LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Listers Geotechnical Consultants Ltd
Slapton Hill Barn, Blakesley Road
Slapton, Towcester
Northants. NN12 8QD

Tel: +44 (0)1327 860060
info@listersgeotechnics.co.uk
www.listersgeotechnics.co.uk

15th July 2016

Our Ref: 14.02.009a

Primus Ltd
Level 4
120-128 Moorgate
London
EC2 6UR

For the attention of Mr Fergal McCloskey

Dear Mr McCloskey

Post Remediation Verification – Willingham Close, Willingham Terrace, Camden, NW5 2UY

Introduction

A first phase Remediation Verification has been undertaken for a residential re-development at Willingham Close, Willingham Terrace, Camden, London, NW5 2UY. The Ordnance Survey National Grid reference for the site is approximately 529350, 185250.

This report describes the site activities carried out by ListersGeo in order to provide verification of the remediation undertaken to date at the development. Instructions to undertake the investigation were received by Primus Ltd in their email instruction dated 16th March 2016.

This verification report follows a Desk Study and Ground Investigation report which was prepared by ListersGeo (reference number 14.02.009, dated November 2014). The Ground Investigation report presents a remedial strategy for the site.

This report has been prepared for the sole use of the client and their professional advisors. This report shall not be relied upon by third parties without the express written authority of ListersGeo. If an unauthorised third party comes into possession of this report they must not rely on it and the authors owe them no duty of care and skill.

Site Information and Walkover Survey

A walkover survey of the site and its immediate surrounds was undertaken on the 21st June 2016. A selection of site photographs is presented in Appendix B. The site consists of an irregular shaped parcel of land measuring approximately 15m by 45m and the site extends to 0.08ha in area.

The site lies in a residential area on the southern margin of Kentish Town centred on Leighton Road. The domestic garage structures noted on the site during the previous site walkover in November 2014 have been removed and the site is currently occupied by a residential construction site. A stockpile of imported Topsoil in 12no. bulk bags were located in the northern portion of the site.

Several mature coniferous trees approximately 8 to 10m in height are adjacent to the northern eastern boundary of the site. A retaining wall runs along the northern and eastern boundaries of the site.

Geology

The previous site investigation confirmed the published geology with the natural soils comprising the London Clay Formation. However variable and locally deep Made Ground was encountered across the site to depths of between 0.50m and 3.00m on the site. In addition, localised Possibly Reworked Ground was encountered beneath the Made Ground, particularly in the north of the site, to depths of between 1.20m and 3.90m.

Previous Work

The Ground Investigation report identified elevated concentrations of polyaromatic hydrocarbon compounds, lead and arsenic within the Made Ground at the site and considered that remediation was necessary to protect future end users of the site.

The report recommended that remediation of the site would be achieved by placing a layer of clean capping in garden areas, thus removing the pollutant linkage between the source of the contamination and the human health receptors.

Remedial measures

A clean soil cover system of 600mm in thickness was recommended to be implemented in the gardens and soft landscaped areas at the site as part of the previous report. The cover system should consist of 200mm of clean topsoil and 400mm of clean sub-soil.

The remedial options within our original report recommended that any new soil imported to the site should have been tested for a range of contaminants. The levels of these contaminants should not exceed the appropriate S4ULs for the site and chemical testing certificates for the material should be provided for approval.

Remediation Implementation to date

In June 2016, 12no. bulk bags of Topsoil were imported from the SRC Aggregates site, Crown Quarry, Aldleigh, CO7 7QR direct to Willingham Close, Willingham Terrace, Camden, London, NW5 2UY.

Cover System Thickness Verification and Chemical Validation

A site visit was made on the 21st June 2016 to undertake verification of the remedial measures. However, at that point the imported Topsoil had not been placed to form a capping layer in the required areas of the site and therefore it was not possible to verify the capping layer thickness.

The imported Topsoil in the bulk bags was accompanied by a certificate of chemical testing from Chemtest Ltd, a copy of which is provided in Appendix C.

In addition, six soil samples were obtained at random from the 12no. bulk bags of imported Topsoil present on the site at the time of the visit by ListersGeo to further validate the material for the proposed end-use.

The suite of testing carried out on the samples was decided upon following consultation of R&D CLR Publications, published as part of the Contaminated Land Exposure Assessment (CLEA), a joint venture between the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency.

The test suite included a range of:

- Metals and inorganic substances
- Speciated Polyaromatic Hydrocarbons (PAH)
- Total Petroleum Hydrocarbons (TPH), with eight-band split
- Asbestos

The soil samples were tested to obtain 'Total' values within the soil.

The results of the tests from this investigation are included in Appendix D.

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Human Health Risk Assessment

The human health risk assessment has been undertaken using the guidance provided in the Environment Agency's publication CLR11, Model Procedures for the Management of Contaminated Land, published in September 2004.

Human health assessment criteria used are based upon the proposed final land use of the site. The guidelines for 'Residential with home-grown produce' end use have been used.

Soil Assessment Criteria

The results of the topsoil and sub-soil chemical testing have been compared to acceptable criteria for this specific site, being the published DEFRA Category 4 Screening Levels (C4SLs) and, where C4SLs are unavailable, the published LQM Suitable 4 Use Levels (S4ULs) appropriate for general residential end use.

Results of Total Soil Tests

The results of the testing for the Topsoil recorded levels of all contaminants tested well below the acceptable levels for a 'residential with home-grown produce' end use.

Conclusions

The imported Topsoil in the bulk bags has been verified by independent laboratory test data provided by Chemtest Ltd to be suitable for the proposed 'residential with home-grown produce' end use.

A clean soil cover system is generally required to be 600mm in thickness in soft landscaped areas, based upon a residential with plant uptake end use as recommended in BRE 465.

Once the developer has placed the capping layer on the site, a further site visit will be required to validate the cover layer thickness to ensure that the above remedial specification has been met and to establish that remediation of the site has been achieved.

Yours sincerely,

Mr David Webster
Senior Geotechnical Engineer

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Enc.

Appendix 'A' – Site Location Plan and Site Layout Plan
Appendix 'B' – Site Photographs
Appendix 'C' – Supplier Source Material Testing Certificate – Chemtest Ltd
Appendix 'D' – On-site Topsoil and Sub-soil Testing Certificates – Chemtest Ltd

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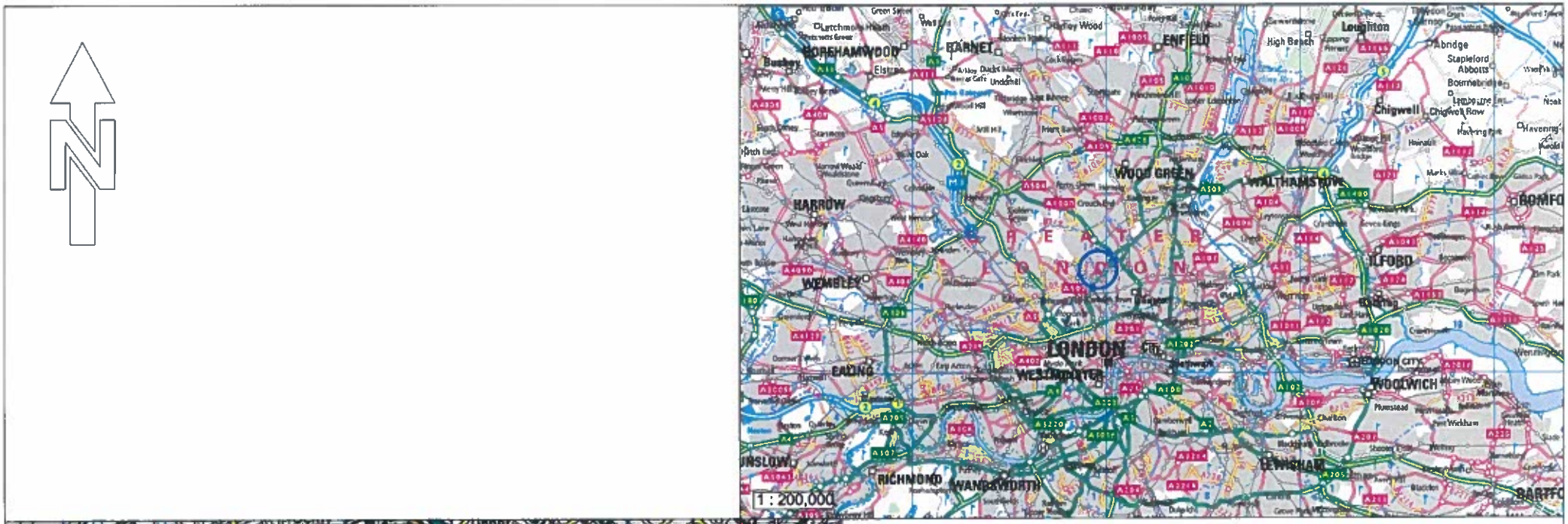
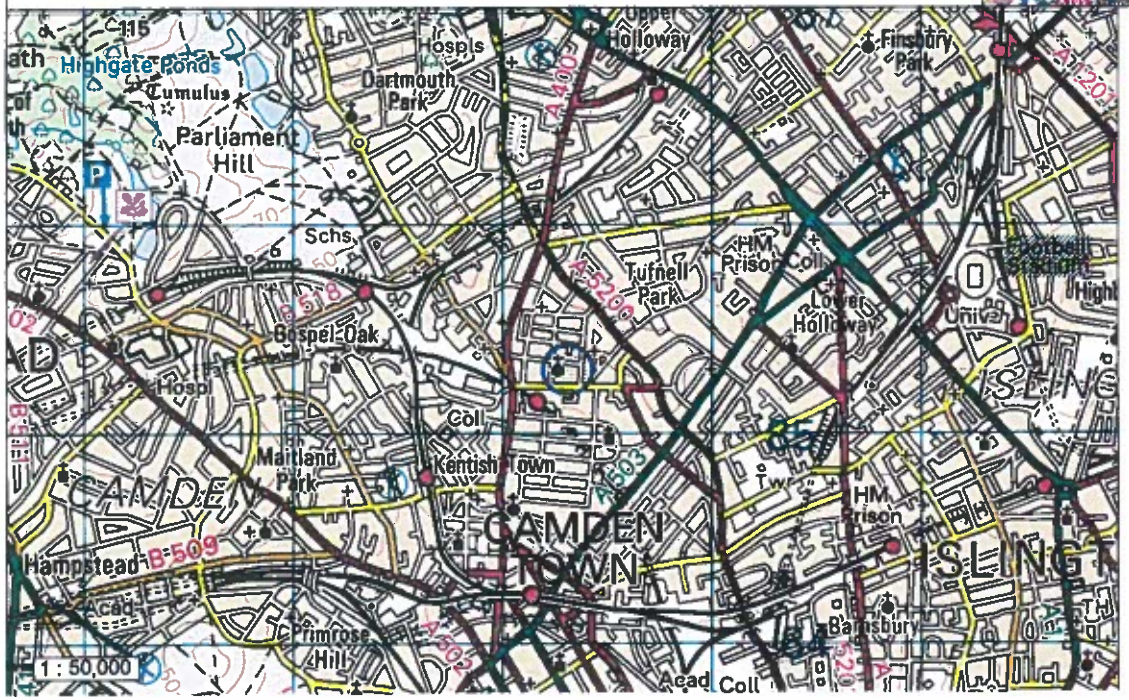
APPENDIX A
SITE LOCATION PLAN AND SITE LAYOUT PLAN





Key:

Approximate Site Location

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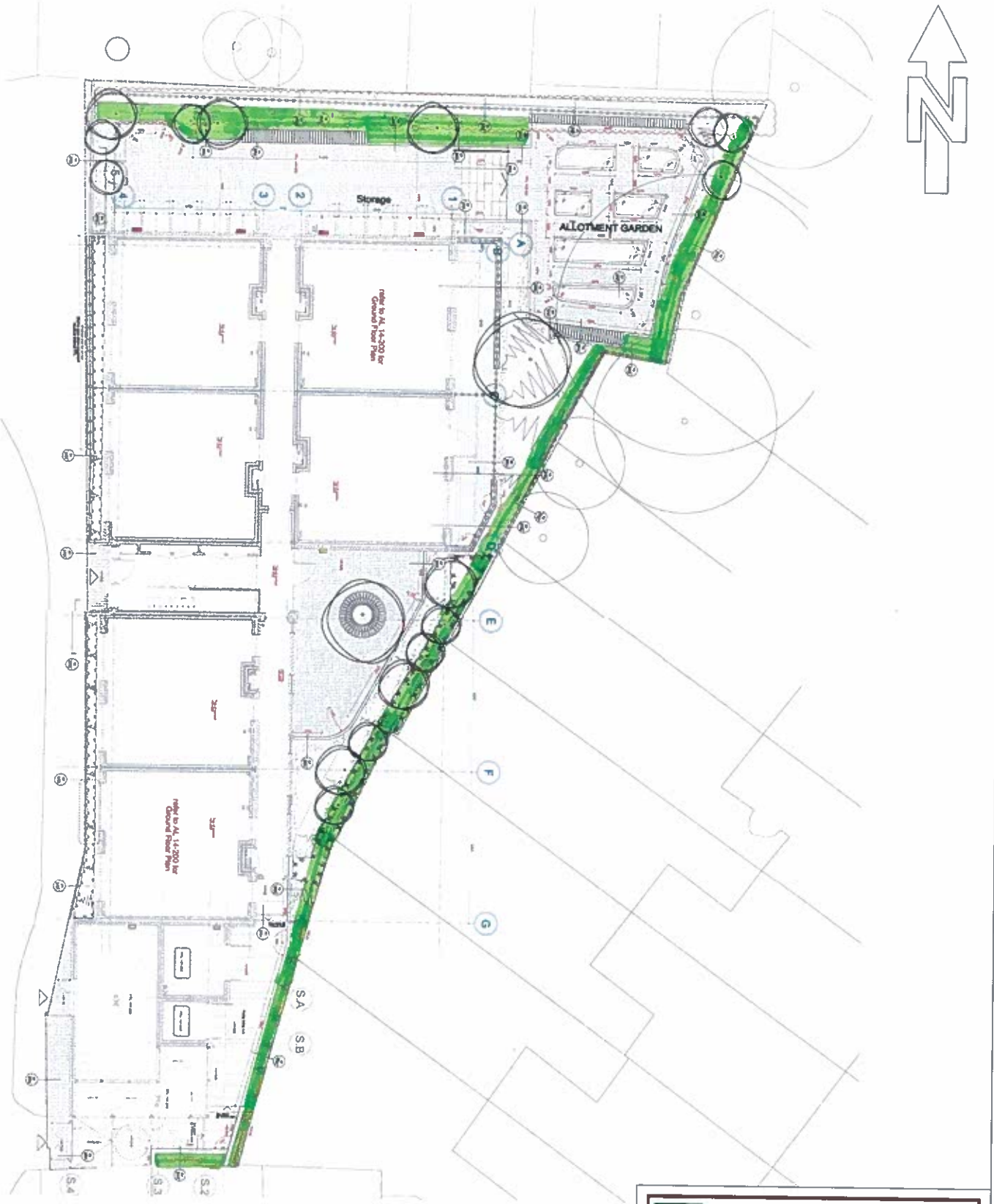
Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

Title:	Site Location Plan	
Site:	Willingham Close, Willingham Terrace, Camden, NW5 2UY	
Scale: NTS	Job No: 14.02.009a	Drawn By: BL



Green highlighting denotes area where reduced capping depth of 300mm is agreed

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Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

Title:	Plan Showing Existing Site Layout	
Site:	Willingham Close, Willingham Terrace, Camden, NW5 2UY	
Scale: NTS	Job No: 14.02.009a	Drawn By: BL

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APPENDIX B
SITE PHOTOGRAPHS

Photograph A– View south along the eastern boundary.

Photograph B – View north along the western boundary.

Site Photographs	Report: 14.02.009a

Photograph C– View north towards the northern boundary.

Photograph D – View of stockpiled imported Topsoil.

Site Photographs	Report: 14.02.009a

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APPENDIX C
SUPPLIER SOURCE MATERIAL TESTING CERTIFICATE – CHEMTEST LTD

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING
2183

Final Report

Report No.:	16-02437-1
Initial Date of Issue:	05-Feb-2016
Client	SRC Aggregates
Client Address:	B Lodge Highwood Quarry Takeley CM6 1SL
Contact(s):	Matthew Yeates
Project	Crown Quarry, Ardleigh, CO7 7QR

Quotation No.:		**Date Received:**	03-Feb-2016
Order No.:		**Date Instructed:**	03-Feb-2016
No. of Samples:	1	**Target Date:**	05-Feb-2016
Turnaround (Wkdays):	3	**Results Due:**	05-Feb-2016
Date Approved:	05-Feb-2016		

Approved By:

Details: Robert Monk, Technical Development Chemist

Chemtest
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Results - Soil

Project: Crown Quarry, Ardleigh, CO7 7QR

Client: SRC Aggregates			Chemtest Job No.:		16-02437
Quotation No.:			Chemtest Sample ID.:		249339
Order No.:			Client Sample Ref.:		Stockpile
			Client Sample ID.:		Topsoil
			Sample Type:		SOIL
			Date Sampled:		01-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
Moisture	N	2030	%	0.020	9.1
Stones	N	2030	%	0.020	< 0.020
pH	U	2010		N/A	7.8
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.74
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.071
Cyanide (Free)	U	2300	mg/kg	0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0
Sulphide (Easily Liberatable)	U	2325	mg/kg	0.50	1.4
Sulphate (Total)	U	2430	%	0.010	0.070
Arsenic	U	2450	mg/kg	1.0	6.2
Cadmium	U	2450	mg/kg	0.10	0.10
Chromium	U	2450	mg/kg	1.0	9.3
Copper	U	2450	mg/kg	0.50	11
Mercury	U	2450	mg/kg	0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	5.6
Lead	U	2450	mg/kg	0.50	20
Selenium	U	2450	mg/kg	0.20	< 0.20
Vanadium	U	2450	mg/kg	5.0	19
Zinc	U	2450	mg/kg	0.50	27
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
Organic Matter	U	2625	%	0.40	1.3
Total TPH >C6-C40	U	2670	mg/kg	10	[C] < 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	0.18
Pyrene	U	2700	mg/kg	0.10	0.19
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10

Chemtest
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Results - Soil

Project: Crown Quarry, Ardleigh, CO7 7QR

Client: SRC Aggregates			**Chemtest Job No.:**		16-02437
Quotation No.:			**Chemtest Sample ID.:**		249339
Order No.:			Client Sample Ref.:		Stockpile
			Client Sample ID.:		Topsoil
			Sample Type:		SOIL
			Date Sampled:		01-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	[C] < 1.0
Toluene	U	2760	µg/kg	1.0	[C] < 1.0
Ethylbenzene	U	2760	µg/kg	1.0	[C] < 1.0
m & p-Xylene	U	2760	µg/kg	1.0	[C] < 1.0
o-Xylene	U	2760	µg/kg	1.0	[C] < 1.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30

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Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample ID:	Sample Ref:	Sample ID:	Sampled Date:	Deviation Code(s):	Containers Received:
249339	Stockpile	Topsoil	01-Feb-2016	C	Plastic Tub 500g

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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 our Coventry 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

Sample Retention and Disposal

All soil samples will be retained for a period of 60 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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APPENDIX D
ON-SITE TOPSOIL AND SUB-SOIL TESTING CERTIFICATES – CHEMTEST LTD

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING
2183

Final Report

Report No.:	16-14999-1
Initial Date of Issue:	01-Jul-2016
Client	Listers Geotechnical Consultants
Client Address:	Slapton Hill Barn, Blakesley Road Slapton Towcester Northamptonshire NN12 8QD
Contact(s):	Dave Webster
Project	14.02.009a Camden

Quotation No.:		**Date Received:**	24-Jun-2016
Order No.:	14.02.009a/332	**Date Instructed:**	24-Jun-2016
No. of Samples:	6		
Turnaround (Wkdays):	5	**Results Due:**	30-Jun-2016
Date Approved:	01-Jul-2016		

Approved By:

Details: Robert Monk, Technical Development Chemist

Chemtest
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Results - Soil

Project: 14.02.009a Camden

Client: Listers Geotechnical Consultants				Chemtest Job No.:	16-14999	16-14999	16-14999	16-14999	16-14999	16-14999
Quotation No.:				Chemtest Sample ID.:	314244	314245	314246	314247	314248	314249
				Client Sample ID.:	Bag 1	Bag 2	Bag 3	Bag 4	Bag 5	Bag 6
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Date Sampled:	21-Jun-2016	21-Jun-2016	21-Jun-2016	21-Jun-2016	21-Jun-2016	21-Jun-2016
				Asbestos Lab:	COVENTRY		COVENTRY			
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A	-		-			
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected		No Asbestos Detected			
Moisture	N	2030	%	0.020	13	14	15	14	15	15
Stones	N	2030	%	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
pH	U	2010		N/A	8.2	8.2	8.1	8.1	8.1	8.0
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.53	0.62	0.81	0.85	0.74	0.78
Arsenic	U	2450	mg/kg	1.0	7.6	5.7	5.6	6.2	7.0	13
Cadmium	U	2450	mg/kg	0.10	0.16	0.10	0.10	0.10	0.11	0.21
Chromium	U	2450	mg/kg	1.0	16	12	18	15	14	26
Copper	U	2450	mg/kg	0.50	15	12	11	12	14	23
Mercury	U	2450	mg/kg	0.10	0.12	0.11	0.12	0.12	0.12	0.22
Nickel	U	2450	mg/kg	0.50	11	7.9	7.7	8.1	8.5	14
Lead	U	2450	mg/kg	0.50	35	30	29	33	39	58
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.26
Zinc	U	2450	mg/kg	0.50	40	27	26	29	32	51
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
TPH >C5-C6	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C6-C7	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C7-C8	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C8-C10	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C10-C12	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C12-C16	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.9
TPH >C16-C21	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	8.2
TPH >C21-C35	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	28
Total TPH >C5-C35	N	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10	47
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	85
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 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	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	0.22	0.46	0.31	0.58
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	0.24	0.39	0.36	0.59
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 14.02.009a Camden

Client: Listers Geotechnical Consultants					Chemtest Job No.:	16-14999	16-14999	16-14999	16-14999	16-14999	16-14999
Quotation No.:					Chemtest Sample ID.:	314244	314245	314246	314247	314248	314249
					Client Sample ID.:	Bag 1	Bag 2	Bag 3	Bag 4	Bag 5	Bag 6
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Date Sampled:	21-Jun-2016	21-Jun-2016	21-Jun-2016	21-Jun-2016	21-Jun-2016	21-Jun-2016
					Asbestos Lab:	COVENTRY		COVENTRY			
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Chemtest
The right chemistry to deliver results

Report Information

Key

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SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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I/S	Insufficient Sample
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>	"greater than"

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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 our Coventry 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

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