

Your Ref:

Our Ref: BC486 L.001 / JT

Surefix Home Improvements
175 London Road
Waterlooville
PO7 7RJ.

For the attention of Nigel Perfect

14th November 2019

Dear Nigel

**LITTLE FOXES, ROSE HILL. WATERLOOVILLE, HANTS PO8 9QU
GROUND INVESTIGATION**

1 INTRODUCTION

The Brownfield Consultancy was instructed by Surefix Home Improvements to undertake a ground investigation at a site known as Little Foxes, Rose Hill. Waterlooville, Hampshire, where it is proposed to construct a two-storey dwelling in place of the existing residence.

The purpose of the site investigation is to provide an assessment of the geotechnical properties of the soils and give comments and recommendations. This report is subject to limitations which are presented in Appendix E.

2 THE SITE

The site consists of a bungalow with large rear garden. The site is rectangular in shape with its long axis east-west. The site is surrounded by residential dwellings in all compass directions. Photographs of the site are presented below:



Front of bungalow



Rear Garden

3 FIELDWORK AND MONITORING

The intrusive fieldwork was carried out on 21st October 2019 and comprised three dynamic windowless sampler boreholes, one dynamic probe, two hand dug trial pits and two soil infiltration tests.

The site work was undertaken by The Brownfield Consultancy, with the ground investigation procedures and sample descriptions based on BS 5930 (2015) 'Code of Practice for Site Investigations'. The locations of the exploratory holes are shown on the Drawing included in Appendix A. The exploratory hole records are presented in Appendix B. The full details of the fieldwork undertaken are summarised in the following sections.

3.1 Dynamic Sampler Boreholes

The dynamic sampler boreholes, designated WS1 to WS3, were advanced to 5.45m depth. The windowless sampling technique utilises a lightweight tracked rig to advance the borehole in 1m stages using 1m long steel sampler tubes containing plastic liners, into which the substrata deposits are driven, at diameters of 100mm reducing to 70mm. The soils are then recovered from each sampler tube as continuous core samples, which are then logged and sub-sampled on site. Standard Penetration Tests (SPTs) were undertaken in accordance with BS EN ISO 22476-3:2005+A1:2011 at 1.0m intervals.

3.2 Dynamic Probe

The dynamic probe was commenced from the base of WS2 and advanced to 10.0m depth. The super-heavy dynamic probe test (DPSH) used, comprises a 63.5kg weight falling through a constant drop of 760mm, driving a solid 51mm diameter steel cone of 90° angle into the deposits under test. The relative density of the deposit is determined by recording the number of blows per 100mm of penetration. The probe provides a continuous profile of the relative density of the soils and the energy and dynamics of the test are similar to that of the Standard Penetration Test (SPT) undertaken in the boreholes.

3.3 Trial Pits

Two trial pits were hand-excavated against the blockwork retaining wall along the northern site boundary to enable the dimensions and depth of the foundation to be measured.

4 LABORATORY TESTING

4.1 Geotechnical and Geochemical

A programme of laboratory testing was scheduled to determine the geotechnical and geochemical properties of selected soil samples obtained from the investigation. The details of the geotechnical testing are summarised in the following table:-

Summary of Geotechnical and Geochemical Laboratory Testing Suites

Sulphate, pH etc.: BRE SD1 Suite B	4
Atterberg Limits with moisture content measurement	5

The tests were carried out in accordance with BS1377 (1990) "Methods of test for Soils for Civil Engineering purposes" and Building Research Establishment Special Digest 1 "Concrete in Aggressive Ground". The results of the testing are presented in Appendix C.

5 GROUND AND GROUNDWATER CONDITIONS

5.1 Strata Encountered

BGS mapping indicates the site to be underlain by the Lambeth Group overlying the Tarrant Chalk Member, both representing bedrock formations. No Superficial Deposits are indicated. However, while the boreholes did reveal deposits overlying the chalk, they are considered to be Head Deposits rather than the Lambeth Group. Minor deposits of Made Ground were also present.

A summary of the exploratory hole findings is provided in the following sections. For full details of the strata encountered, samples taken, information on groundwater encountered, results of any in-situ testing and any other relevant information, reference should be made to the exploratory hole logs presented in Appendix B.

5.2 Made Ground

Made Ground was found to depths of 0.20m to 0.30m in WS1, WS2 and SA1, and consisted of reworked Topsoil with gravel of flint, carbonaceous fragments and rare brick fragments. In WS3, a 20mm layer of tarmac was lying on concrete to 0.20m depth, in turn, bearing on soft clay with flint gravel, brick and carbonaceous fragments to 0.90m.

5.3 Head Deposits

The Head Deposits generally comprised soft, or very soft, variably gravelly, very sandy clay, although some shallow and thin firm beds were also present. The Head Deposits were found to depths of 1.30m to 3.50m.

Determinations of the Atterberg Limits of five samples of the Head Deposits yielded Plastic Limits of 15% to 37%, Liquid Limits of 29% to 90%, yielding Plasticity Indices of 14% to 53%. This indicates the deposits to be variable between clays (and one of silt) of low through to very high plasticity (BS1377:1990) and low to high volume-change potential with respect to the NHBC Standards Chapter 4.2 classification.

5.4 Tarrant Chalk Member

As is typical of chalk, the depth of the upper surface varied markedly over short distances from 1.30m to 3.50m. The chalk was recovered as a structureless, white, locally buff, silty, locally very silty medium to coarse gravel. It was noted that the chalk was locally damp. SPTs indicated the chalk to be of very low strength in its upper levels, with only a modest increase in strength with depth. The probe commenced from the base of WS2, indicated slightly greater strength below 6.5m, continuing to approximately 8.5m, before a significant increase in resistance.

5.5 Groundwater

Groundwater was not observed in the boreholes.

5.6 Retaining Wall

The two hand-excavated trial pits undertaken against the retaining wall along the northern site boundary revealed the top of the 200mm thick concrete foundation to be at ground level. It incorporates a grill-covered drainage channel and projects 300mm from the wall. The footing is bearing in soft, or very soft orange-brown, locally very sandy clay, assumed to be Head Deposits.

6 SOIL INFILTRATION TESTS

Soil infiltration test were undertaken in a hand dug trial pit (SA1) excavated to 1.00m with dimensions of 0.30m x 0.30m. The base of the pit terminated in brown gravelly clay and was unsuccessful.

A second soil infiltration test was conducted in WS1 drilled to a depth of 5.45m and terminating in the Tarrant Chalk. One successful test was undertaken recording an infiltration rate of 3.5×10^{-6} m/s. The test results are presented in Appendix D.

7 GEOTECHNICAL ENGINEERING ASSESSMENT

7.1 Proposed Redevelopment

It is understood that the proposed development comprises the construction of a two-storey residence in place of the existing dwelling.

7.1 Summary of Ground Conditions

Beneath minor deposits of Made Ground, the site is underlain by what are considered to be Head Deposits overlying the Tarrant Chalk member. The Head Deposits consisted of mainly soft, or very soft, variably gravelly, very sandy clays. The chalk was encountered at depths of 1.3m to 3.5m and was of very low strength to a significant depth.

Groundwater was not observed in the boreholes, although the chalk was noted to be damp, locally.

7.2 Foundations

The generally very low strength clays and chalk extend to significant depth rendering spread foundations both impractical and economically unviable, even at the relatively modest loads that would be generated by the proposed structure. Even if spread foundations could be utilised at low bearing pressures, settlement is still likely to be excessive. It is considered, therefore, that piled foundations will be necessary. The use of vibro-compaction techniques are unlikely to be efficient in these ground conditions and the scale of the development would probably render it uneconomic.

The advice of specialist piling contractors should be sought but most types of pile would be suitable in these ground conditions. Driven systems are unlikely to be environmentally acceptable given the proximity of neighbouring residences. Further investigation will be required to obtain pile design data on the soil/rock at depth.

It will be necessary to undertake an assessment of the proximity of any trees to the proposed building, along with their species and height. If the building falls within their zone of influence, as defined in NHBC Standards Chapter 4.2 (or similar), assuming a soil *medium* volume-change potential classification, then it would be prudent to sleeve the piles through the clay soils to prevent the generation of excessive tensile forces arising from any future clay heave following the death or lopping of the trees.

7.3 Floor Slab

If the building does fall within the zone of influence of any trees, as discussed above, then the appropriate measures as regards voids/void formers beneath and against the ground floor slab and ground beams should be implemented, in accordance with the NHBC Standards, assuming *medium* volume-change potential.

7.4 Excavations

The short-term stability of excavations is unpredictable through the low strength ground, although groundwater does not appear to be present at shallow depth. The need for shoring should be considered, therefore. As with all sites, where personnel are required to enter excavations greater than 1.2m deep, or excavations of any depth that are exhibiting instability, shoring or battering back of the sides should be undertaken in any case.

7.5 Chemical Considerations for Buried Concrete

Chemical testing on four five soil samples in accordance with BRE SD1 (2005) "Concrete in aggressive ground", indicated water-soluble sulphate concentrations (SO₄ in 2:1 soil aqueous extract) of 7mg/l to 18mg/l, and pH values of 7.6 to 8.4. These values, along with a *static* groundwater regime, place the site in design sulphate class **DS-1** and Aggressive Chemical Environment for Concrete (ACEC) class **AC-1s**. Calculation of the oxidisable sulphides (OS) from the total sulphate and total sulphur results using the method of the digest does not indicate a significant presence of pyrite in the samples. No adjustment to the classifications is required, therefore.

No special precautions will be necessary to protect buried concrete from potential chemical attack.

7.6 Pavement Construction

For pavement design, it is recommended that a CBR of 1% is assumed for the near-surface Head Deposits. Proof-rolling is recommended to highlight any excessively compressible zones that may need treatment or replacement. It should also be borne in mind that some of the near-surface soils may be frost susceptible.

We trust the above is sufficient for your purposes. However please do not hesitate to contact me should you have any queries.

Prepared and Approved by



Jim Twaddle cGeol
Director

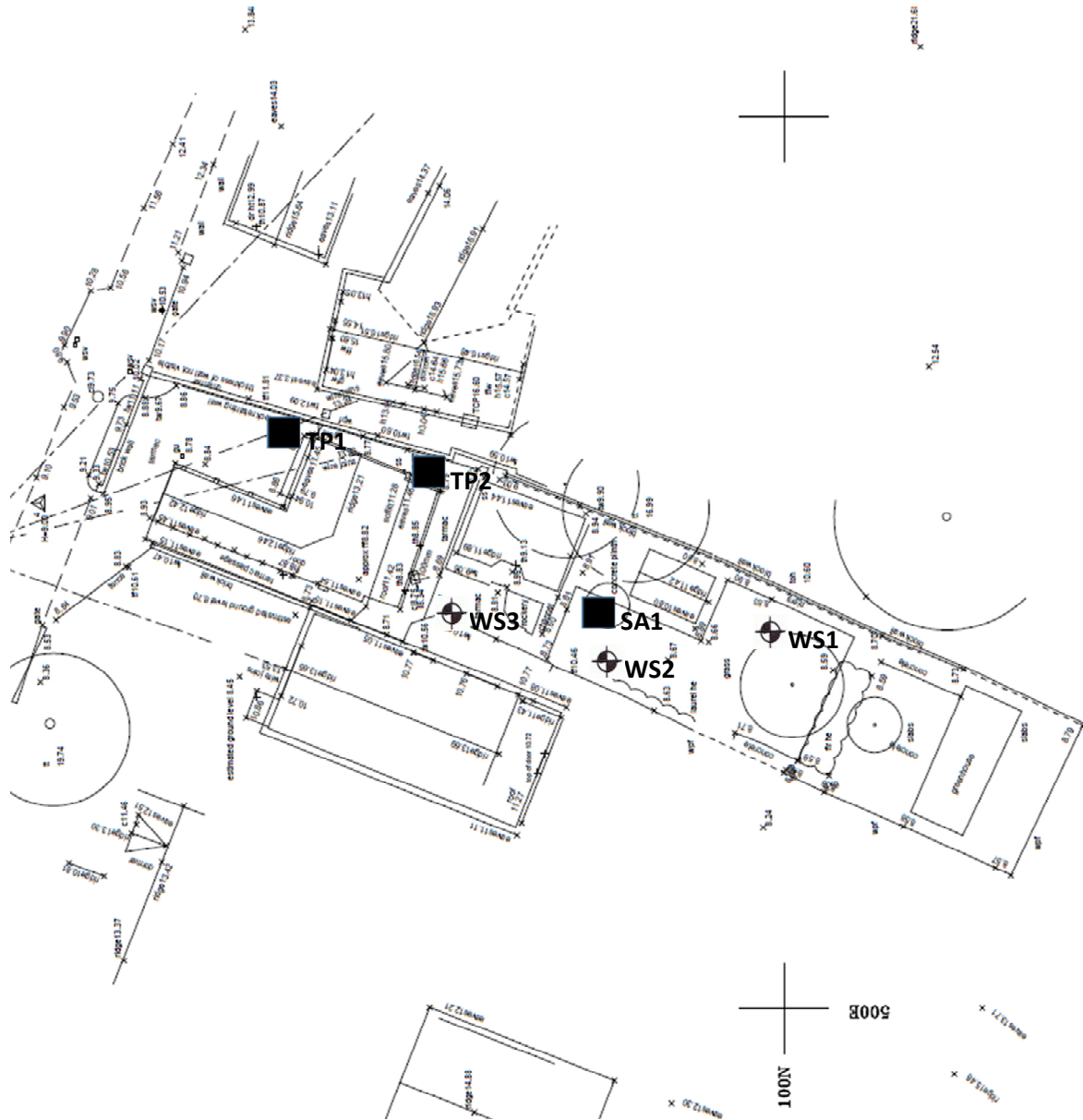
Appendix A	Exploratory Hole Location Plan
Appendix B	Exploratory Hole Records
Appendix C	Geotechnical Laboratory Analysis
Appendix D	Soakaway Results
Appendix E	Limitations

APPENDIX A

Exploratory Hole Location Plan

Little Foxes, Rose Hill, Waterlooville. PO8 9QU

Exploratory Hole Location Plan



APPENDIX B

Exploratory Hole Logs

BOREHOLE LOG

Project Little Foxes, Rose Hill, Waterlooville. PO8 9QU				BOREHOLE No WS1
Job No BC486	Date 21-10-19	Ground Level (m)	Co-Ordinates ()	
Contractor Brownfield Consultancy Ltd				Sheet 1 of 1

SAMPLES & TESTS			STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION		
0.20	ES					0.25	Grass over dark brown slightly gravelly TOPSOIL with angular to subangular, fine to medium gravel of flint, carbonaceous fragments and rare fragments of red brick. (MADE GROUND)		
0.60	D					(0.45) 0.70	Firm orange brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Occasional carbonaceous fragments. (HEAD DEPOSITS)		
1.20	D					(0.60) 1.30	Firm red brown gravelly CLAY. Gravel is angular to subangular fine to coarse flint. (HEAD DEPOSITS)		
1.20		N5 1,1/ 1,1,2,1					Very soft orange brown sandy CLAY. Occasional carbonaceous fragments and angular to subangular coarse gravel of flint. (HEAD DEPOSITS)		
1.90	D								
2.00		N4 1,0/ 1,1,1,1				(2.50)			
2.60	D								
3.00		N4 0,1/ 1,1,1,1				3.80			
3.80	D						TARRANT CHALK MEMBER : Recovered as structureless white locally buff brown silty locally very silty angular to subangular medium and coarse GRAVEL of chalk. Chalk surfaces are locally damp.		
4.00		N4 1,0/ 1,1,0,2				(1.65)			
5.00	D					5.45			
5.00		N10 1,1/ 1,1,4,4							
							Borehole terminated. Groundwater not encountered.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Backfilled with arisings.
All dimensions in metres Scale 1:50			Client Surefix Home Improvements			Method/ Plant Used Dynamic Sampling Rig			Logged By JT		

BROWNFIELD DS LOG WATERLOOVILLE LOGS.GPJ GINT STD AGS.3.1.GDT 22/10/19

BOREHOLE LOG

Project Little Foxes, Rose Hill, Waterlooville. PO8 9QU				BOREHOLE No WS2
Job No BC486	Date 21-10-19	Ground Level (m)	Co-Ordinates ()	
Contractor Brownfield Consultancy Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.10	ES					0.30	Grass over dark brown slightly gravelly TOPSOIL with angular to subangular, fine to medium gravel of flint, carbonaceous fragments and rare fragments of red brick. (MADE GROUND)		
						0.60			
0.80	ES					(0.70)	Soft orange brown slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Occasional carbonaceous fragments. (HEAD DEPOSITS)		
1.20		N5 2,1/ 1,1,1,2				1.30			
						1.55	Firm red brown gravelly CLAY. Gravel is angular to subangular fine to coarse flint. (HEAD DEPOSITS)		
1.40	D						Soft orange brown very sandy CLAY. (HEAD DEPOSITS)		
1.80	D						Very soft brown locally sandy slightly gravelly CLAY. Gravel is angular to subangular medium to coarse flint. Rare carbonaceous fragments. (HEAD DEPOSITS)		
2.00		N3 1,1/ 0,1,1,1				(1.95)	2.30 - 2.50 Gravel of flint. 2.80 - 2.90 <5mm roots.		
2.30	D								
3.00	D								
3.00		N2 1,1/ 0,1,0,1				3.50			
3.70	D						TARRANT CHALK MEMBER : Recovered as structureless white locally buff brown silty locally very silty angular to subangular medium and coarse GRAVEL of chalk. Chalk surfaces are locally damp.		
4.00		N4 1,0/ 1,0,2,1				(1.95)			
4.50	D								
5.00		N13 3,2/ 2,4,4,3				5.45			
							Borehole terminated. Groundwater not encountered.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Backfilled with arisings.
All dimensions in metres Scale 1:65.625			Client	Surefix Home Improvements			Method/ Plant Used	Dynamic Sampling Rig			Logged By JT

BROWNFIELD DS LOG WATERLOOVILLE LOGS.GPJ GINT STD AGS 3.1.GDT 22/10/19

Project Little Foxes, Rose Hill, Waterloooville. PO8 9QU				BOREHOLE No WS3
Job No BC486	Date 21-10-19	Ground Level (m)	Co-Ordinates ()	
Contractor Brownfield Consultancy Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		
0.20	ES				0.02	Tarmac. (MADE GROUND)		
					0.20	Concrete - unreinforced. (MADE GROUND)		
0.60	ES				(0.70)	Soft locally firm brown slightly gravelly CLAY. Gravel is angular to subangular fine to coarse flint, carbonaceous fragments and red brick. (MADE GROUND)		
					0.90			
					(0.40)	Soft orange brown very sandy CLAY. (HEAD DEPOSITS)		
1.20	D	N9 1,1/ 3,2,2,2			1.30	TARRANT CHALK MEMBER : Recovered as structureless white locally buff brown silty locally very silty angular to subangular medium and coarse GRAVEL of chalk. Chalk surfaces are locally damp.		
1.20								
2.00		N3 1,0/ 1,1,0,1						
2.50	D							
3.00		N4 1,1/ 1,1,1,1						
3.40	D				(4.15)			
4.00		N8 1,2/ 2,1,1,4						
4.90								
5.00	D	N13 3,2/ 3,3,3,4			5.45			
						Borehole terminated. Groundwater not encountered.		

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

DYNAMIC PROBE LOG

Project Little Foxes, Rose Hill, Waterlooville. PO8 9QU				PROBE No WS2
Job No BC486	Date 21-10-19	Ground Level (m)	Co-Ordinates ()	
Contractor Brownfield Consultancy Ltd				Sheet 1 of 1

Depth (m)	Readings (blows/100mm)	Diagram (N100 Values)						Torque (Nm)	Remarks
		5	10	15	20	25	30		
1									
2									
3									
4									
5									
6	1 1 1 1 1								
7	1 1 3 2 1								
8	4 3 2 1 2								
9	2 2 1 2 3								
10	7 4 4 4 6								
11	5 2 2 4								
12	5 5 9 7 5								
13	5 5 5 5 7								
14	9 10 8 6 5								

Hammer Wt (kg)	63.5		GENERAL REMARKS
Hammer Drop (mm)	760		
Cone Dia (mm)	50.5		
Cone Type	Fixed		
Damper			

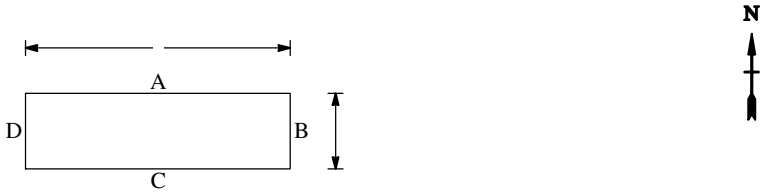
All dimensions in metres Scale 1:65.625	Client Surefix Home Improvements	Method/ Plant Used Dynamic Sampling Rig	Logged By JT
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BROWNFIELD DP LOG WATERLOOVILLE LOGS.GPJ GINT STD AGS.3.1.GDT 22/10/19

TRIAL PIT LOG

Project Little Foxes, Rose Hill, Waterlooville. PO8 9QU				TRIAL PIT No SA1
Job No BC486	Date 21-10-19	Ground Level (m)	Co-Ordinates ()	
Contractor Brownfield Consultancy Ltd				Sheet 1 of 1

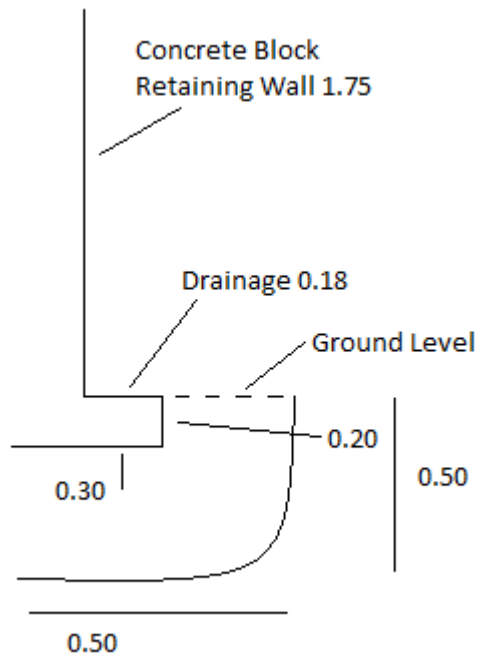
STRATA				SAMPLES & TESTS		
Depth	No		DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30			Grass over dark brown slightly gravelly TOPSOIL with angular to subangular, fine to medium gravel of flint, carbonaceous fragments and rare fragments of red brick. (MADE GROUND)			
0.30-0.65			Soft orange brown slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Occasional carbonaceous fragments. (HEAD DEPOSITS)			
0.65-1.00			Firm red brown gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. (HEAD DEPOSITS)			
1.00			Trial pit terminated.			

Shoring/Support: Stability: Sides stable.				GENERAL REMARKS	
				Soakaway Test undertaken. Backfilled with arisings.	

All dimensions in metres Scale 1:25	Client Surefix Home Improvements	Method/ Plant Used Hand tools	Logged By JT
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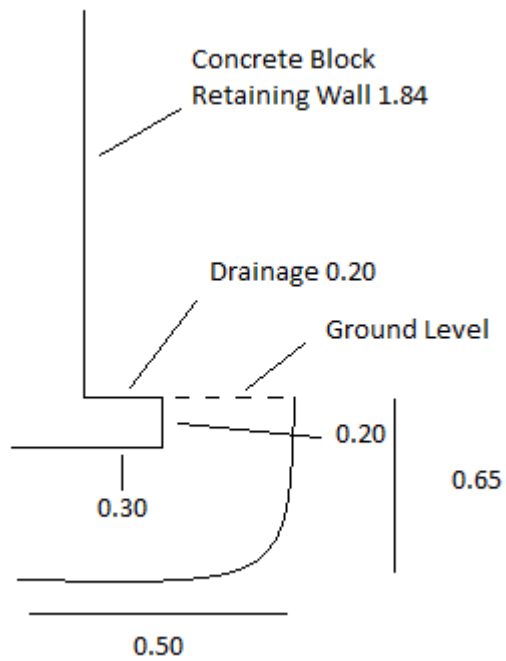
TP 1

GL – 0.02	Tarmac
0.02 – 0.17	Concrete with no rebar
0.17 – 0.50	Soft orangey brown CLAY. (PROBABLE HEAD)



TP 2

GL – 0.03	Tarmac
0.03 – 0.19	Concrete with no rebar
0.19 – 0.65	Very soft orangey brown very sandy CLAY. (PROBABLE HEAD)



APPENDIX C

Geotechnical Laboratory Results



TEST CERTIFICATE

Liquid and Plastic Limits

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



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: The Brownfield Consultancy
Client Address: Woodstock, Memorial Road,
Fenny Compton, Warwickshire,
CV47 2XU
Contact: Jim Twaddle
Site Name: Rose Hill, Waterlooville
Site Address: Not Given

Client Reference: BC486
Job Number: 19-68304
Date Sampled: Not Given
Date Received: 22/10/2019
Date Tested: 28/10/2019
Sampled By: Not Given

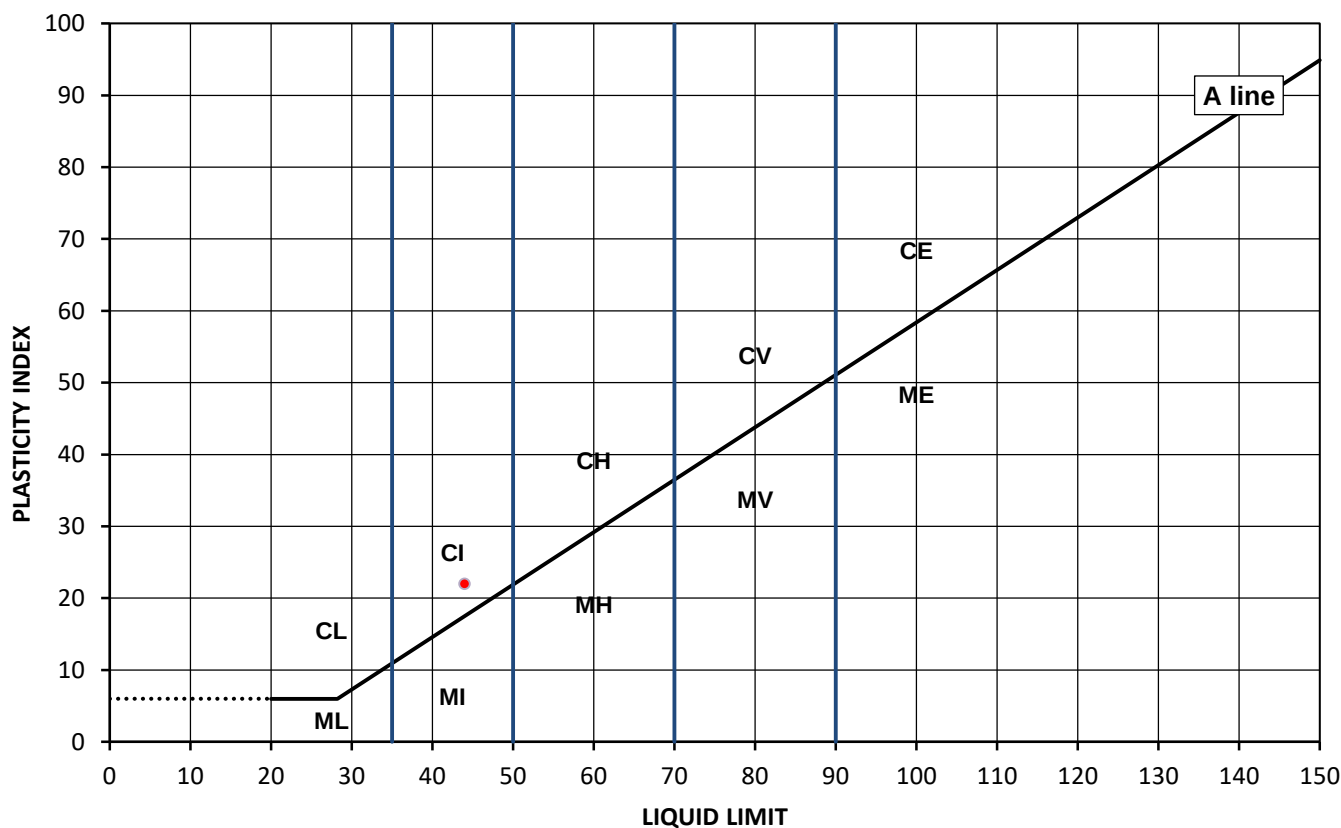
Test Results:

Laboratory Reference: 1343432
Hole No.: WS1
Sample Reference: Not Given
Soil Description: Orangish brown sandy CLAY

Depth Top [m]: 1.20
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
19	44	22	22	100



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

C	Clay	Plasticity	Liquid Limit
M	Silt	L	below 35
		I	35 to 50
		H	50 to 70
		V	70 to 90
		E	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 05/11/2019

Signed: Darren Berrill
Geotechnical General Manager
for and on behalf of i2 Analytical Ltd GF 232.5

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The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland.*

Any assessment of compliance with specifications based the analytical results in a report take in to account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



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Environmental Science

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Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: The Brownfield Consultancy
Client Address: Woodstock, Memorial Road,
Fenny Compton, Warwickshire,
CV47 2XU
Contact: Jim Twaddle
Site Name: Rose Hill, Waterlooville
Site Address: Not Given

Client Reference: BC486
Job Number: 19-68304
Date Sampled: Not Given
Date Received: 22/10/2019
Date Tested: 28/10/2019
Sampled By: Not Given

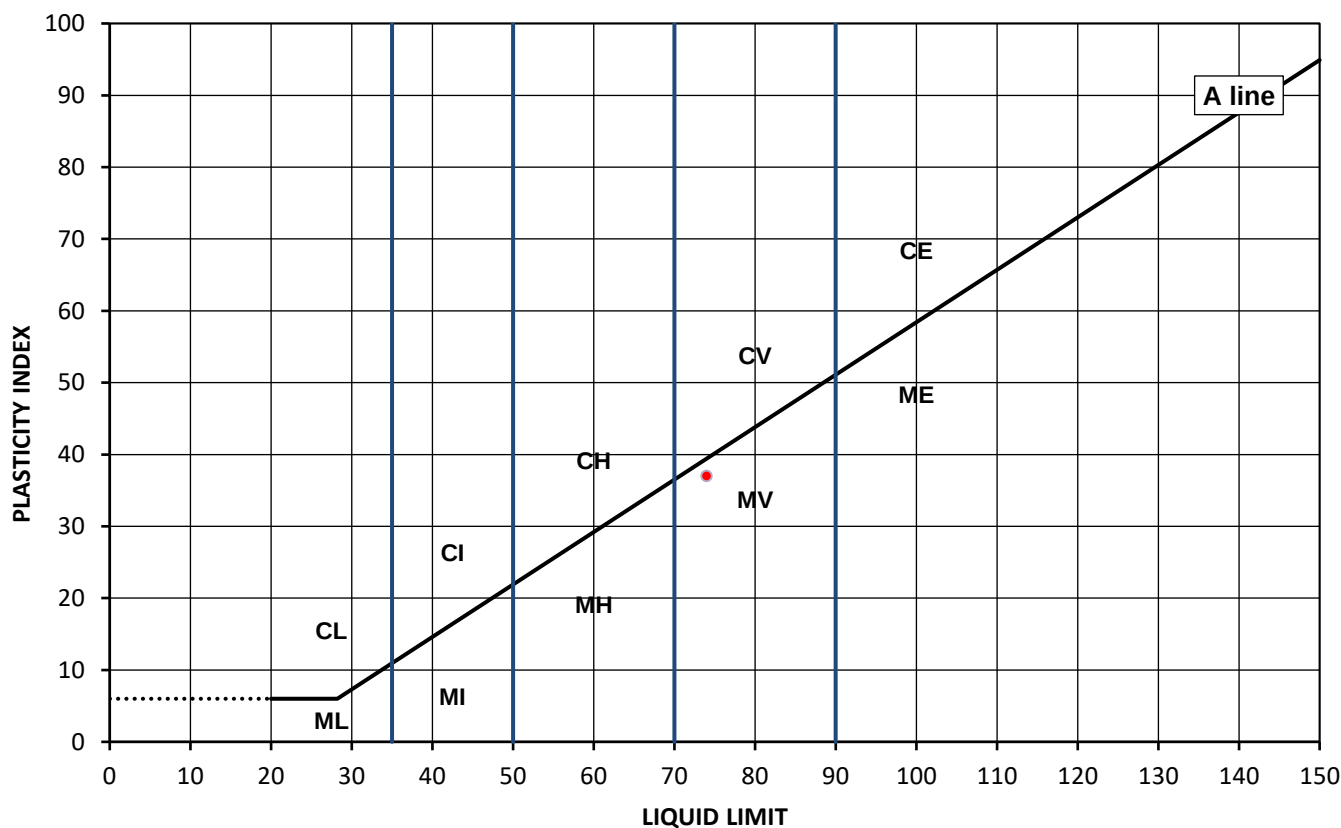
Test Results:

Laboratory Reference: 1343433
Hole No.: WS1
Sample Reference: Not Given
Soil Description: Orangish brown silty CLAY with fragments of chalk

Depth Top [m]: 3.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
49*	74	37	37	100



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

C	Clay	Plasticity	Liquid Limit
M	Silt	L	Low
		I	Medium
		H	High
		V	Very high
		E	Extremely high
			below 35
			35 to 50
			50 to 70
			70 to 90
			exceeding 90
	Organic	O	append to classification for organic material (eg CHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: *Sample is wet

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 05/11/2019

Signed: Darren Berrill
Geotechnical General Manager
for and on behalf of i2 Analytical Ltd GF 232.5

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Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: The Brownfield Consultancy
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Contact: Jim Twaddle
Site Name: Rose Hill, Waterlooville
Site Address: Not Given

Client Reference: BC486
Job Number: 19-68304
Date Sampled: Not Given
Date Received: 22/10/2019
Date Tested: 28/10/2019
Sampled By: Not Given

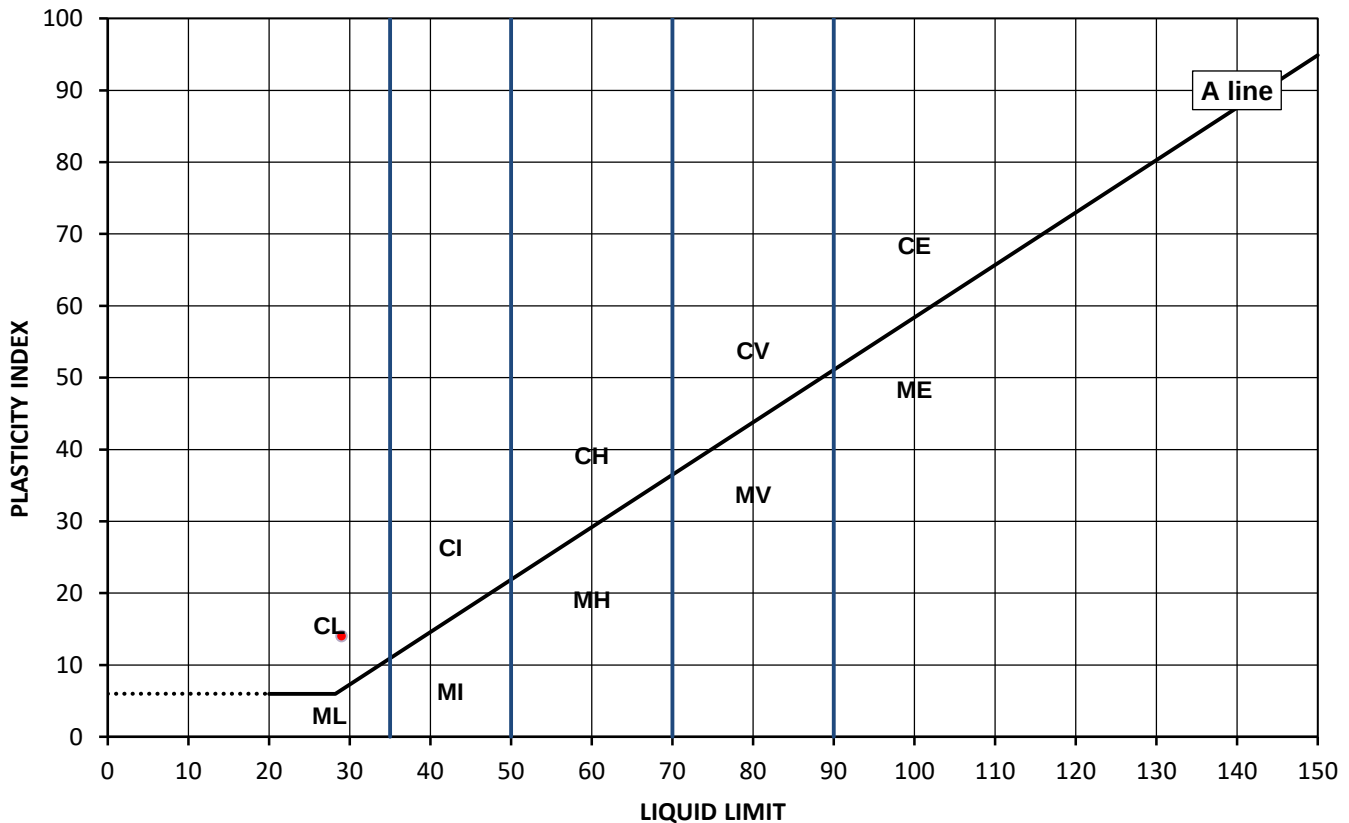
Test Results:

Laboratory Reference: 1343434
Hole No.: WS2
Sample Reference: Not Given
Soil Description: Orangish brown very sandy CLAY

Depth Top [m]: 1.40
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
20	29	15	14	100



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

C	Clay	Plasticity	Liquid Limit
M	Silt	L	below 35
		I	35 to 50
		H	50 to 70
		V	70 to 90
		E	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 05/11/2019

Signed: Darren Berrill
Geotechnical General Manager
for and on behalf of i2 Analytical Ltd GF 232.5

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Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: The Brownfield Consultancy
Client Address: Woodstock, Memorial Road,
Fenny Compton, Warwickshire,
CV47 2XU
Contact: Jim Twaddle
Site Name: Rose Hill, Waterlooville
Site Address: Not Given

Client Reference: BC486
Job Number: 19-68304
Date Sampled: Not Given
Date Received: 22/10/2019
Date Tested: 28/10/2019
Sampled By: Not Given

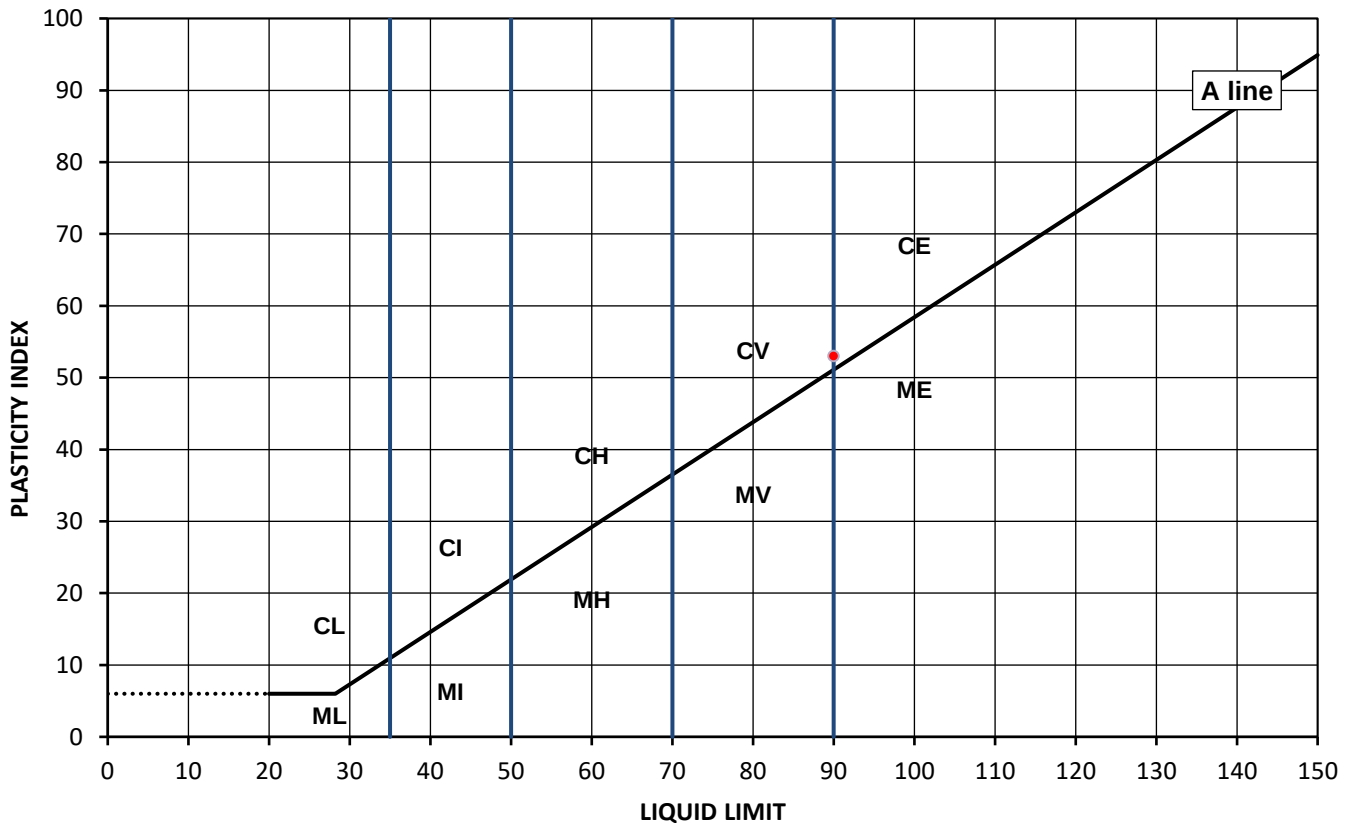
Test Results:

Laboratory Reference: 1343435
Hole No.: WS2
Sample Reference: Not Given
Soil Description: Orangish brown silty CLAY with fragments of chalk

Depth Top [m]: 2.30
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
49*	90	37	53	100



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

C	Clay	Plasticity	Liquid Limit
M	Silt	L	Low
		I	Medium
		H	High
		V	Very high
		E	Extremely high
			below 35
			35 to 50
			50 to 70
			70 to 90
			exceeding 90
	Organic	O	append to classification for organic material (eg CHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: *Sample is wet

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 05/11/2019

Signed: Darren Berrill
Geotechnical General Manager
for and on behalf of i2 Analytical Ltd GF 232.5

*Opinions and interpretations expressed here in are outside of the scope of the UKAS Accreditation.
This report may not be reproduced other than in full without the prior written approval of the issuing laboratory.
The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland.*

Any assessment of compliance with specifications based the analytical results in a report take in to account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



TEST CERTIFICATE

Liquid and Plastic Limits

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



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: The Brownfield Consultancy
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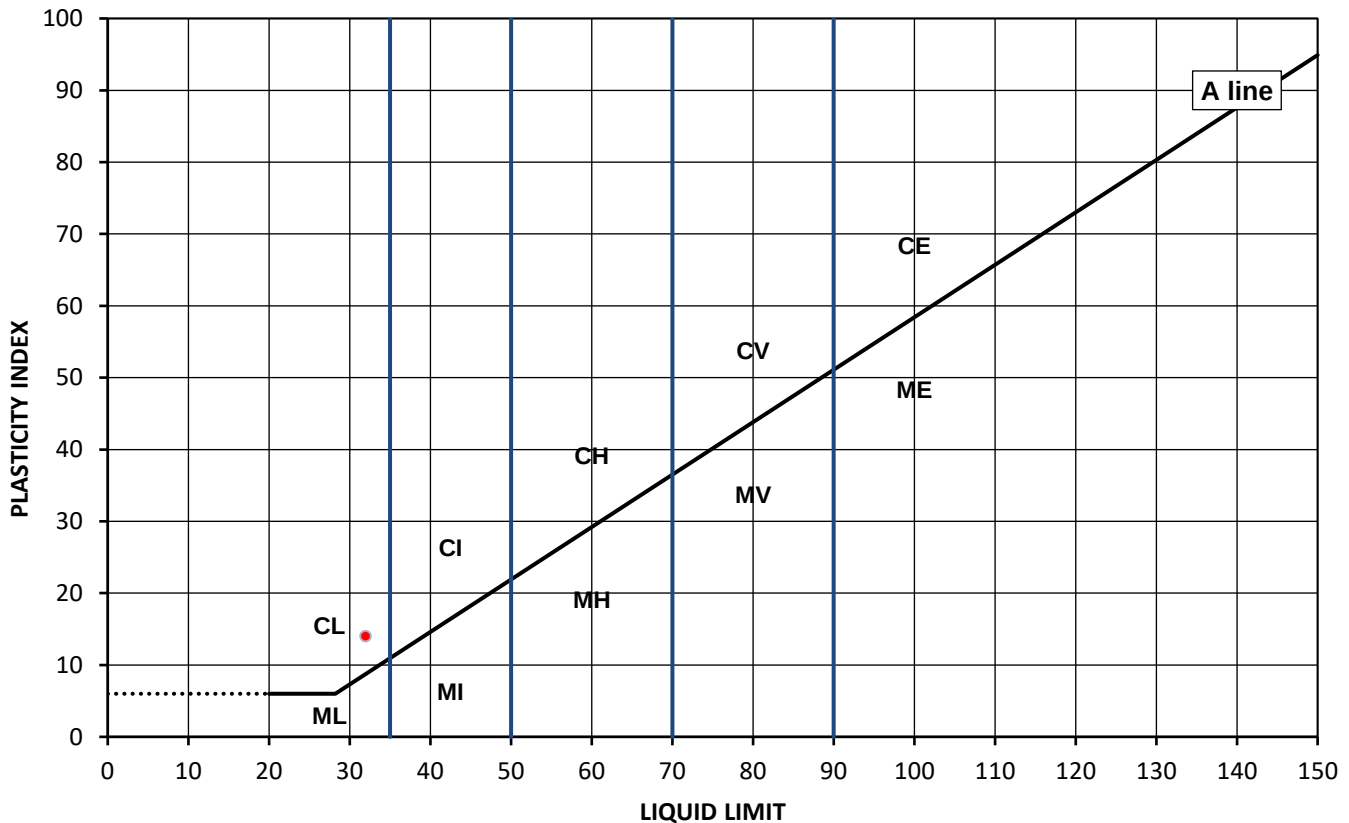
Test Results:

Laboratory Reference: 1343436
Hole No.: WS3
Sample Reference: Not Given
Soil Description: Orangish brown slightly gravelly very sandy CLAY

Depth Top [m]: 1.20
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
28	32	18	14	98



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

C	Clay	Plasticity	Liquid Limit
M	Silt	L	below 35
		I	35 to 50
		H	50 to 70
		V	70 to 90
		E	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 05/11/2019

Signed: Darren Berrill
Geotechnical General Manager
for and on behalf of i2 Analytical Ltd GF 232.5

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SUMMARY REPORT

Summary of Classification Test Results

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



Tested in Accordance with:

MC by BS 1377-2: 1990: Clause 3.2; WC by BS EN 17892-1: 2014; Atterberg
by BS 1377-2: 1990: Clause 4.3, Clause 4.4 and 5; PD by BS 1377-2: 1990:
Clause 8.2

Client Reference: BC486

Job Number: 19-68304

Date Sampled: Not Given

Date Received: 22/10/2019

Date Tested: 28/10/2019

Sampled By: Not Given

Client: The Brownfield Consultancy
Client Address: Woodstock, Memorial Road,
Fenny Compton, Warwickshire,
CV47 2XU
Contact: Jim Twaddle
Site Name: Rose Hill, Waterlooville
Site Address: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	MC	WC	Atterberg				Density			Total Porosity#		
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um	LL	PL	PI	bulk Mg/m3	dry Mg/m3	PD Mg/m3			
1343432	WS1	Not Given	1.20	Not Given	D	Orangish brown sandy CLAY	Atterberg 1 Point	19		100	44	22	22						
1343433	WS1	Not Given	3.00	Not Given	D	Orangish brown silty CLAY with fragments of chalk	Atterberg 1 Point	49*		100	74	37	37						
1343434	WS2	Not Given	1.40	Not Given	D	Orangish brown very sandy CLAY	Atterberg 1 Point	20		100	29	15	14						
1343435	WS2	Not Given	2.30	Not Given	D	Orangish brown silty CLAY with fragments of chalk	Atterberg 1 Point	49*		100	90	37	53						
1343436	WS3	Not Given	1.20	Not Given	D	Orangish brown slightly gravelly very sandy CLAY	Atterberg 1 Point	28		98	32	18	14						

Note: # Non accredited; NP - Non plastic

Comments: *Sample is wet

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 05/11/2019

Signed: Darren Berrill
Geotechnical General Manager
for and on behalf of i2 Analytical Ltd GF 234.7

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation.
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The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."

"Any assessment of compliance with specifications based the analytical results in a report take in to account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

**Jim Twaddle**

The Brownfield Consultancy
Woodstock
Memorial Road
Fenny Compton
Warwickshire
CV47 2XU

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

e: jim.twaddle@brownfieldconsultancy.co.uk

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 19-68313

Project / Site name:	Rose Hill, Waterlooille	Samples received on:	22/10/2019
Your job number:	BC486	Samples instructed on:	23/10/2019
Your order number:		Analysis completed by:	05/11/2019
Report Issue Number:	1	Report issued on:	05/11/2019
Samples Analysed:	4 soil samples		

Signed: 

Zina Abdul Razzak
Senior Quality Specialist

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Iss No 19-68313-1 Rose Hill, Waterlooille BC486

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The results included within the report are representative of the samples submitted for analysis.

Page 1 of 5



Analytical Report Number: 19-68313

Project / Site name: Rose Hill, Waterloooville

Lab Sample Number				1343478	1343479	1343480	1343481	
Sample Reference				WS1	WS1	WS1	WS2	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				5.00	0.60	1.90	1.80	
Date Sampled				Deviating	Deviating	Deviating	Deviating	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	24	14	14	22	
Total mass of sample received	kg	0.001	NONE	0.74	0.60	0.60	0.60	

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	7.6	7.8	7.7	
Total Sulphate as SO ₄	%	0.005	MCERTS	0.042	0.020	0.022	0.029	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0070	0.015	0.0076	0.018	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	7.0	14.8	7.6	18.0	
Total Sulphur	%	0.005	MCERTS	0.015	0.009	0.008	0.014	



Analytical Report Number : 19-68313

Project / Site name: Rose Hill, Waterloooville

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1343478	WS1	None Supplied	5.00	Light grey chalk.**
1343479	WS1	None Supplied	0.60	Light brown clay with gravel.
1343480	WS1	None Supplied	1.90	Brown clay with gravel.
1343481	WS2	None Supplied	1.80	Light brown clay with gravel.

** NON MCERTS MATRIX

Analytical Report Number : 19-68313

Project / Site name: Rose Hill, Waterlooille

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests"	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample Deviation Report



Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS1		S	19-68313	1343478	a			
WS1		S	19-68313	1343479	a			
WS1		S	19-68313	1343480	a			
WS2		S	19-68313	1343481	a			

APPENDIX D

Results of Soakaway Testing

The Brownfield Consultancy	SOIL INFILTRATION TEST
Woodstock Memorial Road Fenny Compton CV47 2XU Tel: 07852881086	Project: Rose Hill, Waterlooville
	Project No: BC486

Test Location: SA1
Test No: 1
Date: 21.10.19

Water level during test

Time mins	Depth m bgl
0	0.330
22	0.340
40	0.350
80	0.370
120	0.385
156	0.395
186	0.415

Trial pit dimensions

depth (m)	1.00
length (m)	0.30
width (m)	0.30

$$f = \frac{V_p}{\alpha_p \times t_p}$$

f = soil infiltration rate
V_p = volume of water from 75% to 25% effective depth
α_p = Internal surface area at 50% effective depth
t_p = time for the water level to fall from 75% to 25% effective depth

time at 75% effective depth (mins)
0

time at 25% effective depth (mins)
0

(from graph)

Calculated Soil Infiltration Rate =
- m/sec

Depth to Water vs Elapsed Time
Elapsed Time, minutes

Time (mins)	0	20	40	60	80	100	120	140	160	180	200
0.35 m bgl	0.330	0.340	0.350								
0.50 m bgl											
0.75 m bgl											

The Brownfield Consultancy

SOIL INFILTRATION TEST

Woodstock
Memorial Road
Fenny Compton
CV47 2XU
Tel: 07852881086

Project:
Rose Hill, Waterlooville

Project No:
BC486

Test Location: WS2

Test No: 1

Date: 21.10.19

Water level during test

Time mins	Depth m bgl
0	0.280
3	0.345
8	0.490
18	0.810
28	1.540
40	2.470
52	2.990
62	3.380
72	3.690
90	4.040
112	4.350

Borehole dimensions

depth (m)	5.45
dia (m)	0.08

$$f = \frac{V_p}{\alpha_p \times t_p}$$

f = soil infiltration rate

V_p = volume of water from 75% to 25% effective depth

α_p = Internal surface area at 50% effective depth

t_p = time for the water level to fall from 75% to 25% effective depth

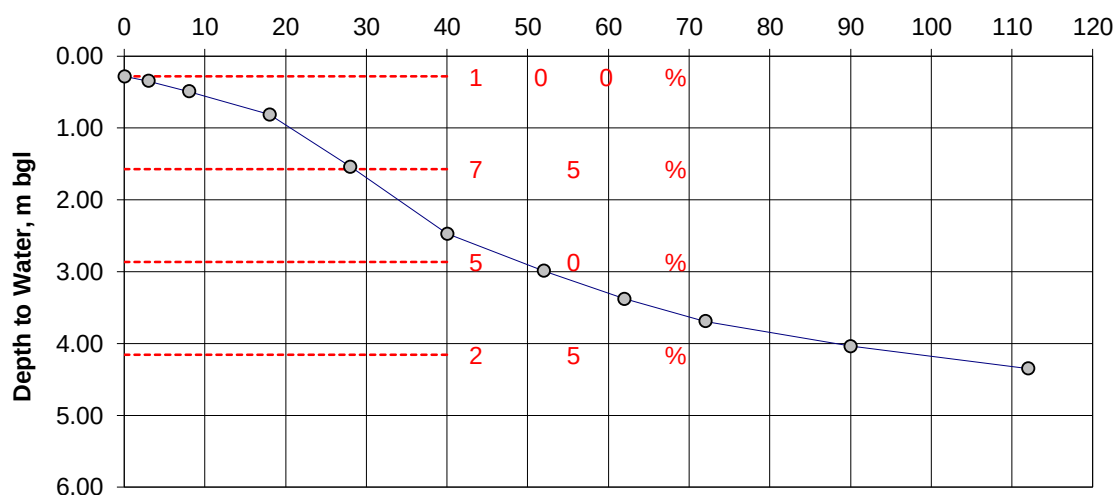
time at 75% effective depth (mins) 28

time at 25% effective depth (mins) 95

(from graph)

Calculated Soil Infiltration Rate = 3.5E-06 m/sec

Depth to Water vs Elapsed Time
Elapsed Time, minutes



APPENDIX E

Limitations

NOTES ON LIMITATIONS

This report has been prepared by the Brownfield Consultancy with all reasonable skill, care and diligence. This report is confidential and has been prepared solely for the benefit of the client as stated at the front of the report in relation to a specific development or scheme; and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from The Brownfield Consultancy; a charge may be levied against such approval. We accept no responsibility or liability for the consequences of this document being used for any purpose or project other than for which it was commissioned, and: this document to any third party with whom an agreement has not been executed.

Any comments given are based on the understanding that the proposed development will be as detailed. The Brownfield Consultancy warrants the accuracy of this report up to and including the published date. Additional information, improved practice or changes in legislation may necessitate this report having to be reviewed in whole or in part after that date.

This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report. Whilst this report and the opinion made herein are correct to the best of our belief we cannot guarantee the accuracy or completeness of any information provided by third parties.

The opinions and recommendations expressed in this report are based on statute, guidance, and appropriate practice current at the date of its preparation. The Brownfield Consultancy does not accept any liability whatsoever for the consequences of any future legislative changes or the release of subsequent guidance documentation, etc. Such changes may render some of the opinions and advice in this report inappropriate or incorrect and we will be pleased to advise if any report requires revision due to changing circumstances. Following delivery of a report we have no obligation to advise the Client or any other party of such changes or their repercussions.

Phase 1 Reports

The work undertaken to provide the basis of a Phase I report comprised a study of available documented information from a variety of sources, together with (where appropriate) a brief walk over inspection of the site. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Historical maps and aerial photographs provide a “snap shot” in time about conditions or activities at the site and cannot be relied upon as indicators of any events or activities that may have taken place at other times.

Phase II Intrusive Investigations

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, and ground and groundwater conditions to allow a reasonable risk assessment to be made. The conclusions and recommendations made in this site appraisal report and the opinions expressed are based on the information reviewed and/or the ground conditions encountered in exploratory holes and the results of any field or laboratory testing undertaken. There may be ground conditions at the site that have not been disclosed by the information reviewed or by the investigative work undertaken. Such undisclosed conditions cannot be taken into account in any analysis and reporting.

Some of the conclusions in this site appraisal report may be based on third party data. No guarantee can be given for the accuracy or completeness of any of the third party data used.

The evaluation and conclusions do not preclude the existence of contamination, which could not reasonably have been revealed by the current work. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. The number of sampling points and the methods of sampling and testing do not preclude the existence of localised “hotspots” of contamination where concentrations may be significantly higher than those actually encountered. Hence this report should be used for information purposes only and should not be construed as a comprehensive characterisation of all site conditions.

It should be noted that groundwater levels, groundwater chemistry, surface water levels, surface water chemistry, soil gas concentrations and soil gas flow rates can vary due to seasonal, climatic, tidal and man-made effects.

The interpretation carried out in this report is based on scientific and engineering appraisal carried out by suitably experienced and qualified technical consultants based on the scope of our engagement. We have not taken into account the perceptions of, for example, banks, insurers, other funders, lay people, etc., unless the report has been prepared specifically for that purpose. Advice from other specialists may be required such as the legal, planning and architecture professions, whether specifically recommended in our report or not.

The objectives of the investigation have been linked to establishing the risks associated with potential human targets, building materials, the environment (including adjacent land), and to surface and ground water. The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to areas unoccupied by the building(s) on the site and by buried services.

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