199.5		102.7		3526	17.6		2.13	1.81	
TEST INFO	ORMATION	N Rate of Strain		2.0	2.0 % per Min		Rubber Membrane Th		nickness 0.6 mm		
4		5	10 Strain (%)	15	20	90 80 70 60 50 40 30 20 10		400 600 Total St	800 1000 ress (kPa)	1200 1400	
Specimer	n at failure	Measured Cell	Strain at Failur	Stress Corr		ions (kPa)	Corrected Max.	Shear Stress	Cu, Moh	rs Circle Analysis	
		Pressure, σ3 (kPa)	(%)	Rubbe Membra	r Ine	Piston Friction	Deviator Stress, (σ1-σ3)f (kPa)	½(σ1-σ3) (kPa)	f Cu (kPa)	PHI (degrees)	
Method of Pi		265 533 796 BS 1377: Part 1:	14.9 17.5 20.1	1.8 2.0 2.3		/ 12.7 25.2	424 470 506	212 235 253	180	4.0	
Method of To Type of Sam Comments: Remarks to I	est: ple Key: nclude:	BS 1377: Part 7: U = Undisturbed Tested in Vertica UKAS Calibration Sample disturba temperature if n	1990: 8 Definitiv , B = Bulk, D = Dis al Condition n - loads from 0.2 nce, loss of moist ot 105-110°C	e Method, 199 sturbed, J = Jar to 10kN sure, variation	90: 9 Mu r, W = W form tes	lti-stage loading ater, SPT = Split st procedure, loo	) Spoon Sample, C cation and origin o	= Core Cutter of test specim	en within origina	I sample, oven drying	































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Contract: Northwest Haverhill Relief Road

Serial No: S33252

DETERMINATION OF THE SULPHATE CONTENT AND pH OF SOIL AND GROUNDWATER Conc. of Soluble SO3 Calc'd Sample % Sample рΗ **Borehole** Depth Water Ground Conc. Of Description Remarks Passing Soluble Water SO4 Value / Pit No. (m) 2mm Sieve Type Ref. 2:1 (g/L) (q/L) (q/L) Very stiff brown slightly gravelly slightly sandy silty CP01 0.30 0.05 95 D 1 0.04 7.2 calcareous CLAY with occasional recently active roots. Gravel is fine to medium chalk and flint. Stiff light olive brown slightly gravelly slightly sandy CP01 2.70 0.03 89 D 4 0.02 7.7 silty calcareous CLAY with occasional light bluish grey mottling. Gravel is fine to medium chalk. Very stiff light brownish grey slightly gravelly slightly **CP01** 3.50 D 5 0.03 0.04 7.8 79 sandy silty calcareous CLAY with occasional orange staining. Gravel is fine to medium chalk. Very stiff dark grey slightly gravelly slightly sandy silty CP01 95 12.20 D 10 0.25 0.30 7.4 calcareous CLAY. Gravel is fine to medium chalk. Firm brownish yellow slightly gravelly slightly sandy CP02 1.90 2 0.02 0.03 D 7.8 66 silty calcareous CLAY with rare recently active roots. Gravel is fine to medium chalk and rare flint. Stiff olive yellow slightly gravelly slightly sandy silty CP02 3.30 < 0.01 < 0.01 7.8 87 D 4 calcareous CLAY with occasional light grey mottling, and rare decayed roots. Gravel is fine to coarse chalk. Stiff light olive brown slightly gravelly sandy silty CP02 5.50 D 0.03 0.03 7.6 90 6 calcareous CLAY. Gravel is fine to coarse chalk. Very stiff dark grey slightly gravelly slightly sandy silty CP02 12.30 0.50 91 0.60 D 10 7.3 calcareous CLAY. Gravel is fine to medium chalk. Method of Preparation: BS1377: Part 1: 2016: 8.5. BS1377: Part 3: 1990: 5.3 Soil/Water Extract. 5.4 Groundwater Method of Test: BS1377: Part 3: 1990: 5.5 Type of Sample Key: U= Undisturbed, B= Bulk, D= Disturbed, J= Jar, W= Water, SPT= Split Spoon Sample, C= Core Cutter Comments: Test not UKAS accredited Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location, and origin of test specimen within original sample. Oven drying temperature if not 105-110C.



Contract: Northwest Haverhill Relief Road

Serial No: S33252

DETERMINATION OF THE SULPHATE CONTENT AND pH OF SOIL AND GROUNDWATER Conc. of Soluble SO3 Calc'd Sample % Sample рΗ **Borehole** Depth Water Ground Conc. Of Description Remarks Passing Soluble Water SO4 Value / Pit No. (m) 2mm Sieve Type Ref. 2:1 (g/L) (q/L) (q/L) Very stiff dark olive slightly gravelly slightly sandy silty calcareous CLAY with occasional dark bluish grey WS101 1.00 0.07 88 D 2 0.06 7.7 mottling, and rare recently active roots. Gravel is fine to medium chalk. Very stiff olive grey slightly gravelly slightly sandy WS101 4.00 0.06 0.08 97 D 8 7.8 silty calcareous CLAY. Gravel is fine to medium chalk. Very stiff dark olive slightly gravelly slightly sandy WS102 2.20 D 5 1.38 1.65 7.3 85 silty CLAY with occasional dark grey mottling. Gravel is fine to coarse chalk. Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish WS103 94 3.20 D 7 1.42 1.70 7.4 grey mottling, and rare decayed roots. Gravel is fine to medium chalk. Very stiff olive brown slightly gravelly slightly sandy WS105 0.93 97 1.00 3 0.77 7.5 D silty calcareous CLAY. Gravel is fine to medium chalk. Very stiff olive yellow slightly gravelly slightly sandy 3.00 97 WS106 0.05 0.06 7.8 D 5 silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to medium chalk. Firm brown slightly gravelly slightly sandy silty WS107 1.30 D 3 0.01 0.02 7.5 96 calcareous CLAY with rare recently active roots. Gravel is fine to medium and flint. BS1377: Part 1: 2016: 8.5, BS1377: Part 3: 1990: 5.3 Soil/Water Extract, 5.4 Groundwater Method of Preparation: Method of Test: BS1377: Part 3: 1990: 5.5 Type of Sample Key: U= Undisturbed, B= Bulk, D= Disturbed, J= Jar, W= Water, SPT= Split Spoon Sample, C= Core Cutter Comments: Test not UKAS accredited Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location, and origin of test specimen within original sample. Oven drying temperature if not 105-110C.



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