REPORT ON
GROUND INVESTIGATION
AT
GREEN END, 17 DENE ROAD
NORTHWOOD HA6 2BS

CLIENT: DAVID PARKER ARCHITECTS LIMITED

DATE: 7 FEBRUARY 2018 **REF:** G/121750/001

K F GEOTECHNICAL

CONSULTING GEOTECHNICAL ENGINEERS

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CONTENTS

APPENDICES

1. INTRODUCTION

1.1 We were instructed by David Parker Architects acting on behalf of the developers of the site, to carry out a ground investigation by means of 1 No. shell and auger borehole and 3 No. hand augered boreholes together with associated laboratory soil testing and preliminary contamination testing. We were also instructed to carry out a small-scale soakaway test.

1.2 The purpose of the investigation was to determine ground conditions etc for the design of foundations for the construction of three detached houses with gardens.

1.3 The shell and auger borehole took place on the 6 December 2017 with the follow-up hand augered boreholes and soakaway test etc being undertaken on the 8 January 2017.

2. THE SITE

2.1 Dene Road forms part of a large residential area to the north of Northwood in northwest London. Green End lies within a section of Dene Road which is private and it is a large detached property with significant grounds which lies back from the southern edge of Dene Road and is approached by a driveway leading up to the front left corner of the house to a parking and turning area. Remote from the rear left corner of the house is a garage and there are gardens extending to the front and rear. There is a wooded area towards the rear and in particular the rear right corner of the property and within and behind this it is proposed to construct three detached houses which will be accessed from Foxdell which is a cul-de-sac which consists of a south turning slightly further to the west along Dene Road from the property.

2.2 The site is basically level.

2.3 The Geology of Great Britain indicates that the naturally occurring subsoil is London Clay.

3. SITE WORK

3.1 The layout of the proposed site and the location of our boreholes is indicated on our Location Plan G/121750/101. The logs of the boreholes are appended at the rear of this report.

3.2 Borehole A is an 18.0m deep shell and auger borehole and this revealed topsoil over gravel rejects to 600mm over a firm to stiff brown sandy silty clay becoming stiff silty clay from 3.8m to 5.6m. Below this a stiff orange/brown/grey silty sandy clay down to 10.1m below which is sand which starts off as silver silty sand becoming a dense brown/green silty sand and then at 13.0m sand and gravel which was proved to the base of the borehole at 18.0m. Roots of live appearance were encountered within the top 400mm. The borehole was dry on completion other than some added water lying at the base of the borehole. This water was added continuously from 10.1m to facilitate drilling through the granular material.

3.3 Borehole 1, 2 and 3 were put down by hand auger. Borehole 1 was put down at the front of Plot 1 and revealed topsoil overlying a firm silty clay becoming stiff and more sandy below 800mm. From 2.8m there was some fine gravel and this was proved to the base of the borehole at 3.5m. There was a water strike at 2.8m and the water was standing at 1.8m on completion. Roots of live appearance were encountered to 2.8m.

3.4 Borehole 2 was put down at the rear of Plot 2 and this revealed turf and topsoil to 350mm over fill material consisting of ash and clinker to 850mm. Below this is a firm silty clay becoming stiff below 1.8m and more sandy and this was proved to the base of the borehole at 1.9m below which it was too stiff to auger.

3.5 Borehole 3 was put down towards the front of the proposed Plot 3 and this revealed turf and topsoil to 400mm over a firm silty clay overlying at 2.7m a silty clayey sand which was proved to the base of the borehole at 3.1m. The borehole was terminated at this depth due to an obstruction which would appear to be claystone. There was water seepage coincident with a pocket of sand at 1.9m and water was standing at 1.8m on completion.

3.6 In-situ testing by hand held vane test was carried out at regular depths in each of the hand augered boreholes. In the shell and auger borehole SPT tests were carried out at regular intervals throughout the depths of the borehole. The results of all this testing is indicated on the individual logs.

3.7 Disturbed samples were taken at regular depths in all of the boreholes and these were bagged a labelled and sent to our laboratories for appropriate geotechnical analysis.

3.8 Five near surface samples were taken at locations across the site as indicated on the site plan and these were bagged and labelled and sent via coolbox to our specialist laboratories for analysis.

3.9 Each of the samples was typical of topsoil type material except possibly the sample from S3 which was collected close to borehole 2 where there was fill material to at least 850mm.

3.10 A small-scale soakaway test was carried out at the location indicated on the site plan. A 300mm square pit was excavated to a depth of 800mm. At 9.35am 300mm depth of water was fed into the pit but the level had not changed after 4 hours and the test was abandoned.

4. LABORATORY WORK

4.1 Geotechnical Analysis.

4.1.1 Moisture contents were determined on all the samples taken from the hand augered boreholes with liquid and plastic limits being determined on samples taken from 1.0m and 2.0m in borehole 1, 1.0m and 1.5m in borehole 2 and 1.0m and 2.0m in boreholes 3.

4.1.2 Where tested the clay is all of high to very high plasticity and of correspondingly high shrinkage potential according to the NHBC or similar standards. The sample at 2.0m in borehole 1 is anomalous to this, being only of medium shrinkage.

4.1.3 A comparison of the moisture contents with the liquid and plastic limits reveals possible significant desiccation at 2.0m in borehole 1 and again at 2.0m in borehole 3.

4.2 Contamination Analysis

4.2.1 Each of the five near surface samples were placed in suitable sealed containers and sent via coolbox to our specialist laboratories, Chemtest, for analysis.

4.2.2 Each sample was tested for the range of common toxic metals and metalloids, phytotoxic elements and organics, pH and sulphates plus total petroleum hydrocarbons. The results are appended.

4.2.3 There has been recent updated Soil Guideline Values (SGV) issued for arsenic, cadmium, mercury, nickel, selenium and phenol. The results have been compared against appropriate SGV for these determinands. Where new values have not been issued, then the results have been compared against previous SGVs, which relate to lead and chromium or against Generic Assessment Criteria (GAC) based on the CLEA model produced by LQM and others.

4.2.4 The proposal is for houses with gardens and the most appropriate SGVs, C4SLs etc are, therefore, those for Residential with the potential for Plant Uptake.

4.2.5 When the results are compared against the appropriate threshold there are undue concentrations of:

Arsenic. The threshold is 32mg/kg and this exceeded in sample S3 with a concentration of 39mg/kg.

Lead. The threshold based on C4SLs is 200mg/kg and this is exceeded in the near surface sample taken from S1 and S3 with concentrations of 590mg/kg and 280mg/kg respectively.

4.2.6 Waste Acceptance Criteria (WAC) Testing was carried out on a single sample taken from between 300mm and 400mm at location S5. The results indicate that there are no undue concentrations of any of the determinands for inert waste.

5. DISCUSSION

5.1 Geotechnical Aspects

5.1.1 The ground investigation revealed the anticipated geology with the subsoil being London Clay with the clay being of high to very high plasticity. The clay overlies sands and gravels from 10.0m but there were also bands of granular material at shallower depth as indicated by, in particular, borehole 3 which encountered a clayey sand at 2.7m which was also water bearing.

5.1.2 The in-situ vane testing at 1.0m depth leads to a minimum shear strength across the site of 70kPa which equates to a safe bearing capacity of 140kPa. This is consistent with the SPT value at this depth from the deeper borehole. Across the site the clay gets stiffer with depth which may or may not be due to a degree of desiccation brought about by the action of the roots of nearby trees. Live roots were encountered in borehole 1 down to 2.8m but were largely absent in boreholes 2 and 3. The presence of the roots is consistent with the stiffness and the moisture contents of the clay between 1.5m and 2.5m in borehole 1. The lower moisture content at 2.0m in borehole 3 is probably more related to the sand content at this depth.

5.1.3 There are numerous and significant trees on and near the site and when these are taken into account, the depth of the foundations to guard against the potential for clay shrinkage, is likely to be excessive and we would recommend piling of this site. Based on the top 3.0m of the piles being sleeved. which is a general NHBC or similar standards recommendation, we would recommend designing the piles on the basis of a cohesion of 130kPa and an adhesion factor (α) of 0.45. There was water seepage at relatively shallow depth in two of the hand augered boreholes. This is almost certainly perched water standing within bands of more granular material and probably would not have a significant effect on an open hole flight augered pile, but as a precaution we would recommend CFA piling.

5.1.4 As the near surface subsoil is clay across the site we would recommend suspended ground floors. There is no sign of desiccation below 3.0m and therefore anti-heave precautions will not be required to the piles below the sleeved depth but anti-heave measures should be installed beneath any ground beams and this should be installed in-line with NHBC or similar standards.

5.1.5 As anticipated for a clay subsoil, the soakaway did not work. Granular material was encountered below 10.01m in the deep borehole and therefore some form of borehole soakaway might work if extended into this material. In order to determine the adequacy of such a soakaway a falling head test should be carried out in a further borehole.

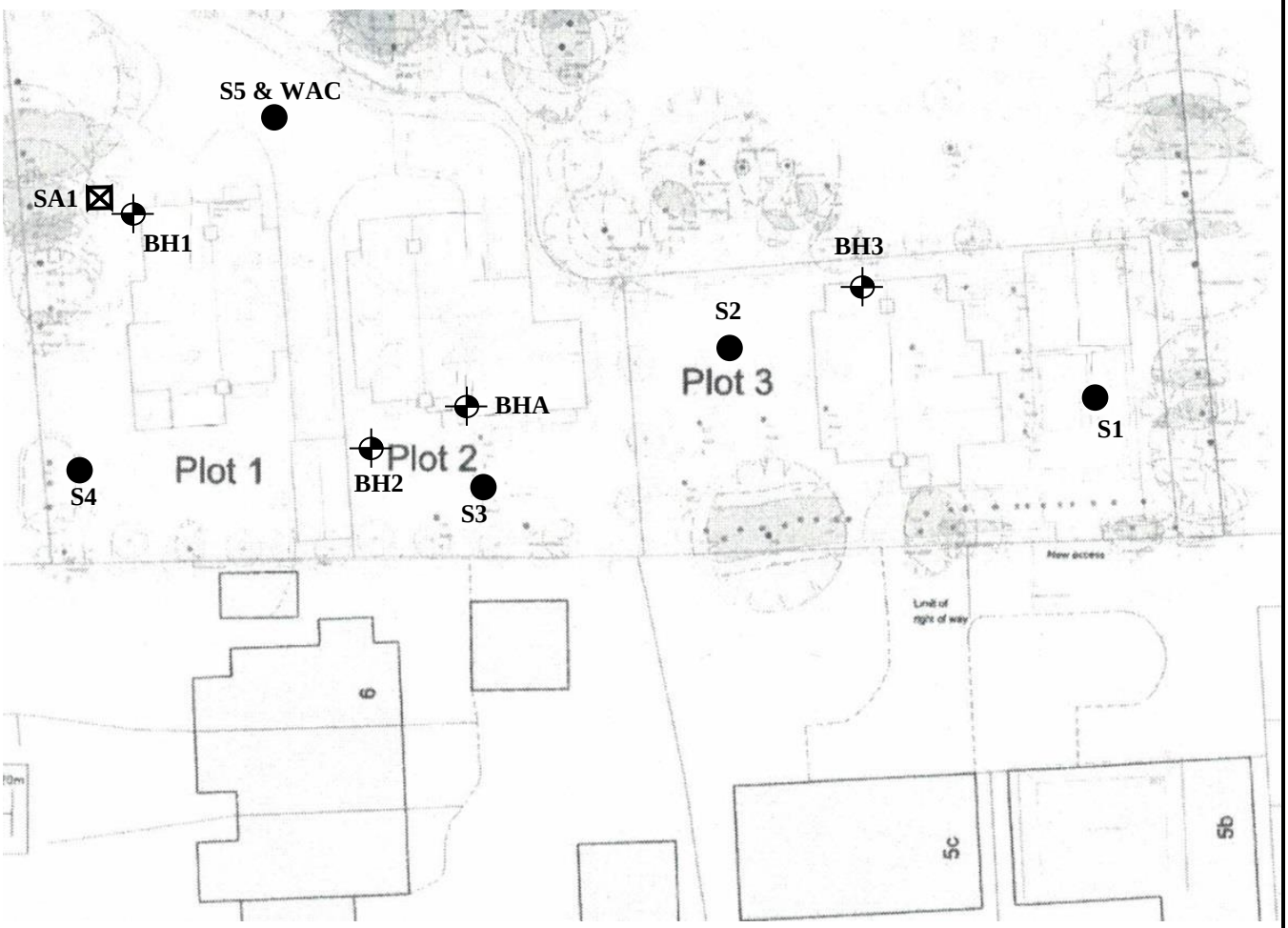
5.2 Contamination Aspects

5.2.1 The contamination testing revealed undue concentrations of arsenic and lead in sample S3 and of lead alone is sample S1. This is probably due to careless disposal of paint or fuel or other household waste as is common at the rear of gardens. Because the subsoil is clay, this contamination will be confined to the near surface topsoil and fill material and this is confirmed by the WAC tests which indicated inert subsoil for landfill purposes. In the light of the contamination test results we would recommend further testing in proposed garden areas to determine the lateral and vertical extent of the contamination. Following this further testing a remediation method statement (if required) can be provided. We would recommend carrying out a series of samples on a 2.0m-3.0m radius from locations S1 and S3 with the samples being taken at between ground level and 300m and again at between 500mm and 600mm at each location.

W J C Wallace

K F Geotechnical 70a Lysons Road Aldershot Hants GU11 3ED	**SITE LOCATION PLAN**		Ref: G/121750/101
	Sheet: 1 of 1	Scale: N/A	Date: 6 Dec 2017 & 8 Jan 2018
	Client: David Parker Architects Limited		

Location: **GREEN END, 17 DENE ROAD, NORTHWOOD, HJA6 2BS**



Remarks:	**Key:**					
	Borehole	SVP	Soil Vent Pipe	MH	Manhole
	Trial pit	RWP	Rainwater Pipe	G	Gully
	Samples		Soakaway (SA)		Tree/Bush (approx. ht in m)

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Borehole A		Ref: G121750
Sheet: 1	Scale: 1:50	Date: 6/12/17
Client: DAVID PARKER ASSOCIATES		
Equipment & Method : Shell & Auger	Location: GREEN END, NORTHWOOD	

Description of Strata [thickness]	Reduced Level	Legend	Depth	Samples Type	Samples Depth	Tests Type	Tests Value	Field Notes
TOPSOIL: dark brown sandy silty clay (0.40)				D	0.30			
Rounded gravel (rejects) (0.20)	-0.40		0.40					Roots of live appearance to 0.4m
Firm to stiff brown sandy silty CLAY (3.20)	-0.60		0.60	D	0.70			
				D	1.00	S	N=11	
				D	2.00	S	N=20	
				D	3.00	S	N=21	
Stiff light brown/orange silty CLAY (1.80)	-3.80		3.80	D	3.80			
				D	4.10	S	N=29	
				D	5.00	S	N=42	
Stiff orange/brown/grey silty sandy CLAY (4.50)	-5.60		5.60	D	5.60			
				D	6.50	S	N=46	
				D	8.00	S	N=58	
				D	9.50	S	N=62	

Where 0.3m penetration has not been achieved, the number of blows for the quoted penetration is given. (Not the N value)
All depths and reduced levels are in metres.
Water level observations during boring are given on the last sheet of the log.

U Undisturbed Sample
D Disturbed Sample
B Bulk Sample
W Water Sample
S Standard Penetration Test
V Vane Test
MP Mackintosh Probe

Remarks

Borehole cased to 17.5m
Water added continuously from 10.1m
Added water lying at 17.1m on completion

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Borehole A		Ref: G121750
Sheet: 1	Scale: 1:50	Date: 6/12/17
Client: DAVID PARKER ASSOCIATES		
Equipment & Method : Shell & Auger	Location: GREEN END, NORTHWOOD	

Description of Strata [thickness]	Reduced Level	Legend	Depth	Samples Type	Samples Depth	Tests Type	Tests Value	Field Notes
(Continued)								
Stiff orange/brown/grey silty sandy CLAY (4.50)	-10.10		10.10	D	10.20	S	N=61 for 60mm	
dense fine silver silty SAND (0.90)	-11.00		11.00					
Dense brown/green silty SAND (2.00)				D	11.50			
	-13.00		13.00	D	13.00			
Dense brown silty SAND and GRAVEL consisting of black rounded stone (5.00)				D	1.50			
				D	16.00			
				D	17.50			
Base of Borehole	-18.00		18.00					

Where 0.3m penetration has not been achieved, the number of blows for the quoted penetration is given. (Not the N value)
All depths and reduced levels are in metres.
Water level observations during boring are given on the last sheet of the log.

U Undisturbed Sample
D Disturbed Sample
B Bulk Sample
W Water Sample
S Standard Penetration Test
V Vane Test
MP Mackintosh Probe

Remarks

Borehole cased to 17.5m
Water added continuously from 10.1m
Added water lying at 17.1m on completion

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Borehole 1		Ref: G121750
Sheet: 1	Scale: 1:20	Date: 8/1/18
Client: DAVID PARKER ASSOCIATES		
Equipment & Method : Hand Auger	Location: GREEN END, NORTHWOOD	

Description of Strata [thickness]	Reduced Level	Legend	Depth	Samples Type	Samples Depth	Tests Type	Tests Value	Field Notes
Turf over TOPSOIL: medium dense clayey gravelly sand (0.30)								
	-0.30		0.30					
Firm brown/orange/grey silty CLAY (0.50				D	0.50	V	92	
	-0.80		0.80					
Stiff brown/orange/grey silty CLAY (2.00)				D	1.00	V	130+	
				D	1.50	V	130+	
				D	2.00	V	130+	
				D	2.50	V	130+	
	-2.80		2.80					
Stiff brown silty sandy gravelly CLAY (0.70)								Roots of live appearance to 2.8m
				D	3.00	V	130+	
				D	3.20			
	-3.50		3.50					
Base of Borehole								

Where 0.3m penetration has not been achieved, the number of blows for the quoted penetration is given. (Not the N value)
All depths and reduced levels are in metres.
Water level observations during boring are given on the last sheet of the log.

U Undisturbed Sample
D Disturbed Sample
B Bulk Sample
W Water Sample
S Standard Penetration Test
V Vane Test
MP Mackintosh Probe

Remarks

Water standing at 1.8m on completion
Borehole collapsing from 3.5m

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Borehole 2		Ref: G121750
Sheet: 1	Scale: 1:20	Date: 8/1/18
Client: DAVID PARKER ASSOCIATES		
Equipment & Method : Hand Auger	Location: GREEN END, NORTHWOOD	

Description of Strata [thickness]	Reduced Level	Legend	Depth	Samples Type	Samples Depth	Tests Type	Tests Value	Field Notes
Turf over TOPSOIL: medium dense clayey gravelly sand (0.35)								
	-0.35		0.35					Roots of live appearance to 0.35m
MADE GROUND: ash and clinker (0.50)								
	-0.85		0.85					
Firm brown/orange/grey silty CLAY (0.95)				D	1.00	V	70	
				D	1.50	V	130+	
	-1.80		1.80					
Stiff brown silty sandy CLAY (0.10)								
	-1.90		1.90					
Base of Borehole								

Where 0.3m penetration has not been achieved, the number of blows for the quoted penetration is given. (Not the N value)
All depths and reduced levels are in metres.
Water level observations during boring are given on the last sheet of the log.

U Undisturbed Sample
D Disturbed Sample
B Bulk Sample
W Water Sample
S Standard Penetration Test
V Vane Test
MP Mackintosh Probe

Remarks
Too stiff/dense to auger below 1.9m

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Borehole 3		Ref: G121750
Sheet: 1	Scale: 1:20	Date: 8/1/18
Client: DAVID PARKER ASSOCIATES		
Equipment & Method : Hand Auger	Location: GREEN END, NORTHWOOD	

Description of Strata [thickness]	Reduced Level	Legend	Depth	Samples Type	Samples Depth	Tests Type	Tests Value	Field Notes
Turf over TOPSOIL: medium dense clayey gravelly sand (0.40)								
	-0.40		0.40					
Firm brown/orange/grey silty CLAY (0.40)				D	0.50	V	52	
	-0.80		0.80					
Firm brown/orange/grey silty CLAY (1.90)				D	1.00	V	70	
				D	1.50	V	102	
				D	2.00	V	96	
				D	2.50	V	90	
	-2.70		2.70					Water strike at 2.7m
Medium dense orange silty clayey SAND (0.40)				D	3.00	V	130+	
Base of Borehole	-3.10		3.10					

Where 0.3m penetration has not been achieved, the number of blows for the quoted penetration is given. (Not the N value)
All depths and reduced levels are in metres.
Water level observations during boring are given on the last sheet of the log.

U Undisturbed Sample
D Disturbed Sample
B Bulk Sample
W Water Sample
S Standard Penetration Test
V Vane Test
MP Mackintosh Probe

Remarks

Water standing at 1.8m on completion
Obstruction at 3.1m. Probably Claystone

Trentside Geotechnical Testing

Highlands Farm, Southend Road
Rettendon, Essex, CM3 8EB
Telephone/Fax: 020 3488 0311 **Mobile:** 07508 853739
Email: info@trentsidegeotechnical.co.uk **Website:** www.trentsidegeotechnical.co.uk

Geotechnical Testing

Client : K F Geotechnical

Site Name : Green End, 17 Dene Road, Northwood

Client Reference : -

Laboratory Reference : TGT2632

Date of Completion : 02-Feb

Content Summary

Lab Reference : TGT2632

Client Reference : -

For the attention of : Bill Wallace

This report comprises of the following : 3 Test Summary Reports

1 Moisture vs Depth Chart

1 Plasticity Chart

1 Limitations

Notes :

General

Please refer to report summary notes for details pertaining to methods undertaken and their subsequent accreditations

Samples were supplied by Customer

All tests performed in-house unless otherwise stated

Deviant Samples

Samples were received in suitable containers	Yes
A date and time of sampling was provided	Yes
Arrived damage/denaturing free	Yes

Laboratory Testing Results

BS 1377 : 1990

Job Number : TGT2632
Client : K F Geotechnical
Client Reference : -
Site Name : Green End, 17 Dene Road, Northwood

Date Received : 23/01/2018
Date Testing Started : 25/01/2018
Date Testing Completed : 02/02/2018
Laboratory Used : Trentside Geotechnical, CM3 8EB

Sample Ref			Sample Type	Moisture Content (%) [1]	Soil Faction >0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity Index (%) [5]	Modified Plasticity Index (%) [6]	Soil Class [7]	Filter Paper Contact Time (h) [8]	Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%)	pH Value [11]	Sulphate Content		
BH/TP/WS	Depth (m)	UID															SO_3 [12]	SO_4 [13]	Class [14]
BH1	0.5	18-0166	D	30	<5														
BH1	1.0	18-0167	D	37	<5	65	23	42	0.32	42	CH								
BH1	1.5	18-0168	D	20	<5														
BH1	2.0	18-0169	D	21	<5	59	22	37	-0.04	37	CH								
BH1	2.5	18-0170	D	19	<5														
BH1	3.0	18-0171	D	26	<5														
BH1	3.5	18-0172	D	31	<5														

Notes :-

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
[8] In-house method SSa adapted from BRE IP 4/93
[9] Values of shear strength were determined in situ by using a Pilcon hand vane or Geonor vane (GV).
[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005

Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

D	Disturbed sample
B	Bulk sample
U	U100 (undisturbed sample)
W	Water sample
ENP	Essentially Non-Plastic
U/S	Underside Foundation

Comments :-

Technician > KW
Checked By > GW
Date Checked > 02-Feb-18

Laboratory Testing Results

BS 1377 : 1990

Job Number : TGT2632
Client : K F Geotechnical
Client Reference : -
Site Name : Green End, 17 Dene Road, Northwood

Date Received : 23/01/2018
Date Testing Started : 25/01/2018
Date Testing Completed : 02/02/2018
Laboratory Used : Trentside Geotechnical, CM3 8EB

Sample Ref			Sample Type	Moisture Content (%) [1]	Soil Faction >0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity Index (%) [5]	Modified Plasticity Index (%) [6]	Soil Class [7]	Filter Paper Contact Time (h) [8]	Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%)	pH Value [11]	Sulphate Content		
BH/TP/WS	Depth (m)	UID															SO_3 [12]	SO_4 [13]	Class [14]
BH2	1.0	18-0173	D	28	<5	76	22	54	0.12	54	CV								
BH2	1.5	18-0174	D	25	<5	74	22	51	0.06	51	CV								

Notes :-

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
[8] In-house method 35a adapted from BRE IP 4/93
[9] Values of shear strength were determined in situ by using a Pilcon hand vane or Geonor vane (DV).
[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005

Note that if the SO_3 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

D	Disturbed sample
B	Bulk sample
U	U100 (undisturbed sample)
W	Water sample
ENP	Essentially Non-Plastic
U/S	Underside Foundation

Comments :- 'n bearing capacity factor

Technician :- KW
Checked By :- GW
Date Checked :- 02-Feb-18

Laboratory Testing Results

BS 1377 : 1990

Job Number : TGT2632
Client : K F Geotechnical
Client Reference : -
Site Name : Green End, 17 Oene Road, Northwood

Date Received : 23/01/2018
Date Testing Started : 25/01/2018
Date Testing Completed : 02/02/2018
Laboratory Used : Trentside Geotechnical, CM3 8EB

Sample Ref			Sample Type	Moisture Content (%) [1]	Soil Faction >0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity Index (%) [5]	Modified Plasticity Index (%) [6]	Soil Class [7]	Filter Paper Contact Time (h) [8]	Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%) [10]	pH Value [11]	Sulphate Content		
BH/TP/WS	Depth	UID															SO_3 [12]	SO_4 [13]	Class [14]
BH3	0.5	18-0175	D	35	<5														
BH3	1.0	18-0176	D	32	<5	71	22	49	0.20	49	CV								
BH3	1.5	18-0177	D	29	<5														
BH3	2.0	18-0178	D	21	<5	74	23	51	-0.03	51	CV								
BH3	2.5	18-0179	D	26	<5														
BH3	3.0	18-0180	D	25	<5														

Notes :-

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
[8] In-house method 53a adapted from BRE IP 4/93
[9] Values of shear strength were determined in situ by using a Pilcon hand vane or Geonor vane (GV)
[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005

Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

D	Disturbed sample
B	Bulk sample
U	U100 (undisturbed sample)
W	Water sample
ENP	Essentially Non-Plastic
U/S	Underside Foundation

Comments :-

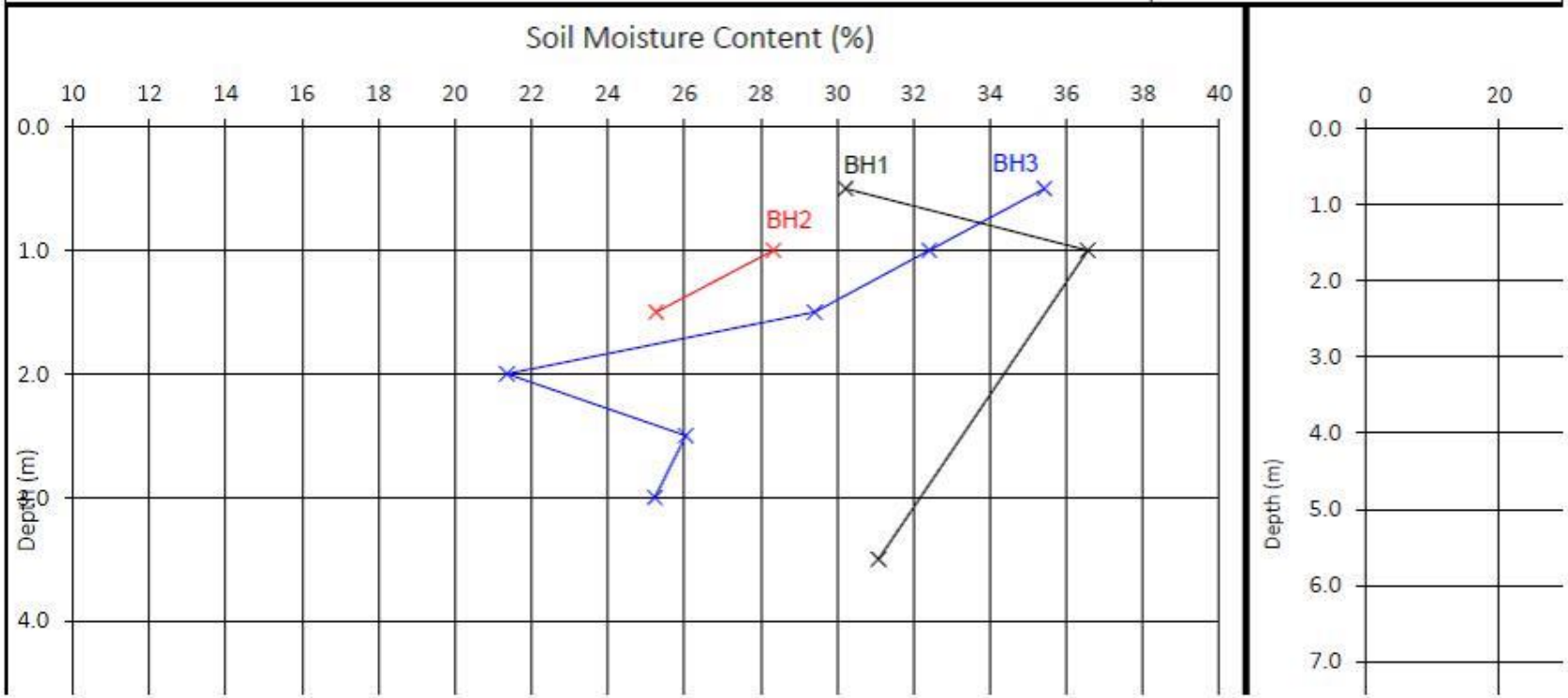
Technician > KW
Checked By > GW
Date Checked > 02-Feb-18

Laboratory Testing Results

Moisture Content/Shear Strength Profile

Job Number : TGT2632
Client : K F Geotechnical
Client Reference : -
Site Name : Green End, 17 Dene Road, Northwood

Date Received : 23/01/2018
Date Testing Started : 25/01/2018
Date Testing Completed : 02/02/2018
Laboratory : Trentside Geotechnical, CM3 8EB

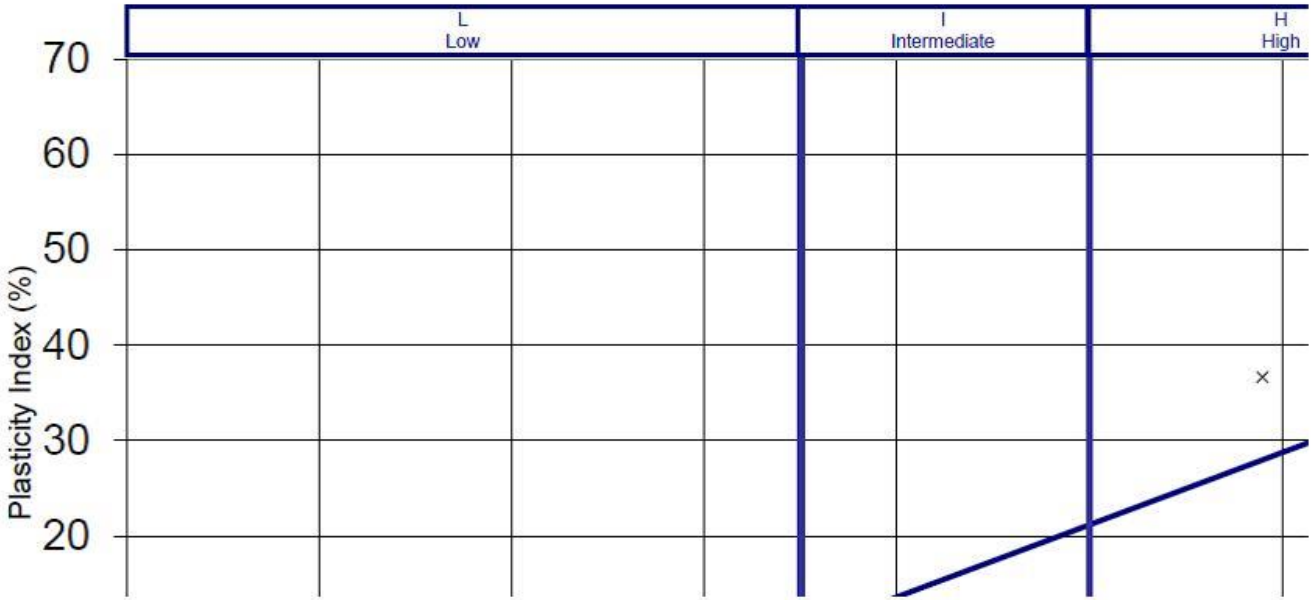


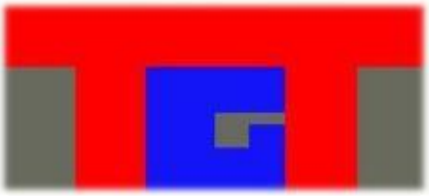
Laboratory Testing Results

Plasticity Chart for the classification of fine soils and the finer part of coarse soils
In Compliance with BS5930 : 1999

Job Number : TGT2632
Client : K F Geotechnical
Client Reference : -
Site Name : Green End, 17 Dene Road, Northwood

Date Received : 23/01/2018
Date Testing Started : 25/01/2018
Date Testing Completed : 02/02/2018
Laboratory : Trentside Geotechnical, CM3 8EB





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Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING
2183

Final Report

Report No.:	18-00837-1
Initial Date of Issue:	18-Jan-2018
Client	KF Geotechnical
Client Address:	70a Lysons Road Aldershot Hampshire GU11 EED
Contact(s):	Ann Richardson
Project	Green End, 17 Dent Road, Northwood

Quotation No.:		**Date Received:**	12-Jan-2018
Order No.:		**Date Instructed:**	12-Jan-2018
No. of Samples:	5		
Turnaround (Wkdays):	5	**Results Due:**	18-Jan-2018
Date Approved:	18-Jan-2018		

Approved By:

Details: Robert Monk, Technical Manager

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Results - Soil

Project: Green End, 17 Dent Road, Northwood

Client: KF Geotechnical				Chemtest Job No.:	18-00837	18-00837	18-00837	18-00837	18-00837
Quotation No.:				Chemtest Sample ID.:	562750	562751	562752	562753	562754
Order No.:				Client Sample Ref.:	S1	S2	S3	S4	S5
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.00	0.00	0.00	0.00	0.00
				Bottom Depth (m):	0.30	0.30	0.30	0.30	0.30
				Date Sampled:	09-Jan-2018	09-Jan-2018	09-Jan-2018	09-Jan-2018	09-Jan-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Moisture	N	2030	%	0.020	25	26	29	34	35
Stones and Removed Materials	N	2030	%	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
pH	U	2010		N/A	7.9	7.4	7.4	7.2	5.5
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	2.2	1.6	2.4	1.7	0.75
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.059	0.017	0.024	0.015	0.013
Cyanide (Free)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	0.70	< 0.50	< 0.50	< 0.50	< 0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	U	2325	mg/kg	0.50	12	14	8.5	4.9	3.0
Sulphate (Total)	U	2430	%	0.010	0.29	0.23	0.24	0.20	0.14
Arsenic	U	2450	mg/kg	1.0	29	24	39	25	17
Cadmium	U	2450	mg/kg	0.10	1.6	0.62	0.83	0.34	0.18
Chromium	U	2450	mg/kg	1.0	35	25	29	26	30
Copper	U	2450	mg/kg	0.50	75	43	58	32	25
Mercury	U	2450	mg/kg	0.10	0.43	0.29	0.52	0.35	0.39
Nickel	U	2450	mg/kg	0.50	31	22	28	27	18
Lead	U	2450	mg/kg	0.50	590	190	280	110	82
Selenium	U	2450	mg/kg	0.20	1.0	0.96	1.2	1.3	1.1
Zinc	U	2450	mg/kg	0.50	610	230	320	120	76
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	12	10	11	9.3	6.7
Total TPH >C8-C40	U	2670	mg/kg	10	[C] 52	[C] < 10	[C] < 10	[C] < 10	[C] < 10
Naphthalene	U	2700	mg/kg	0.10	0.15	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	0.16	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	0.62	0.68	0.32	0.22	< 0.10
Anthracene	U	2700	mg/kg	0.10	0.18	0.16	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	1.9	1.8	0.82	0.67	0.39
Pyrene	U	2700	mg/kg	0.10	1.9	1.8	0.84	0.57	0.34
Benzo[a]anthracene	U	2700	mg/kg	0.10	1.3	1.2	0.52	0.14	< 0.10
Chrysene	U	2700	mg/kg	0.10	1.7	1.1	0.63	0.15	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	2.1	1.4	0.94	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	1.0	0.63	0.52	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	1.6	0.96	0.72	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	1.1	0.96	0.44	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.26	< 0.10	0.19	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	1.3	0.72	0.60	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	15	11	6.5	< 2.0	< 2.0

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Results - Soil

Project: Green End, 17 Dent Road, Northwood

Client: KF Geotechnical					Chemtest Job No.:	18-00837	18-00837	18-00837	18-00837
Quotation No.:					Chemtest Sample ID.:	562750	562751	562752	562753	562754
Order No.:					Client Sample Ref.:	S1	S2	S3	S4	S5
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.00	0.00	0.00	0.00	0.00
					Bottom Depth (m):	0.30	0.30	0.30	0.30	0.30
					Date Sampled:	09-Jan-2018	09-Jan-2018	09-Jan-2018	09-Jan-2018	09-Jan-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Total Phenols	U	2920	mg/kg	0.30		< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

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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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C8–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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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"

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 45 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:
customerservices@chemtest.co.uk

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Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

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Final Report

Report No.:	18-00840-1
Initial Date of Issue:	22-Jan-2018
Client	KF Geotechnical
Client Address:	70a Lysons Road Aldershot Hampshire GU11 EED
Contact(s):	Ann Richardson
Project	Green End, 17 Dent Road, Northwood

Quotation No.:		**Date Received:**	12-Jan-2018
Order No.:		**Date Instructed:**	12-Jan-2018
No. of Samples:	1		
Turnaround (Wkdays):	7	**Results Due:**	22-Jan-2018
Date Approved:	22-Jan-2018		

Approved By:

Details: Martin Dyer, Laboratory Manager

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Results - 2 Stage WAC

Project: Green End, 17 Dent Road, Northwood

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-00840								
Chemtest Sample ID:	562780								
Sample Ref:	S5								
Sample ID:									
Top Depth(m):	0.30								
Bottom Depth(m):	0.40								
Sampling Date:	09-Jan-2018								
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%			1.2	3	5	6
Loss On Ignition	2610	U	%			5.8	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	U				6.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0040	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	0.0016	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.0012	0.0025	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	0.0023	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	0.0011	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0023	< 0.010	0.020	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0010	0.0053	< 0.50	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 1.0	< 10	< 10	800	15000	25000
Fluoride	1220	U	0.092	0.18	< 1.0	1.7	10	150	500
Sulphate	1220	U	< 1.0	1.8	< 10	16	1000	20000	50000
Total Dissolved Solids	1020	N	7.7	8.5	15	83	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	2.7	< 2.5	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	28

Leachate Test Information	
Leachant volume 1st extract/l	0.283
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.220

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Test Methods

SOP	Title	Parameters Included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
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.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS

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