APPENDIX D part 2: Geotechnical and geoenvironmental site investigation report part 2 of 2

APPENDIX 3

LABORATORY TESTS

APPENDIX 3

GENERAL NOTES ON LABORATORY TESTS ON SOILS

A3.1 GENERAL

A3.1.1 Where applicable all tests are carried out in accordance with the relevant British Standard. The laboratory test procedures are given in the laboratory test reports.

A3.1.2 Any discussion in this report is based on the values and results obtained from the appropriate tests. Due allowance should be made, when considering any result in isolation, of the possible inaccuracy of any such individual result. Details of the accuracy of results are included in this section, where applicable.

A3.2 SOIL CLASSIFICATION

A3.2.1 Classification of soils is usually undertaken by means of the Plasticity Classification Chart, sometimes called the A-Line Chart. This is graphical plot of PI against LL with the A-Line defined as PI = 0.73(LL - 20).

A3.2.2 This line is defined from experimental evidence and does not represent a well-defined boundary between soil types, but forms a useful reference datum. When the values of LL and PI for inorganic clays are plotted on the chart they generally lie just above the A-Line in a narrow band parallel to it, while silts and organic clays plot below this line.

A3.2.3 Clays and silts are divided into five zones of plasticity:

Low Plasticity (L)	LL less than 35
Intermediate Plasticity (I)	LL between 35 and 50
High Plasticity (H)	LL between 50 and 70
Very High Plasticity (V)	LL between 70 and 90
Extremely High Plasticity (E)	LL greater than 90

A3.2.4 In general, clays of high plasticity are likely to have a lower permeability, are more compressible and consolidate over a longer period of time under load than clays of low plasticity. Clays of high plasticity are more difficult to compact as fill material.

Project Name:	Fitzjohn's Avenue, Hampstead NW3 6PA	**Samples Received:**	26/08/2014
		Project Started:	27/08/2014
Client:	Ian Farmer Associates	**Testing Started:**	10/09/2014
Project No:	522474A **Our job/report no:** 17352	**Date Reported:**	15/09/2014

K4 SOILS

Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
BH1	D6	3.10	Light brown and orange brown slightly gravelly slightly fine sandy silty CLAY (gravel is fmc and sub-rounded)	18	33	15	18	79	
BH3	D2	1.40	Light brown fine sandy silty CLAY	25	47	16	31	100	
BH3	D4	2.50	Light brown fine sandy silty CLAY	21	43	19	24	100	
BH4	D4	1.80	Orange brown and greenish grey mottled slightly gravelly fine sandy silty CLAY with occasional roots and rotlets (gravel is fine)	16	48	15	33	98	
BH4	D6	2.90	Light brown fine sandy silty CLAY	11	47	16	31	100	
BH5	D5	2.90	Orange brown and light brown fine sandy silty CLAY with pockets of light green grey fine sand	20	43	15	28	100	
BH5	D7	3.50	Orange brown, light brown and blue grey mottled fine sandy silty CLAY	22	41	17	24	100	

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Summary of Test Results

BS 1377 : Part 2 : Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method.
BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index.
BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.

Checked and Approved
Initials: K.P
Date: 17/09/2014

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

All samples connected with this report ,incl any on 'hold' will be stored and disposed off according to Company policy.Acopy of this policy is available on request. MSF-11/R2

Figure A3.1

Project Name:	Arthur West House, 79 Fitzjohn's Avenue, Hampstead NW3 6PA	**Samples Received:**	29/08/2014
		Project Started:	01/09/2014
Client:	Ian Farmer Associates	**Testing Started:**	15/09/2014
Project No:	52247a **Our job/report no:** 17375	**Date Reported:**	17/09/2014

K4 SOILS

Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
BH2	B5	9.00	Dark grey slightly gravelly silty CLAY with occasional pockets of reddish brown fine sand	25	60	23	37	100	
BH3	D3	1.90	Brown clayey silty SAND	24					
BH4	D5	2.30	Orange brown silty sandy CLAY	14					
BH4	D7	3.30	Orange brown silty sandy CLAY	15					
BH4	D8	3.80	Orange brown and slightly grey clayey silty SAND	21					

UKAS TESTING 2519

Summary of Test Results

BS 1377 : Part 2 : Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method.
BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index.
BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.

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Initials: K.P
Date: 17/09/2014

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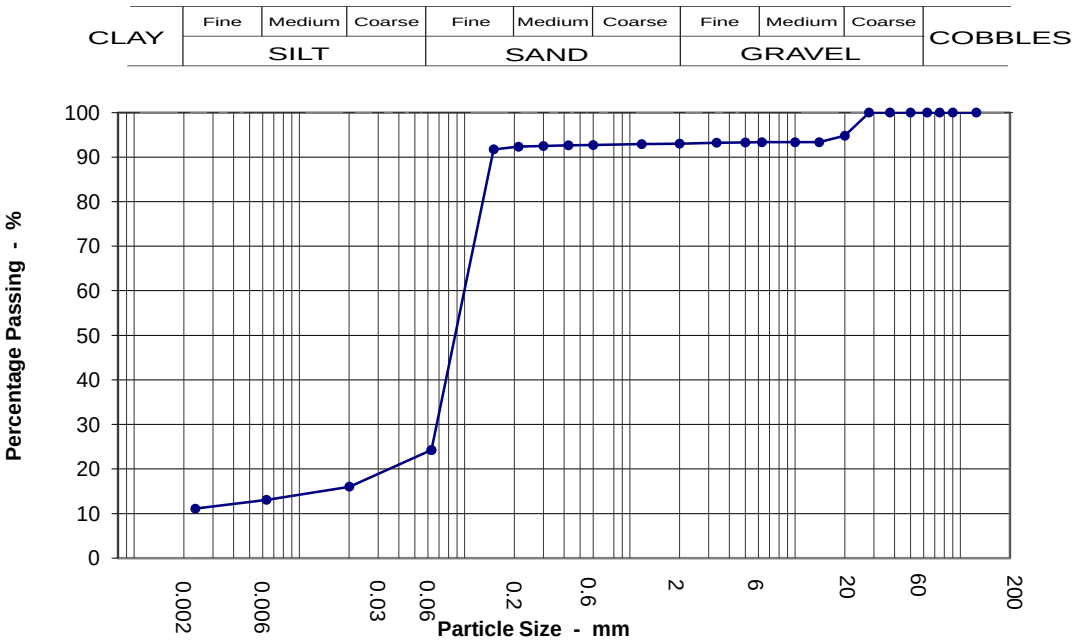
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17352
		Project No:	522474A
Location	Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH1
		Depth	2.50 m
Visual Soil Description	Brown gravelly clayey silty fine SAND (gravel is fmc and sub-rounded to rounded)	Sample Type/No	D - 5



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	16
90	100	0.006	13
75	100	0.002	11
63	100		
50	100		
37.5	100		
28	100		
20	95		
14	93		
10	93		
6.3	93		
5	93		
3.35	93		
2	93		
1.18	93		
0.6	93		
0.425	93		
0.3	92		
0.212	92		
0.15	92		
0.063	24		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	7.0
Sand	69.3
Silt & Clay	23.7

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

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Date: 15/09/2014

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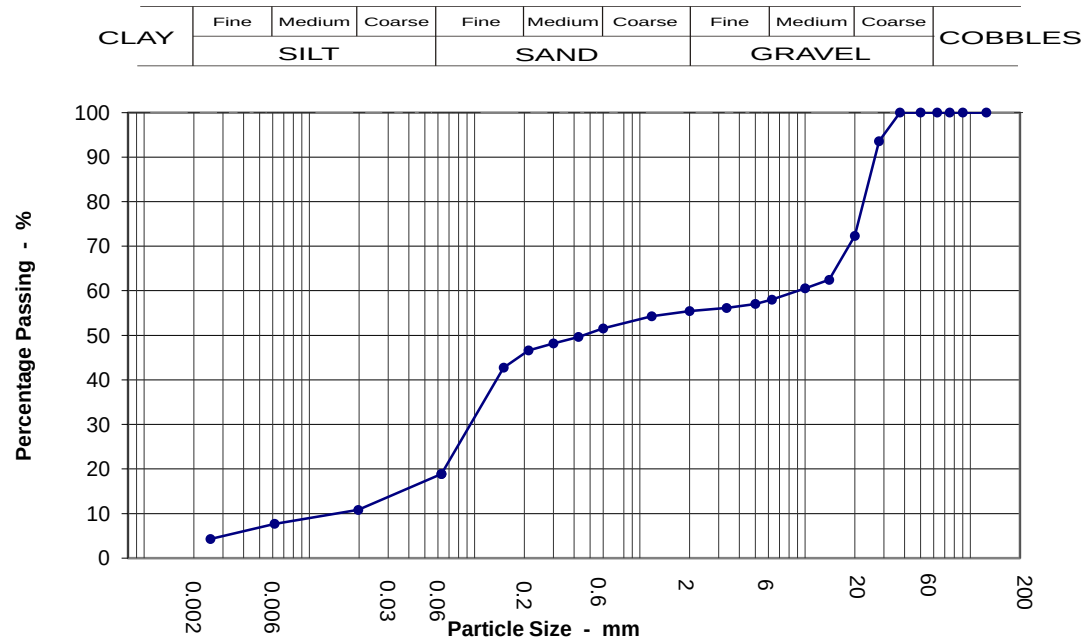
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17352
		Project No:	522474A
Location	Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH1
		Depth	4.90 m
Visual Soil Description	Dark greyish brown silty clayey very sandy GRAVEL (gravel is fmc and sub-rounded to rounded)	Sample Type/No	D - 10



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	11
90	100	0.006	8
75	100	0.003	4
63	100		
50	100		
37.5	100		
28	94		
20	72		
14	62		
10	61		
6.3	58		
5	57		
3.35	56		
2	55		
1.18	54		
0.6	52		
0.425	50		
0.3	48		
0.212	47		
0.15	43		
0.063	19		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	44.6
Sand	37.1
Silt & Clay	18.3

Grading Analysis	
D100	125.0
D60	9.2
D10	
Uniformity Coefficient	N/A

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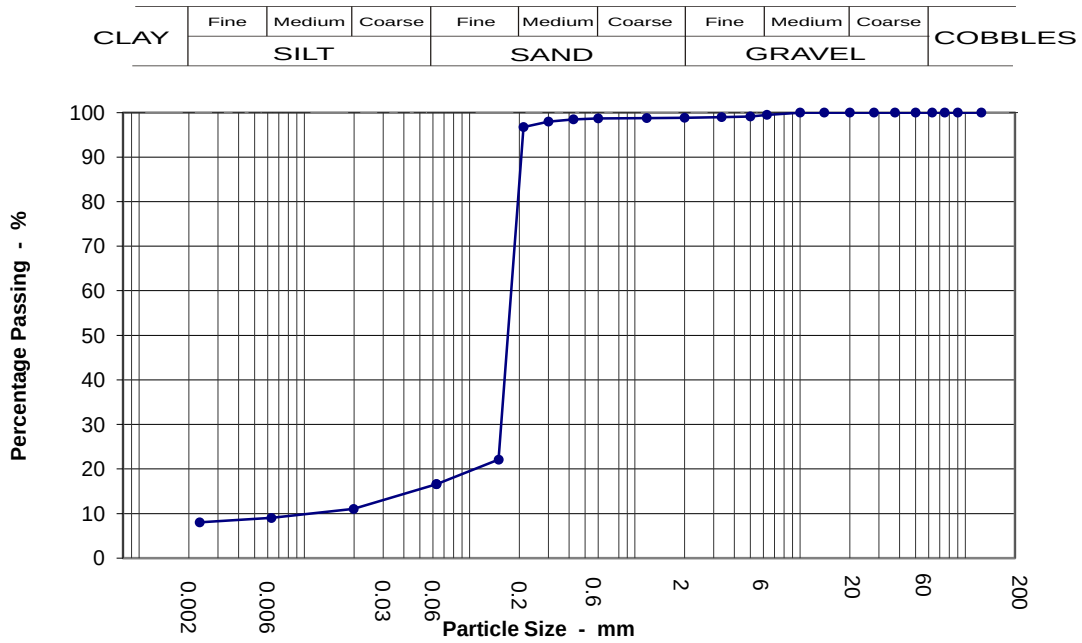
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17375
		Project No:	52247a
Location	Arthur West House, 79 Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH2
		Depth	2.00 m
Visual Soil Description	Brown clayey silty SAND with rare fine gravel	Sample Type/No	D - 3



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	11
90	100	0.006	9
75	100	0.002	8
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	99		
2	99		
1.18	99		
0.6	99		
0.425	98		
0.3	98		
0.212	97		
0.15	22		
0.063	17		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	1.2
Sand	82.6
Silt & Clay	16.2

Grading Analysis	
D100	125.0
D60	0.2
D10	
Uniformity Coefficient	N/A

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Date: 17/09/2014

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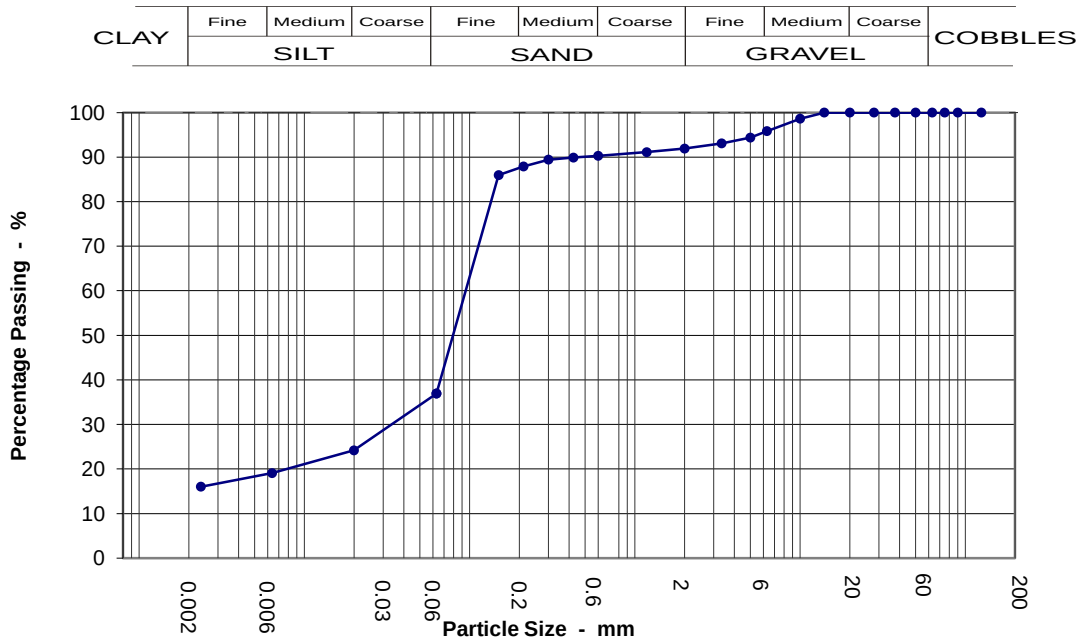
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17375
		Project No:	52247a
Location	Arthur West House, 79 Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH2
		Depth	5.00 m
Visual Soil Description	Brown and occasional grey and reddish brown sandy silty CLAY with occasional fm mudstone fragments	Sample Type/No	D - 6



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	24
90	100	0.006	19
75	100	0.002	16
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	96		
5	94		
3.35	93		
2	92		
1.18	91		
0.6	90		
0.425	90		
0.3	89		
0.212	88		
0.15	86		
0.063	37		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	8.1
Sand	55.9
Silt & Clay	36.1

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

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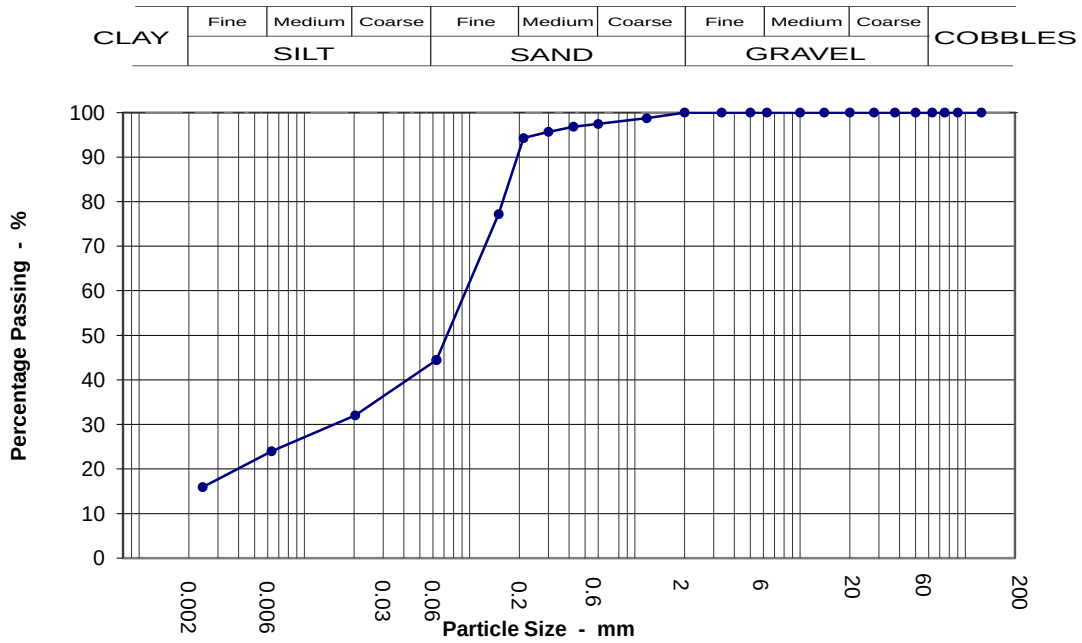
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17375
		Project No:	52247a
Location	Arthur West House, 79 Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH2
		Depth	15.50 m
Visual Soil Description	Grey sandy silty CLAY	Sample Type/No	D - 20



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	32
90	100	0.006	24
75	100	0.002	16
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	97		
0.425	97		
0.3	96		
0.212	94		
0.15	77		
0.063	44		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	56.4
Silt & Clay	43.6

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

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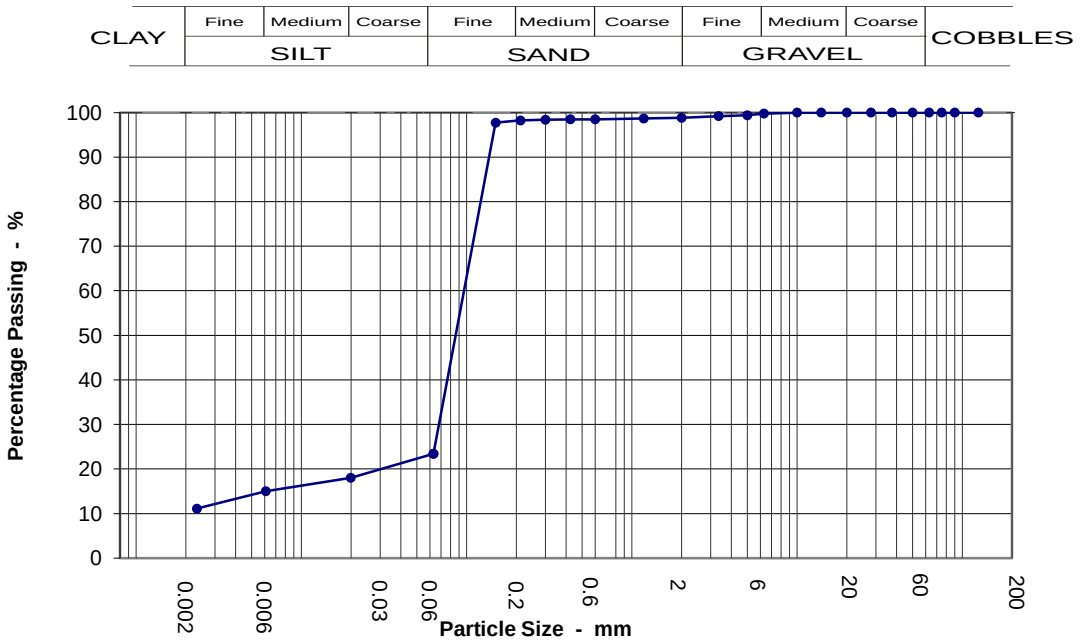
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17352
		Project No:	522474A
Location	Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH3
		Depth	6.50 m
Visual Soil Description	Orange brown and occasional grey slightly gravelly silty clayey SAND (gravel is fine and angular)	Sample Type/No	D - 10



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	18
90	100	0.006	15
75	100	0.002	11
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	99		
1.18	99		
0.6	98		
0.425	98		
0.3	98		
0.212	98		
0.15	98		
0.063	23		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	1.2
Sand	75.8
Silt & Clay	23.0

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

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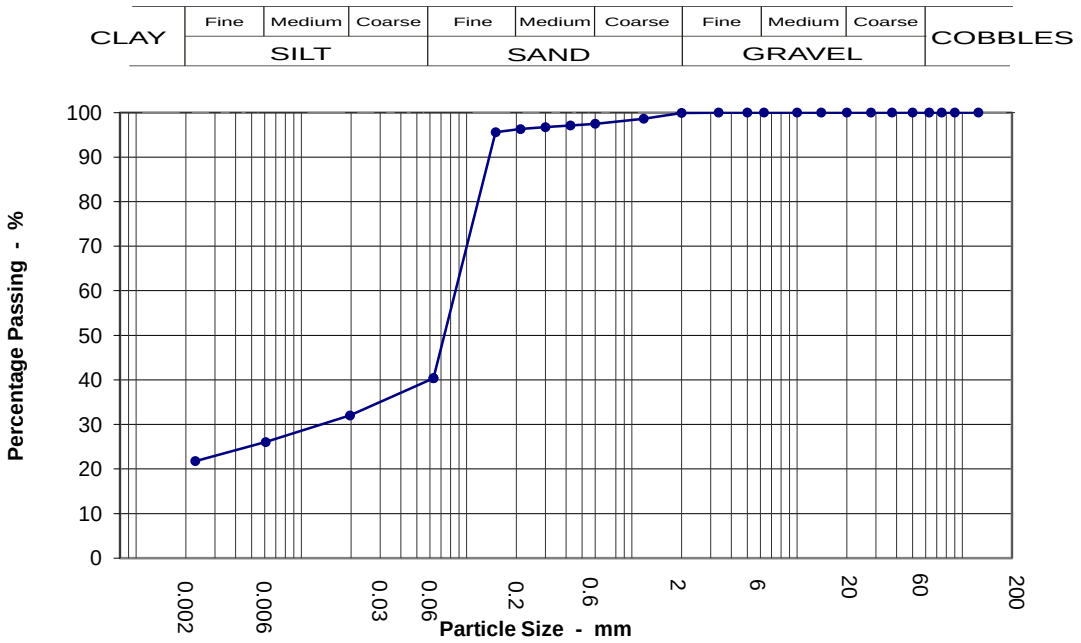
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17352
		Project No:	522474A
Location	Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH4
		Depth	6.20 m
Visual Soil Description	Greyish brown and occasional orange brown sandy silty CLAY	Sample Type/No	D - 14



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	32
90	100	0.006	26
75	100	0.002	22
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	97		
0.425	97		
0.3	97		
0.212	96		
0.15	96		
0.063	40		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	0.1
Sand	60.1
Silt & Clay	39.8

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

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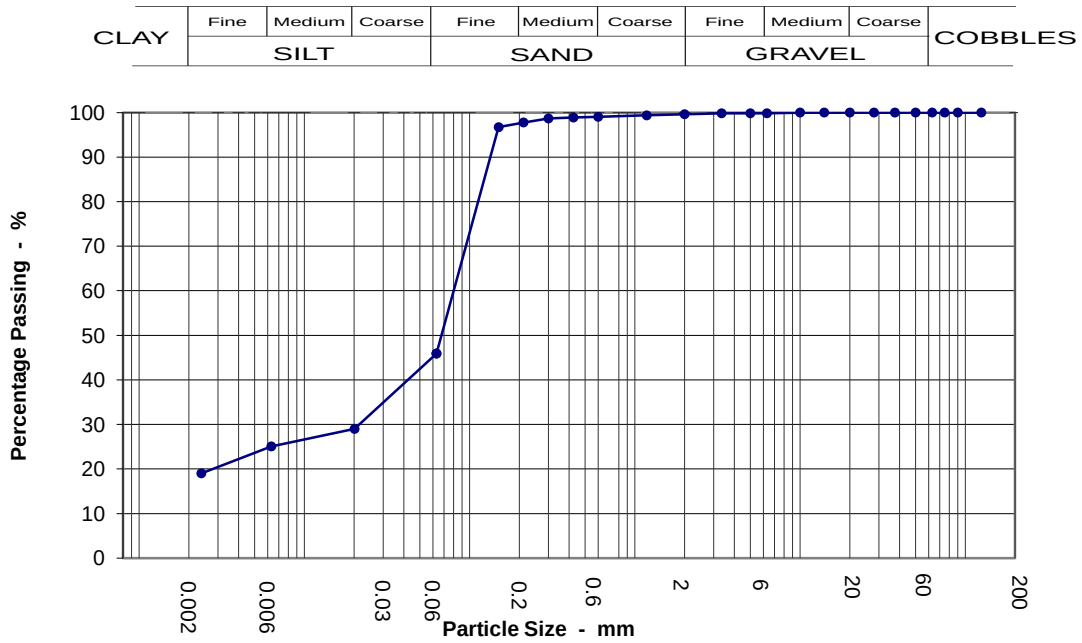
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17352
		Project No:	522474A
Location	Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH4
		Depth	7.50 m
Visual Soil Description	Pale grey, pale brown and occasional orange brown fine sandy silty CLAY	Sample Type/No	D - 16



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	29
90	100	0.006	25
75	100	0.002	19
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99		
0.425	99		
0.3	99		
0.212	98		
0.15	97		
0.063	46		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	0.4
Sand	54.9
Silt & Clay	44.7

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

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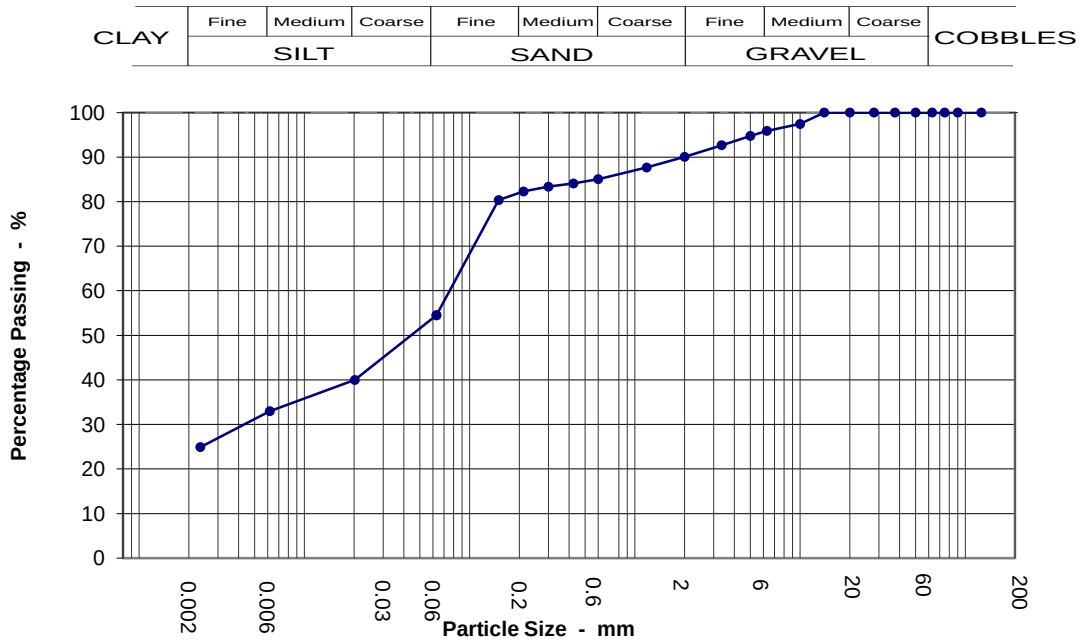
UKAS TESTING

Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17352
		Project No:	522474A
Location	Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH4
		Depth	10.00 m
Visual Soil Description	Orange brown and grey sandy silty CLAY with occasional fm mudstone fragments	Sample Type/No	D - 20



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	40
90	100	0.006	33
75	100	0.002	25
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	97		
6.3	96		
5	95		
3.35	93		
2	90		
1.18	88		
0.6	85		
0.425	84		
0.3	83		
0.212	82		
0.15	80		
0.063	55		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	9.9
Sand	36.6
Silt & Clay	53.5

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

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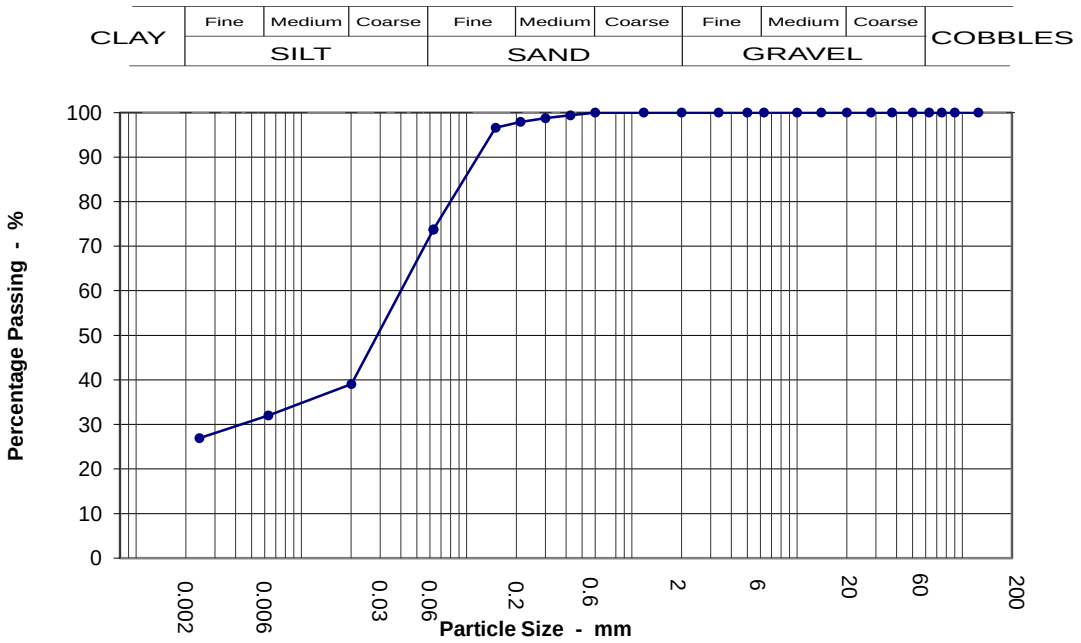
UKAS TESTING

Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17352
		Project No:	522474A
Location	Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH5
		Depth	3.00 m
Visual Soil Description	Pale brown and pale grey slightly sandy silty CLAY	Sample Type/No	D - 6



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	39
90	100	0.006	32
75	100	0.002	27
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	99		
0.212	98		
0.15	97		
0.063	74		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	28.7
Silt & Clay	71.3

Grading Analysis	
D100	125.0
D60	
D10	
Uniformity Coefficient	N/A

K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU.
E-mail: k4soils@aol.com

Approved Signatories:
K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 15/09/2014

UKAS TESTING

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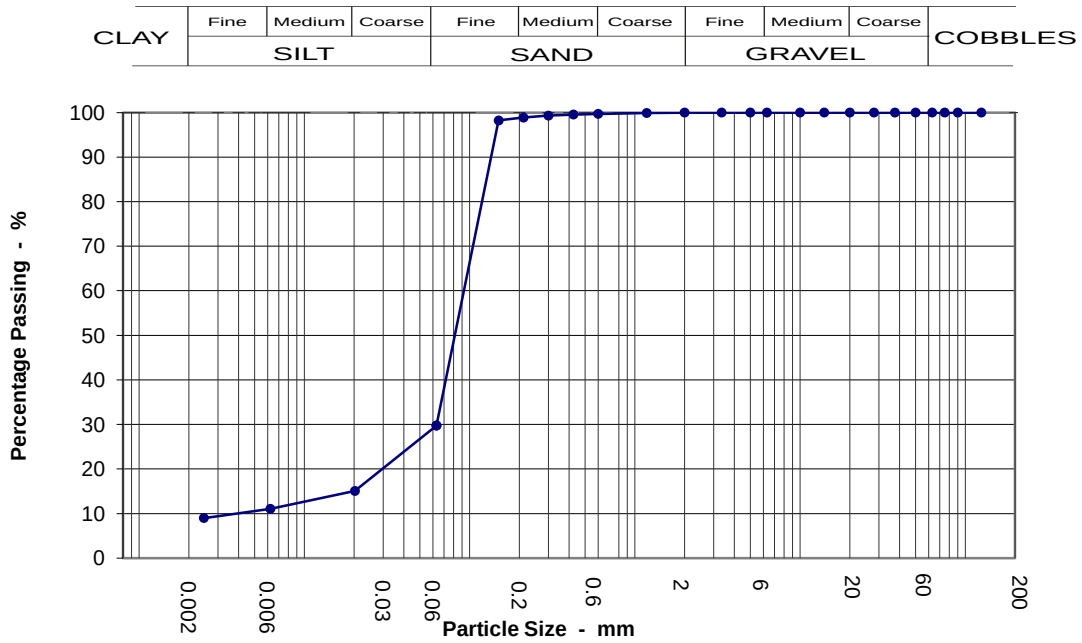
Figure A3.1

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	17352
		Project No:	522474A
Location	Fitzjohn's Avenue, Hampstead NW3 6PA	Borehole / Trial Pit No:	BH5
		Depth	8.00 m
Visual Soil Description	Greyish brown clayey silty SAND	Sample Type/No	D - 14



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.020	15
90	100	0.006	11
75	100	0.002	9
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	99		
0.15	98		
0.063	30		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.4
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	71.3
Silt & Clay	28.7

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU.
E-mail: k4soils@aol.com

Approved Signatories:
K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 15/09/2014

UKAS TESTING

2519

Figure A3.1

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-14078

03-Sep-14

Client Ian Farmer Associates
1A Batford Mill
Lower Luton Road
Harpenden
Herts
AL5 5BZ

Our Reference 14-14078

Client Reference 52247

Contract Title Fitzjohn's Avenue, Hampstead

Description 9 Soil samples.

Date Received 28-Aug-14

Date Started 28-Aug-14

Date Completed 03-Sep-14

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

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Figure A3.2

Summary of Chemical Analysis
Soil Samples

Our Ref 14-14078
Client Ref 52247
Contract Title Fitzjohn's Avenue, Hampstead

			Lab No	691461	691462	691463	691464	691465	691466	691467	691468	691469
			Sample ID	BH1	BH1	BH3	BH4	BH5	BH3	BH5	BH5	BH5
			Depth	1.20	2.00	0.70	1.20	0.50	1.90	4.00	13.00	16.00
			Other ID									
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	13/08/14	13/08/14	14/08/14	15/08/14	21/08/14	14/08/14	21/08/14	21/08/14	21/08/14
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**									
Inorganics												
pH	DETSC 2008#			7.5	7.5	11.1	7.2	8.5	7.3	6.6	7.7	7.6
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	24	62	1300	59	27	36	48	61	280
Total Sulphur as S	DETSC 2320	0.01	%						0.05	< 0.01	0.03	0.60
Total Sulphate as SO4	DETSC 2321#	0.01	%						0.14	0.02	0.07	0.12

Figure A3.2

Key: # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 14-14078
Client Ref 52247
Contract Fitzjohn's Avenue, Hampstead

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
691461	BH1 1.20 SOIL	13/08/14	PG	pH (7 days)	
691462	BH1 2.00 SOIL	13/08/14	PG	pH (7 days)	
691463	BH3 0.70 SOIL	14/08/14	PG	pH (7 days)	
691464	BH4 1.20 SOIL	15/08/14	PG	pH (7 days)	
691465	BH5 0.50 SOIL	21/08/14	PT 1L		
691466	BH3 1.90 SOIL	14/08/14	PG	pH (7 days)	
691467	BH5 4.00 SOIL	21/08/14	PT 1L		
691468	BH5 13.00 SOIL	21/08/14	PT 1L		
691469	BH5 16.00 SOIL	21/08/14	PT 1L		

Key: P-Plastic G-Bag T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Figure A3.2

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-14566

10-Sep-14

Client Ian Farmer Associates
1A Batford Mill
Lower Luton Road
Harpenden
Herts
AL5 5BZ

Our Reference 14-14566

Client Reference 52247

Contract Title Fitzjohn's Avenue, Hampstead

Description 4 Soil samples.

Date Received 03-Sep-14

Date Started 03-Sep-14

Date Completed 10-Sep-14

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

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Figure A3.2

Summary of Chemical Analysis
Soil Samples

Our Ref 14-14566
Client Ref 52247
Contract Title Fitzjohn's Avenue, Hampstead

			Lab No	694365	694366	694367	694368
			Sample ID	BH2	BH2	BH2	BH2
			Depth	0.50	3.00	8.50	10.50
			Other ID				
			Sample Type	D	D	D	D
			Sampling Date	27/08/14	27/08/14	27/08/14	27/08/14
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Inorganics							
pH	DETSC 2008#			8.5	6.1	7.2	7.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	31	63	350	180
Total Sulphur as S	DETSC 2320	0.01	%		0.02	0.48	0.51
Total Sulphate as SO4	DETSC 2321#	0.01	%		0.04	0.12	0.11

Key: # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Figure A3.2

Information in Support of the Analytical Results

Our Ref 14-14566
Client Ref 52247
Contract Fitzjohn's Avenue, Hampstead

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
694365	BH2 0.50 SOIL	27/08/14	PT 1L		
694366	BH2 3.00 SOIL	27/08/14	PT 1L		
694367	BH2 8.50 SOIL	27/08/14	PT 1L		
694368	BH2 10.50 SOIL	27/08/14	PT 1L		

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Figure A3.2

IAN FARMER ASSOCIATES Geotechnical & Environmental Specialists	**PLASTICITY CLASSIFICATION CHART**	Job no. 52247A
	Fitzjohn's Avenue, Hampstead, NW3 6PA	Fig no. A3.3

APPENDIX 4

CHEMICAL TESTS

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-13464-2

22-Sep-14

Client Ian Farmer Associates
1A Batford Mill
Lower Luton Road
Harpenden
Herts
AL5 5BZ

Our Reference 14-13464-2

Client Reference 52247

Contract Title Fitzjohn's Avenue

Description 4 Soil samples, 2 Leachate samples.

Date Received 19-Aug-14

Date Started 19-Aug-14

Date Completed 22-Sep-14

Test Procedures Identified by prefix DETSn (details on request), Asbestos Analysis DETSC 1101.

Notes **This report supersedes 14-13464-1. Leachates added**

Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2139

Figure A4.1

Summary of Chemical Analysis
Matrix Descriptions

Our Ref 14-13464-2
Client Ref 52247
Contract Title Fitzjohn's Avenue

Sample ID	Depth	Lab No	Completed	Matrix Description
BH1	0.3	687704	22/09/2014	brown gravelly sandy CLAY
BH1	0.9	687705	22/09/2014	brown gravelly sandy CLAY
BH3	0.5	687706	22/09/2014	brown gravelly sandy CLAY
BH3	1	687707	22/09/2014	brown gravelly sandy CLAY

Figure A4.1

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13464-2
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	687704	687705	687706	687707
			Sample ID	BH1	BH1	BH3	BH3
			Depth	0.30	0.90	0.50	1.00
			Other ID				
			Sample Type	SOIL	SOIL	SOIL	SOIL
			Sampling Date	13/08/14	13/08/14	14/08/14	14/08/14
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Metals							
Arsenic	DETSC 2301#	0.2	mg/kg	22	15	8.0	12
Boron (water soluble)	DETSC 2123#	0.2	mg/kg	2.4	2.2	1.5	2.0
Cadmium	DETSC 2301#	0.1	mg/kg	1.5	0.7	0.2	0.4
Chromium	DETSC 2301#	0.15	mg/kg	78	93	81	91
Hexavalent Chromium	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	83	41	8.2	15
Lead	DETSC 2301#	0.3	mg/kg	1500	330	54	180
Mercury	DETSC 2325#	0.05	mg/kg	0.43	0.52	< 0.05	0.17
Nickel	DETSC 2301#	1	mg/kg	28	20	14	18
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	0.6	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	450	120	44	83
Inorganics							
pH	DETSC 2008#			7.5	7.5	11.2	10.5
Cyanide free	DETSC 2130#	0.1	mg/kg	0.2	< 0.1	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%	4.7			0.6
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	11
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	28
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	39
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	7.8
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	19
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	0.6	< 0.6	< 0.6	440
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	2900
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	3300
TPH Ali/Aro	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	3400
Benzene	DETSC 3321#	0.01	mg/kg			< 0.01	
Ethylbenzene	DETSC 3321#	0.01	mg/kg			< 0.01	
Toluene	DETSC 3321#	0.01	mg/kg			< 0.01	
Xylene	DETSC 3321#	0.01	mg/kg			< 0.01	
MTBE	DETSC 3321	0.01	mg/kg			< 0.01	
PAHs							
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	< 0.1

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Figure A4.1

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13464-2
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	687704	687705	687706	687707
			Sample ID	BH1	BH1	BH3	BH3
			Depth	0.30	0.90	0.50	1.00
			Other ID				
			Sample Type	SOIL	SOIL	SOIL	SOIL
			Sampling Date	13/08/14	13/08/14	14/08/14	14/08/14
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	1.3	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	1.3	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	1.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	1.2	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	2.3	0.6	0.3	0.4
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.9	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	2.1	0.7	0.3	0.4
PAH	DETSC 3301	1.6	mg/kg	11	< 1.6	< 1.6	< 1.6

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Figure A4.1

Summary of Chemical Analysis
Leachate Samples

Our Ref 14-13464-2
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	701272	701273
			Sample ID	BH1	BH3
			Depth	0.90	1.00
			Other ID		
			Sample Type	LEACHATE	LEACHATE
			Sampling Date	13/08/14	14/08/14
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Preparation					
NRA Leachate Preparation	DETS 036*			Y	Y
Metals					
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	2.6	1.3
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	1.0	1.5
Copper, Dissolved	DETSC 2306	0.4	ug/l	4.4	1.1
Lead, Dissolved	DETSC 2306	0.09	ug/l	6.2	0.86
Mercury, Dissolved	DETSC 2306	0.01	ug/l	0.02	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.8	0.8
Selenium, Dissolved	DETSC 2306	0.25	ug/l	1.8	1.3
Zinc, Dissolved	DETSC 2306	1.25	ug/l	3.23	< 1.25
Inorganics					
pH	DETSC 2008			5.8	7.0
Cyanide free	DETSC 2130	20	ug/l	< 20	< 20
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 15.0	< 15.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 15.0	< 15.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 15.0	< 15.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 15.0	< 15.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	60	60
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 15.0	< 15.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 15.0	< 15.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 15.0	< 15.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 15.0	< 15.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	60	60
TPH Ali/Aro	DETSC 3072*	10	ug/l	120	120

Key: * -not accredited. n/s -not supplied.

Figure A4.1

Summary of Asbestos Analysis
Soil Samples

Our Ref 14-13464-2
Client Ref 52247
Contract Title Fitzjohn's Avenue

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
687704	BH1 0.30	SOIL	Amosite	Amosite present as fibre bundles	Jeff Cruddas
687706	BH3 0.50	SOIL	NAD	none	Jeff Cruddas

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Figure A4.1

Information in Support of the Analytical Results

Our Ref 14-13464-2
Client Ref 52247
Contract Fitzjohn's Avenue

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
687704	BH1 0.30 SOIL	13/08/14	GJ 250ml (250ml), GV (40ml), PT 1L (1kg)		
687705	BH1 0.90 SOIL	13/08/14	GJ 250ml (250ml), GV (40ml), PT 1L (1kg)		
687706	BH3 0.50 SOIL	14/08/14	GJ 250ml (250ml), GV (40ml), PT 1L (1kg)		
687707	BH3 1.00 SOIL	14/08/14	GJ 250ml (250ml), GV (40ml), PT 1L (1kg)		
701272	BH1 0.90 LEACHATE	13/08/14	GJ 1L (1L)		
701273	BH3 1.00 LEACHATE	14/08/14	GJ 1L (1L)		

Key: G-Glass P-Plastic J-Jar V-Vial T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Figure A4.1

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Figure A4.1

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-13783

29-Aug-14

Client Ian Farmer Associates
1A Batford Mill
Lower Luton Road
Harpenden
Herts
AL5 5BZ

Our Reference 14-13783

Client Reference 52247

Contract Title Fitzjohn's Avenue

Description 2 Soil samples.

Date Received 22-Aug-14

Date Started 22-Aug-14

Date Completed 29-Aug-14

Test Procedures Identified by prefix DETSn (details on request), Asbestos Analysis DETSC 1101.

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2139

Figure A4.1

Summary of Chemical Analysis
Matrix Descriptions

Our Ref 14-13783
Client Ref 52247
Contract Title Fitzjohn's Avenue

Sample ID	Depth	Lab No	Completed	Matrix Description
BH5	0.5	689432	29/08/2014	Brown gravelly sandy CLAY
BH5	1	689433	29/08/2014	Brown gravelly sandy CLAY with odd rootlets

Figure A4.1

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13783
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	689432	689433
			Sample ID	BH5	BH5
			Depth	0.50	1.00
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	18/08/14	18/08/14
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	7.1	10
Boron (water soluble)	DETSC 2123#	0.2	mg/kg	0.8	1.1
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	0.2
Chromium	DETSC 2301#	0.15	mg/kg	97	82
Hexavalent Chromium	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	8.4	7.0
Lead	DETSC 2301#	0.3	mg/kg	14	11
Mercury	DETSC 2325#	0.05	mg/kg	0.05	0.06
Nickel	DETSC 2301#	1	mg/kg	5.8	8.7
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	25	29
Inorganics					
Cyanide free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%		0.4
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
TPH Ali/Aro	DETSC 3072*	10	mg/kg	< 10	< 10

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Figure A4.1

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13783
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	689432	689433
			Sample ID	BH5	BH5
			Depth	0.50	1.00
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	18/08/14	18/08/14
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
PAHs					
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
PAH	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6

Figure A4.1

Summary of Asbestos Analysis
Soil Samples

Our Ref 14-13783
Client Ref 52247
Contract Title Fitzjohn's Avenue

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
689432	BH5 0.50	SOIL	NAD	none	Keith Wilson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Figure A4.1

Information in Support of the Analytical Results

Our Ref 14-13783
Client Ref 52247
Contract Fitzjohn's Avenue

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
689432	BH5 0.50 SOIL	18/08/14	GJ 250ml (250ml), GV (40ml), PT 1L (1kg)		
689433	BH5 1.00 SOIL	18/08/14	GJ 250ml (250ml), GV (40ml), PT 1L (1kg)		

Key: G-Glass P-Plastic J-Jar V-Vial T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Figure A4.1

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Figure A4.1

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-13784-1

22-Sep-14

Client Ian Farmer Associates
1A Batford Mill
Lower Luton Road
Harpenden
Herts
AL5 5BZ

Our Reference 14-13784-1

Client Reference 52247

Contract Title Fitzjohn's Avenue

Description 2 Soil samples, 1 Leachate sample.

Date Received 22-Aug-14

Date Started 22-Aug-14

Date Completed 22-Sep-14

Test Procedures Identified by prefix DETSn (details on request), Asbestos Analysis DETSC 1101.

Notes **This report supersedes 14-13784. Leachates added**

Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2139

Figure A4.1

Summary of Chemical Analysis
Matrix Descriptions

Our Ref 14-13784-1
Client Ref 52247
Contract Title Fitzjohn's Avenue

Sample ID	Depth	Lab No	Completed	Matrix Description
BH4	0.4	689434	22/09/2014	Dark grey gravelly sandy CLAY with odd rootlets
BH4	0.8	689435	22/09/2014	Brown gravelly sandy CLAY (made ground includes brick)

Figure A4.1

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13784-1
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	689434	689435
			Sample ID	BH4	BH4
			Depth	0.40	0.80
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	15/08/14	15/08/14
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	13	11
Boron (water soluble)	DETSC 2123#	0.2	mg/kg	1.3	1.1
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.2
Chromium	DETSC 2301#	0.15	mg/kg	100	120
Hexavalent Chromium	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	28	19
Lead	DETSC 2301#	0.3	mg/kg	84	97
Mercury	DETSC 2325#	0.05	mg/kg	0.19	0.43
Nickel	DETSC 2301#	1	mg/kg	17	10
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	73	45
Inorganics					
pH	DETSC 2008#			7.9	7.7
Cyanide free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%		1.6
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
TPH Ali/Aro	DETSC 3072*	10	mg/kg	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	
MTBE	DETSC 3321	0.01	mg/kg	< 0.01	
PAHs					
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Figure A4.1

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13784-1
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	689434	689435
			Sample ID	BH4	BH4
			Depth	0.40	0.80
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	15/08/14	15/08/14
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.3	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	0.3	< 0.1
PAH	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6

Summary of Chemical Analysis
Leachate Samples

Our Ref 14-13784-1
Client Ref 52247
Contract Title Fitzjohn's Avenue

Lab No	701271
Sample ID	BH4
Depth	0.80
Other ID	
Sample Type	LEACHATE
Sampling Date	15/08/14
Sampling Time	n/s

Test	Method	LOD	Units	
Preparation				
NRA Leachate Preparation	DETS 036*			Y
Metals				
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	2.7
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	2.6
Copper, Dissolved	DETSC 2306	0.4	ug/l	2.6
Lead, Dissolved	DETSC 2306	0.09	ug/l	3.9
Mercury, Dissolved	DETSC 2306	0.01	ug/l	0.02
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	2.3
Zinc, Dissolved	DETSC 2306	1.25	ug/l	1.60
Inorganics				
pH	DETSC 2008			5.5
Cyanide free	DETSC 2130	20	ug/l	< 20
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	6.1
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	7.5
Aromatic C12-C16	DETSC 3072*	1	ug/l	8.4
Aromatic C16-C21	DETSC 3072*	1	ug/l	13
Aromatic C21-C35	DETSC 3072*	1	ug/l	11
Aromatic C5-C35	DETSC 3072*	10	ug/l	40
TPH Ali/Aro	DETSC 3072*	10	ug/l	47

Key: * -not accredited. n/s -not supplied.

Figure A4.1

Summary of Asbestos Analysis
Soil Samples

Our Ref 14-13784-1
Client Ref 52247
Contract Title Fitzjohn's Avenue

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
689434	BH4 0.40	SOIL	NAD	none	Keith Wilson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Figure A4.1

Information in Support of the Analytical Results

Our Ref 14-13784-1
Client Ref 52247
Contract Fitzjohn's Avenue

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
689434	BH4 0.40 SOIL	15/08/14	GJ 250ml (250ml), GJ 60ml (60ml), PT 1L (1kg)		
689435	BH4 0.80 SOIL	15/08/14	GJ 250ml (250ml), PT 1L (1kg)		
701271	BH4 0.80 LEACHATE	15/08/14	GJ 1L (1L)		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Figure A4.1

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Figure A4.1

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-14255

04-Sep-14

Client Ian Farmer Associates
1A Batford Mill
Lower Luton Road
Harpenden
Herts
AL5 5BZ

Our Reference 14-14255

Client Reference 52247

Contract Title Fitzjohn's Avenue

Description 2 Soil samples.

Date Received 29-Aug-14

Date Started 29-Aug-14

Date Completed 04-Sep-14

Test Procedures Identified by prefix DETSn (details on request), Asbestos Analysis DETSC 1101.

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

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Figure A4.1

Summary of Chemical Analysis
Matrix Descriptions

Our Ref 14-14255
Client Ref 52247
Contract Title Fitzjohn's Avenue

Sample ID	Depth	Lab No	Completed	Matrix Description
TP1	0.2	692710	04/09/2014	Brown clayey sandy GRAVEL (sample matrix outside MCERTS scope of accreditation)
TP2	0.5	692711	04/09/2014	Dark brown grey gravelly silty sandy CLAY (made ground includes brick)

Figure A4.1

Summary of Chemical Analysis
Soil Samples

Our Ref 14-14255
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	692710	692711
			Sample ID	TP1	TP2
			Depth	0.20	0.50
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	27/08/14	27/08/14
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	10	7.7
Boron (water soluble)	DETSC 2123#	0.2	mg/kg	1.4	1.4
Cadmium	DETSC 2301#	0.1	mg/kg	0.5	0.9
Chromium	DETSC 2301#	0.15	mg/kg	96	98
Hexavalent Chromium	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	10	20
Lead	DETSC 2301#	0.3	mg/kg	16	310
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.19
Nickel	DETSC 2301#	1	mg/kg	29	9.1
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	62	55
Inorganics					
pH	DETSC 2008#			8.6	8.3
Cyanide free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	1.9
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	25
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	270
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	300
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	7.8
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	32
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	40
TPH Ali/Aro	DETSC 3072*	10	mg/kg	< 10	340
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	
MTBE	DETSC 3321	0.01	mg/kg	< 0.01	
PAHs					
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.4

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Figure A4.1

Summary of Chemical Analysis
Soil Samples

Our Ref 14-14255
Client Ref 52247
Contract Title Fitzjohn's Avenue

			Lab No	692710	692711
			Sample ID	TP1	TP2
			Depth	0.20	0.50
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	27/08/14	27/08/14
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	0.6
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.3
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.4
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.7
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	0.2
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.3	0.5
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.4	0.2
Pyrene	DETSC 3301	0.1	mg/kg	0.2	0.4
PAH	DETSC 3301	1.6	mg/kg	< 1.6	3.5

Figure A4.1

Summary of Asbestos Analysis
Soil Samples

Our Ref 14-14255
Client Ref 52247
Contract Title Fitzjohn's Avenue

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
692710	TP1 0.20	SOIL	NAD	none	Colin Patrick

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Figure A4.1

Information in Support of the Analytical Results

Our Ref 14-14255
Client Ref 52247
Contract Fitzjohn's Avenue

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
692710	TP1 0.20 SOIL	27/08/14	GJ 250ml (250ml), GJ 60ml (60ml), PT 1L (1kg)		
692711	TP2 0.50 SOIL	27/08/14	GJ 250ml (250ml), GJ 60ml (60ml), PT 1L (1kg)		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Figure A4.1

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Figure A4.1

Waste Classification Report

VJQ5F-AQF86-N4WF6

Job name

52247A Fitzjohn's Avenue

Waste stream

Default Contaminated Land

Comments

Apartment block for over 55s

Project

52247A

Site

Fitzjohn's Avenue

Classified by

Name:
Greenwood, Gavin
Date:
17/09/2014 15:02
Telephone:
01582 460018

Company:
Ian Farmer Associates
Unit 1A, Batford Mill
Lower Luton Road
Harpenden
AL5 5BZ

Report

Created by: Greenwood, Gavin
Created date: 17/09/2014 15:02

Job summary

Figure A4.2

APPENDIX 5

DESIGN CONSIDERATIONS

APPENDIX 5

GUIDELINES FOR THE DESIGN OF PILES

FIRST APPROXIMATION OF WORKING LOAD

A5.1 GENERAL

The ultimate carrying capacity, Qu, of a particular pile is taken as the sum of the ultimate shaft friction resistance, Qs, and the ultimate end bearing resistance, Qb. This may be expressed as follows:-

$$Qu = Qs + Qb$$

$$= f.As + q.Ab$$

where f = unit shaft resistance

As = embedded surface area of pile

q = unit end bearing resistance

Ab = effective cross-sectional area of pile base

A5.2 COHESIVE SOILS

A5.2.1 Shaft Resistance

The ultimate shaft resistance, f, for piles in both compression or tension in cohesive soils is determined by applying a factor to the undrained shear strength, Cs, which exists in the soils along the embedded length of the pile, and is given by:-

$$f = \alpha.Cs$$

Where α is an adhesion factor, which for straight-shafted bored piles may be taken as 0.45 to 0.60.

Ultimate unit shaft friction should not exceed 100kPa.

A5.2.2 End Bearing

For piles terminating in cohesive soils, the ultimate unit end bearing resistance q, is given by:-

$$q = Nc.Cb$$

where Cb is the undrained shear strength at the base of the pile

and Nc is a bearing capacity factor

The value of Nc for a cohesive material is variable, depending on the depth of the penetration of the pile into the bearing stratum. Generally, Nc could be taken to have a value of 9, except in the case of large diameter short piles where a lesser value should be used.

A5.3 COHESIONLESS SOILS

A5.3.1 Shaft Resistance

For piles driven in cohesionless soils the ultimate unit shaft resistance, f, may be calculated using the following method, which gives:-

$$f = 0.5\gamma' (D+d) Ks \tan \delta$$

where γ' = average effective unit weight of soil surrounding the pile

D = depth to the pile toe or to the base of the granular stratum whichever is the lesser

d = depth to the top of the granular stratum

δ = angle of friction between pile and soil (see below)

Ks = a coefficient (see below)

VALUES OF Ks AND δ

Pile Type	δ	Ks		
		Relative Density		Tension Piles
		Low	High	
Steel	20°	0.5	1.5	0.5
Concrete	0.75ϕ	1.0	2.0	0.5

For bored and cast-in-place piles, $\delta = 22°$ and $Ks = 1$ should be used to allow for loosening of the soil during boring.

It has been found that the ultimate unit shaft resistance does not exceed 100kPa and therefore this value should not be exceeded in design.

A5.3.2 End Bearing

The unit ultimate end bearing resistance (q) of piles in cohesionless soils may be calculated as follows:-

$$q = \gamma'.D.Nq$$

where γ' = average effective unit weight of soil surrounding the pile

D = depth to pile toe

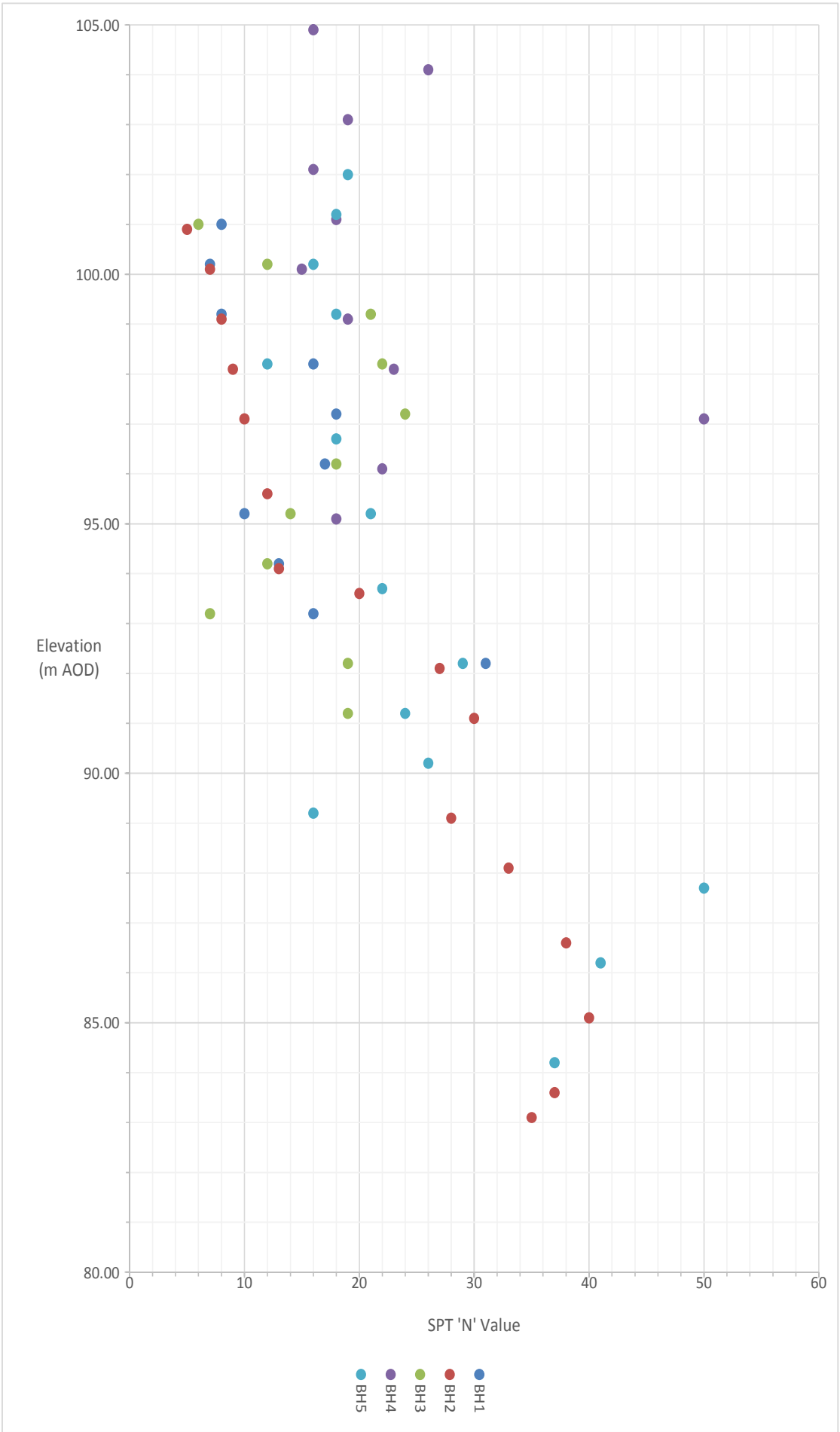
Nq = bearing capacity factor

In addition, the ultimate unit base resistance should not exceed a value of 11,000kPa. For bored and cast-in-place piles the value of Nq used should correspond to loose soil conditions.

A5.4 FACTORS OF SAFETY

A5.4.1 Cohesive and Non-cohesive Soils

For cohesive and non-cohesive soils a factor of safety of 3 may be used to obtain the allowable or safe carrying capacity of piles from the ultimate carrying capacity.



IAN FARMER ASSOCIATES Geotechnical & Environmental Specialists	**PLOT OF SPT 'N' VALUE WITH ELEVATION**	Job no. 52247A
	Fitzjohn's Avenue, Hampstead, NW3 6PA	Fig No A5.1

APPENDIX 6

CONTAMINATION ASSESSMENT

APPENDIX 6

GENERAL NOTES ON CONTAMINATION ASSESSMENT

A6.1 STATUTORY FRAMEWORK AND DEFINITIONS

A6.1.1 The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref. 10.18, which was introduced by the Environment Act 1995, ref. 10.19;

'Land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being, or is likely to be, caused.'

A6.1.2 The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, ref. 10.35 was published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by DEFRA and the Environment Agency and updated version of CLR 9 and 10 were produced in the form of Science Reports SR2, ref. 10.26 and SR3, ref. 10.20.

A6.1.3 In establishing whether a site fulfils the statutory definition of 'contaminated land' it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A6.1.4 A *'pollutant linkage'* may be defined as the link between a contaminant *'source'* and a *'receptor'* by means of a *'pathway'*.

A6.2 ASSESSMENT METHODOLOGY

A6.2.1 The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

A6.2.2 Stages 1 and 2 develop a *'conceptual model'* based upon information collated from desk based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2, ref. 10.41. The formation of a conceptual model is an iterative process and as such, it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

A6.2.3 The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3, ref. 10.42. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. CLR 8, ref. 10.43, together with specific DoE 'Industry Profiles' provides guidance on the nature of contaminants relating to specific industrial processes. Although CLR 8 has been withdrawn, no replacement guidance has been published that lists the contaminants likely to be present on contaminated sites and as such the guidance relating to this issue of CLR 8 is considered to still be relevant.

A6.2.4 If potential pollutant linkages are identified within the conceptual model, a Phase 2 site investigation and report will be recommended. The investigation should be planned in general accordance with CLR 4, ref. 10.1. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the conceptual model can be updated and relevant pollutant linkages can be identified.

A6.2.5 A two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.

A6.2.6 All site works should be in general accordance with the British Standards, BS 5930:1999, ref. 10.3, ISO 1997, ref. 10.4 and BS 10175:2001, ref. 10.2.

A6.2.7 The generic contamination risk assessment screens the results of the chemical analysis against generic guidance values. Soils will be compared to Assessment Criteria (AC) generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.06, ref. 10.22. Toxicological and physico-chemical/fate and transport data used to generate the AC has been derived from a hierarchy of data sources as follows:

1. Environment Agency or Department of Environment Food and Rural Affairs

   (DEFRA) documents;

2. Other documents produced by UK Government or state organisations;

3. European institution documents;

4. International organisation documents;

5. Foreign government institutions.

A6.2.8 In the case of the majority of contaminants considered, the toxicological data has been drawn from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), ref. 10.21, where available. Where no TOX report is available reference has been made to the health criteria values, derived for use in Land Quality Press (2006), ref. 10.27, as this is considered to represent a peer reviewed data source. Similarly, fate and transport data has been derived in the first instance from Environment Agency (2003), ref. 10.44 and for contaminants not considered in this document the fate and transport data used in previous versions of the CLEA model has been used.

A6.2.9 Recommendations for tolerable intakes of lead are based on evaluation of the relationship between exposure and blood lead levels. Consequently the Tox report for lead considers a health criteria value based on an uptake dose, whereas the CLEA model estimates exposure in terms of an intake dose, therefore, the CLEA model is not considered appropriate for determining an assessment criteria for lead. In the absence of a current published assessment criterion, the SGVs for lead reported in R&D Publication CLR 10 ref. 10.45 have been used in this assessment.

A6.2.10 Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CIEH and CL:AIRE 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', ref. 10.22. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.

A6.2.11 Initially the distribution of the data set is tested using the Shapiro-Wilk normality test, ref. 10.25 to determine if the data set is, or is not, normally distributed. Where the distribution of the data is shown to be normal, the mean value test is applied to determine whether the mean characteristics of the selected soil unit present a significant possibility of significant harm to human health. Where the data is not normally distributed a method based on the Chebychev Theorem can be applied to test the same hypothesis. The significance of the data is further tested using the maximum value test. This determines whether the highest recorded contaminant concentrations are from the same statistical distribution or whether they may represent a 'hot spot'.

A6.2.12 Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.

A6.2.13 The risk evaluation will address the potential pollutant linkages between an identified source of contamination and the likely receptors both on and off site.

A6.2.14 The potential receptors include:

1) Humans – current site occupants, construction workers, future site users and neighbouring site users.

2) Controlled Waters – surface water and groundwater resources

3) Plants – current and future site vegetation

4) Building materials

A6.2.15 The potential hazards to be considered in relation to contamination are:

a) Ingestion and inhalation.

b) Uptake of contaminants via cultivated vegetables.

c) Dermal contact

d) Phytotoxicity (the prevention or inhibition of plant growth)

e) Contamination of water resources

f) Chemical attack on building materials and services

g) Fire and explosion

A6.2.16 Dependent on the outcome of the initial, generic contamination risk assessment, further detailed assessment of the identified risks may be required.

A6.3 Generic Guidance Values Used Within Contamination Risk Assessment

Residential End Use

	Determinant	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Primary Data Source
		1% SOM	2.5% SOM	6% SOM	
PAH	Acenaphthene	210	450	1000	LQM CIEH GAC
	Acenaphthylene	170	400	850	LQM CIEH GAC
	Anthracene	2300	4900	9200	LQM CIEH GAC
	Benzo(a)anthracene	3.1	4.7	5.9	LQM CIEH GAC
	Benzo(a)pyrene	0.83	0.94	1	LQM CIEH GAC
	Benzo(b)fluoranthene	5.6	6.5	7	LQM CIEH GAC
	Benzo(ghi)perylene	44	46	47	LQM CIEH GAC
	Benzo(k)fluoranthene	8.5	9.6	10	LQM CIEH GAC
	Chrysene	6	8	9.3	LQM CIEH GAC
	Dibenzo(ah)anthracene	0.76	0.86	0.90	LQM CIEH GAC
	Fluoranthene	260	460	670	LQM CIEH GAC
	Fluorene	160	380	780	LQM CIEH GAC
	Indeno(123-cd)pyrene	3.2	3.9	4.2	LQM CIEH GAC
	Naphthalene	1.5	3.7	8.7	LQM CIEH GAC
	Phenanthrene	92	200	380	LQM CIEH GAC
	Pyrene	560	1000	1600	LQM CIEH GAC
Other Organics	Phenol	210	390	780	LQM CIEH GAC
Metals	Arsenic	32	32	32	EA 2009
	Beryllium	51	51	51	LQM CIEH GAC
	Boron	291	291	291	LQM CIEH GAC
	Cadmium	10	10	10	EA 2009
	Chromium (III)	3000	3000	3000	LQM CIEH GAC
	Chromium (VI)	4.3	4.3	4.3	LQM CIEH GAC
	Copper	2330	2330	2330	LQM CIEH GAC
	Lead	450	450	450	CLEA SGV 10
	Inorganic Mercury	169	169	169	EA 2009
	Nickel	130	130	130	EA 2009
	Selenium	350	350	350	EA 2009
	Vanadium	75	75	75	LQM CIEH GAC
	Zinc	3750	3750	3750	LQM CIEH GAC

SOM = Soil Organic Matter

Commercial End Use

	Determinant	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Primary Data Source
		1% SOM	2.5% SOM	6% SOM	
PAH	Acenaphthene	85000 (57)	98000 (141)	100000	LQM CIEH GAC
	Acenaphthylene	84000 (86)	97000 (212)	100000	LQM CIEH GAC
	Anthracene	530000	540000	540000	LQM CIEH GAC
	Benzo(a)anthracene	90	95	97	LQM CIEH GAC
	Benzo(a)pyrene	14	14	14	LQM CIEH GAC
	Benzo(b)fluoranthene	100	100	100	LQM CIEH GAC
	Benzo(ghi)perylene	650	660	660	LQM CIEH GAC
	Benzo(k)fluoranthene	140	140	140	LQM CIEH GAC
	Chrysene	140	140	140	LQM CIEH GAC
	Dibenzo(ah)anthracene	13	13	13	LQM CIEH GAC
	Fluoranthene	23000	23000	23000	LQM CIEH GAC
	Fluorene	64000 (31)	69000	71000	LQM CIEH GAC
	Indeno(123-cd)pyrene	60	61	62	LQM CIEH GAC
	Naphthalene	200 (76)	480 (183)	1100 (432)	LQM CIEH GAC
	Phenanthrene	22000	22000	23000	LQM CIEH GAC
	Pyrene	54000	54000	54000	LQM CIEH GAC
Other Organics	Phenol	1100000 (24200)	1100000 (38100)	1200000	LQM CIEH GAC
Metals	Arsenic	640	640	640	EA 2009
	Beryllium	420	420	420	LQM CIEH GAC
	Boron	192000	192000	192000	LQM CIEH GAC
	Cadmium	230	230	230	EA 2009
	Chromium (III)	30400	30400	30400	LQM CIEH GAC
	Chromium (VI)	35	35	35	LQM CIEH GAC
	Copper	71700	71700	71700	LQM CIEH GAC
	Lead	750	750	750	CLEA SGV 10
	Inorganic Mercury	3640	3640	3640	EA 2009
	Nickel	1800	1800	1800	EA 2009
	Selenium	13000	13000	13000	EA 2009
	Vanadium	3160	3160	3160	LQM CIEH GAC
	Zinc	665000	665000	665000	LQM CIEH GAC

SOM = Soil Organic Matter
Values in brackets indicate the solubility or vapour saturation limit where this is exceeded by the GAC

A6.3.1 Generic Assessment Criteria for Petroleum Hydrocarbons

Residential	Guidance Value (mg/kg) 1% SOM	Guidance Value (mg/kg) 2.5% SOM	Guidance Value (mg/kg) 6% SOM	Primary Data Source
Aliphatic				
EC 5-6	30	55	110	LQM CIEH GAC
EC >6-8	73	160	370	LQM CIEH GAC
EC >8-10	19	46	110	LQM CIEH GAC
EC >10-12	93 (48)	230 (118)	540 (283)	LQM CIEH GAC
EC >12-16	740 (24)	1700 (59)	3000 (142)	LQM CIEH GAC
EC >16-35	45000 (8.48)	64000 (21)	76000	LQM CIEH GAC
EC >35-44	45000 (8.48)	64000 (21)	76000	LQM CIEH GAC
Aromatic				
EC 5-7 (benzene)	65	130	280	LQM CIEH GAC
EC >7-8 (toluene)	120	270	611	LQM CIEH GAC
EC >8-10	27	65	151	LQM CIEH GAC
EC >10-12	69	160	346	LQM CIEH GAC
EC >12-16	140	310	593	LQM CIEH GAC
EC >16-21	250	480	770	LQM CIEH GAC
EC >21-35	890	1100	1230	LQM CIEH GAC
EC >35-44	890	1100	1230	LQM CIEH GAC
Aliphatic and Aromatic				
EC >44-70	1200	1300	1300	LQM CIEH GAC
BTEX				
Benzene	0.08	0.18	0.33	EA 2009
Toluene	119	319	611	EA 2009
Ethylbenzene	65.2	183	354	EA 2009
Xylenes	45.2	126	246	EA 2009

SOM = Soil Organic Matter
Values in brackets indicate the solubility or vapour saturation limit where this is exceeded by the GAC

Commercial	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Primary Data Source
	1% SOM	2.5% SOM	6% SOM	
Aliphatic				
EC 5-6	3400 (304)	6200 (558)	13000 (1150)	LQM CIEH GAC
EC >6-8	8300 (144)	18000 (322)	42000 (736)	LQM CIEH GAC
EC >8-10	2100 (78)	5100 (190)	12000 (451)	LQM CIEH GAC
EC >10-12	10000 (48)	24000 (118)	49000 (283)	LQM CIEH GAC
EC >12-16	61000 (24)	83000 (59)	91000 (142)	LQM CIEH GAC
EC >16-35	1600000	1800000	1800000	LQM CIEH GAC
EC >35-44	1600000	1800000	1800000	LQM CIEH GAC
Aromatic				
EC 5-7 (benzene)	28000 (1220)	49000 (2260)	90000 (4710)	LQM CIEH GAC
EC >7-8 (toluene)	59000 (869)	110000 (1920)	190000 (4360)	LQM CIEH GAC
EC >8-10	3700 (613)	8600 (1500)	18000 (3580)	LQM CIEH GAC
EC >10-12	17000 (364)	29000 (899)	34500 (2150)	LQM CIEH GAC
EC >12-16	36000 (169)	37000	37800	LQM CIEH GAC
EC >16-21	28000	28000	28000	LQM CIEH GAC
EC >21-35	28000	28000	28000	LQM CIEH GAC
EC >35-44	28000	28000	28000	LQM CIEH GAC
Aliphatic and Aromatic				
EC >44-70	28000	28000	28000	LQM CIEH GAC
BTEX				
Benzene	28.1	57	94.7	EA 2009
Toluene	59000 (869)	125000 (2260)	189000 (4360)	EA 2009
Ethylbenzene	16800 (518)	40400 (1450)	65700 (2840)	EA 2009
Xylenes	6940 (478)	18600 (1330)	34600 (2620)	EA 2009

SOM = Soil Organic Matter
Values in brackets indicate the vapour saturation limit where this is exceeded by the GAC or SGV

END USE: Residential with plant uptake		Risk Assessment Value	Sample Id				BH1	BH1	BH3	BH3	BH4	BH4	BH5	BH5	TP1	TP2
			Depth - m				0.30	0.90	0.50	1.00	0.40	0.80	0.50	1.00	0.20	0.70
			US_{95}	T	Outlier	Average										
Metals																
Arsenic	mg/kg	32	14	-	-	12	22	15	8.0	12	13	11	7.1	10	10	7.7
Boron (water soluble)	mg/kg	290	1.8	-	-	1.5	2.4	2.2	1.5	2.0	1.3	1.1	0.80	1.1	1.4	1.4
Cadmium	mg/kg	10	0.83	-	-	0.53	1.8	0.70	0.20	0.40	0.30	0.20	0.10	0.20	0.50	0.90
Chromium	mg/kg	3000	101	-	-	94	78	93	81	91	100	120	97	82	96	98
Hexavalent Chromium	mg/kg	4.3	1.00	-	-	1.00	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1.0	<1.0
Copper	mg/kg	2330	37	-	-	24	83	41	8.2	15	28	19	8.4	7.0	10	20
Lead	mg/kg	450	521	1.8	No	260	1500	330	54	180	84	97	14	11	16	310
Mercury	mg/kg	1	0.32	-	-	0.21	0.43	0.52	<0.05	0.17	0.19	0.43	0.05	0.06	<0.05	0.19
Nickel	mg/kg	130	21	-	-	16	28	20	14	18	17	10	5.8	8.7	29	9.1
Selenium	mg/kg	350	0.53	-	-	0.51	<0.5	0.60	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	mg/kg	3750	172	-	-	99	450	120	44	83	73	45	25	29	62	55
Inorganics																
pH		5-9	-	-	-	8.7	7.5	7.5	11.2	10.5	7.90	7.70			8.6	8.3
Free Cyanide	mg/kg	34	0.13	-	-	0.11	0.20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organic matter	%		-	-	-	1.8	4.7			0.60		1.6		0.40		
Petroleum Hydrocarbons																
Aliphatic C5-C6	mg/kg	30	0.01	-	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatic C6-C8	mg/kg	73	0.01	-	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatic C8-C10	mg/kg	19	0.01	-	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatic C10-C12	mg/kg	93	1.5	-	-	1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Aliphatic C12-C16	mg/kg	740	1.4	-	-	1.3	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	1.9
Aliphatic C16-C21	mg/kg	45000	9.3	-	-	4.8	<1.5	<1.5	<1.5	11	<1.5	<1.5	<1.5	<1.5	<1.5	25
Aliphatic C21-C35	mg/kg	45000	81	-	-	33	<3.4	<3.4	<3.4	28	<3.4	<3.4	<3.4	<3.4	<3.4	270
Aromatic C5-C7	mg/kg	65	0.01	-	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatic C7-C8	mg/kg	120	0.01	-	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatic C8-C10	mg/kg	27	0.01	-	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatic C10-C12	mg/kg	69	2.7	-	-	1.5	<0.9	<0.9	<0.9	7.8	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Aromatic C12-C16	mg/kg	140	5.7	-	-	2.4	<0.5	<0.5	<0.5	19	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aromatic C16-C21	mg/kg	250	126	-	-	45	0.60	<0.6	<0.6	440	<0.6	<0.6	<0.6	<0.6	<0.6	7.8
Aromatic C21-C35	mg/kg	890	825	-	-	294	<1.4	<1.4	<1.4	2900	<1.4	<1.4	<1.4	<1.4	<1.4	32
TPH Ali/Aro	mg/kg		-	-	-	-	<10	<10	<10	3400	<10	<10	<10	<10	<10	340
PAHs																
Acenaphthene	mg/kg	210	0.10	-	-	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	170	0.10	-	-	0.10	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	2300	0.20	-	-	0.14	0.20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.40
Benzo(a)pyrene	mg/kg	0.83	0.50	-	-	0.27	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.60
Benzo(a)anthracene	mg/kg	3.1	0.46	-	-	0.24	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.30
Benzo(b)fluoranthene	mg/kg	5.6	0.42	-	-	0.23	1.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.40
Benzo(k)fluoranthene	mg/kg	8.5	0.33	-	-	0.20	0.50	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.70
Benzo(g,h,i)perylene	mg/kg	44	0.10	-	-	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	6	0.42	-	-	0.22	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.20
Dibenzo(a,h)anthracene	mg/kg	0.76	0.10	-	-	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	260	0.85	-	-	0.47	2.3	0.30	0.30	0.40	0.30	<0.1	<0.1	<0.1	0.30	0.50
Fluorene	mg/kg	160	0.10	-	-	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	mg/kg	3.2	0.10	-	-	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	mg/kg	1.5	0.10	-	-	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	92	0.37	-	-	0.22	0.90	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.40	0.20
Pyrene	mg/kg	560	0.78	-	-	0.43	2.1	0.30	0.30	0.40	0.30	<0.1	<0.1	<0.1	0.20	0.40
Total PAH	mg/kg						11	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	3.5
BTEX Compounds																
Benzene	mg/kg	0.08	0.01	-	-	0.01			<0.01		<0.01				<0.01	
Toluene	mg/kg	119	0.01	-	-	0.01			<0.01		<0.01				<0.01	
EthylBenzene	mg/kg	65.2	0.01	-	-	0.01			<0.01		<0.01				<0.01	
o-Xylene	mg/kg	250	0.01	-	-	0.01			<0.01		<0.01				<0.01	
m-Xylene	mg/kg	240	0.01	-	-	0.01			<0.01		<0.01				<0.01	
p-Xylene	mg/kg	230	0.01	-	-	0.01			<0.01		<0.01				<0.01	
MTBE	mg/kg	23	0.01	-	-	0.01			<0.01		<0.01				<0.01	
Miscellaneous																
Asbestos	-		-	-	-	-	Amosite		NAD		NAD		NAD		NAD	

IAN FARMER ASSOCIATES

RESULTS OF CONTAMINATION TESTS (SOIL)

Job No: 52247

Fitzjohn's Avenue, Hampsetad, NW3 6PA

Fig. No: A6.1

STATISTICAL ANALYSIS OF LEAD DATA

Data

Exploratory Hole Number	Depth m	Value mg/kg	Log_{10} Value
BH1	0.3	1500	3.176
BH1	0.9	330	2.519
BH3	0.5	54	1.732
BH3	1	180	2.255
BH4	0.4	84	1.924
BH4	0.8	97	1.987
BH5	0.5	14	1.146
BH5	1	11	1.041
TP1	0.2	16	1.204
TP2	0.7	310	2.491
	MEAN	259.6	1.948

The sample mean value (x) based on only a few samples may be a poor estimate of the true (population) mean. Therefore, any decision made on the basis of x < RAV may not be adequately health protective when x is computed from a small number of samples. It is desirable to state with a given level of confidence (95th percentile) that the population mean is less than the relevant RAV.

Mean Value Test

This provides the upper 95th percentile of the sample population and is calculated from;

$$US_{95} = x + (t.s/(n)^{0.5})$$

In this case, the values used are as follows;

x (arithmentic mean) = 259.6
s (unbiased standard deviation) = 451.35
t (t value from published values) = 1.833
n (sample population) = 10

US_{95} = 521.22

Is the 95th percentile less than the RAV for lead?

No. Further sampling may be necessary.

Maximum Value Test

The Maximum Value Test calculates a value of T. If this T is smaller than some critical value, then the maximum value may be accepted as a member of the underlying population. If T is greater than the critical value, then the maximum value is treated as an outlier i.e.; a hot-spot which may be indicative of a localised area of contamination.

The Maximum Value Test is calculated by;

$$T = (y_{max} - y)/Sy$$

In this case, the values used are as follows;

y (log transformed arithmetic mean) =	1.948
Sy (unbiased standard deviation of y values) =	0.69
y_{max} =	3.176
T =	1.78

Is T smaller than the critical value for the given population (*n*);

n (sample population) =	10
5% Critical Value =	2.18
10% Critical Value =	2.04

Does this represent an outlier: No

Figure A6.1

STATISTICAL ANALYSIS OF BENZO(A)PYRENE DATA

Data

Exploratory Hole Number	Depth m	Value mg/kg	Log_{10} Value
BH1	0.3	1.3	0.114
BH1	0.9	0.1	-1.000
BH3	0.5	0.1	-1.000
BH3	1	0.1	-1.000
BH4	0.4	0.1	-1.000
BH4	0.8	0.1	-1.000
BH5	0.5	0.1	-1.000
BH5	1	0.1	-1.000
TP1	0.2	0.1	-1.000
TP2	0.7	0.6	-0.222
	MEAN	0.27	-0.81

The sample mean value (x) based on only a few samples may be a poor estimate of the true (population) mean. Therefore, any decision made on the basis of x < RAV may not be adequately health protective when x is computed from a small number of samples. It is desirable to state with a given level of confidence (95th percentile) that the population mean is less than the relevant RAV.

Mean Value Test

This provides the upper 95th percentile of the sample population and is calculated from;

$$US_{95} = x + (t.s/(n)^{0.5})$$

In this case, the values used are as follows;

x (arithmentic mean) = 0.27
s (unbiased standard deviation) = 0.39
t (t value from published values) = 1.833
n (sample population) = 10

US_{95} = 0.50

Is the 95th percentile less than the RAV for benzo(a)pyrene?

Yes. Therefore, no action is required in the averaging area based on the mean value test.

STATISTICAL ANALYSIS OF TPH AROMATIC C12-C16 DATA

Data

Exploratory Hole Number	Depth m	Value mg/kg	Log_{10} Value
BH1	0.3	0.5	-0.301
BH1	0.9	0.5	-0.301
BH3	0.5	0.5	-0.301
BH3	1	19	1.279
BH4	0.4	0.5	-0.301
BH4	0.8	0.5	-0.301
BH5	0.5	0.5	-0.301
BH5	1	0.5	-0.301
TP1	0.2	0.5	-0.301
TP2	0.7	0.5	-0.301
	MEAN	2.35	-0.14

The sample mean value (x) based on only a few samples may be a poor estimate of the true (population) mean. Therefore, any decision made on the basis of x < RAV may not be adequately health protective when x is computed from a small number of samples. It is desirable to state with a given level of confidence (95th percentile) that the population mean is less than the relevant RAV.

Mean Value Test

This provides the upper 95th percentile of the sample population and is calculated from;

$$US_{95} = x + (t.s/(n)^{0.5})$$

In this case, the values used are as follows;

x (arithmentic mean) = 2.35
s (unbiased standard deviation) = 5.85
t (t value from published values) = 1.833
n (sample population) = 10

US_{95} = 5.74

Is the 95th percentile less than the RAV for TPH Aromatic C12-C16?

Yes. Therefore, no action is required in the averaging area based on the mean value test.

STATISTICAL ANALYSIS OF TPH AROMATIC C21-C35 DATA

Data

Exploratory Hole Number	Depth m	Value mg/kg	Log_{10} Value
BH1	0.3	1.4	0.146
BH1	0.9	1.4	0.146
BH3	0.5	1.4	0.146
BH3	1	2900	3.462
BH4	0.4	1.4	0.146
BH4	0.8	1.4	0.146
BH5	0.5	1.4	0.146
BH5	1	1.4	0.146
TP1	0.2	1.4	0.146
TP2	0.7	32	1.505
	MEAN	294.32	0.61

The sample mean value (x) based on only a few samples may be a poor estimate of the true (population) mean. Therefore, any decision made on the basis of x < RAV may not be adequately health protective when x is computed from a small number of samples. It is desirable to state with a given level of confidence (95th percentile) that the population mean is less than the relevant RAV.

Mean Value Test

This provides the upper 95th percentile of the sample population and is calculated from;

$$US_{95} = x + (t.s/(n)^{0.5})$$

In this case, the values used are as follows;

x (arithmentic mean) = 294.32
s (unbiased standard deviation) = 915.59
t (t value from published values) = 1.833
n (sample population) = 10

US_{95} = 825.04

Is the 95th percentile less than the RAV for TPH Aromatic C21-C35?

Yes. Therefore, no action is required in the averaging area based on the mean value test.

		Sample Id	BH1	BH3	BH4							
END USE:		Depth - m	0.90	1.00	0.80							
Freshwater - DWS		Date	-	-	-							
Metals		Risk Assessment Value										
Arsenic	ug/l	50	2.6	1.3	2.7							
Boron	ug/l	2000										
Cadmium	ug/l	5	<0.03	<0.03	<0.03							
Chromium	ug/l	5	1.00	1.5	2.6							
Copper	ug/l	1	4.4	1.1	2.6							
Lead	ug/l	4	6.2	0.86	3.9							
Mercury	ug/l	1	0.02	<0.01	0.02							
Nickel	ug/l	50	0.80	0.80	0.50							
Selenium	ug/l	10	1.8	1.3	2.3							
Zinc	ug/l	8	3.2	<1.25	1.6							
Inorganics												
pH		5-9	5.8	7.0	5.5							
Organics												
TPH	ug/l	10	<10	<10	47							

IAN FARMER ASSOCIATES

RESULTS OF CNTAMINATION TESTS (LEACHATE) — **Job No: 52247A**

Fitzjohn's Avenue, Hampstead, NW3 6PA — **Fig. No: A6.2**

APPENDIX 7

GAS GENERATION

APPENDIX 7

GENERAL NOTES ON GAS GENERATION

A7.1 GENERAL

A7.1.1 In the past, a series of guidance documents were published by CIRIA, ref. 10.45, providing advice on hazards associated with methane. This earlier guidance was consolidated in CIRIA Document C659 to provide a risk based approach to gas contaminated land. This was subsequently re-issued as CIRIA Document C665, ref. 10.47. In 2007, British Standard, BS8485, ref. 10.48, dealing with ground gas was published. It is recommended that guidance in C665 and BS8485 is adopted to provide a consistent approach in dealing with ground gas contamination, the principal details being as follows.

A7.1.2 This guidance is based on a similar approach to that for dealing with contaminated soil. The presence of hazardous gases could be deemed to be the 'source' in a 'pollutant linkage' that could lead to the conclusion that significant harm is or could be caused to people, buildings or the environment. In such circumstances the land could be deemed 'contaminated', ref. 10.18.

A7.1.3 Should a potential source of gas be identified in the conceptual model, a gas risk assessment should be carried out, sufficient to demonstrate to the local authority that the proposals mitigate any hazards associated with ground gas. The authority enforces compliance with Approved Document Part C of the Building Regulations, ref. 10.49.

A7.2 APPROACH

A7.2.1 A flow chart detailing the approach to assessing a site is given in CIRIA document C665, Figure 1.1. This may be summarised as follows.

- Carry out Phase 1 desk study, including initial conceptual model
- Assess site, potential presence of gas / potential unacceptable risk / identify further action, if necessary
- Monitor gas concentrations
- Assessment of Risk
- Recommendations / remediation
- Validation

A7.3 POLLUTANT LINKAGE ASSESSMENT

A7.3.1 A pollutant linkage assessment is presented in Appendix 3 of the Phase 1 Desk Study Report.

A7.3.2 Using the risk model in the desk study, the pollutant linkage can be identified and a preliminary estimate of risk undertaken. If there is no relevant pollutant linkage identified there is no risk. If there is a very low risk, it is likely that no further assessment is required. If further assessment is necessary, then gas monitoring is required.

A7.4 SITE MONITORING

A7.4.1 For sites with low generation potential, giving consistently low concentrations of soil gas under the worst-case conditions, a limited programme of monitoring would be appropriate. Where high or variable concentrations are anticipated or recorded, an extended programme of monitoring would be appropriate. The following guideline has been proposed, ref. 10.51.

Table A7.1

		Generation potential of source				
Sensitivity of development		**Very low**	**Low**	**Moderate**	**High**	**Very high**
	Low (Commercial)	4/1	6/2	6/3	12/6	12/12
	Moderate (Flats)	6/2	6/3	9/6	12/12	24/24
	High (Residential with gardens)	6/3*	9/6	12/6	24/12	24/24

Notes

1. First number is minimum number of readings and second number is minimum period in months, for example 4/1 – Four sets of readings over 1 month.

2. At least two sets of readings must be at low and falling atmospheric pressure (but not restricted to periods below <1000mb) known as worst case conditions (see Boyle and Witherington, 2006).

3. The frequency and period stated are considered to represent typical minimum requirements. Depending on specific circumstances fewer or additional readings may be required (e.g. any such variation subject to site specific justification). * The NHBC guidance is also recommending these periods/frequency of monitoring (Boyle and Witherington, 2006)

4. Historical data can be used as part of the data set.

5. Not all sites will require gas monitoring however, this would need to be confirmed with demonstrable evidence.

6. Placing high sensitivity end use on a high hazard site is not normally acceptable unless the source is removed or treated to reduce its gassing potential. Under such circumstances long-term monitoring may not be appropriate or required.

A7.4.2 Before taking any readings, zero the instrument, record atmospheric pressure and temperature.

A7.4.3 Gas flow should be recorded, giving the range of pressures, ensuring positive or negative flow is recorded.

A7.4.4 Record gas levels, recording peak and steady. Where steady state not obtained within 3 minutes, record change in concentration, where concentrations are decreasing, always record peak value. For very high concentrations, record for longer period of up to 10 minutes.

A7.5 ASSESSMENT OF RISK AND RECOMMENDATIONS

A7.5.1 The main method of characterising a site is the method described by Wilson and Card, ref. 10.52 and is termed Situation A. This can be used for all types of development except conventional low-rise housing with suspended ground floor and ventilated underfloor void.

A7.5.2 Low rise housing, Situation B, was developed by Boyle and Witherington, ref. 10.53 and was developed for the NHBC for classifying gassing sites for houses with suspended ground floor slab with ventilated void.

A7.5.3 Although the Code of Practice, ref. 10.48, assesses the characteristic gas situation as CIRIA recommend for Situation A, see Table A7.2 below, their solution for gas protection systems is different, see section A7.10.

A7.6 SITUATION A - ASSESSMENT

A7.6.1 This system proposed by Wilson and Card, ref. 10.52 was originally developed in CIRIA Report 149, ref. 10.45.

A7.6.2 The method uses both gas concentrations and borehole flow rate for methane and carbon dioxide to define a Characteristic Situation for a site.

A7.6.3 Gas Screening Value (litre/hr) = borehole flow rate (litre/hr) x (gas concentration (%))/100. The GSV is determined for methane and carbon dioxide and the worst case adopted. The Characteristic Situation can then be determined from the table below. The GSV can be exceeded if the conceptual model indicates it is safe to do so, and other factors may lead to a change in the Characteristic Situation.

Table A7.2

Characteristic Situation	Risk Classification	Gas screening value (CH_4 or CO_2(1/hr)[1]	Additional factors	Typical source of generation
1	Very low risk	<0.07	Typically methane ≤1% and/or carbon dioxide ≤5%. Otherwise consider increase to Situation 2	Natural soils with low organic content "Typical" Made Ground
2	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to Characteristic Situation 3	Natural soil, high peat/organic content. "Typical" Made Ground
3	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
4	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures	Mineworking – susceptible to flooding, completed landfill (WMP 26B criteria)
5	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
6	Very high risk	>70		Recent landfill site

1. Site characterisation should be based on gas monitoring of concentrations and borehole flow rates for the minimum periods defined in Table A7.1
2. Source of gas and generation potential/performance must be identified.
3. If there is no detectable flow use the limit of detection of the instrument.

A7.7 SITUATION A – SOLUTION

A7.7.1 The Characteristic Situation can be used to define the scope of gas protective measures required.

A7.7.2 The CIRIA approach uses the characteristic situation to define the level of gas protection as follows:

Table A7.3

Characteristic situation	**Residential building (Not low-rise traditional housing)**		**Office/commercial/industrial development**	
	Number of levels of protection	**Typical scope of protective measures**	**Number of levels of protection**	**Typical scope of protective measures**
1	None	No special precautions	None	No special precautions
2	2	a) Reinforced concrete cast in situ floor slab (suspended non-suspended or raft) with at least 1200g DPM and underfloor venting b) Beam and block or pre-cast concrete and 2000g DPM / reinforced gas membrane and underfloor venting All joints and penetrations sealed	1 to 2	a) Reinforced concrete cast in-situ floor slab (suspended non-suspended or raft) with at least 1200g DPM b) Beam and block or pre cast concrete slab and minimum 2000g DPM/reinforced gas membrane c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on use All joints and penetrations sealed
3	2	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space	1 to 2	All types of floor slab as above. All joints and penetrations sealed. Minimum 2000g/reinforced gas proof membrane and passively ventilated underfloor sub-space or positively pressurised underfloor sub-space
4	3	All types of floor slab as above.	2 to 3	All types of floor slab as above.

Characteristic situation	Residential building (Not low-rise traditional housing)		Office/commercial/industrial development	
		All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated underfloor subspace or positively pressurised underfloor sub-space, oversite capping or blinding and in ground venting layer		All joints and penetration sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility
5	4	Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and ventilated or positively pressurised underfloor sub-space, oversite capping and in ground venting wells or barriers	3 to 4	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility. In ground venting wells or barriers
6	5	Not suitable unless gas regime is reduced first and quantitative risk assessment carried out to assess design of protection measures in conjunction with foundation design	4 to 5	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and actively ventilated or positively pressurised underfloor sub-space with monitoring facility, with monitoring. In ground venting wells and reduction of gas regime.

1. Typical scope of protective measures may be rationalised for specific developments on the basis of quantitative risk assessments.

2. Note the type of protection is given for illustration purposes only. Information on the detailing and construction of passive protection measures is given in BR414, ref. 10.50.

3. In all cases there should be minimum penetration of ground slabs by services and minimum number of confined spaces such as cupboards above the ground slab. Any confined spaces should be ventilated.

4. Foundation design must minimise differential settlement particularly between structural elements and ground-bearing slabs.

5. Commercial buildings with basement car parks, provided with ventilation in accordance with the Building Regulations, may not require gas protection for characteristic situations 3 and 4.

6. Floor slabs should provide an acceptable formation on which to lay the gas membrane. If a block and beam floor is used it should be well detailed so it has no voids in it that membranes have to span, and all holes for service penetrations should be filled. The minimum density of the blocks should be 600kg/m^3 and the top surface should have a 4:1 sand cement grout brushed into all joints before placing any membrane (this is also good practice to stabilise the floor and should be carried out regardless of the need for gas membrane).

7. The gas-resistant membrane can also act as the damp-proof membrane.

A7.8 SITUATION B -ASSESSMENT

A7.8.1 The NHBC has developed a characterisation system that is similar to Situation A but is specific to low-rise housing development with a clear ventilated underfloor void. The gas emission rates are compared to generic 'Traffic Lights'.

A7.8.2 The Traffic Lights include a Typical Maximum Concentration that is used for initial screening purposes. Where the Typical Maximum Concentration is exceeded the risk-based Gas Screening Value, GSV, should be adopted. The GSVs are determined for the 'model' low rise development and where they differ from this model, the GSV should be reassessed, ref. 10.47.

A7.8.3 The calculations should be made for both methane and carbon dioxide, and the worst case adopted. The GSV is only a guideline.

Table A7.4

Traffic light	Methane		Carbon dioxide	
	Typical maximum concentration[2] (% v/v)	**Gas screening value (GSV)[3] (litres per hour)**	**Typical maximum concentration[2] (% v/v)**	**Gas screening value (GSV)[1,2] (litres per hour)**
Green				
	1	**0.16**	5	**0.78**
Amber 1				
	5	**0.63**	10	**1.56**
Amber 2				
	20	**1.56**	30	**3.13**
Red				

1. Generic GSVs are based on guidance contained within latest revision of Department of the Environment and the Welsh Office (2004 edition) "The Building Regulations: Approved Document C" and used a sub-floor void of 150mm thickness.

2. The Typical Maximum Concentrations can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional judgement will be required, based on a thorough understanding of the gas-regime identified at the site where monitoring in the worst temporal conditions has occurred.

3. The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

A7.9 SITUATION B – SOLUTION

A7.9.1 On the basis of this Traffic Light classification the following protection should be applied to low-rise housing.

Table A7.5

Traffic Light Classification	Protection measures required
Green	Negligible gas regime identified and gas protection measures are not considered necessary.
Amber 1	Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.
Amber 2	Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. A specialist contractor should always fit membranes. As with Amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided.
Red	High gas regime identified. It is considered that standard residential housing would not normally be acceptable without a further Gas Risk Assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.

A7.10 CODE OF PRACTICE – SOLUTIONS

A7.10.1 The Characteristic Gas Situation is determine in a similar manner to that recommended by CIRIA, see Table A7.2 above.

A7.10.2 Having selected the Characteristic Gas Situation, the appropriate gas protection could be selected for the building. The tables below give a guide as to the relative performance of the various designs and systems.

A7.10.3 A guidance value for the required gas protection, in the range 0 to 7 should be obtained from Table A7.6 below. Then, a combination of ventilation and/or barrier system should be chosen from Table A7.7 to meet that requirement.

Table A7.6

Characteristic gas situation, CS	NHBC *traffic light*	Required gas protection			
		Non-managed property, e.g. private housing	**Public building [A)]**	**Commercial buildings**	**Industrial buildings [B)]**
1	*Green*	0	0	0	0
2	*Amber 1*	3	3	2	1[C)]
3	*Amber 2*	4	3	2	2
4	*Red*	6[D)]	5[D)]	4	3
			6[E)]	5	4
				7	6

NOTE: Traffic light indications are taken from NHBC Report no.: 10627-R01 (04) [3] and are mainly applicable to low-rise residential housing. These are for comparative purposes but the boundaries between the traffic light indications and CS values do not coincide.

A) Public buildings include, for example, managed apartments, schools and hospitals.
B) Industrial buildings are generally open and well ventilated. However, areas such as office pods might require a separate assessment and may be classified as commercial buildings and require a different scope of gas protection to the main building.
C) Maximum methane concentration 20% otherwise consider an increase to CS3.
D) Residential building on higher traffic light/CS sites is not recommended unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations.
E) Consideration of issues such as ease of evacuation and how false alarms will be handled are needed when completing the design specification of any protection scheme.

A7.10.4 Having determined the appropriate guidance value from Table A7.6, an element or combination of elements from a), b), c) or d) in Table A7.7, should be chosen to achieve the required level of protection.

Table A7.7

PROTECTION ELEMENT/SYSTEM		SCORE	COMMENTS
a) Venting/dilution			
Passive sub floor ventilation (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.)[A)]	Very good performance	2.5	*Ventilation performance in accordance with Annex A, ref. 10.48*
	Good performance	1	*If passive ventilation is poor this is generally unacceptable and some form of active system will be required*

PROTECTION ELEMENT/SYSTEM		SCORE	COMMENTS
Subfloor ventilation with active abstraction/pressurization (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.)[A)]		2.5	*There have to be robust management systems in place to ensure the continued maintenance of any ventilation system.* *Active ventilation can always be designed to meet good performance.* *Mechanically assisted systems come in two main forms: extraction and positive pressurization.*
Ventilated car park (basement or undercroft)		4	*Assumes car park is vented to deal with car exhaust fumes, designed to Building Regulations Document F and IstructE guidance*
b) Barriers			
Floor slabs			
Block and beam floor slab		0	*It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum.* *Breached in floor slabs such as joints have to be effectively sealed against gas ingress in order to maintain these performances*
Reinforced concrete ground bearing floor slab		0.5	
Reinforced concrete ground bearing foundation raft with limited service penetrations that are cast into slab		1.5	
Reinforced concrete cast in situ suspended slab with minimal service penetrations and water bars around all slab penetrations and at joints		1.5	
Fully tanked basement		2	
c) Membranes			
Taped and sealed membrane to reasonable levels of workmanship/in line with current good practice with validation[B), C)]		0.5	*The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation, and the integrity of joints*
Proprietary gas resistant membrane to reasonable levels of workmanship/in line with current good practice under independent inspection (CQA)[B), C)]		1	
Proprietary gas resistant membrane installed to reasonable levels of workmanship/in line with current good practice under CQA with integrity testing and independent validation		2	
d) Monitoring and detection (not applicable to non-managed property, or in isolation)			
Intermittent monitoring using hand held equipment		0.5	*Where fitted, permanent monitoring systems ought to be installed in the underfloor venting/dilution system in the first instance but can also be provided within the occupied space as a fail safe.*
Permanent monitoring and alarm system[A)]	Installed in the underfloor venting/ dilution system	2	
	Installed in the building	1	
e) Pathway intervention			

PROTECTION ELEMENT/SYSTEM	SCORE	COMMENTS
Pathway intervention	-	*This can consist of site protection measures for off-site or on-site sources (see Annex A, ref. 10.48)*

NOTE: In practice the choice of materials might well rely on factors such as construction method and the risk of damage after installation. It is important to ensure that the chosen combination gives an appropriate level of protection

A) It is possible to test ventilation systems by installing monitoring probes for post installation validation.

B) If a 1200 g DPM material is to function as a gas barrier it should be installed according to BRE 414, ref. 10.50 being taped and sealed to all penetrations.

C) Polymeric Materials >1200g can be used to improve confidence in the barrier. Remember that their gas resistance is little more than the standard 1200g (proportional to thickness) but their physical properties mean that they are more robust and resistant to site damage.