



Compass Geotechnical

Geotechnical, Geoenvironmental and Civil Engineering Consultants


REPORT ON A GROUND INVESTIGATION FOR A PROPOSED RESIDENTIAL DEVELOPMENT AT BULLS BRIDGE FARM, BUMPSTEAD ROAD, HEMPSTEAD, SAFFRON WALDEN, ESSEX, CB10 2PP

Report No: 212869B

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Compass Geotechnical Limited

13 Willow Park, Upton Lane, Stoke Golding, Warwickshire, CV13 6EU


www.compassgeotechnical.co.uk



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Oak House,
41a London Road,
Harston,
CB22 7QQ

Report Prepared By: Compass Geotechnical Limited
13 Willow Park
Upton Lane
Stoke Golding
CV13 6EU

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BULLS BRIDGE FARM, BUMPSTEAD ROAD, HEMPSTEAD, SAFFRON WALDEN,
ESSEX, CB10 2PP

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REPORT ON A GROUND INVESTIGATION FOR A PROPOSED RESIDENTIAL DEVELOPMENT AT BULLS BRIDGE FARM, BUMPSTEAD ROAD, HEMPSTEAD, SAFFRON WALDEN, ESSEX, CB10 2PP

1. INTRODUCTION AND OBJECTIVES

- 1.1 This report has been prepared on instructions given by BRD Tech (1a Church Street, Sawbridgeworth, Herts, CM21 9AB) on behalf of the Client, M and H Build Ltd (Oak House, 41a London Road, Harston, CB22 7QQ).
- 1.2 The site is located around 7.1 km to the south of Haverhill and 14.7km to the east of Saffron Walden and immediately to the north of the B1054 as shown on Figure 1, Appendix (i). As shown on Figure 2, Appendix (i), the site is irregular in shape and comprises a number of buildings and hardstanding. The site is at and around National Grid Reference 566240,239960 and covers an area of around 0.21ha (Reference 1).
- 1.3 Proposals are to demolish most of the existing buildings whilst retaining the barn in the south eastern corner which is to be converted and extended into a dwelling. Two further dwellings are to be built in the northern half of the site with gardens to the north and car parking, an access road and areas of landscaping to the west and south. A plan of the proposed development is included as Figure 3, Appendix (i).
- 1.4 This report details the findings of a geotechnical investigation to provide advice on the ground conditions in relation to foundation design for the new properties. Further investigative works have been undertaken at the site on behalf of the current landowner to assess potential contamination. The findings of the contamination investigation are presented in a separate report.
- 1.5 The aims of the geotechnical investigation were to:
- Investigate the near surface ground and groundwater conditions so that suitable methods of design and construction may be adopted for the foundations and ground floor slabs for the proposed houses.
 - Undertake material property testing of samples recovered from an intrusive investigation.
 - Present an interpretative report on the findings.
- 1.6 The investigation, assessment and reporting has been carried out in general accordance with the following:
- BS 5930:2015+A1:2020. Code of Practice for Ground Investigations.
 - BS 10175:2011+A2:2017. Investigation of potentially contaminated sites – Code of practice.
 - BS 8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gasses for new buildings.
 - BS 8576:2013. Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).



BS EN ISO 14688-1:2018. Geotechnical investigation and testing – Identification and classification of a soil – Part 1: Identification and description.
BS EN ISO 14688-2:2018. Geotechnical investigation and testing – Identification and classification of a soil – Part 2: Principles for a classification.
BS EN ISO 22476-2:2005+A1:2011. Geotechnical investigation and testing – Field testing – Part 2: Dynamic Probing.
BS EN ISO 22476-3:2005+A1:2011. Geotechnical investigation and testing – Field testing – Part 3: Standard Penetration Test.
BS EN ISO 14689:2018. Geotechnical investigation and testing – Identification and classification of rock – Part 1: Identification and description.
BS EN ISO 22475-1:2006. Geotechnical investigation and testing – Sampling methods and groundwater measurements – Part 1: Technical principles for execution.
BS 1377-9:1990. Soils for civil engineering purposes – Part 9 In-situ tests.
BS EN 1997-1:2004+A1:2013 Eurocode 7: Geotechnical design – Part 1: General Rules.
NA to BS EN 1997-1:2004+A1:2013. UK National Annex to Eurocode 7: Geotechnical design – Part 1: General Rules.
BS EN 1997-2:2007. Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing.
NA to BS EN 1997-2:2007. UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing.

2. SITE RECONNAISSANCE

2.1 As shown on Figure 2, Appendix (i), the area under consideration is irregular in shape. The site was accessed via a pair of steel gates on the western boundary along an unmade track to the north of the B1054 Bumpstead Road. Along the northern boundary of the site was a row of storage units of wooden construction with a corrugated steel roof and a wooden barn containing a number of drums of creosote. To the south of the storage units and barn was an area of concrete hardstanding extending over the central portion of the site. At the eastern end the hardstanding sloped down to a lower section close to the eastern boundary and the lean-to which previous covered this section had been removed. To the south east was a large brick barn with double doors, facing Bumpstead Road, which it is understood is to be retained and converted to a dwelling. A second row of storage units, now removed, ran westwards from the western wall of the barn into the central area of the site on the southern side of the concrete hardstanding. A large bunded tank was originally present immediately to the north of the storage units but this had also been removed. It is understood from the site owner that this tank was used for wood treatment (creosote). Debris was noted across the surface of the site including wood, fence panels, cables, occasional small mounds of gravel, and fragments of ACM sheeting.



In the south of the site was a part concrete, part grassed and part gravelled storage area containing two large steel storage containers, a small mound of gravel, a lawn mower, window frames, and other debris including some ACM sheeting fragments.

Off site to the north behind the storage units a number of mature and semi-mature trees were present including a field maple and limes. A hedge formed part of the southern boundary to the site.

- 2.2 The topography of the general area falls in a southerly direction.
- 2.3 Other than the presence of fragments of ACM sheeting, no evidence of significant contamination was uncovered during the site walkover.

3. PUBLISHED GEOLOGY AND RADON

- 3.1 Published geological information (Reference 2) indicates that the site lies in an area where the general downwards strata succession is as detailed in Table 3.1 below:

Table 3.1 Geological Sequence

Lithology	Lithological Description	Age Range
Lowestoft Formation	Diamicton - Chalky till, together with outwash sands and gravels, silts and clays	Quaternary Period (2 Ma)
Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated)	White Chalk interbedded with flint and marls	Cretaceous Period (84 to 94Ma)

The published geological map (Reference 2) indicates that the site is underlain by the superficial deposits of the Lowestoft Formation over the solid deposits of the Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated).

- 3.2 A search of the British Geological Survey borehole database (GeoIndex) indicates that there are few borehole records in the area of the site. The closest borehole record, drilled in 1983, is approximately 350m to the west and confirms deposits of Diamicton to at least 32.3m depth, a second borehole record drilled in 2011 some 600m to the west confirms Diamicton to 40m depth overlying chalk.
- 3.3 Published sources on the occurrence of radon and the need for protection measures in new dwellings (Reference 3) indicate that the development is in an area which is unaffected by radon.
- 3.4 Swallow holes and other solution features can form in chalk strata. Whilst it is appreciated that the chalk is likely to be at significant depth below the site the Building Control Department of the Local Authority should be contacted to check if swallow holes are a problem locally.



4. SITE WORK

- 4.1 For the geotechnical assessment, five exploratory holes (WS01 to WS05) were drilled by windowless sampling techniques to a maximum depth of 6.0m. Continuous samples were recovered from the full depth of all of the window sample holes and standard penetration tests (SPTs) were undertaken at regular intervals in all of the holes. A further series of holes WS06 to WS13 were drilled at the site primarily for the contamination appraisal but are taken into account in this report.
- 4.2 The exploratory holes were drilled on 5th and 10th January 2022.
- 4.3 The investigation and sampling strategies for the geotechnical investigation were to obtain representative samples of any fill, natural deposits and groundwater, where encountered, and to recover materials for laboratory soil property analysis and appraisal. The investigation was in general accordance with the documents of Section 1.6.
- 4.4 All of the samples were transported to the laboratory for detailed examination by an experienced geologist and selected samples were programmed for testing.
- 4.5 Details of the strata encountered in the exploratory holes are given on the exploratory hole logs presented in Appendix (ii) and the positions of the holes are shown on Figure 2, Appendix (i).

5. LABORATORY WORK

- 5.1 Detailed below in Table 5.1 is the material property testing undertaken as part of this investigation:

Table 5.1 Summary of Material Property Tests

Material Property Test	Number of Tests Natural Soils
Natural Moisture Content	7
Liquid and Plastic Limit	7
Soluble Sulphate Content	5
pH Value	5

- 5.2 The material property test results are included as Appendix (iii).
- 5.3 The laboratory testing was undertaken during the period 6th January to 1st February 2022.
- 5.4 The testing was undertaken at a UKAS accredited laboratory.



6. ENGINEERING ASSESSMENT AND RECOMMENDATIONS

6.1 Soil Profile

The following discussion on soil profile is based primarily on the conditions found in WS1 to WS5 drilled for the geotechnical investigation. Where relevant, pertinent information on the ground conditions uncovered during the contamination investigation is also included.

Surface construction comprising concrete was present over much of the central, northern and eastern sections of the site (WS03, WS04 and WS10 to WS13) where the yard and buildings were present. The concrete was up to 0.2m thick.

Beneath the concrete and from ground surface across the remainder of the site, variable made ground was present comprising crushed brick and concrete, clays with various inclusions, chalk and gravel infilled with clay. Reference should be made to the individual exploratory hole logs for a full description of the materials present. The made ground extended to depths between 0.18 and 1.07m below ground level, but was generally around 0.4 to 0.6m deep. The thickest made ground was present towards the east and north east of the site.

Beneath the made ground, natural soils thought to represent the Lowestoft Formation were present. These deposits generally comprised clays and slightly gravelly slightly sandy silty clays of firm and stiff consistency, with occasional thin horizons of sands, which extended to the full depth of the investigation (6.0m bgl). The geotechnical parameters for the clays of the Lowestoft Formation are presented in Table 6.1 below.

Table 6.1 Geotechnical Parameters – Lowestoft Formation

Parameter (units)	Results	Classification	Comments
Undrained Shear Strength Cu (kPa) Cohesive deposits	Typically 45 to 200 (assessed from SPT N value)	Low to high strength	General increase in strength with depth
SPT N Value (uncorrected)	9 – 51		
Water Content (%)	17.9 – 21.3		
Liquid Limit (%)	45 – 50	CI – CI/CH Soils Medium Shrinkability	
Plastic Limit (%)	15 – 18		
Plasticity Index (%)	27 – 33		
Modified Plasticity Index (%)	24 – 26		
Soluble Sulphate Content SO ₄ (g/l)	<0.01 – 0.058	AC-1	
pH Value	8.4 – 8.6		



6.2 Ground Contamination Observations

No visual or olfactory evidence of significant contamination was noted during the investigation. Although there is some made ground across much of the site.

6.3 Groundwater Conditions

Other than in WS02 at 3.0m depth no groundwater seepages were encountered during the investigation.

It should be borne in mind that groundwater conditions can vary with seasonal and other effects and thus at times may be at variance with the conditions noted at the time of the site work.

6.4 Excavations

Random falls and collapse of vertical excavation faces can be expected in the made ground and natural materials dependent on the depth of excavation, the length of time excavations stand open, and the incidence of any groundwater entries.

Consideration should be given to providing at least intermittent support in deepened vertical sided excavations where personnel are required to enter. The adequacy of all excavation support should be continually inspected by experienced personnel.

6.5 Structural Foundations

It is understood that the development is to comprise two storey houses of traditional construction. Foundation recommendations for building take account of the following:-

Ultimate Limit State (ULS) (stability)

Serviceability Limit State (SLS) (settlements and ground movements)

The ULS assessment of stability examines the bearing resistance of the ground. The SLS assessment limits the settlements to assessed acceptable limits. The SLS also requires that suitable foundation depths and construction are adopted to cater for the potential ground movements due to the presence of trees and other major vegetation (including future planting) in close proximity to the proposed building.

The strata encountered comprise firm and stiffer clays of the Lowestoft Formation. Strip or trench fill foundations may prove acceptable for the proposed new houses depending on the proposed loadings. A characteristic undrained shear strength of 50kPa has been adopted based on the lower shear vane values within the upper 1m. Calculations suggest that a preliminary design bearing resistance of around 95kPa would be acceptable for a strip foundation, 0.6m wide, bearing on the firm clays at around 1.0m depth. Under these conditions the footing would have an adequate factor of safety against shear failure and settlements should be limited to less than 25mm. The ULS and SLS calculations are presented in Appendix (v). If the foundations are taken down to bear in the firm to stiff and stiffer clays (possible depths of around



1.0 to 1.5m bgl) it should be possible to justify a preliminary design bearing resistance of around 125kPa.

There are a few trees around the perimeter of the site. Consideration may need to be given to deepening of foundations and the provision of heave precautions within influencing distance of the trees in accordance with NHBC Standards (Reference 5) for clays of medium shrinkability.

All old foundations and other below ground obstructions should be broken out away from new construction. New foundations should be taken down to bear in undisturbed soils below any ground disturbed by the removal of old foundations.

6.6 Ground Floor Slabs

In proximity to trees, floor slabs would best be constructed as suspended over an appropriate void in accordance with NHBC Standards (Reference 5). Away from the influence of trees ground bearing floor slabs may prove acceptable however, where significant volumes of made ground or disturbed soils are present, floor slabs should be suspended.

6.7 Chemical Attack on Concrete

Laboratory determinations of soluble sulphate content have been undertaken on samples of the natural clay soil present at the site. Reported concentrations of SO_4 were between <0.01 to 0.058g/l SO_4 in association with alkaline pH values.

In accordance with BRE Special Digest 1 (Reference 6), the site has been classed as 'natural ground' and the groundwater regime is considered 'mobile' as groundwater was recorded.

Comparison of the characteristic sulphate contents for the soil (based on the mean of the two highest results) and lowest pH concentrations with Table C1 of Reference 6, suggests the ACEC class for the site is AC-1.

R. Foord BSc, MSc, MCSM, CGeol, FGS



REFERENCES

1. Ordnance Survey 1:50,000 Series Sheet 154 Cambridge and Newmarket, Saffron Walden 2016.
2. British Geological Survey 1:50,000 Series Sheet 205 Saffron Walden, Bedrock and Superficial Deposits 2002.
3. HPA-RPD-033 2007 Indicative Atlas of Radon in England and Wales. Public Health England.
4. Stroud, M. A. and Butler, F. G. 1975. 'The Standard Penetration Test and the Engineering Properties of Glacial Materials' Proceedings of the Symposium of University of Birmingham 21-23 April 1975.
5. NHBC Standards Chapter 4.2 2022 'Building Near Trees' National House Building Council.
6. BRE Special Digest 1:2005 Third Edition Concrete in Aggressive Ground. BRE Construction Division.



GENERAL NOTES

The copyright of this report and other plans and documents prepared by Compass Geotechnical Limited are owned by them. The copyright in the written materials shall remain the property of Compass Geotechnical Limited but with a royalty-free perpetual license to the client deemed to be granted on payment in full to Compass Geotechnical Limited by the client of the outstanding monies.

The report is provided for the sole use of the client and is confidential to them, their professional advisors, no responsibility whatsoever for the contents of the report will be accepted to any person other than the client.

New information, improved practices, changes in legislation, or changes in guidelines from Statutory Bodies may necessitate a re-interpretation of the report in whole or part after its original submission.

The report and/or opinion will be prepared and written for the specific purposes and/or development stated in the document and in relation to the nature and extent of proposals made available to us at the time of writing. The recommendations should not be used for other schemes on or adjacent to the site.

The report is based on the ground conditions encountered in the exploratory holes together with the results of field and laboratory testing in the context of the proposed development. Conditions between exploratory holes have been interpolated, however soil conditions are highly variable and may differ from the interpolation. There may be conditions, appertaining to the site, which may not be revealed by the investigation, and which may not be taken into account in the report.

The accuracy of the results reported will depend on the technique of measurement, investigation and test used and these values should not be regarded necessarily as characteristic of the strata as a whole. Where such measurements are critical, the technique of the investigation will need to be reviewed and supplementary investigation undertaken in accordance with the advice of the company where necessary.

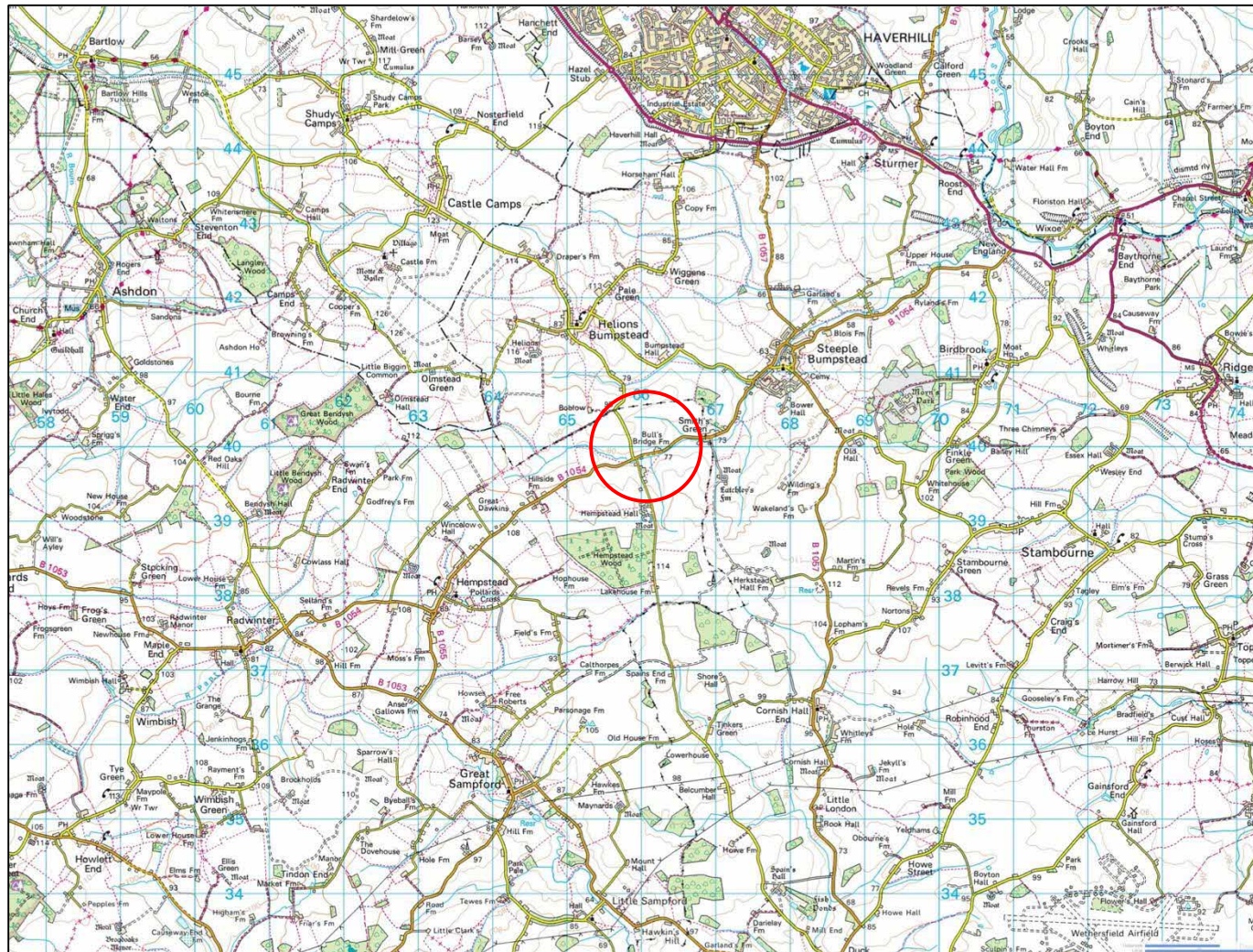
The economic viability of the proposal referred to in the report, or of the solutions put forward to any problems encountered, will depend on very many factors in addition to the geotechnical considerations hence its evaluation will be outside the scope of the report.

Where any data supplied by the Client or from other sources, including previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by Compass Geotechnical Limited for inaccuracies in the data supplied by any other party.

The investigation does not include the identification of Japanese Knotweed. Any such survey should be undertaken by a specialist.



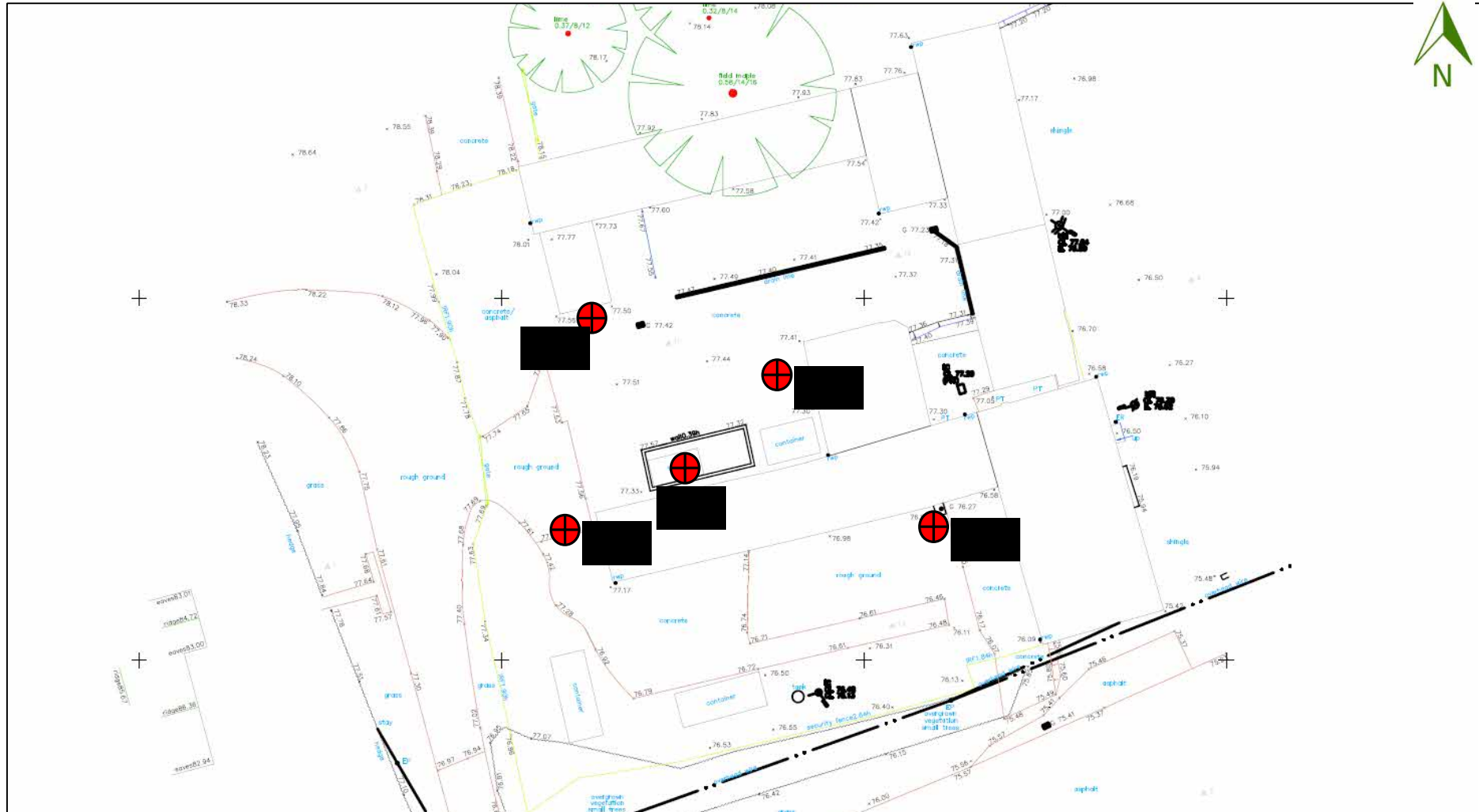
Appendix (i)
Figures



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Figure 1	Site Location Plan
Date	January 2022
Not to Scale	

Report on a Ground Investigation for a Proposed Residential
Development at Bulls Bridge Farm, Bumpstead Road,
Hempstead, Saffron Walden, Essex, CB10 2PP



Extract from BRD Drawing No: BRD/19/068/001-Existing Site Survey Dated November 2019

Figure 2 Exploratory Hole Plan

Date January 2022

Not to Scale



Extract from BRD Proposed Site and Location Plan. Drawing No: BRD/19/068/003-A Dated December 2019

Figure 3	Proposed Development Plan
Date	January 2022
Not to Scale	



Appendix (ii)
Windowless Sample Hole Logs



Introduction

All sampling and in-situ test methods are carried out in accordance with the relevant British and European standards as referenced below.

Abbreviations Used

Exploratory hole records are presented in graphical format with the use of standard abbreviations as outlined below.

Sampling Method

BH	Borehole
TP	Trial Pit
WS	Windowless Sample Hole
CC	Concrete Cored Hole

Sample Types

D	Disturbed Sample
B	Bulk Sample
ES	Environmental Sample
PID	Sample for total VOC screen
L	Liner Tube Sample
U	Undisturbed Sample
UT	Thin Wall Undisturbed Sample
NR	No Recovery
W	Water Sample
C	Rotary Core

In-Situ Tests

DP	Dynamic Probe Test
CPT	Cone Penetrometer Test
SPT	Standard Penetrometer Test
V	Hand Shear Vane Strength Determination (kPa) – manufacturer's calibration of 1.491 applied to direct reading
V*	Hand Shear Vane Strength Determination (kPa) on excavated block of material

References

BS 5930:2015 + A1:2020 Code of Practice for Ground Investigations

BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites – Code of Practice

BS EN ISO 14688-1:2018 Geotechnical Investigation and Testing – Identification and Classification of Soil: Part 1 Identification and description.

BS EN ISO 14688-2:2018 Geotechnical Investigation and Testing – Identification and Classification of Soil: Part 2 Principles of Classification.

BS EN ISO 22475-1:2006 Geotechnical Investigation and Testing – Sampling Methods and Groundwater measurements: Part 1 Technical Principles for Execution.




BS EN ISO 22476-2:2005+A1:2011 Field Testing Part 2: Dynamic Probing.

BS EN ISO 22476-3:2005 + A1:2011 Geotechnical Investigation and Testing – Field Testing: Part 3: Standard Penetration Test.

EUR 26227 EN, 2013 Eurocode 7 Chapter 5 Ground Investigation and Testing.

Samples & In Situ Teseng			Strata Details		
Depth (mBGL)	Sample / Test ID	Test Result	Level (mAOD)	Depth (mBGL)	Legend
				0.43	
				0.57	
				0.86	
				0.95	
				1.36	
				1.45	
				2.89	
				5.45	

Samples & In Situ Teseng			Strata Details		
Depth (mBGL)	Sample / Test ID	Test Result	Level (mAOD)	Depth (mBGL)	Legend
				0.34	
				0.53	
				0.67	
				1.36	
				2.13	
				2.43	
				3.48	
				3.56	
				5.45	

Samples & In Situ Teseng			Strata Details		
Depth (mBGL)	Sample / Test ID	Test Result	Level (mAOD)	Depth (mBGL)	Legend
				0.20	
				0.29	
				0.51	
				2.16	
				6.00	

Samples & In Situ Teseng			Strata Details		
Depth (mBGL)	Sample / Test ID	Test Result	Level (mAOD)	Depth (mBGL)	Legend
				0.21	
				0.46	
				1.57	
				1.89	
				4.18	
				5.45	

Samples & In Situ Teseng			Strata Details		
Depth (mBGL)	Sample / Test ID	Test Result	Level (mAOD)	Depth (mBGL)	Legend
				0.36	
				0.54	
				0.93	
				2.44	
				6.00	





Appendix (iii)
Laboratory Test Results – Material Properties



TEST REPORT
ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 01/02/2022



Contract	Bulls Bridge Farm	
Serial No.	39986_1	
Client:	Soil Property Testing Ltd	
Compass Geotechnical Limited 13 Willow Park Upton Lane Stoke Golding Nuneaton Warwickshire CV13 6EU	15, 16, 18 Halcyon Court, St Margaret's Way, Stukeley Meadows, Huntingdon, Cambridgeshire, PE29 6DG  Website: www.soilpropertytesting.com	
Samples Submitted By: Compass Geotechnical Limited	Approved Signatories:	
Samples Labelled: Bulls Bridge Farm	<input checked="" type="checkbox"/> J.C. Garner B.Eng (Hons) FGS Technical Director & Quality Manager <input type="checkbox"/> W. Johnstone Materials Lab Manager 	
Date Received: 13/01/2022	Samples Tested Between: 13/01/2022 and 01/02/2022	
Remarks: For the attention of Rachel Foord		
Notes:	1 All remaining samples or remnants from this contract will be disposed of after 21 days from today, unless we are notified to the contrary. 2 Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. 3 Tests marked "NOT UKAS ACCREDITED" in this test report are not included in the UKAS Accreditation Schedule for this testing laboratory. 4 This test report may not be reproduced other than in full except with the prior written approval of the issuing laboratory. 5 The results within this report only relate to the items tested or sampled.	



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 01/02/2022



0998

Contract		Bulls Bridge Farm																	
Serial No.		39986_1										Target Date		27/01/2022					
Scheduled By		Compass Geotechnical Limited																	
Schedule Remarks																			
Bore Hole No.	Type	Sample Ref.	Top Depth	<div style="display: flex; justify-content: space-between;"> Water Content (BSI/N) Liquid/Plastic Limits Wet Sieve Preparation </div>												Sample Remarks			
WS1	D	-	1.20	1	1														
WS1	D	-	1.80	1	1	1													
WS2	D	-	1.80	1	1														
WS3	D	-	1.50	1	1														
WS4	D	-	0.80	1	1														
WS4	D	-	2.85	1	1	1													
WS5	D	-	1.70	1	1	1													
Totals				7	7	3													End of Schedule



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 01/02/2022



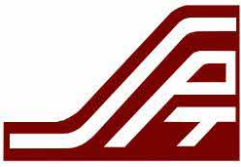
Contract	Bulls Bridge Farm
Serial No.	39986_1

SUMMARY OF WATER CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole /Pit No.	Depth (m)	Type	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index	Sample Preparation				Description	Class
									Method	Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	Curing Time (hrs)		
WS1	1.20 - 1.30	D	-	20.4	45	15	30	0.18	From Natural	4 (A)		67	Firm mottled olive and bluish grey slightly gravelly slightly sandy silty CLAY. Gravel is fine and medium chert	CI
WS1	1.80 - 2.00	D	-	18.3	46	18	28	0.01	Wet Sieved	14 (M)	21.2*	70	Stiff yellowish brown slightly gravelly slightly sandy silty CLAY with occasional bluish grey mottling and rare decayed roots. Gravel is fine and medium chalk and chert	CI
WS2	1.80 - 1.90	D	-	18.8	46	16	30	0.09	From Natural	4 (A)		68	Stiff olive slightly gravelly slightly sandy silty CLAY with rare recently active and decayed roots. Gravel is fine and medium chert	CI
WS3	1.50 - 1.70	D	-	20.5	50	17	33	0.10	From Natural	3 (A)		68	Firm olive yellow slightly gravelly slightly sandy silty CLAY with rare decayed roots. Gravel is fine and medium chert	CI/CH
WS4	0.80 - 1.00	D	-	21.3	45	15	30	0.21	From Natural	2 (A)		67	Firm olive slightly gravelly slightly sandy silty CLAY with occasional bluish grey mottling and rare recently active and decayed roots. Gravel is fine and medium chert	CI
WS4	2.85 - 3.00	D	-	19.0	45	18	27	0.04	Wet Sieved	9 (M)	20.8*	69	Stiff olive slightly gravelly slightly sandy silty CLAY with rare decayed roots. Gravel is fine and medium chalk and chert	CI
WS5	1.70 - 1.85	D	-	17.9	46	18	28	0.00	Wet Sieved	7 (M)	19.2*	72	Stiff yellowish brown slightly gravelly slightly sandy silty CLAY with occasional bluish grey mottling and rare decayed roots. Gravel is fine and medium chalk and chert	CI

Method Of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: *Corrected water content assume material greater than 0.425mm is non-porous. See BS1377: Part 2: 1990 Clause 3 Note 1.

Table Notation: Ret'd 0.425mm: (A) = Assumed, (M) = Measured



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 01/02/2022

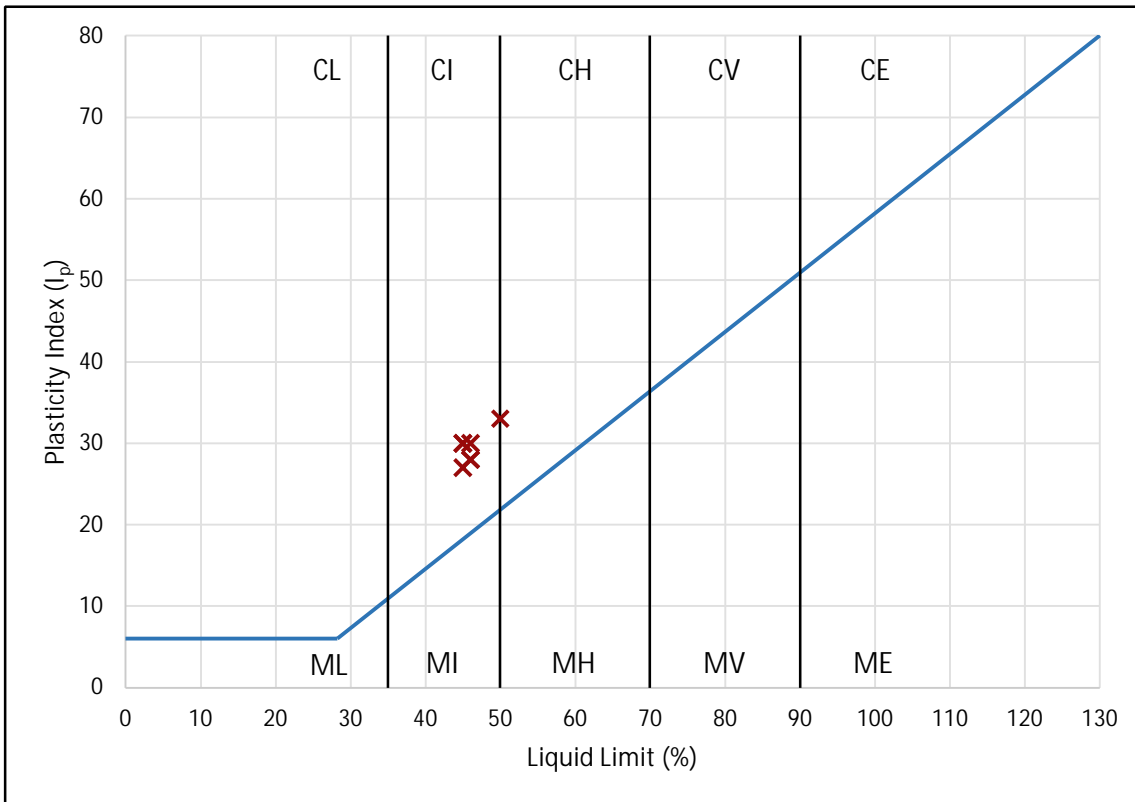


0998

Contract	Bulls Bridge Farm
Serial No.	39986_1

PLOT OF PLASTICITY INDEX AGAINST LIQUID LIMIT USING CASAGRANDE CLASSIFICATION CHART

Plasticity				
Low	Medium	High	Very High	Extremely High



Plasticity Chart BS5930: 2015: Figure 8

High	NHBC Volume Change Potential
Medium	
Low	

Method of Preparation:	BS 1377: Part 2: 1990: 4.2
Method of Test:	BS1377: Part 2: 3.2, 4.4, 5.3, 5.4
Type of Sample Key:	U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
Comments:	Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index



TEST REPORT

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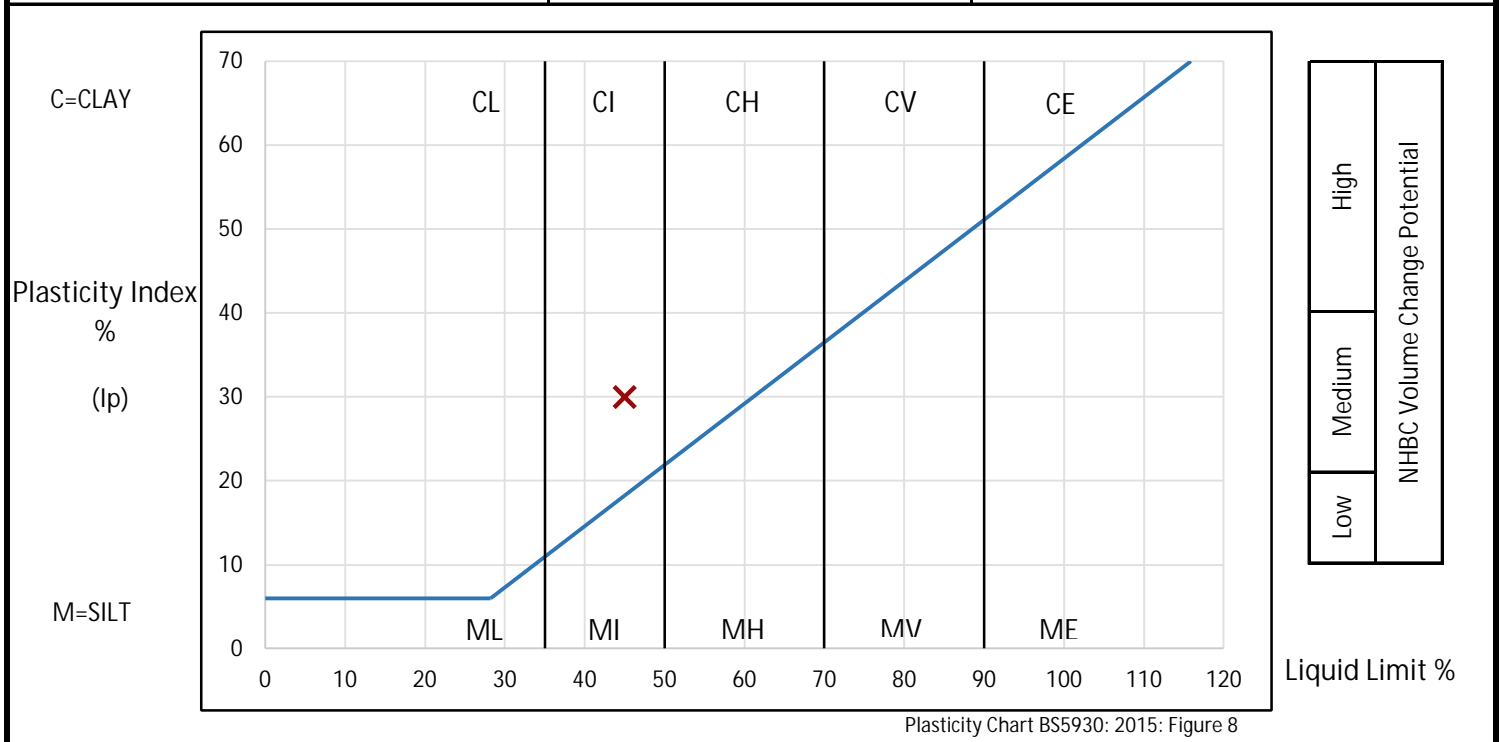
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Contract	Bulls Bridge Farm
Serial No.	39986_1

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS1	1.20 - 1.30	D	-	20.4	Firm mottled olive and bluish grey slightly gravelly slightly sandy silty CLAY. Gravel is fine and medium chert	

PREPARATION			Liquid Limit	45 %	
Method of preparation	From natural/gravel picked out by hand		Plastic Limit	15 %	
Sample retained 0.425mm sieve (Approximate)		4 %	Plasticity Index	30 %	
Corrected water content for material passing 0.425mm			Liquidity Index	0.18	
Sample retained 2mm sieve (Approximate)		4 %	NHBC Modified (I'p)	n/a	
Curing time	67 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments:



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DATE ISSUED: 01/02/2022

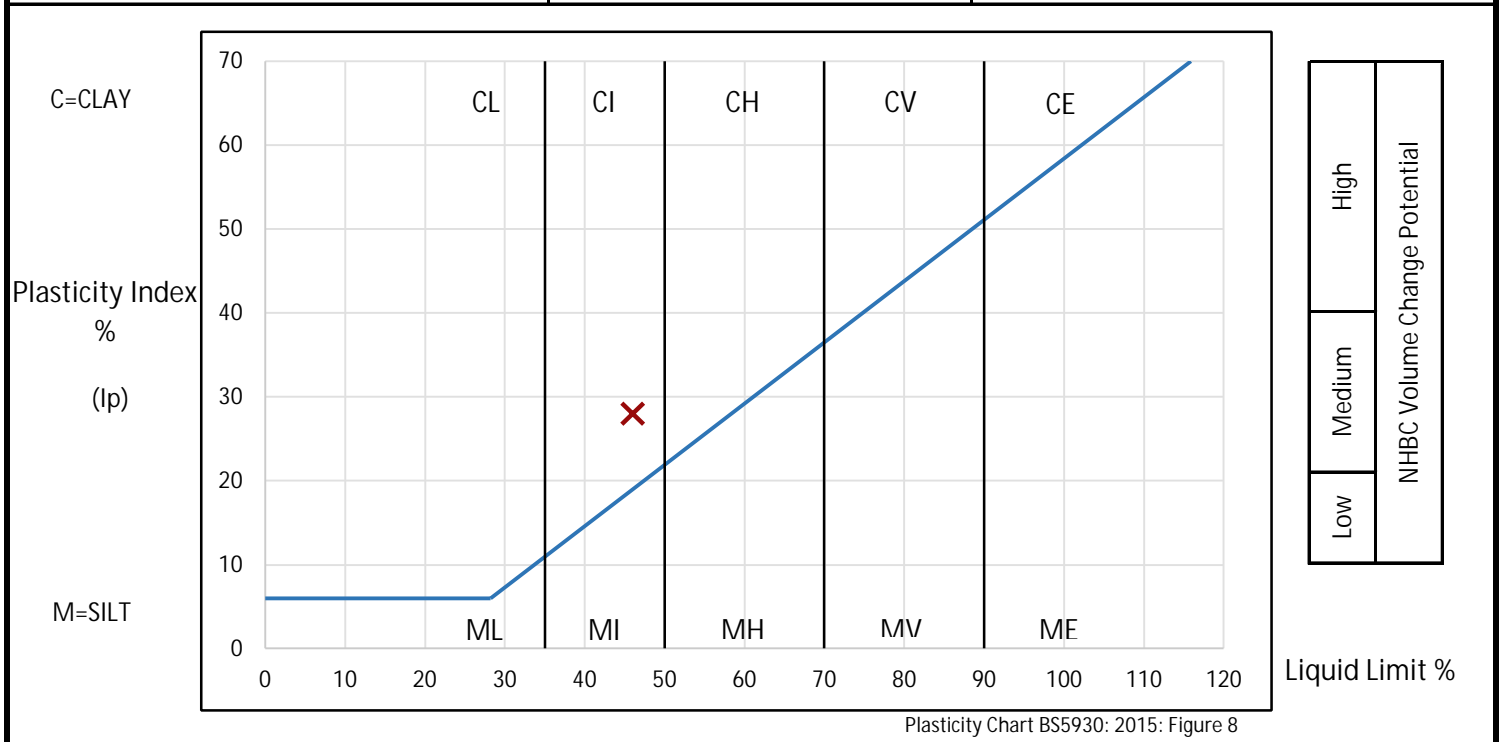


Contract	Bulls Bridge Farm
Serial No.	39986_1

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS1	1.80 - 2.00	D	-	18.3	Stiff yellowish brown slightly gravelly slightly sandy silty CLAY with occasional bluish grey mottling and rare decayed roots. Gravel is fine and medium chalk and chert	

PREPARATION			Liquid Limit	46 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	18 %	
Sample retained 0.425mm sieve	(Measured)	14 %	Plasticity Index	28 %	
Corrected water content for material passing 0.425mm			Liquidity Index	0.01	
Sample retained 2mm sieve	(Measured)	13 %	NHBC Modified (I'p)	24 %	
Curing time	70 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: 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)



TEST REPORT

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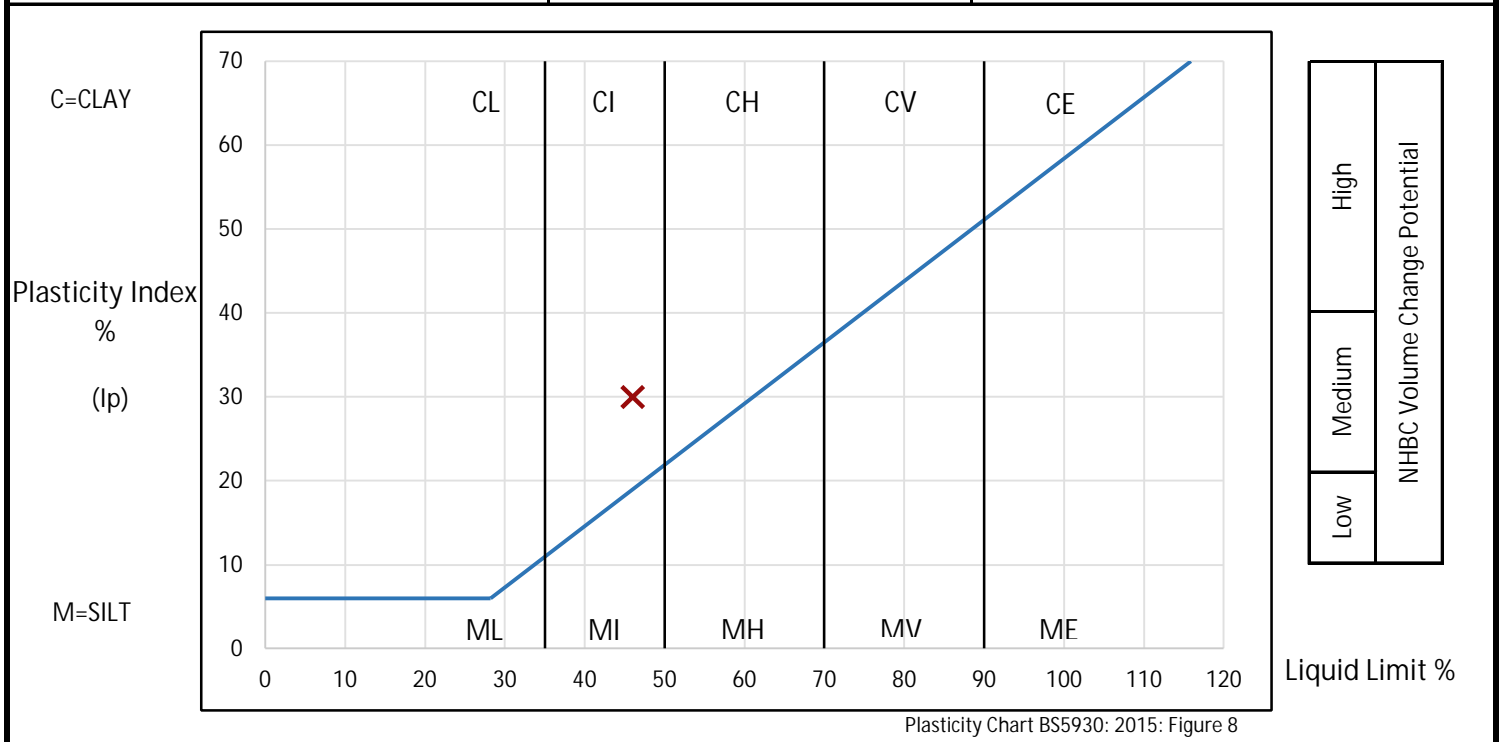
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Contract	Bulls Bridge Farm
Serial No.	39986_1

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS2	1.80 - 1.90	D	-	18.8	Stiff olive slightly gravelly slightly sandy silty CLAY with rare recently active and decayed roots. Gravel is fine and medium chert	

PREPARATION	Liquid Limit	46 %
Method of preparation	From natural/gravel picked out by hand	Plastic Limit
Sample retained 0.425mm sieve (Approximate)	4 %	Plasticity Index
Corrected water content for material passing 0.425mm		Liquidity Index
Sample retained 2mm sieve (Approximate)	4 %	NHBC Modified (I'p)
Curing time	68 hrs	Clay Content
	Not analysed	Derived Activity
		Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments:



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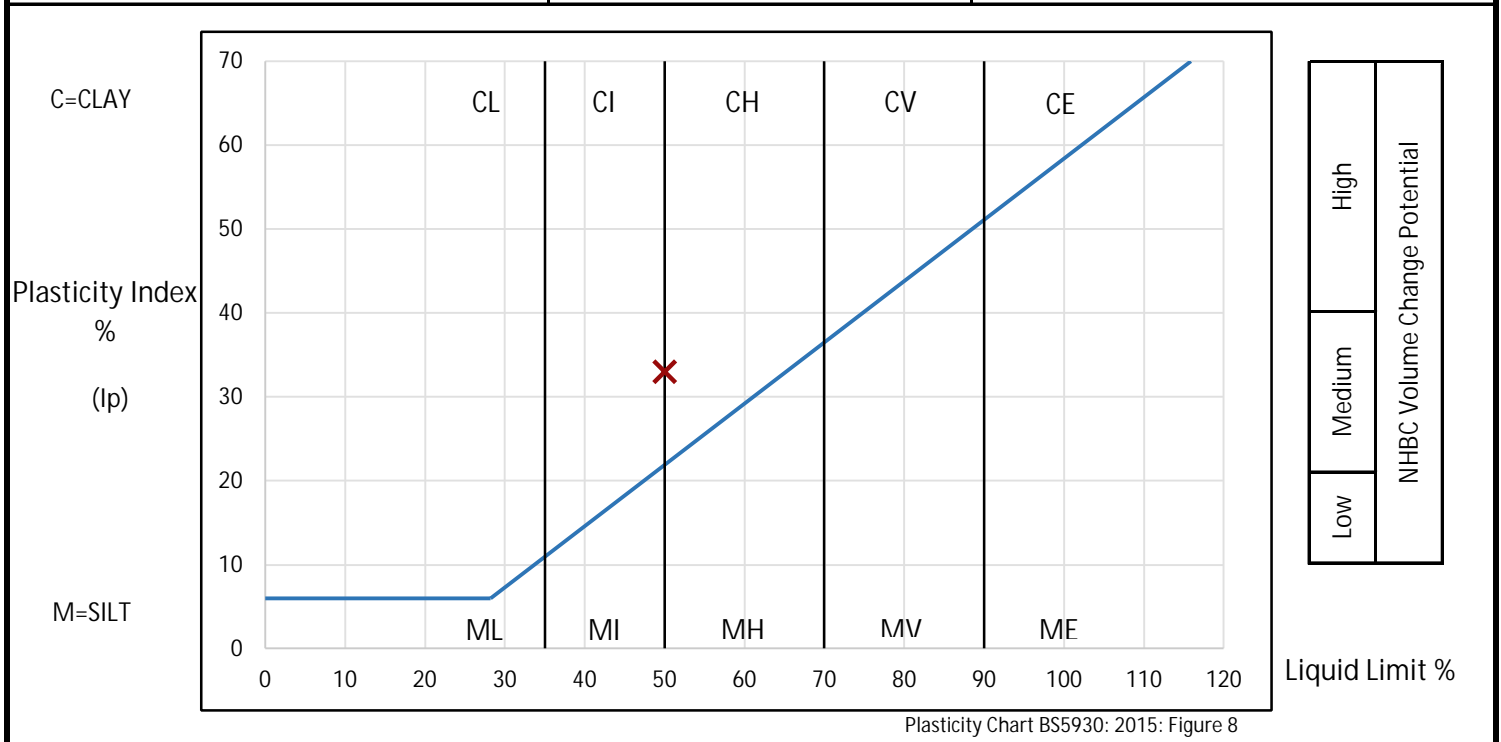


Contract	Bulls Bridge Farm
Serial No.	39986_1

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS3	1.50 - 1.70	D	-	20.5	Firm olive yellow slightly gravelly slightly sandy silty CLAY with rare decayed roots. Gravel is fine and medium chert	

PREPARATION	Liquid Limit	50 %
Method of preparation	From natural/gravel picked out by hand	Plastic Limit
Sample retained 0.425mm sieve (Approximate)	3 %	Plasticity Index
Corrected water content for material passing 0.425mm		Liquidity Index
Sample retained 2mm sieve (Approximate)	3 %	NHBC Modified (I'p)
Curing time	68 hrs	Clay Content
	Not analysed	Derived Activity
		Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments:



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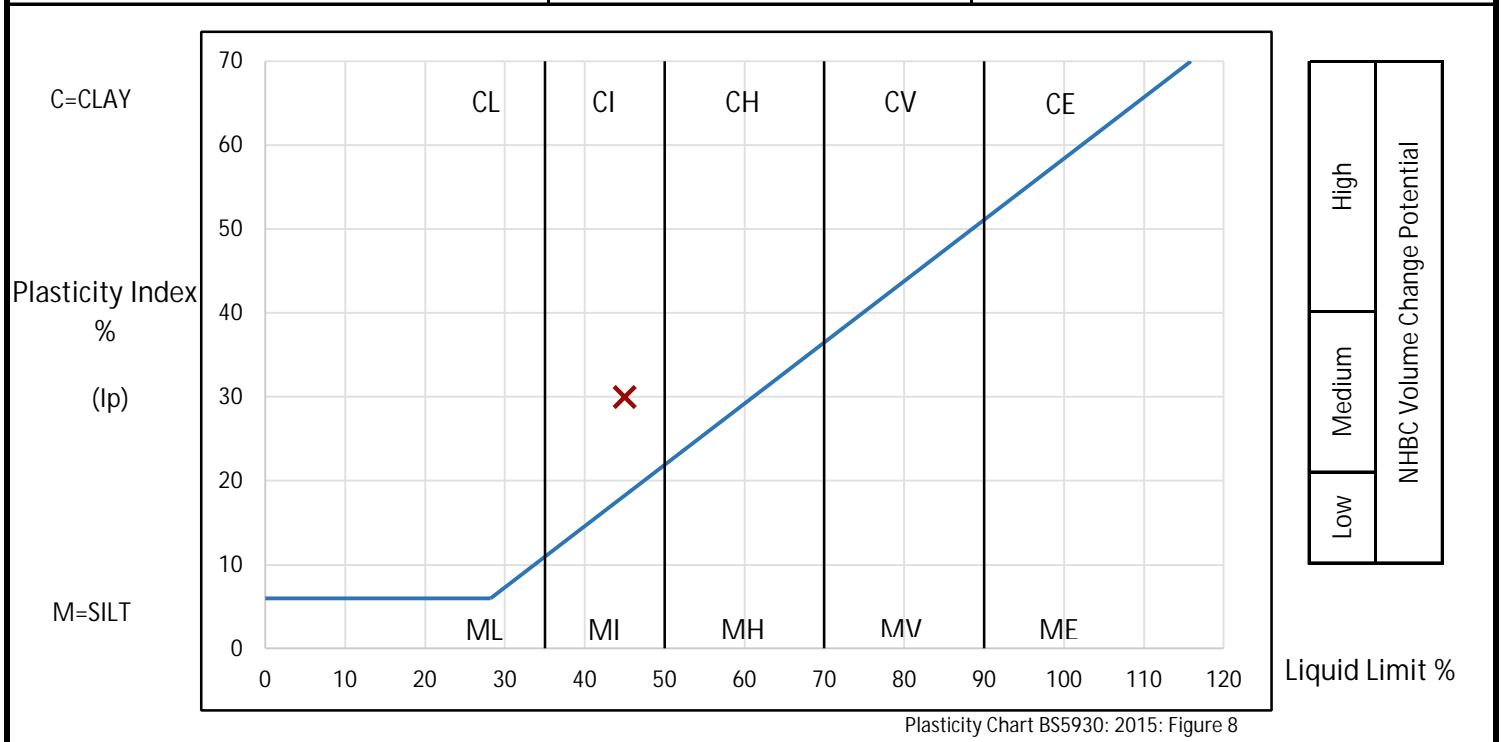
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Contract	Bulls Bridge Farm
Serial No.	39986_1

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS4	0.80 - 1.00	D	-	21.3	Firm olive slightly gravelly slightly sandy silty CLAY with occasional bluish grey mottling and rare recently active and decayed roots. Gravel is fine and medium chert	

PREPARATION			Liquid Limit	45 %	
Method of preparation	From natural/gravel picked out by hand		Plastic Limit	15 %	
Sample retained 0.425mm sieve (Approximate)	2 %		Plasticity Index	30 %	
Corrected water content for material passing 0.425mm			Liquidity Index	0.21	
Sample retained 2mm sieve (Approximate)	2 %		NHBC Modified (I'p)	n/a	
Curing time	67 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments:



TEST REPORT

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DATE ISSUED: 01/02/2022



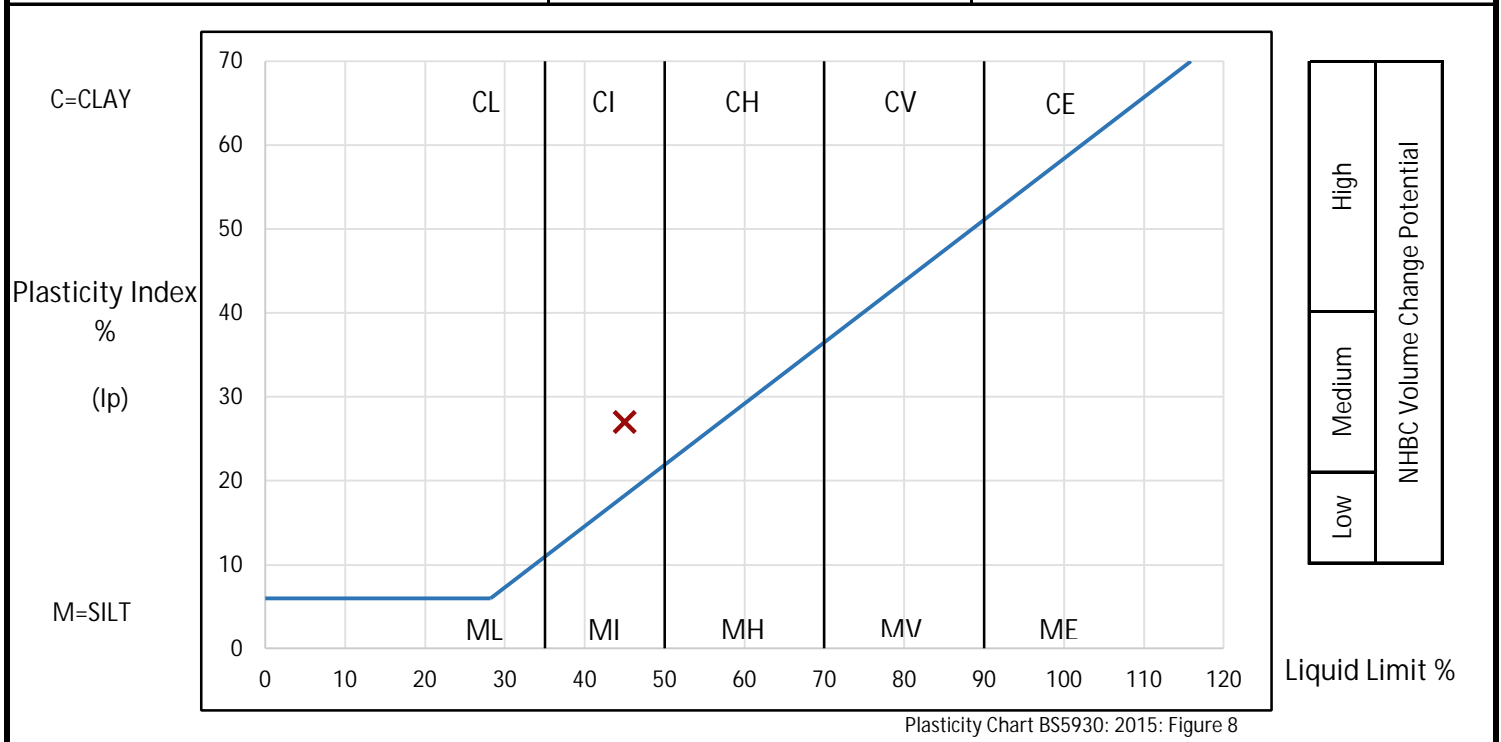
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Contract	Bulls Bridge Farm
Serial No.	39986_1

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS4	2.85 - 3.00	D	-	19.0	Stiff olive slightly gravelly slightly sandy silty CLAY with rare decayed roots. Gravel is fine and medium chalk and chert	

PREPARATION	Liquid Limit	45 %
Method of preparation	Wet sieved over 0.425mm sieve	Plastic Limit
Sample retained 0.425mm sieve (Measured)	9 %	Plasticity Index
Corrected water content for material passing 0.425mm	20.8 %	Liquidity Index
Sample retained 2mm sieve (Measured)	7 %	NHBC Modified (I'p)
Curing time	69 hrs	Clay Content
	Not analysed	Derived Activity
		Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: 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)



TEST REPORT

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DATE ISSUED: 01/02/2022

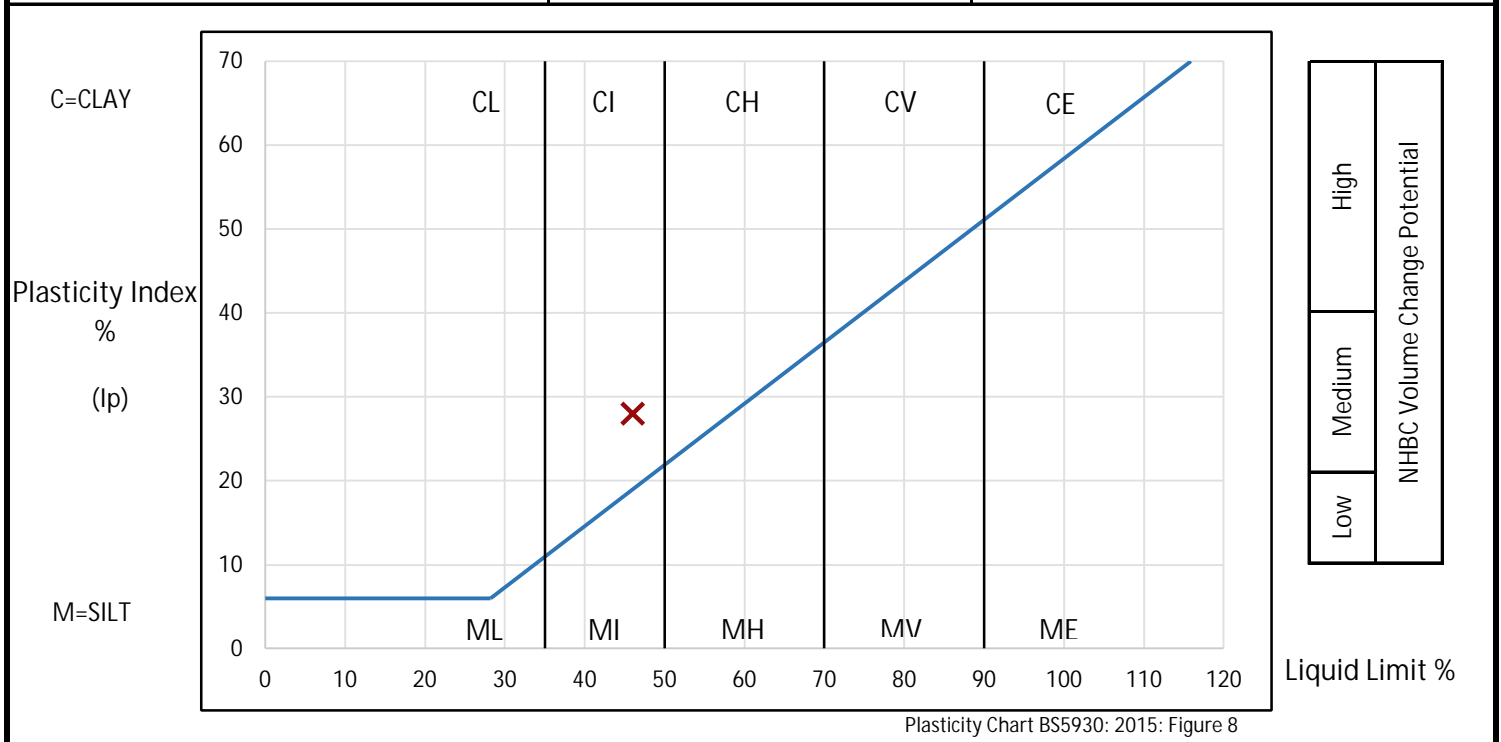


Contract	Bulls Bridge Farm
Serial No.	39986_1

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS5	1.70 - 1.85	D	-	17.9	Stiff yellowish brown slightly gravelly slightly sandy silty CLAY with occasional bluish grey mottling and rare decayed roots. Gravel is fine and medium chalk and chert	

PREPARATION			Liquid Limit	46 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	18 %	
Sample retained 0.425mm sieve	(Measured)	7 %	Plasticity Index	28 %	
Corrected water content for material passing 0.425mm			Liquidity Index	0.00	
Sample retained 2mm sieve	(Measured)	5 %	NHBC Modified (I'p)	26 %	
Curing time	72 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: 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)



Final Report

Report No.: 22-00510-1
Initial Date of Issue: 14-Jan-2022
Client: Compass Geotechnical Limited
Client Address: 13 Willow Park, Upton Lane
Stoke Golding
Warwickshire
CV13 6EU

Contact(s): [Redacted]

Project: Bulls Bridge Farm

Quotation No.: Q19-18078 **Date Received:** 11-Jan-2022

Order No.: 212869A **Date Instructed:** 11-Jan-2022

No. of Samples: 3

Turnaround (Wkdays): 5 **Results Due:** 17-Jan-2022

Date Approved: 14-Jan-2022

Approved By:
[Redacted]

Details: Stuart Henderson, Technical
Manager

Results - Soil

Project: Bulls Bridge Farm

Client: Compass Geotechnical Limited	Chemtest Job No.:				22-00510	22-00510	22-00510
Quotation No.: Q19-18078	Chemtest Sample ID.:				1349384	1349388	1349389
	Client Sample ID.:				ES	ES	ES
	Sample Location:				WS1	WS2	Ws3
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.9	2.7	1.5
	Bottom Depth (m):				1.0	2.9	1.7
	Date Sampled:				06-Jan-2022	06-Jan-2022	06-Jan-2022
	Time Sampled:				12:00	12:00	12:00
Determinand	Accred.	SOP	Units	LOD			
Moisture	N	2030	%	0.020	19	17	15
pH	U	2010		4.0	8.6	8.4	8.5
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	0.049	< 0.010

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:





Final Report

Report No.: 22-01268-1
Initial Date of Issue: 20-Jan-2022
Client: Compass Geotechnical Limited
Client Address: 13 Willow Park, Upton Lane
Stoke Golding
Warwickshire
CV13 6EU

Contact(s): [Redacted]

Project: Bulls Bridge Farm

Quotation No.: Q19-18078 **Date Received:** 17-Jan-2022

Order No.: 202869C **Date Instructed:** 17-Jan-2022

No. of Samples: 2

Turnaround (Wkdays): 5 **Results Due:** 21-Jan-2022

Date Approved: 20-Jan-2022

Approved By:
[Redacted]

Details: Stuart Henderson, Technical
Manager

Results - Soil

Project: Bulls Bridge Farm

Client: Compass Geotechnical Limited	Chemtest Job No.:		22-01268	22-01268		
Quotation No.: Q19-18078	Chemtest Sample ID.:		1352372	1352375		
	Client Sample ID.:		ES	ES		
	Sample Location:		WS4	WS5		
	Sample Type:		SOIL	SOIL		
	Top Depth (m):		0.8-1.0	1.7		
	Bottom Depth (m):			1.85		
	Date Sampled:		12-Jan-2022	12-Jan-2022		
	Time Sampled:		0:00	0:00		
Determinand	Accred.	SOP	Units	LOD		
Moisture	N	2030	%	0.020	17	13
pH	U	2010		4.0	8.4	8.6
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.032	0.058

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:





Appendix (iv)
ULS & SLS Calculations



Calculation of Preliminary Bearing Pressure - Strip Foundation on Clays

For undrained conditions using $R/A = (\pi + 2)C + q$

Input Parameters

Term	Symbol	Value	Units
Width of rising wall	d	0.3	m
Height of concrete foundation	h	0.3	m
Depth below ground level	D	1	m
Breadth of foundation	B	0.6	m
density of soil	$\gamma_{s;k}$	20	kN/m ³
density of concrete	$\gamma_{c;k}$	24	kN/m ³
density of brick and infill	$\gamma_{b;k}$	22	kN/m ³
Undrained shear strength	C_u	50	kPa
Assumed imposed vertical load		80	kN/mrun
Permanent characteristic vertical load			
Weight of rising wall		4.62	kN/mrun
Weight of foundation		4.32	kN/mrun
Weight of backfill		4.2	kN/mrun
Total characteristic vertical load	V_k	93.14	kN/mrun

Design Approach 1

Undrained Conditions simplified for the case of a vertical load action at the centre of strip

Area of footing	A	0.6	m ² /mrun
Combination 1 (A1, M1, R1)			
Design Load (A1)	V_{d1}	125.74	kN/mrun
Design Strength (M1)	C_{ud1}	50	kPa
Soil Surcharge adj to footing	q_{d1}	20	kPa
Design Bearing Resistance (R1)	R_{d1}	166.26	kPa

Check if $V_{d1} \leq R_{d1}$ acceptable for Design Approach 1 Combination 1

Combination 2 (A2, M2, R1)

Design Load (A2)	V_{d2}	93.14	kN/mrun
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Design Strength (M2)	C_{ud2}	35.7	kPa	
Soil surcharge adj to footing	q_{d2}	20	kPa	
Design Bearing Resistance (R1)	R_{d2}	122.2	kPa	
Check if $V_{d2} \leq R_{d2}$				acceptable for Design Approach 1 Combination 2
Critical Combination Check				
Combination 1	R_{d1}/V_{d1}	1.3223		
Combination 2	R_{d2}/V_{d2}	1.3119		Combination 2 is more critical
Settlements (SLS Limit State)				
Limit to settlements by $V_k = R_k/3$				using unfactored values
Vertical Load	V_k	93.14	kN/mrun	
Bearing Resistance	R_k	166.26	kN/mrun	
	R_k/V_k	1.7851		Less than 3 consider increasing foundation size or reducing load
To give V_k for $R_k/3$	V_k	55.42	kN/mrun	
Preliminary design bearing resistance		92.367	kPa	
Imposed wall loading		42.28	kN/mrun	



Compass Geotechnical

Geotechnical, Geoenvironmental and Civil Engineering Consultants

13 Willow Park, Upton Lane, Stoke Golding, Warwickshire, CV13 6EU

www.compassgeotechnical.co.uk