

# LABORATORY REPORT



4043

**Contract Number: PSL15/0995**

Client's Reference:

Report Date: 10 March 2015

Client Name: Stratus Environmental LTD  
4245 Park Approach  
Thorpe Park  
Leeds  
LS15 8GB

**For the attention of: Andy Coxen**

Contract Title: Halfod Sidewall

Date Received: 27/2/2015

Date Commenced: 27/2/2015

Date Completed: 10/3/2014

**Notes: Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson  
(Director)

A Watkins  
(Director)

M Beastall  
(Laboratory Manager)

D Lambe  
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(Senior Technician)

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Page 1 of

# SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Test Number	Layer Number	Grid Ref	Description of Sample
TL1/C1A/L1	1	T Pad	Reddish brown gravelly very sandy very silty CLAY.
TL1/C2A/L1	1	T Pad	Reddish brown gravelly very sandy very silty CLAY.
TL1/C3A/L1	1	T Pad	Reddish brown gravelly very sandy very silty CLAY.
TL1/C4A/L2	2	T Pad	Reddish brown gravelly very sandy very silty CLAY.
TL1/C5A/L2	2	T Pad	Reddish brown gravelly very sandy very silty CLAY.
TL1/C6A/L2	2	T Pad	Reddish brown gravelly very sandy very silty CLAY.
TL1/L1/Bulk 1	1	T Pad	Reddish brown very gravelly sandy very silty CLAY.
TL1/L2/Bulk 2	2	T Pad	Reddish brown gravelly very sandy very silty CLAY.
A2/L1/C8A	1	A2	Reddish brown gravelly very sandy very silty CLAY.
A4/L1/C10A	1	A4	Reddish brown gravelly very sandy very silty CLAY.
A1/L1/Bulk 3	1	A1	Reddish brown gravelly very sandy very silty CLAY.
A3/L1/Bulk 4	1	A3	Reddish brown gravelly very sandy very silty CLAY.
A5/L1/Bulk 5	1	A5	Reddish brown very gravelly very sandy very silty CLAY.
A1/L2/C12A	2	A1	Reddish brown gravelly very sandy very silty CLAY.
A2/L2/Bulk 6	2	A2	Reddish brown very gravelly very sandy very silty CLAY.
A4/L2/C15A	2	A4	Reddish brown gravelly very sandy very silty CLAY.



**Professional Soils Laboratory**

Compiled by	Date	Checked by	Date	Approved by	Date
	10/03/15		10/03/15		10/03/15
HAFOD SIDEWALL.				Contract No:	PSL15/0995
				Client Ref:	-

(B.S. 1377 : PART 2 : 1990)

**SYMBOLS: NP : Non Plastic**

**HOW**

Compiled by 

Date 10/

Checked by \_\_\_\_\_

<b>Date</b>	10/03/15
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proved by

Date 10/03/15

**HAFOD SIDEWALL.**

**Contract No:** PSL15/0995

**Client Ref:**

**(B.S.5930 : 1999)**

Page of



# Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

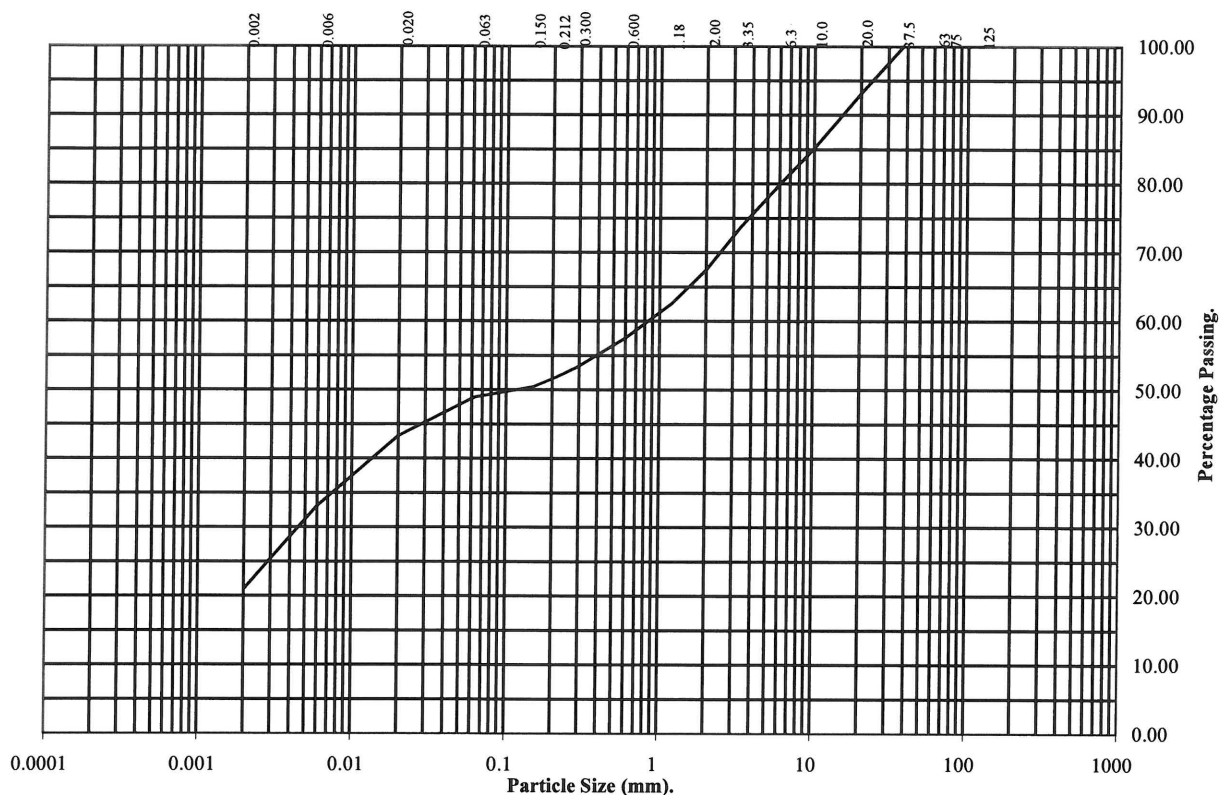
Test Number: TL1/L1/Bulk 1

Grid Ref:

T Pad

Layer: 1

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	93
10	85
6.3	80
3.35	74
2	67
1.18	62
0.6	58
0.3	53
0.212	52
0.15	50
0.063	49

Particle Diameter	Percentage Passing
0.02	43
0.006	33
0.002	21

Soil Fraction	Total Percentage
Cobbles	0
Gravel	33
Sand	18
Silt	28
Clay	21

## Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	10/03/15		10/03/15

**PSL**

Professional Soils Laboratory

HAFOD SIDEWALL.

Contract No.:  
PSL15/0995

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

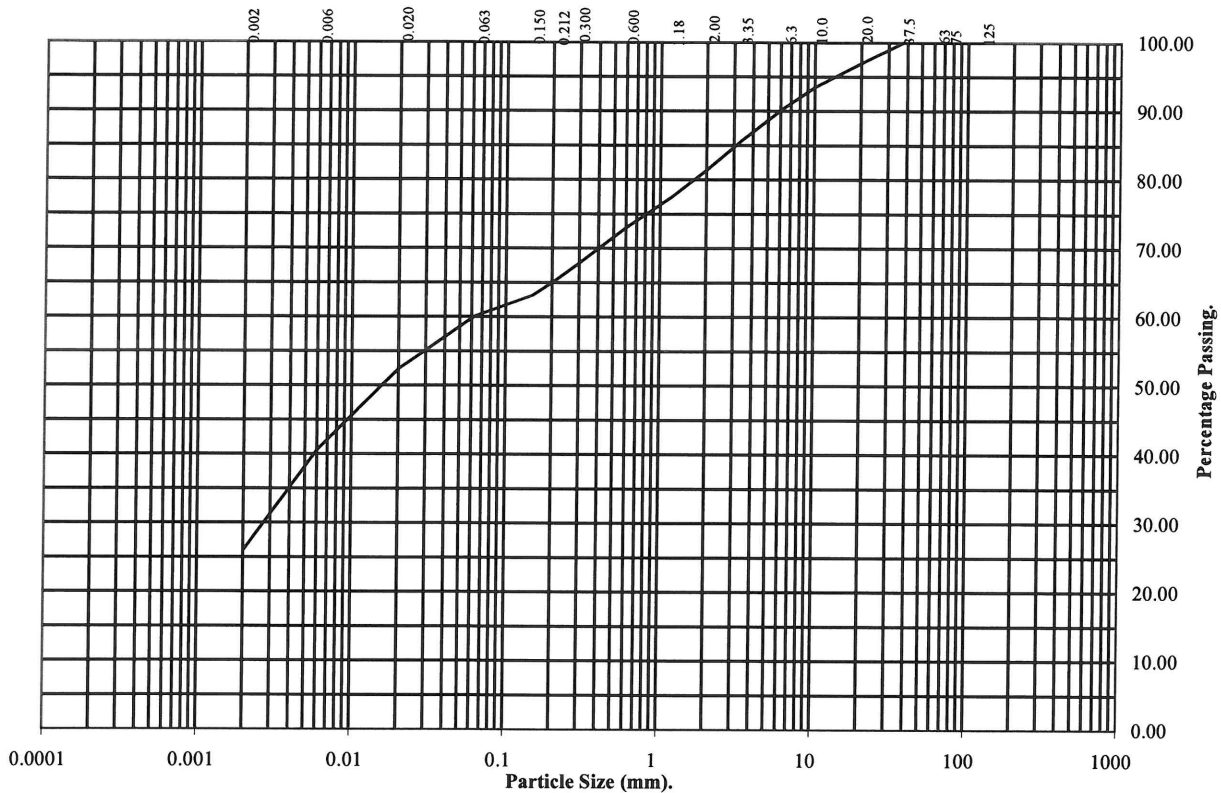
Test Number: TL1/L2/Bulk 2

Grid Ref:

T Pad

Layer: 2

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	97
10	93
6.3	90
3.35	86
2	81
1.18	77
0.6	73
0.3	68
0.212	65
0.15	63
0.063	60

Particle Diameter	Percentage Passing
0.02	52
0.006	41
0.002	26

Soil Fraction	Total Percentage
Cobbles	0
Gravel	19
Sand	21
Silt	34
Clay	26

**Remarks:**

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	10/03/15		10/03/15

**PSL**

Professional Soils Laboratory

HAFOD SIDEWALL.

Contract No.:  
PSL15/0995

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

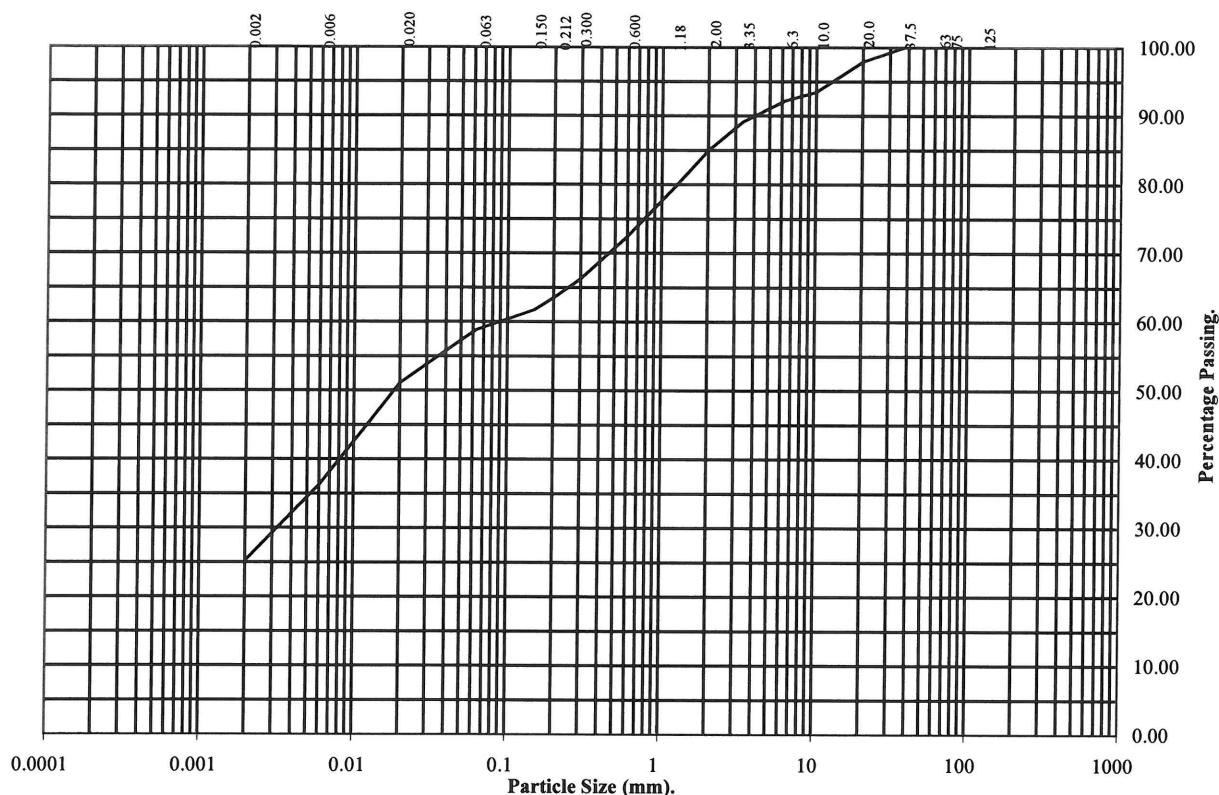
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Test Number: A1/L1/Bulk 3

Grid Ref: A1

Layer: 1

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	98
10	93
6.3	92
3.35	89
2	85
1.18	79
0.6	72
0.3	66
0.212	64
0.15	62
0.063	59

Particle Diameter	Percentage Passing
0.02	51
0.006	36
0.002	25

Soil Fraction	Total Percentage
Cobbles	0
Gravel	15
Sand	26
Silt	34
Clay	25

## Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	10/03/15		10/03/15

**PSL**

Professional Soils Laboratory

HAFOD SIDEWALL.

Contract No.:  
PSL15/0995

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

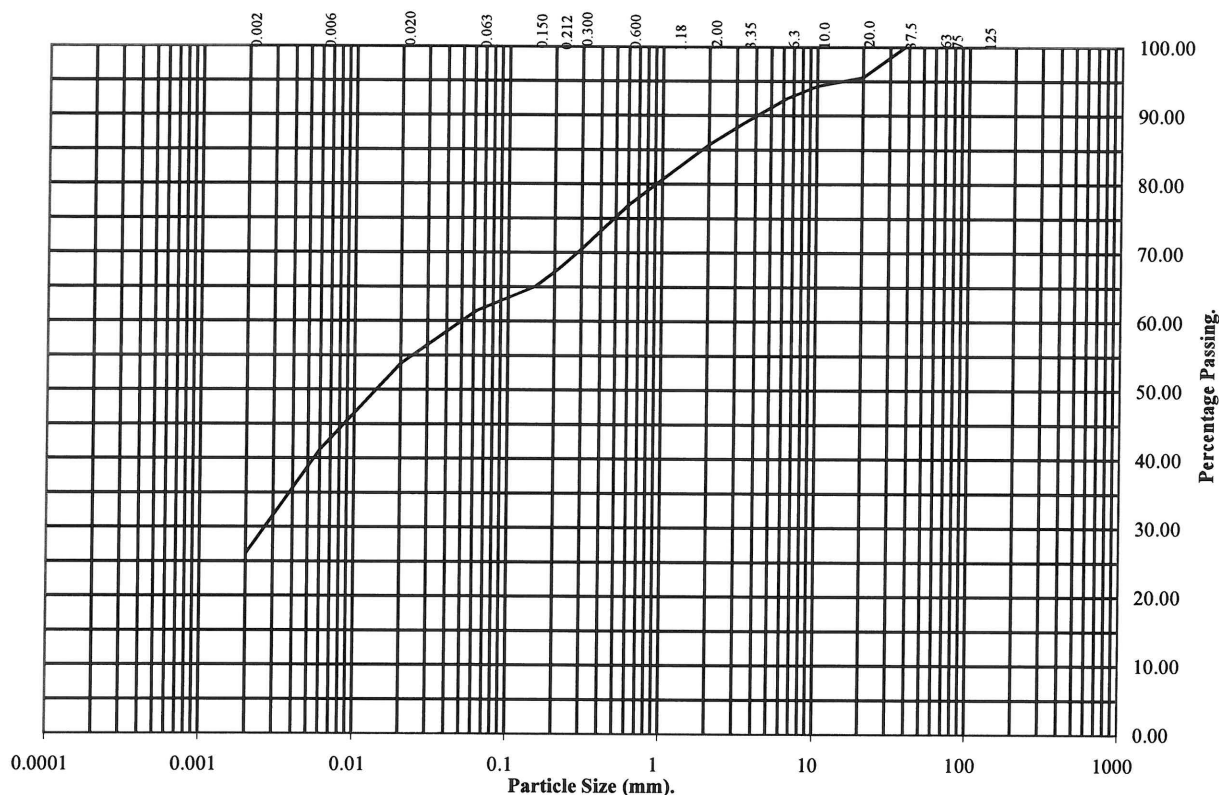
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Test Number: A3/L1/Bulk 4

Grid Ref: A3

Layer: 1

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	94
6.3	92
3.35	89
2	86
1.18	82
0.6	77
0.3	71
0.212	68
0.15	65
0.063	62

Particle Diameter	Percentage Passing
0.02	54
0.006	41
0.002	26

Soil Fraction	Total Percentage
Cobbles	0
Gravel	14
Sand	24
Silt	36
Clay	26

**Remarks:**  
See summary of soil descriptions.

Checked By	Date	Approved By	Date
<i>[Signature]</i>	10/03/15	<i>[Signature]</i>	10/03/15

**PSL**

Professional Soils Laboratory

HAFOD SIDEWALL.

Contract No.:  
PSL15/0995

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

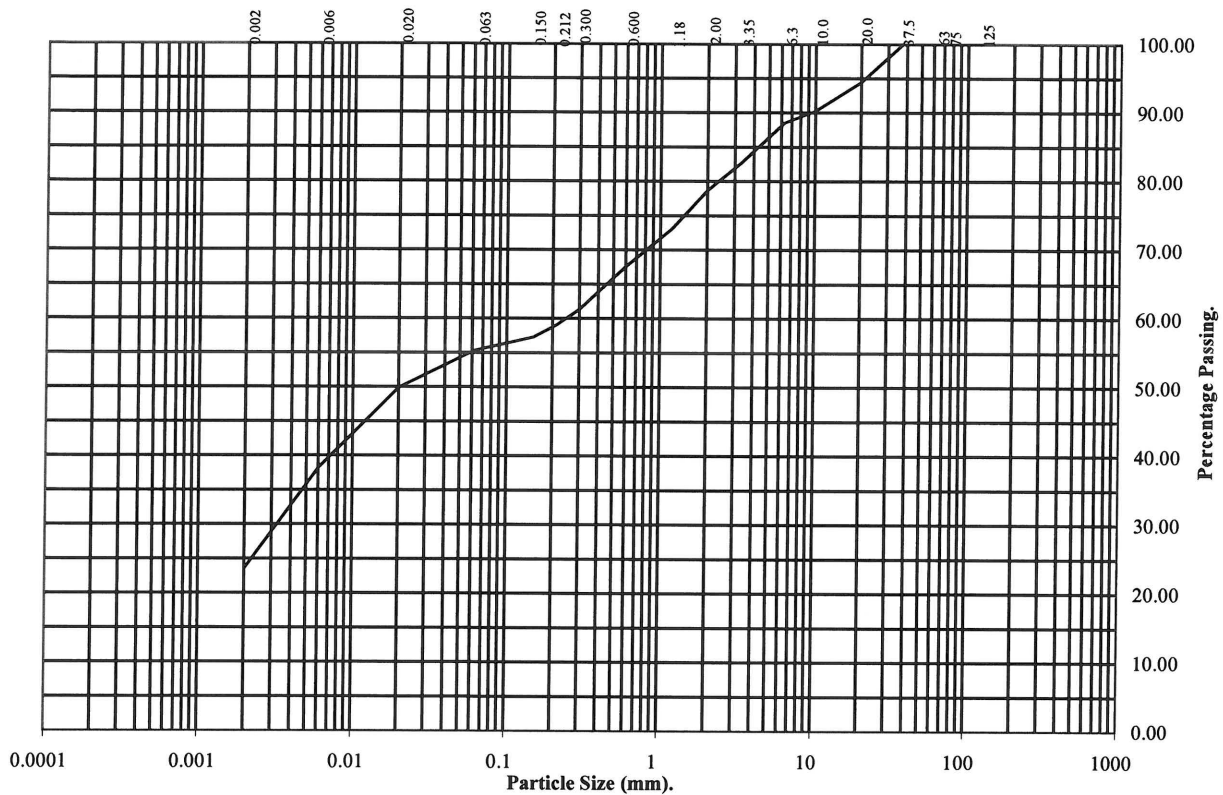
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Test Number: A5/L1/Bulk 5

Grid Ref: A5

Layer: 1

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	90
6.3	89
3.35	83
2	79
1.18	73
0.6	68
0.3	61
0.212	59
0.15	57
0.063	55

Particle Diameter	Percentage Passing
0.02	50
0.006	38
0.002	23

Soil Fraction	Total Percentage
Cobbles	0
Gravel	21
Sand	24
Silt	32
Clay	23

## Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	10/03/15		10/03/15

**PSL**

Professional Soils Laboratory

HAFOD SIDEWALL.

Contract No.:  
PSL15/0995

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

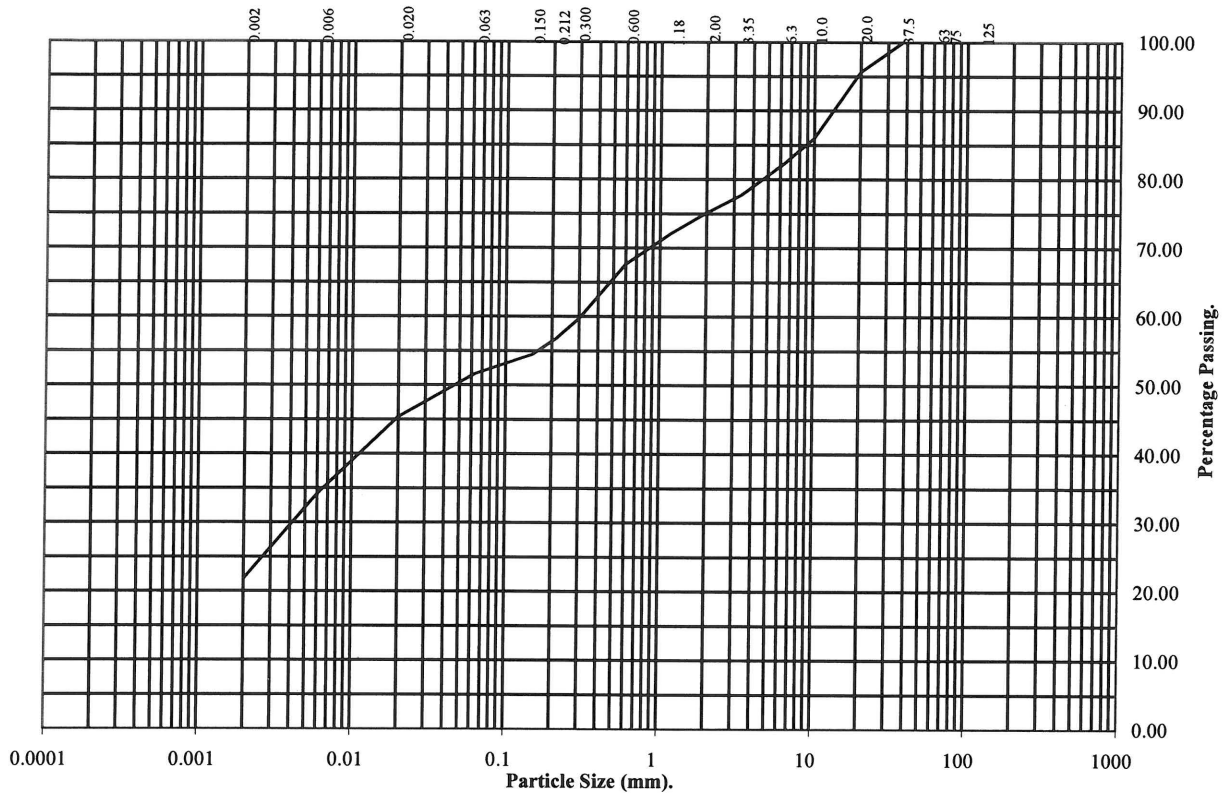
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Test Number: A2/L2/Bulk 6

Grid Ref: A2

Layer: 2

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	86
6.3	82
3.35	78
2	75
1.18	72
0.6	68
0.3	60
0.212	57
0.15	54
0.063	52

Particle Diameter	Percentage Passing
0.02	45
0.006	34
0.002	22

Soil Fraction	Total Percentage
Cobbles	0
Gravel	25
Sand	23
Silt	30
Clay	22

## Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	10/03/15		10/03/15

**PSL**

Professional Soils Laboratory

HAFOD SIDEWALL.

Contract No.:  
PSL15/0995



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407593

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Size Distribution (PSD) of a soil sample-  
washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2**  
Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	<b>Yes</b>
Laboratory Ref. No:	<b>S51811</b>
Client Ref. No:	<b>CT1</b>
Date and Time of Sampling:	<b>09/03/2015</b>
Date of Receipt at Lab:	<b>17/03/2015</b>
Date of Start of Test:	<b>20/03/2015</b>
Sampling Location:	<b>Western Upper Sidewall</b>
Name of Source:	<b>Unknown</b>
Method of Sampling:	<b>Disturbed Bulk Sample</b>
Sampled By:	<b>Client</b>
Material Description:	<b>Red/brown slightly gravelly very sandy silty CLAY</b>
Target Specification:	<b>N/A</b>

**RESULTS:**

**SEE ATTACHED**


**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: - 

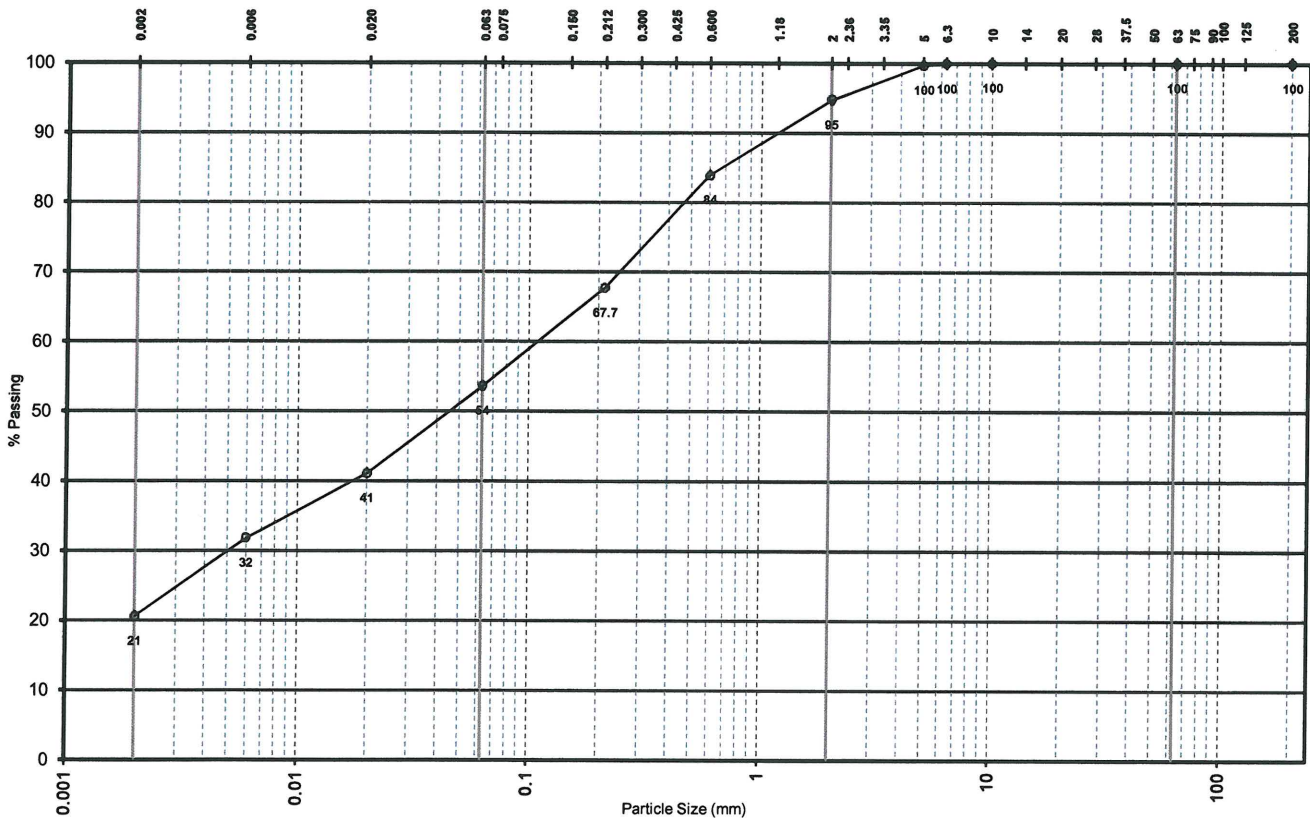
Eric Goulden  
Technical Manager

Test Report Ref: STR 407593: Page 2 of 2

**MATERIAL DESCRIPTION**

Red/brown slightly gravelly very sandy silty CLAY

Method of pre-treatment:		N/A			
Sieve Size mm	% Passing	Sieve Size mm	% Passing	Cobbles	0.0
				Gravel	5.3
				Sand	41.1
200	100.0	3.35		Silt	33.0
125		2.36		Clay	20.6
100		2.0	94.7		
90		1.18			
75		0.600	83.9		
63	100.0	0.425			
50		0.300			
37.5		0.212	67.7		
28		0.150			
20		0.075			
14		0.063	53.6		
10	100.0	0.020	41.1		
6.3	99.9	0.006	31.8		
5.0	99.7	0.002	20.6		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine 0.002	Medium 0.006	Coarse 0.02	Fine 0.063	Medium 0.2	Coarse 0.63	Fine 2.0	Medium 6.3	Coarse 20	

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407592

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Density of Soil – Gas Jar method, in accordance with **BS 1377 : Part 2 : 1990 : Clause 8.2.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	CT1
Date and Time of Sampling:	09/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification	N/A

**RESULTS:**

**Particle Density = 2.70 Mg/m<sup>3</sup>**

**Comments**


None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: -



Eric Goulden  
Technical Manager



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407591

LS15 8GB

Order No: 819/CE1005/Rclarke

Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Plastic Limit, Liquid Limit, and Plasticity Index of sample in accordance with  
**BS 1377:Part 2:1990 Clause 5.3, Clause 4.3, and Clause 5.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. :	CT1
Date and Time of Sampling:	09/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Soil Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A

**RESULTS:**

History of sample:	:	Natural state/After wet sieving
% Materials passing 425µm	=	76
Plastic Limit	=	17
Liquid Limit	=	43
Plasticity Index	=	26

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by:



Eric Goulden  
Technical Manager

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407590

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Undrained Shear Strength in Triaxial Compression  
Without Measurement of Pore Pressure in accordance with  
**BS 1377-7: 1990 Clause 8**

**SAMPLE DETAILS:**

Certificate of sampling received:	<b>Yes</b>
Laboratory Ref. No:	<b>S51811</b>
Client Ref. No:	<b>USS1</b>
Date and Time of Sampling:	<b>09/03/2015</b>
Date of Receipt at Lab:	<b>17/03/2015</b>
Date of Start of Test:	<b>25/03/2015</b>
Sampling Location:	<b>Western Upper Sidewall</b>
Name of Source:	<b>Unknown</b>
Method of Sampling:	<b>U38 Tube</b>
Sampled By:	<b>Client</b>
Material Description:	<b>Red/brown slightly gravelly very sandy silty CLAY</b>
Target Specification:	<b>N/A</b>

**RESULTS:**

**See attached**

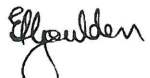
**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: - 

Eric Goulden  
Technical Manager

Test Report Ref: STR 407590 - Page 2 of 2

Sample Condition:

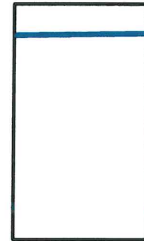
UNDISTURBED/REMOULDED\*

If remoulded state method of compaction:

~~2.5kg rammer/4.5kg rammer~~\*

\* Delete as appropriate.

ORIENTATION AND POSITION OF UNDISTURBED SAMPLE  
WITHIN SAMPLING CONTAINER



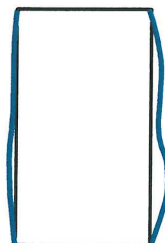
Initial Specimen Length	76 mm
Initial Specimen Diameter	38 mm
Initial Moisture Content	13.7 %
Bulk Density	2.133 Mg/m <sup>3</sup>
Dry Density	1.876 Mg/m <sup>3</sup>
Rate of Strain	1.0 %/min
Latex Membrane Thickness	0.2 mm
Membrane Correction	2.0 kPa
Cell Pressure	200 kPa
Corrected Maximum Deviator Stress at failure	364 kPa
Strain at Failure	20.0 %
<b>Shear Strength C<sub>u</sub></b>	<b>182 kPa</b>

Mode of Failure: Plastic Failure-(Barrelling) \*

~~Brittle Failure (Shear Plane) \*~~

~~Intermediate Type \*~~

\* Delete as appropriate.





Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407596

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Size Distribution (PSD) of a soil sample-  
washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2**  
Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	CT2
Date and Time of Sampling:	09/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	20/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A


**RESULTS:**

**SEE ATTACHED**

**Comments**

None

Certificate  
Prepared by:-   
Meical Owen  
Assistant Laboratory Manager

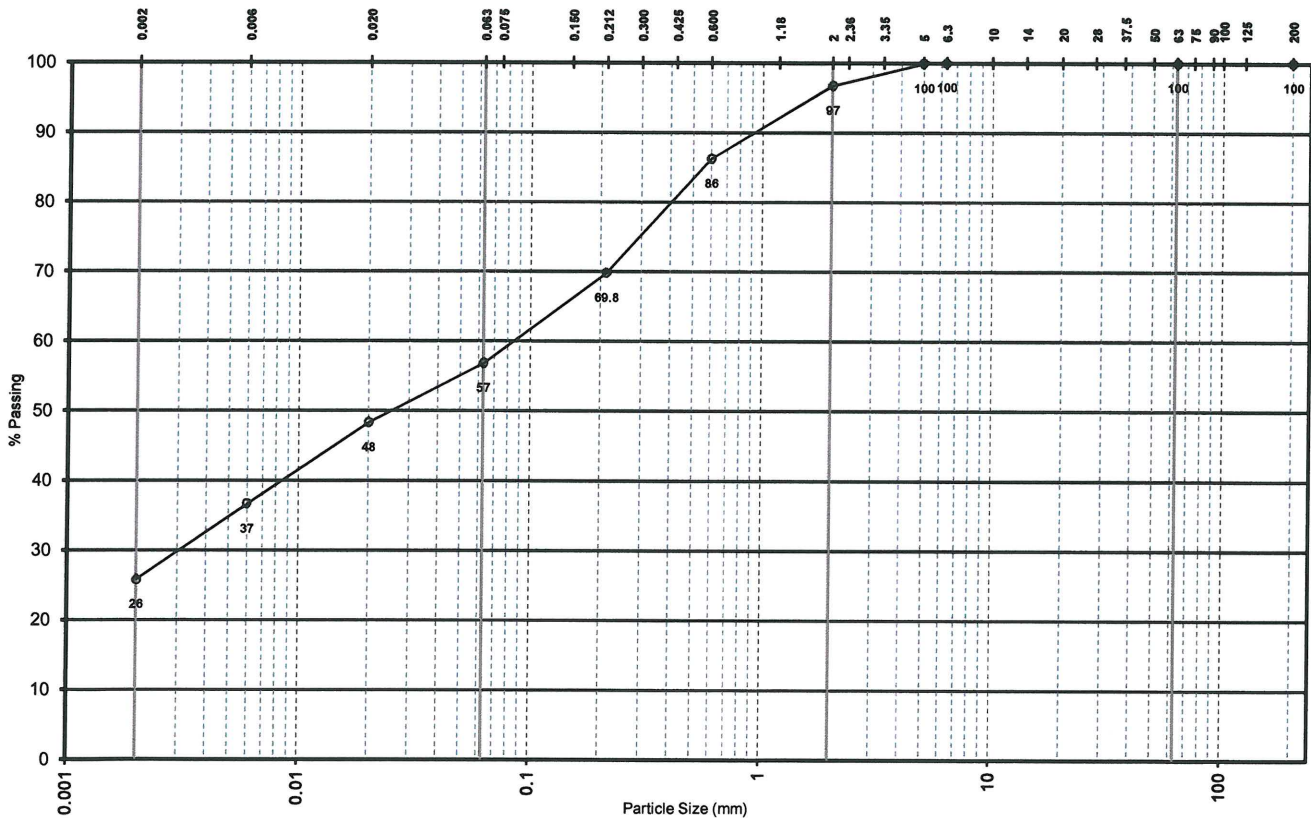
Approved by: -   
Eric Goulden  
Technical Manager

Test Report Ref: STR 407596: Page 2 of 2

**MATERIAL DESCRIPTION**

Red/brown slightly gravelly very sandy silty CLAY

Method of pre-treatment:		N/A			
Sieve Size mm	% Passing	Sieve Size mm	% Passing	Cobbles	0.0
				Gravel	3.3
				Sand	39.9
200	100.0	3.35		Silt	31.0
125		2.36		Clay	25.8
100		2.0	96.7		
90		1.18			
75		0.600	86.2		
63	100.0	0.425			
50		0.300			
37.5		0.212	69.8		
28		0.150			
20		0.075			
14		0.063	56.8		
10		0.020	48.3		
6.3	100.0	0.006	36.6		
5.0	99.9	0.002	25.8		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
	0.002	0.006	0.02	0.063	0.2	0.63	2.0	6.3	20	63 200

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407595

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Particle Density of Soil – Gas Jar method, in accordance with **BS 1377 : Part 2 : 1990 : Clause 8.2.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	CT2
Date and Time of Sampling:	09/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification	N/A

**RESULTS:**

**Particle Density = 2.72 Mg/m<sup>3</sup>**


**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: - 

Eric Goulden  
Technical Manager



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407594

LS15 8GB

Order No: 819/CE1005/Rclarke

Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Plastic Limit, Liquid Limit, and Plasticity Index of sample in accordance with  
**BS 1377:Part 2:1990 Clause 5.3, Clause 4.3, and Clause 5.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. :	CT2
Date and Time of Sampling:	09/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Soil Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A

**RESULTS:**

History of sample:	:	<del>Natural state</del> /After wet sieving
% Materials passing 425µm	=	79
Plastic Limit	=	16
Liquid Limit	=	35
Plasticity Index	=	19

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by:



Eric Goulden  
Technical Manager

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407598

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Undrained Shear Strength in Triaxial Compression  
Without Measurement of Pore Pressure in accordance with  
**BS 1377-7: 1990 Clause 8**

**SAMPLE DETAILS:**

Certificate of sampling received:	<b>Yes</b>
Laboratory Ref. No:	<b>S51811</b>
Client Ref. No:	<b>USS2</b>
Date and Time of Sampling:	<b>10/03/2015</b>
Date of Receipt at Lab:	<b>17/03/2015</b>
Date of Start of Test:	<b>25/03/2015</b>
Sampling Location:	<b>Western Upper Sidewall</b>
Name of Source:	<b>Unknown</b>
Method of Sampling:	<b>U38 Tube</b>
Sampled By:	<b>Client</b>
Material Description:	<b>Red/brown slightly gravelly very sandy silty CLAY</b>
Target Specification:	<b>N/A</b>

**RESULTS:**

**See attached**

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: -



Eric Goulden  
Technical Manager

Test Report Ref: STR 407598 - Page 2 of 2

Sample Condition:

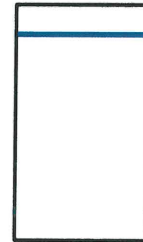
UNDISTURBED/REMOULDED\*

If remoulded state method of compaction:

~~2.5kg rammer/4.5kg rammer~~\*

\* Delete as appropriate.

ORIENTATION AND POSITION OF UNDISTURBED SAMPLE  
WITHIN SAMPLING CONTAINER



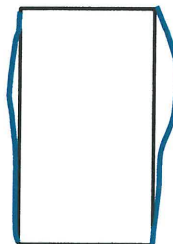
Initial Specimen Length	75 mm
Initial Specimen Diameter	38 mm
Initial Moisture Content	15.8 %
Bulk Density	2.111 Mg/m <sup>3</sup>
Dry Density	1.823 Mg/m <sup>3</sup>
Rate of Strain	1.5 %/min
Latex Membrane Thickness	0.2 mm
Membrane Correction	2.0 kPa
Cell Pressure	200 kPa
Corrected Maximum Deviator Stress at failure	289 kPa
Strain at Failure	20.0 %
<b>Shear Strength C<sub>u</sub></b>	<b>145 kPa</b>

Mode of Failure: Plastic Failure-(Barrelling) \*

~~Brittle Failure (Shear Plane) \*~~

~~Intermediate Type \*~~

\* Delete as appropriate.





Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407601

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Size Distribution (PSD) of a soil sample-  
washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2**  
Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	<b>Yes</b>
Laboratory Ref. No:	<b>S51811</b>
Client Ref. No:	<b>CT3</b>
Date and Time of Sampling:	<b>10/03/2015</b>
Date of Receipt at Lab:	<b>17/03/2015</b>
Date of Start of Test:	<b>20/03/2015</b>
Sampling Location:	<b>Western Upper Sidewall</b>
Name of Source:	<b>Unknown</b>
Method of Sampling:	<b>Disturbed Bulk Sample</b>
Sampled By:	<b>Client</b>
Material Description:	<b>Red/brown slightly gravelly very sandy silty CLAY</b>
Target Specification:	<b>N/A</b>

**RESULTS:**

**SEE ATTACHED**

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: -



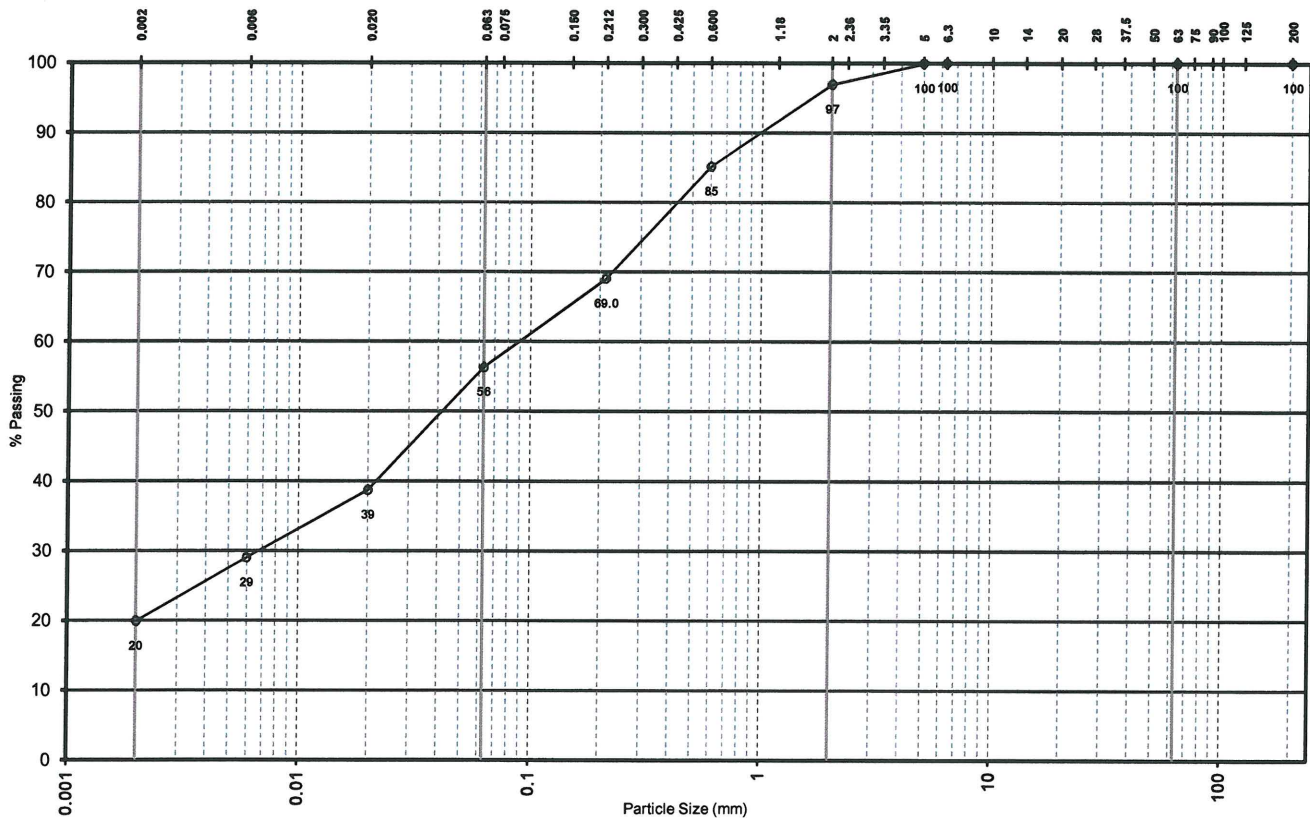
Eric Goulden  
Technical Manager

Test Report Ref: STR 407601: Page 2 of 2

**MATERIAL DESCRIPTION**

Red/brown slightly gravelly very sandy silty CLAY

Method of pre-treatment:		N/A			
Sieve Size mm	% Passing	Sieve Size mm	% Passing	Cobbles	0.0
				Gravel	3.1
				Sand	40.6
				Silt	36.4
				Clay	19.9
200	100.0	3.35			
125		2.36			
100		2.0	96.9		
90		1.18			
75		0.600	85.1		
63	100.0	0.425			
50		0.300			
37.5		0.212	69.0		
28		0.150			
20		0.075			
14		0.063	56.3		
10		0.020	38.7		
6.3	100.0	0.006	29.0		
5.0	99.9	0.002	19.9		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine 0.002	Medium 0.006	Coarse 0.02	Fine 0.063	Medium 0.2	Coarse 0.63	Fine 2.0	Medium 6.3	Coarse 20	

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407600

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Density of Soil – Gas Jar method, in accordance with **BS 1377 : Part 2 : 1990 : Clause 8.2.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	CT3
Date and Time of Sampling:	10/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification	N/A

**RESULTS:**

**Particle Density = 2.73 Mg/m<sup>3</sup>**

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: -



Eric Goulden  
Technical Manager



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407599

LS15 8GB

Order No: 819/CE1005/Rclarke

Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Plastic Limit, Liquid Limit, and Plasticity Index of sample in accordance with  
**BS 1377:Part 2:1990 Clause 5.3, Clause 4.3, and Clause 5.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. :	CT3
Date and Time of Sampling:	10/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Soil Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A

**RESULTS:**

History of sample:	:	Natural state/After wet sieving
% Materials passing 425µm	=	78
Plastic Limit	=	15
Liquid Limit	=	35
Plasticity Index	=	20

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by:



Eric Goulden  
Technical Manager

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407604

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Size Distribution (PSD) of a soil sample-  
washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2**  
Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	CT4
Date and Time of Sampling:	12/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	20/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A

**RESULTS:**

**SEE ATTACHED**


**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: - 

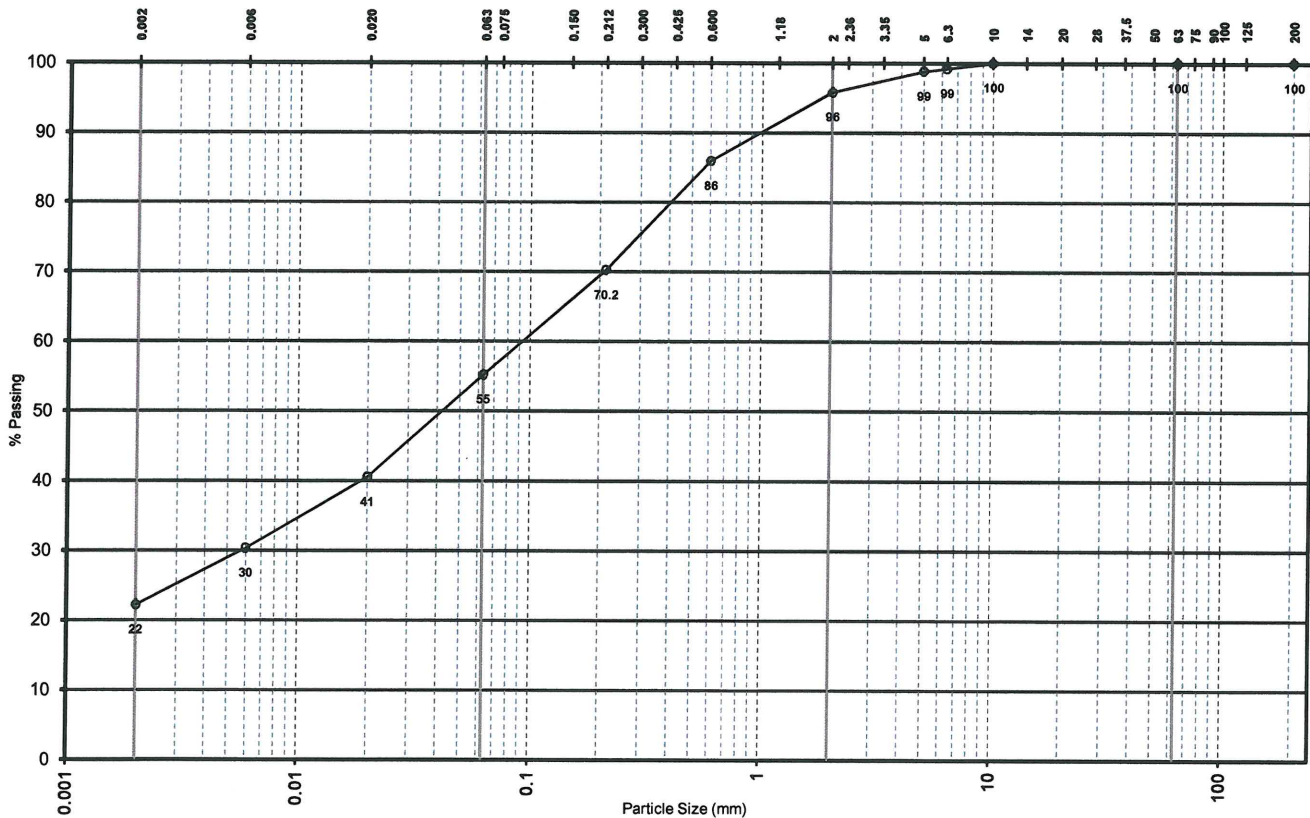
Eric Goulden  
Technical Manager

Test Report Ref: STR 407604: Page 2 of 2

**MATERIAL DESCRIPTION**

Red/brown slightly gravelly very sandy silty CLAY

Method of pre-treatment:		N/A			
Sieve Size mm	% Passing	Sieve Size mm	% Passing	Cobbles	0.0
				Gravel	4.2
				Sand	40.6
200	100.0	3.35		Silt	33.0
125		2.36		Clay	22.2
100		2.0	95.8		
90		1.18			
75		0.600	85.9		
63	100.0	0.425			
50		0.300			
37.5		0.212	70.2		
28		0.150			
20		0.075			
14		0.063	55.2		
10	100.0	0.020	40.5		
6.3	99.2	0.006	30.3		
5.0	98.8	0.002	22.2		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	0.002	0.006	0.02	0.063	0.2	0.63	2.0	6.3	20	
	SILT			SAND			GRAVEL			
										63 200



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407603

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Density of Soil – Gas Jar method, in accordance with **BS 1377 : Part 2 : 1990 : Clause 8.2.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	CT4
Date and Time of Sampling:	12/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification	N/A

**RESULTS:**

Particle Density = 2.72 Mg/m<sup>3</sup>

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: - 

Eric Goulden  
Technical Manager

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407602

LS15 8GB

Order No: 819/CE1005/Rclarke

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Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Plastic Limit, Liquid Limit, and Plasticity Index of sample in accordance with  
**BS 1377:Part 2:1990 Clause 5.3, Clause 4.3, and Clause 5.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. :	CT4
Date and Time of Sampling:	12/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Soil Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A

**RESULTS:**

History of sample:	:	<del>Natural state</del> /After wet sieving
% Materials passing 425µm	=	79
Plastic Limit	=	16
Liquid Limit	=	37
Plasticity Index	=	21

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by:



Eric Goulden  
Technical Manager

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407605

LS15 8GB

Order No: 819/CE1005/Rclarke

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Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Plastic Limit, Liquid Limit, and Plasticity Index of sample in accordance with  
**BS 1377:Part 2:1990 Clause 5.3, Clause 4.3, and Clause 5.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. :	CT5
Date and Time of Sampling:	16/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Soil Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A

**RESULTS:**

History of sample:	:	<del>Natural state</del> /After wet sieving
% Materials passing 425µm	=	74
Plastic Limit	=	16
Liquid Limit	=	34
Plasticity Index	=	18

**Comments**

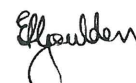
None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by:



Eric Goulden  
Technical Manager

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407606

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Particle Density of Soil – Gas Jar method, in accordance with **BS 1377 : Part 2 : 1990 : Clause 8.2.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	CT5
Date and Time of Sampling:	16/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification	N/A

**RESULTS:**

Particle Density = **2.73 Mg/m<sup>3</sup>**

**Comments**

None


Certificate

Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: -



Eric Goulden  
Technical Manager



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407607

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Size Distribution (PSD) of a soil sample-  
washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2**  
Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	<b>Yes</b>
Laboratory Ref. No:	<b>S51811</b>
Client Ref. No:	<b>CT5</b>
Date and Time of Sampling:	<b>16/03/2015</b>
Date of Receipt at Lab:	<b>17/03/2015</b>
Date of Start of Test:	<b>20/03/2015</b>
Sampling Location:	<b>Western Upper Sidewall</b>
Name of Source:	<b>Unknown</b>
Method of Sampling:	<b>Disturbed Bulk Sample</b>
Sampled By:	<b>Client</b>
Material Description:	<b>Red/brown slightly gravelly very sandy silty CLAY</b>
Target Specification:	<b>N/A</b>

**RESULTS:**

**SEE ATTACHED**


**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: - 

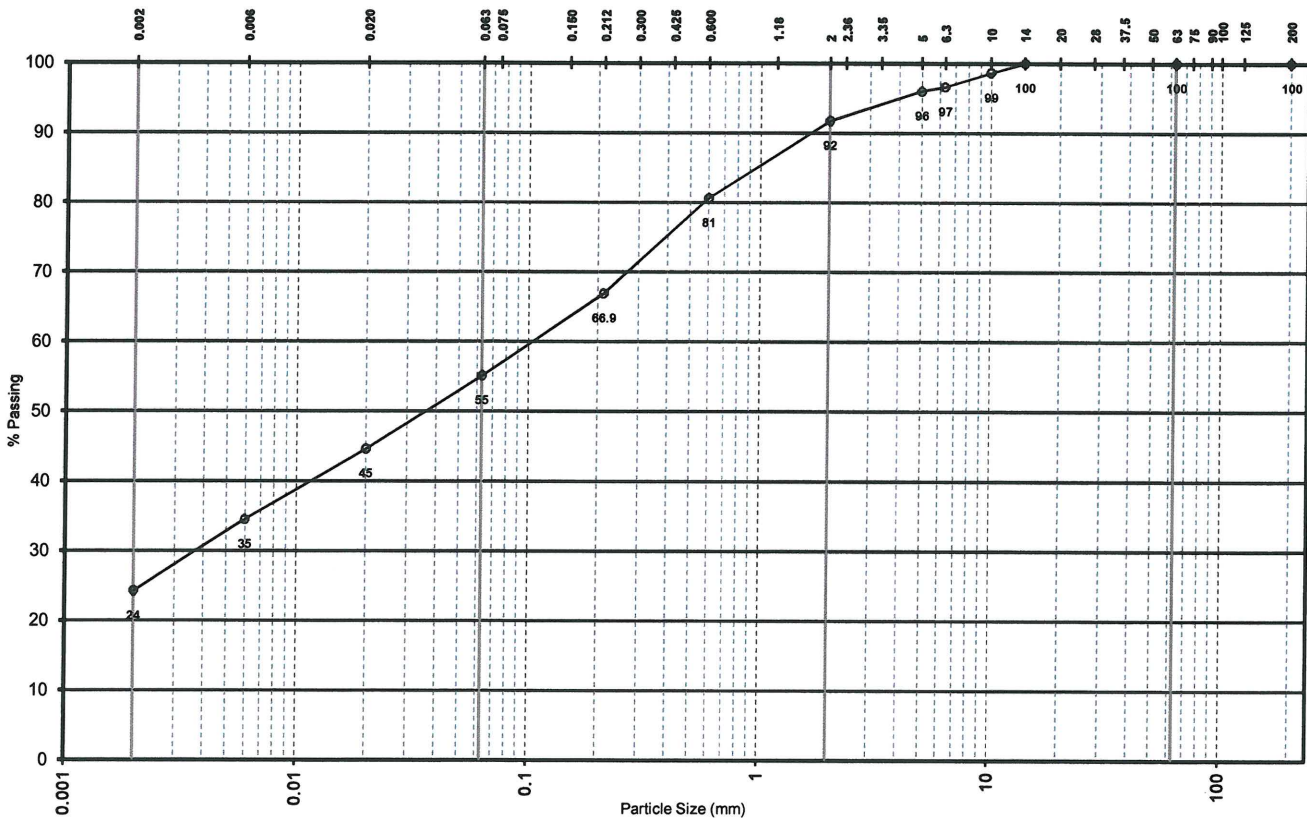
Eric Goulden  
Technical Manager

Test Report Ref: STR 407607: Page 2 of 2

**MATERIAL DESCRIPTION**

Red/brown slightly gravelly very sandy silty CLAY

Method of pre-treatment:		N/A			
Sieve Size mm	% Passing	Sieve Size mm	% Passing	Cobbles	0.0
				Gravel	8.3
				Sand	36.6
200	100.0	3.35		Silt	30.9
125		2.36		Clay	24.2
100		2.0	91.7		
90		1.18			
75		0.600	80.6		
63	100.0	0.425			
50		0.300			
37.5		0.212	66.9		
28		0.150			
20		0.075			
14	100.0	0.063	55.1		
10	98.6	0.020	44.6		
6.3	96.6	0.006	34.5		
5.0	96.0	0.002	24.2		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine 0.002	Medium 0.006	Coarse 0.02	Fine 0.063	Medium 0.2	Coarse 0.63	Fine 2.0	Medium 6.3	Coarse 20	



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407612

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Size Distribution (PSD) of a soil sample-washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2**  
Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	<b>Yes</b>
Laboratory Ref. No:	<b>S51811</b>
Client Ref. No:	<b>CT6</b>
Date and Time of Sampling:	<b>17/03/2015</b>
Date of Receipt at Lab:	<b>17/03/2015</b>
Date of Start of Test:	<b>20/03/2015</b>
Sampling Location:	<b>Western Upper Sidewall</b>
Name of Source:	<b>Unknown</b>
Method of Sampling:	<b>Disturbed Bulk Sample</b>
Sampled By:	<b>Client</b>
Material Description:	<b>Red/brown slightly gravelly very sandy silty CLAY</b>
Target Specification:	<b>N/A</b>

**RESULTS:**

**SEE ATTACHED**

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: - 

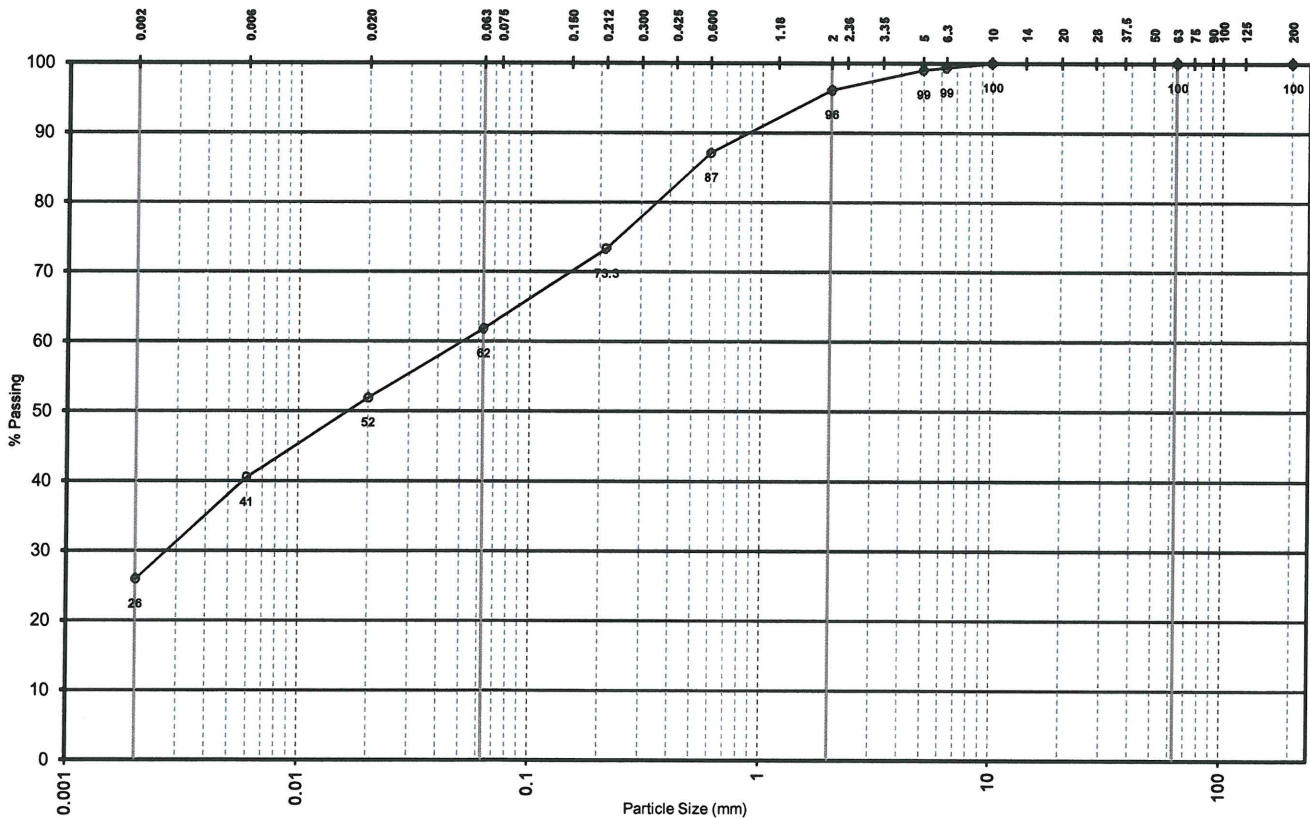
Eric Goulden  
Technical Manager

Test Report Ref: STR 407612: Page 2 of 2

**MATERIAL DESCRIPTION**

Red/brown slightly gravelly very sandy silty CLAY

Method of pre-treatment:		N/A			
Sieve Size mm	% Passing	Sieve Size mm	% Passing	Cobbles	0.0
				Gravel	3.9
				Sand	34.3
				Silt	35.9
				Clay	25.9
200	100.0	3.35			
125		2.36			
100		2.0	96.1		
90		1.18			
75		0.600	87.1		
63	100.0	0.425			
50		0.300			
37.5		0.212	73.3		
28		0.150			
20		0.075			
14		0.063	61.8		
10	100.0	0.020	51.9		
6.3	99.3	0.006	40.5		
5.0	99.0	0.002	25.9		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine 0.002	Medium 0.006	Coarse 0.02	Fine 0.063	Medium 0.2	Coarse 0.63	Fine 2.0	Medium 6.3	Coarse 20	

Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407611

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:** To determine the Particle Density of Soil – Gas Jar method, in accordance with **BS 1377 : Part 2 : 1990 : Clause 8.2.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	CT6
Date and Time of Sampling:	17/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification	N/A

**RESULTS:**

Particle Density = 2.73 Mg/m<sup>3</sup>

**Comments**

None

Certificate

Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: -



Eric Goulden  
Technical Manager



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407610

LS15 8GB

Order No: 819/CE1005/Rclarke

Page 1 of 1

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Plastic Limit, Liquid Limit, and Plasticity Index of sample in accordance with  
**BS 1377:Part 2:1990 Clause 5.3, Clause 4.3, and Clause 5.4.**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. :	CT6
Date and Time of Sampling:	17/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	23/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	Disturbed Bulk Sample
Sampled By:	Client
Soil Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A

**RESULTS:**

History of sample:	:	<del>Natural state</del> /After wet sieving
% Materials passing 425µm	=	81
Plastic Limit	=	17
Liquid Limit	=	45
Plasticity Index	=	28

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by:



Eric Goulden  
Technical Manager



Stratus Environmental Limited  
4245 Park Approach  
Thorpe Park  
Leeds

Date: 31 March 2015  
Test Report Ref: STR 407609

LS15 8GB

Order No: 819/CE1005/Rclarke  
Page 1 of 2

Contract: Hafod Landfill - Western Upper Sidewall

**LABORATORY TEST REPORT**

**TEST REQUIREMENTS:**

To determine the Undrained Shear Strength in Triaxial Compression  
Without Measurement of Pore Pressure in accordance with  
**BS 1377-7: 1990 Clause 8**

**SAMPLE DETAILS:**

Certificate of sampling received:	Yes
Laboratory Ref. No:	S51811
Client Ref. No:	USS3
Date and Time of Sampling:	16/03/2015
Date of Receipt at Lab:	17/03/2015
Date of Start of Test:	25/03/2015
Sampling Location:	Western Upper Sidewall
Name of Source:	Unknown
Method of Sampling:	U38 Tube
Sampled By:	Client
Material Description:	Red/brown slightly gravelly very sandy silty CLAY
Target Specification:	N/A

**RESULTS:**

**See attached**

**Comments**

None

Certificate  
Prepared by:-



Meical Owen  
Assistant Laboratory Manager

Approved by: -



Eric Goulden  
Technical Manager

Test Report Ref: STR 407609 - Page 2 of 2

Sample Condition:

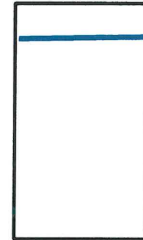
UNDISTURBED/REMOULDED\*

If remoulded state method of compaction:

~~2.5kg rammer/4.5kg rammer~~\*

\* Delete as appropriate.

ORIENTATION AND POSITION OF UNDISTURBED SAMPLE  
WITHIN SAMPLING CONTAINER



Initial Specimen Length	75 mm
Initial Specimen Diameter	38 mm
Initial Moisture Content	12.2 %
Bulk Density	2.090 Mg/m <sup>3</sup>
Dry Density	1.869 Mg/m <sup>3</sup>
Rate of Strain	1.0 %/min
Latex Membrane Thickness	0.2 mm
Membrane Correction	1.1 kPa
Cell Pressure	200 kPa
Corrected Maximum Deviator Stress at failure	389 kPa
Strain at Failure	8.5 %
<b>Shear Strength C<sub>u</sub></b>	<b>195 kPa</b>

Mode of Failure: ~~Plastic Failure (Barrelling)~~\*

Brittle Failure (Shear Plane) \*

~~Intermediate Type~~\*

\* Delete as appropriate.

