PERMANENT GROUND GAS MONITORING FORM

GROUNDTECH
CONSULTING

SITE NAME:	TRINITY ACADEMY, BARNSLEY	**ENGINEER:**	Joshua Turton
CLIENT:	WAERMAN I&E	**DATE:**	27/10/2020
JOB NO:	20063		

Pressure Trend:	Falling	**Weather:**	Raining	**Equipment:**	GFM 436

Ambient:	O_2 (%v/v)	CH_4 (%v/v)	CO_2 (%v/v)	LEL	H_2S (ppm)	CO (ppm)
Start	19.1	0.0	0.0	0.0	0.0	0.0
Finish	19.1	0.0	0.0	0.0	0.0	0.0

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q_{hg} CO_2 (l/hr)	Q_{hg} CH_4 (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady						
RC101	0.3	0.1	0.01	0.0	0.0	0.0	2.9	2.7	14.7	16.7	0.0	0.0	0.0	0.0	0.0087	0.0000	974	-	N	10.72
RC102	0.1	0.1	0.00	0.0	0.0	0.0	0.1	0.3	13.5	16.1	0.0	0.0	0.0	0.0	0.0001	0.0000	974	-	N	NGW
RC103	NA	-0.6	0.00	NA	0.0	0.0	NA	0.0	NA	16.2	NA	0.0	NA	10.0	NA	NA	974	-	N	NGW
RC104	-50.2	-50.2	-7.43	0.0	0.0	0.0	0.1	0.0	1.6	16.2	0.0	0.0	0.0	0.0	0.0001	0.0000	975	-	N	5.48

Notes: RC103 flooded above head so peak concentrations not recorded.

Appendix D Results of Geotechnical Testing

PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL20/5490

Report Date: 30 October 2020

Client's Reference:

Client Name: Waterman
PO Box 499
Manchester
M28 4EE

For the attention of: Andrew Mould

Contract Title: Trinity Academy, Barnsley

Date Received: 9/10/2020
Date Commenced: 9/10/2020
Date Completed: 30/10/2020

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

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

Checked and Approved Signatories:

H Daniels (Senior Technician)	A Watkins (Director)	R Berriman (Quality Manager)
S Royle (Laboratory Manager)	S Eyre (Senior Technician)	L Knight (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP101		D	1.00		Brown slightly gravelly sandy CLAY.
TP101		D	1.50		Brown mottled grey slightly gravelly slightly sandy CLAY.
TP101		B	1.00		Brownish grey very gravelly very sandy CLAY.
TP102		B	0.50		Brown very gravelly very sandy CLAY.
TP103		D	0.80		Brown mottled grey sandy CLAY.
TP103		B	0.50		Brown mottled grey gravelly sandy very silty CLAY.
TP107		D	0.80		Brown slightly gravelly slightly sandy CLAY.
TP107		B	1.00		Brown very gravelly very sandy CLAY.
TP110		D	1.00		Brown mottled grey slightly gravelly sandy CLAY.
TP111		D	0.50		Brown mottled grey slightly gravelly sandy CLAY.
TP111		B	0.50		Brown mottled grey slightly gravelly sandy CLAY.
TP112		D	1.00		Brown slightly gravelly sandy CLAY.
RC104		U	1.20		Very stiff brown slightly gravelly sandy CLAY.

UKAS TESTING 4043	PSL Professional Soils Laboratory	Trinity Academy, Barnsley	Contract No: PSL20/5490 Client Ref:

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

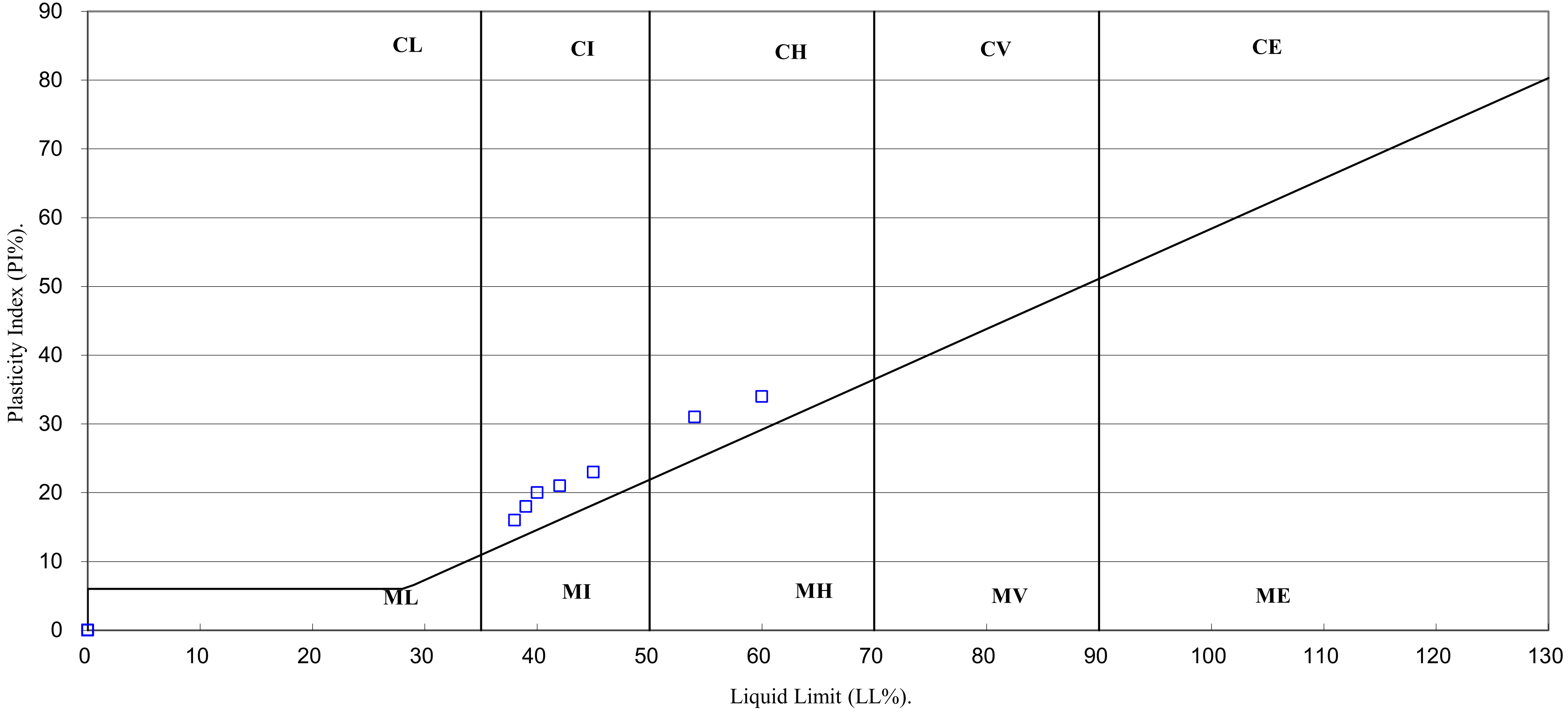
Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP101		D	1.00		18			40	20	20	95	Intermediate plasticity CI.
TP101		D	1.50		20			60	26	34	98	High plasticity CH.
TP103		D	0.80		12			39	21	18	100	Intermediate plasticity CI.
TP107		D	0.80		21			38	22	16	98	Intermediate plasticity CI.
TP110		D	1.00		23			45	22	23	98	Intermediate plasticity CI.
TP111		D	0.50		20			54	23	31	98	High plasticity CH.
TP112		D	1.00		18			42	21	21	97	Intermediate plasticity CI.

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.

UKAS TESTING 4043	PSL Professional Soils Laboratory	Trinity Academy, Barnsley	Contract No: PSL20/5490 Client Ref:

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Trinity Academy, Barnsley	**Contract No:** **PSL20/5490** **Client Ref:**

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		Area	D_e^2	D_e	Failure Load (P)		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	W	D	(mm2)		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
RC101	2.00		A	Perp	85	33	2805	3571.44	59.76	-	0.79	0.22	1.084	0.24	Valid	
RC101	3.50		A	Perp	85	46	3910	4978.37	70.56	-	1.32	0.27	1.168	0.31	Valid	
RC101	5.00		A	Perp	85	35	2975	3787.89	61.55	-	0.97	0.26	1.098	0.28	Valid	
RC101	6.50		A	Perp	85	42	3570	4545.47	67.42	-	0.68	0.15	1.144	0.17	Valid	
RC102	2.50		A	Perp	85	51	4335	5519.49	74.29	-	1.32	0.24	1.195	0.29	Valid	
RC102	4.00		A	Perp	85	31	2635	3354.99	57.92	-	0.63	0.19	1.068	0.20	Valid	
RC102	5.50		A	Perp	85	43	3655	4653.69	68.22	-	0.26	0.06	1.150	0.06	Valid	
RC102	8.50		A	Perp	85	41	3485	4437.24	66.61	-	2.70	0.61	1.138	0.69	Valid	
RC104	4.00		A	Perp	85	34	2890	3679.66	60.66	-	2.29	0.62	1.091	0.68	Valid	
RC104	5.50		A	Perp	85	38	3230	4112.56	64.13	-	7.24	1.76	1.119	1.97	Valid	
RC104	7.00		A	Perp	85	52	4420	5627.72	75.02	-	21.90	3.89	1.200	4.67	Valid	
RC104	10.00		A	Perp	85	33	2805	3571.44	59.76	-	1.12	0.31	1.084	0.34	Valid	

Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular

UKAS TESTING
4043

PSL
Professional Soils Laboratory

Trinity Academy, Barnsley

Contract No:
PSL20/5490
Client Ref:

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_e^2	D_e	Failure Load		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	L	D		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
RC101	2.00		D	Par	-	85	7225	85.00	-	0.31	0.043	1.270	0.05	Valid	
RC101	3.50		D	Par	-	85	7225	85.00	-	0.45	0.062	1.270	0.08	Valid	
RC101	5.00		D	Par	-	85	7225	85.00	-	0.42	0.058	1.270	0.07	Valid	
RC101	6.50		D	Par	-	85	7225	85.00	-	0.22	0.030	1.270	0.04	Valid	
RC102	2.50		D	Par	-	85	7225	85.00	-	0.39	0.054	1.270	0.07	Valid	
RC102	4.00		D	Par	-	85	7225	85.00	-	0.24	0.033	1.270	0.04	Valid	
RC102	5.50		D	Par	-	85	7225	85.00	-	0.47	0.065	1.270	0.08	Valid	
RC102	8.50		D	Par	-	85	7225	85.00	-	1.98	0.274	1.270	0.35	Valid	
RC104	4.00		D	Par	-	85	7225	85.00	-	3.21	0.444	1.270	0.56	Valid	
RC104	5.50		D	Par	-	85	7225	85.00	-	7.17	0.992	1.270	1.26	Valid	
RC104	7.00		D	Par	-	85	7225	85.00	-	28.86	3.994	1.270	5.07	Valid	
RC104	10.00		D	Par	-	85	7225	85.00	-	0.67	0.093	1.270	0.12	Valid	

Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

UKAS TESTING
4043

Professional Soils Laboratory

Trinity Academy, Barnsley

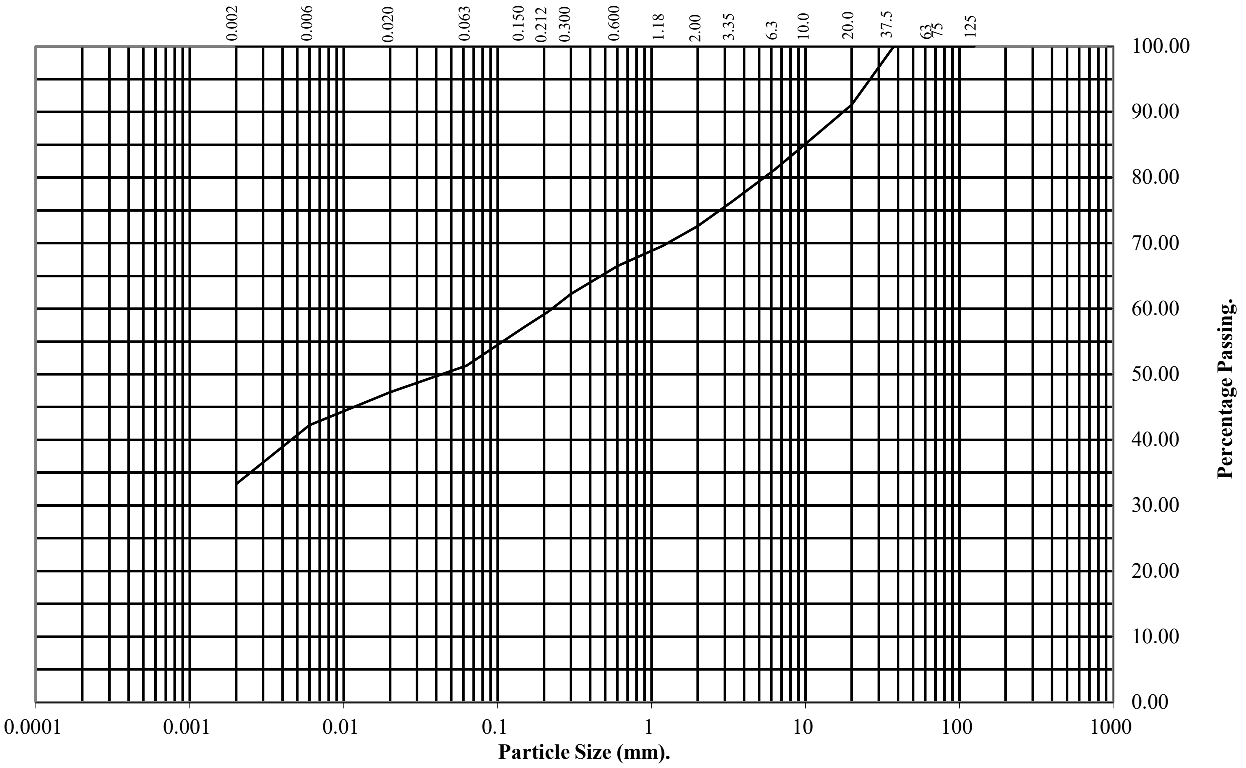
Contract No:
PSL20/5490
Client Ref:

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**TP101**	**Top Depth (m):**	**1.00**
Sample Number:		**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	91
10	85
6.3	81
3.35	76
2	73
1.18	70
0.6	66
0.3	62
0.212	60
0.15	57
0.063	51

Particle Diameter	Percentage Passing
0.02	47
0.006	42
0.002	33

Soil Fraction	Total Percentage
Cobbles	0
Gravel	27
Sand	22
Silt	18
Clay	33

Remarks:

See Summary of Soil Descriptions

4043

PSL Professional Soils Laboratory

Trinity Academy, Barnsley

Contract No:

PSL20/5490

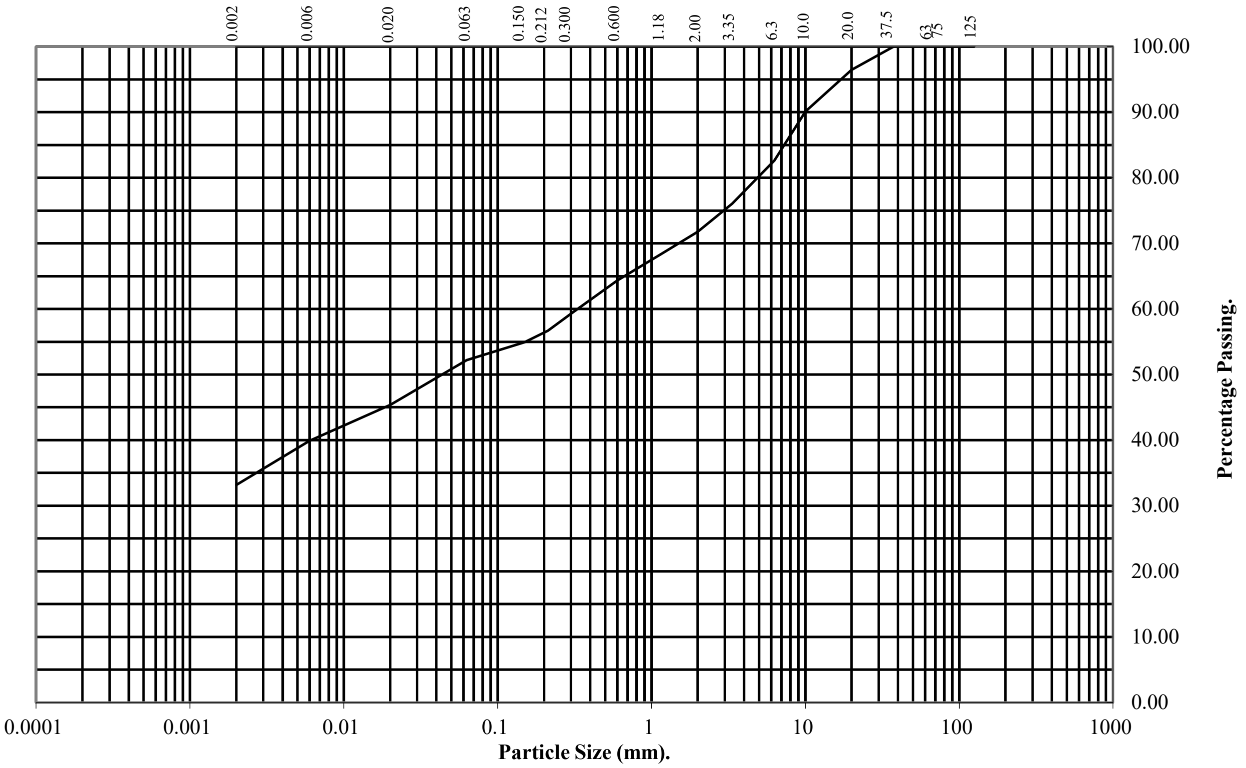
Client Ref:

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**TP102**	**Top Depth (m):**	**0.50**
Sample Number:		**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	90
6.3	83
3.35	76
2	72
1.18	68
0.6	64
0.3	59
0.212	57
0.15	55
0.063	52

Particle Diameter	Percentage Passing
0.02	45
0.006	40
0.002	33

Soil Fraction	Total Percentage
Cobbles	0
Gravel	28
Sand	20
Silt	19
Clay	33

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

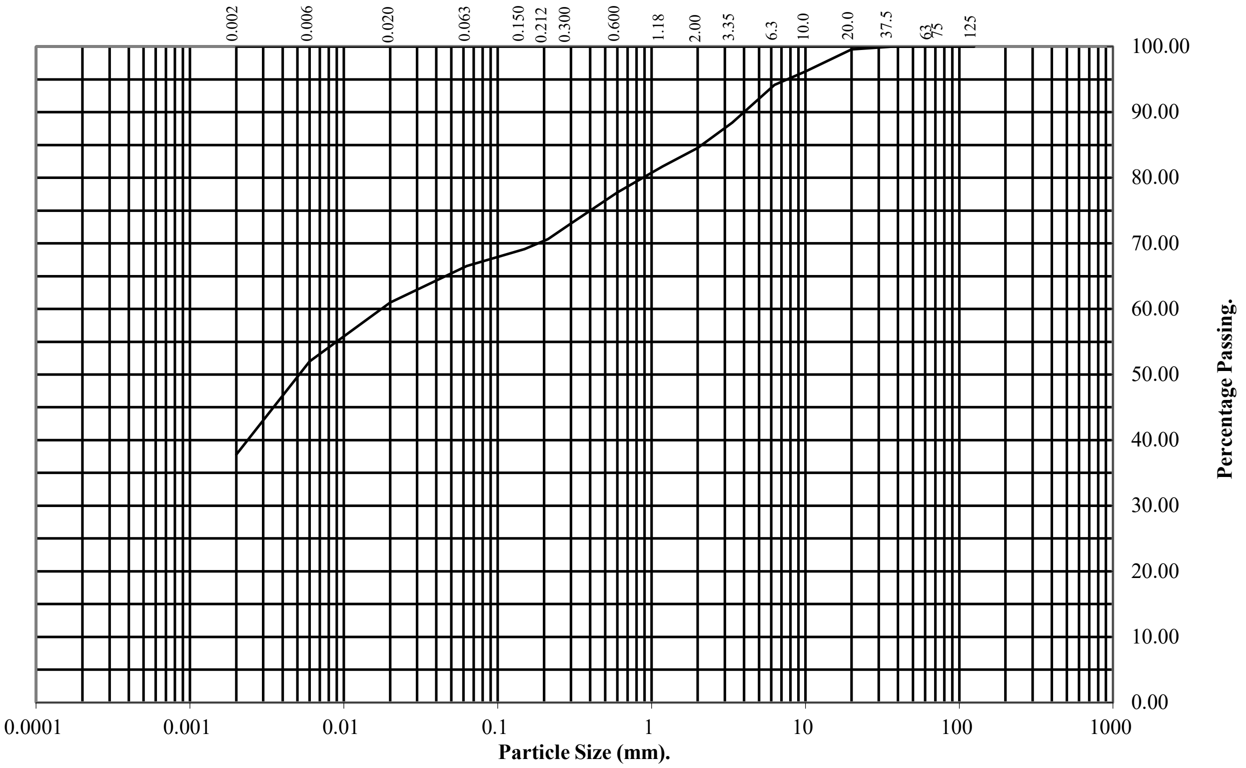
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP103 **Top Depth (m):** 0.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	96
6.3	94
3.35	88
2	85
1.18	82
0.6	78
0.3	73
0.212	71
0.15	69
0.063	67

Particle Diameter	Percentage Passing
0.02	61
0.006	52
0.002	38

Soil Fraction	Total Percentage
Cobbles	0
Gravel	15
Sand	18
Silt	29
Clay	38

Remarks:

See Summary of Soil Descriptions

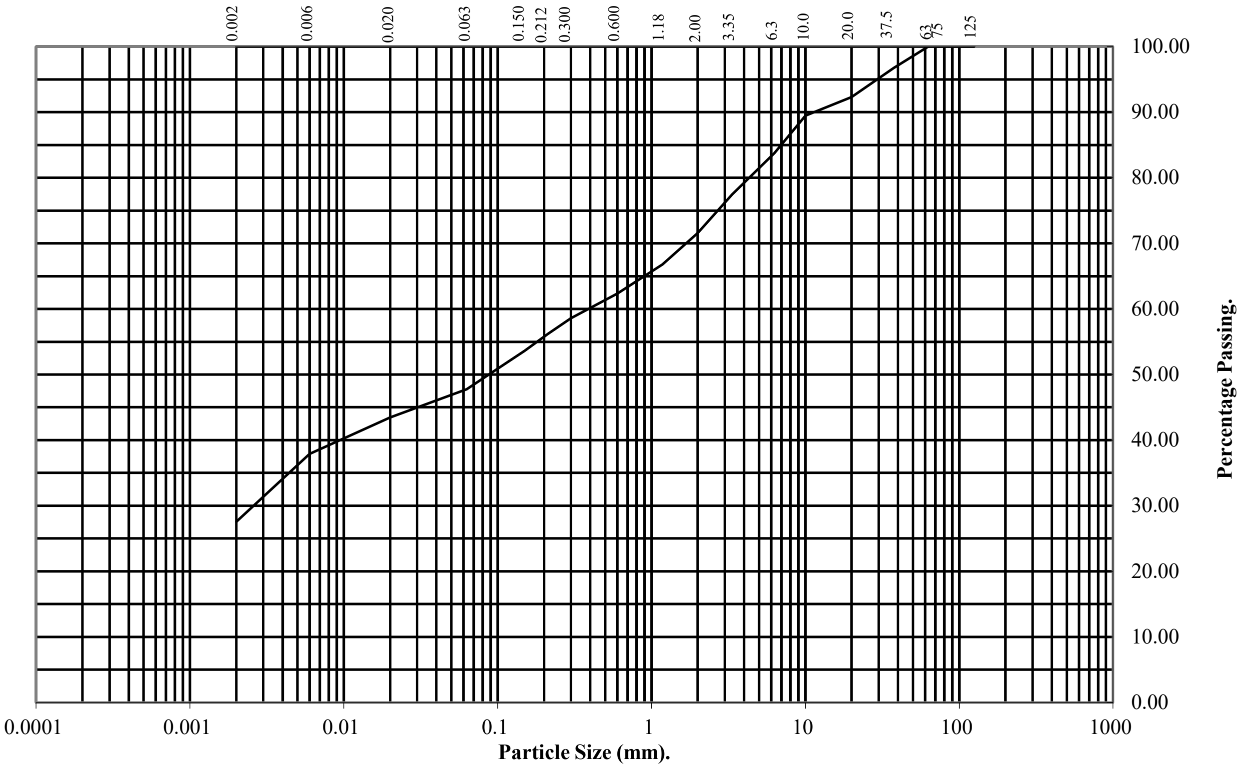
UKAS TESTING 4043	PSL Professional Soils Laboratory	Trinity Academy, Barnsley	**Contract No:** **PSL20/5490** **Client Ref:**

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**TP107**	**Top Depth (m):**	**1.00**
Sample Number:		**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	97
20	92
10	89
6.3	84
3.35	77
2	72
1.18	67
0.6	62
0.3	59
0.212	56
0.15	54
0.063	48

Particle Diameter	Percentage Passing
0.02	43
0.006	38
0.002	28

Soil Fraction	Total Percentage
Cobbles	0
Gravel	28
Sand	24
Silt	20
Clay	28

Remarks:
See Summary of Soil Descriptions

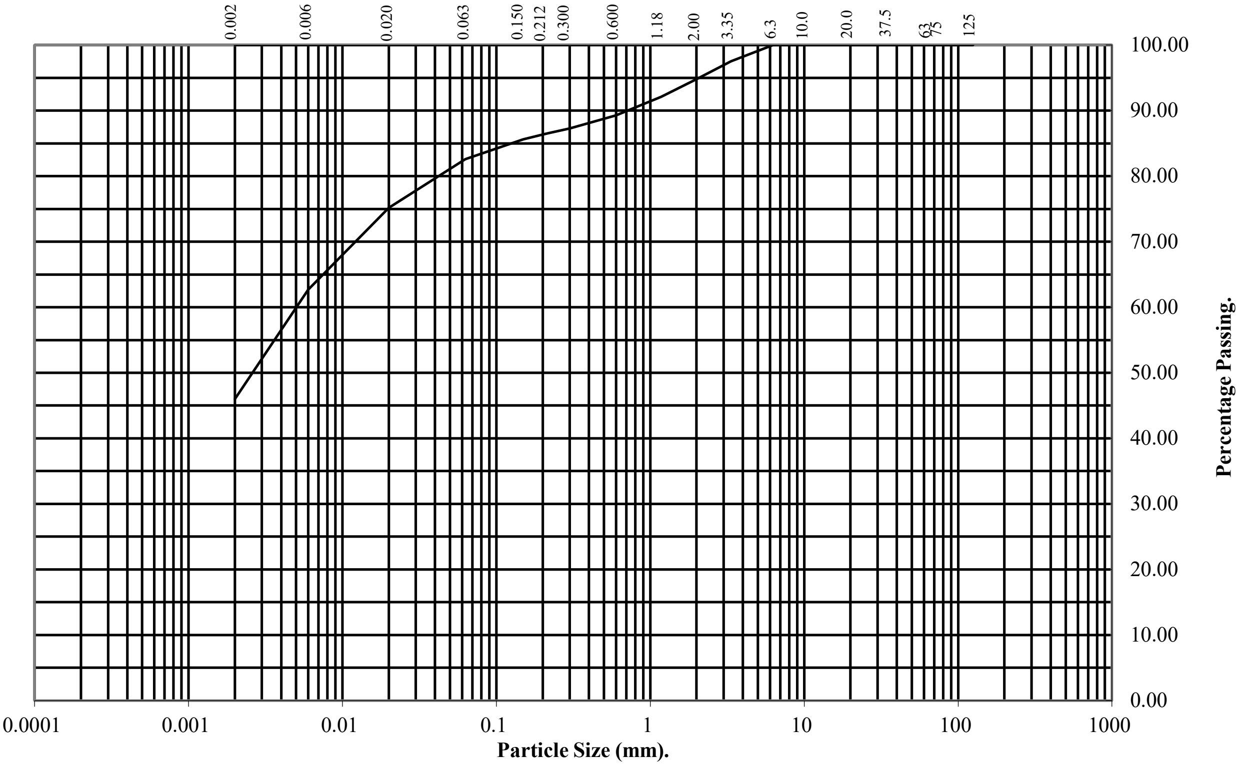
UKAS TESTING 4043	Professional Soils Laboratory	**Trinity Academy, Barnsley**	**Contract No:** **PSL20/5490** **Client Ref:**

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**TP111**	**Top Depth (m):**	**0.50**
Sample Number:		**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	98
2	95
1.18	92
0.6	89
0.3	87
0.212	87
0.15	86
0.063	83

Particle Diameter	Percentage Passing
0.02	75
0.006	63
0.002	46

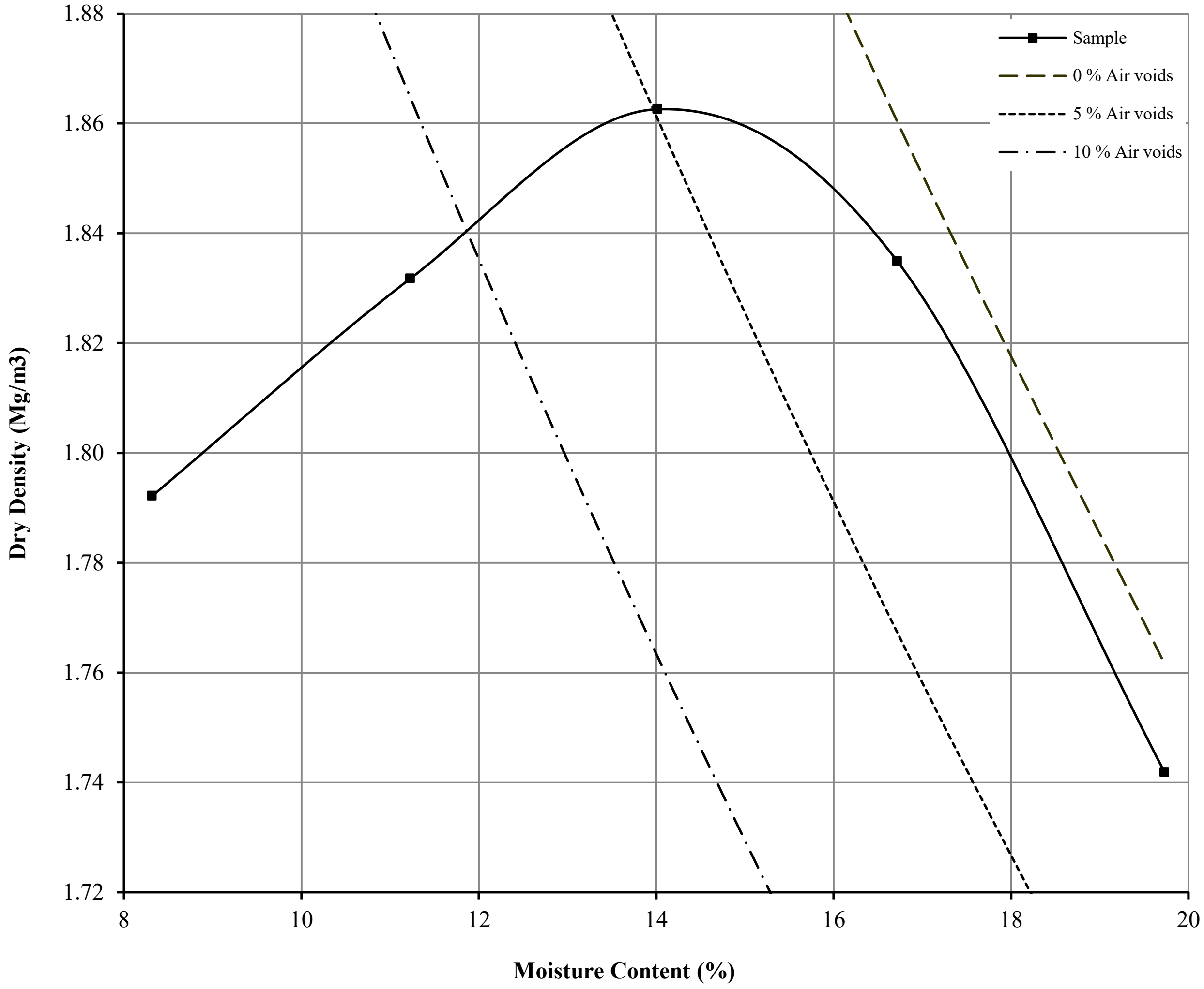
Soil Fraction	Total Percentage
Cobbles	0
Gravel	5
Sand	12
Silt	37
Clay	46

Remarks:
See Summary of Soil Descriptions

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

Hole Number:	**TP102**	**Top Depth (m) :**	**0.50**
Sample Number:		**Base Depth (m) :**	
Sample Type:	**B**		



Initial Moisture Content:		17	Method of Compaction: 2.5kg	Separate Samples
Particle Density (Mg/m3):	2.7	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m3):		1.86	Material Retained on 20.0 mm Test Sieve (%):	4
Optimum Moisture Content (%):		14		

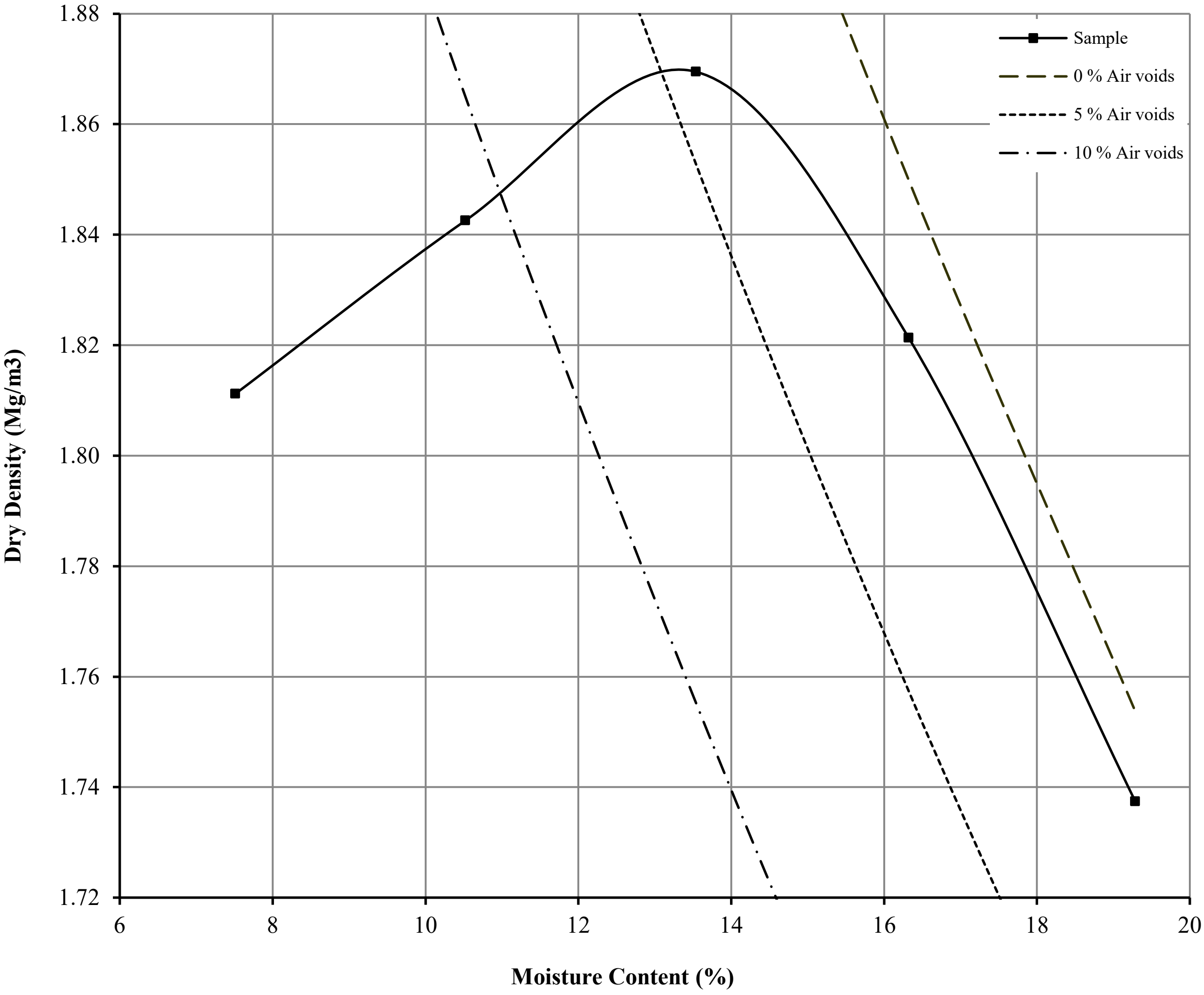
Remarks

See summary of soil descriptions.

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

Hole Number:	**TP103**	**Top Depth (m) :**	**0.50**
Sample Number:		**Base Depth (m) :**	
Sample Type:	**B**		



Initial Moisture Content:		14	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.87	Material Retained on 20.0 mm Test Sieve (%):		0
Optimum Moisture Content (%):		14			

Remarks

See summary of soil descriptions.

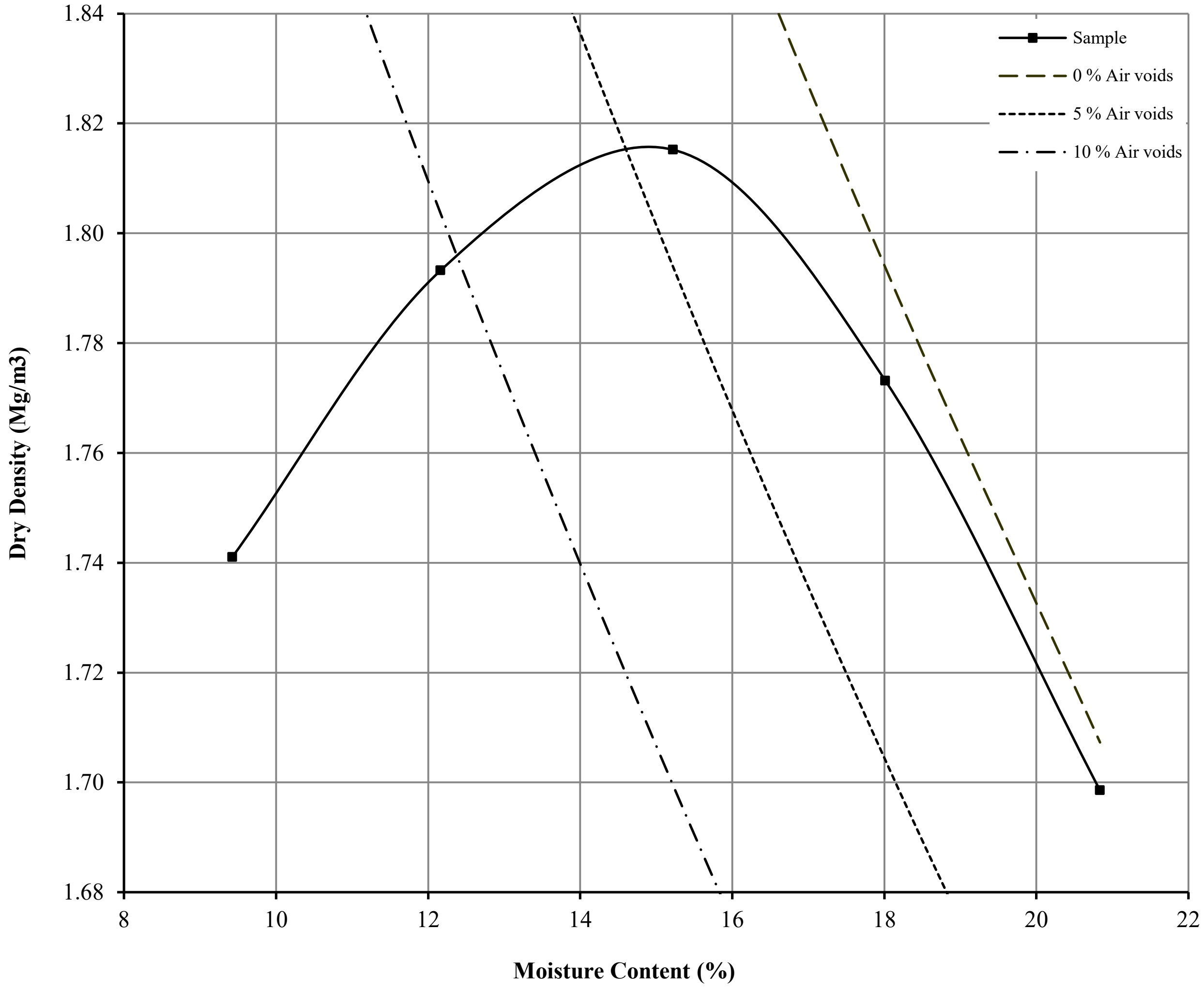
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.4 : 1990

Hole Number: TP107 **Top Depth (m) :** 1.00

Sample Number: **Base Depth (m) :**

Sample Type: B



Initial Moisture Content:		15	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):		3
Maximum Dry Density (Mg/m3):		1.82	Material Retained on 20.0 mm Test Sieve (%):		5
Optimum Moisture Content (%):		15			

Remarks

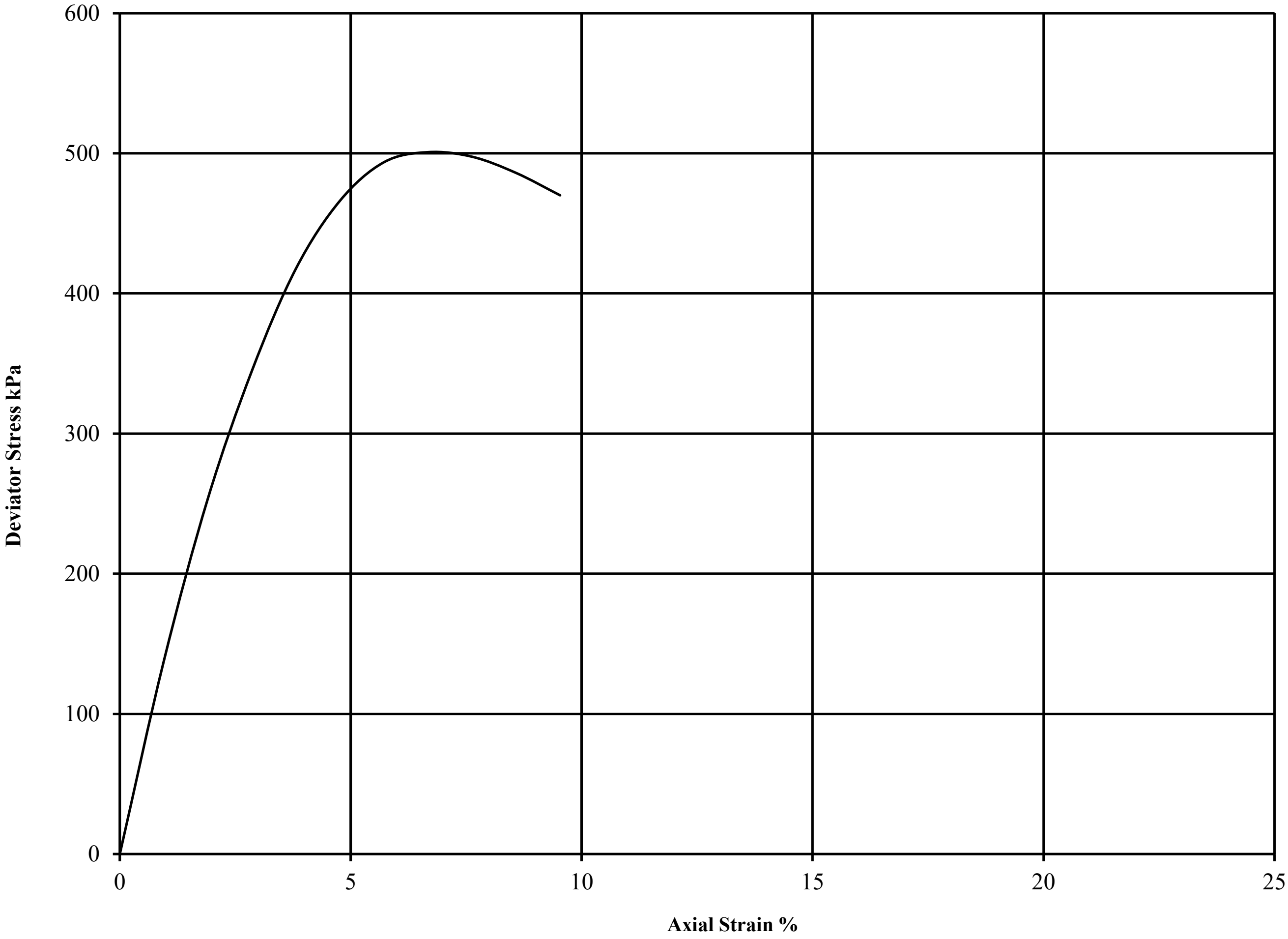
See summary of soil descriptions.

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**RC104**	**Top Depth (m):**	**1.20**
Sample Number:		**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		107	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	11	4.25	3.84	30	501	250	6.7	Brittle	See summary of soil descriptions

4043

Professional Soils Laboratory

Trinity Academy, Barnsley

Contract No:
PSL20/5490
Client Ref:

Appendix E Results of Laboratory analysis

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

P: +44 (0) 1244 833780
F: +44 (0) 1244 833781
W: www.element.com

Waterman Infrastructure & Environment Limited
11 Peter Street
Manchester
M2 5QR

Attention :	Andrew Mould
Date :	14th October, 2020
Your reference :	WIE17125
Our reference :	Test Report 20/13332 Batch 1 Schedule A 20/13332 Batch 1 Schedule C
Location :	Trinity Academy, Barnsley
Date samples received :	30th September, 2020
Status :	Final report
Issue :	1

Thirty nine samples were received for analysis on 30th September, 2020 of which twelve were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Simon Gomery BSc
Project Manager

Client Name:	Waterman Infrastructure & Environment Limited	**Report :**	**Solid**
Reference:	WIE17125		
Location:	Trinity Academy, Barnsley	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Andrew Mould		
EMT Job No:	20/13332		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	4-6	7-9	10-12	13-15	31-33	37-39	46-48	58-60	61-63	79-81			
Sample ID	TP101	TP101	TP102	TP102	TP104	TP105	TP106	TP107	TP108	TP110			
Depth	0.50	1.50	0.10	0.50	0.60	0.10	0.60	1.00	0.10	1.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	23/09/2020	23/09/2020	23/09/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020			
Arsenic #	20.0	3.0	19.2	8.3	9.6	24.0	9.1	9.5	14.4	7.8	<0.5	mg/kg	TM30/PM15
Barium #	82	52	82	62	62	114	56	86	79	60	<1	mg/kg	TM30/PM15
Beryllium	1.5	1.2	1.3	1.3	1.5	1.7	1.5	1.3	1.5	2.3	<0.5	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Chromium #	27.8	39.9	250.6 AA	22.6	56.0	29.5	76.0	46.6	29.1	33.9	<0.5	mg/kg	TM30/PM15
Cobalt #	16.0	9.3	15.1	14.3	14.4	18.9	18.4	22.8	26.5	14.0	<0.5	mg/kg	TM30/PM15
Copper #	34	26	36	24	34	43	23	22	26	31	<1	mg/kg	TM30/PM15
Iron	41560	35020	33750	42240	43570	44710 AA	49180 AA	47860	43170 AA	69690 AA	<20	mg/kg	TM30/PM15
Lead #	71	16	72	24	24	67	22	24	47	27	<5	mg/kg	TM30/PM15
Mercury #	0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	1.7	1.2	2.9	0.5	0.5	1.9	0.5	2.3	1.1	0.3	<0.1	mg/kg	TM30/PM15
Nickel #	22.2	23.2	27.0	24.6	30.7	25.2	27.0	25.0	25.7	27.9	<0.7	mg/kg	TM30/PM15
Selenium #	2	<1	2	<1	1	2	2	2	1	1	<1	mg/kg	TM30/PM15
Vanadium	33	24	34	26	29	39	30	34	34	38	<1	mg/kg	TM30/PM15
Water Soluble Boron #	0.6	0.4	0.8	0.4	0.7	0.8	0.6	0.5	0.6	0.7	<0.1	mg/kg	TM74/PM32
Zinc #	106	81	107	98	112	128	105	95	104	93	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.05	<0.03	<0.03	<0.03	<0.03	0.24	<0.03	<0.03	0.06	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.18	<0.03	0.13	0.03	<0.03	0.37	<0.03	<0.03	0.29	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	0.06	<0.04	<0.04	<0.04	<0.04	0.31	<0.04	<0.04	0.12	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.37	<0.03	0.30	0.06	<0.03	1.47	<0.03	<0.03	0.77	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	0.31	<0.03	0.25	0.06	<0.03	1.34	<0.03	<0.03	0.64	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.24	<0.06	0.19	<0.06	<0.06	1.01	<0.06	<0.06	0.46	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	0.23	<0.02	0.17	0.05	<0.02	1.02	<0.02	<0.02	0.42	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.39	<0.07	0.30	0.08	<0.07	1.91	<0.07	<0.07	0.73	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.21	<0.04	0.17	0.05	<0.04	1.09	<0.04	<0.04	0.38	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	0.16	<0.04	0.12	<0.04	<0.04	0.64	<0.04	<0.04	0.25	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	0.11	<0.04	<0.04	0.05	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.15	<0.04	0.10	<0.04	<0.04	0.64	<0.04	<0.04	0.25	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	0.10	<0.04	<0.04	0.05	<0.04	<0.04	mg/kg	TM4/PM8
PAH 17 Total	2.35	<0.64	1.73	<0.64	<0.64	10.25	<0.64	<0.64	4.47	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.28	<0.05	0.22	0.06	<0.05	1.38	<0.05	<0.05	0.53	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.11	<0.02	0.08	0.02	<0.02	0.53	<0.02	<0.02	0.20	<0.02	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	89	93	95	94	94	95	91	94	97	96	<0	%	TM4/PM8
Methyl Tertiary Butyl Ether #	<0.002	-	-	-	-	-	<0.002	-	-	-	<0.002	mg/kg	TM15/PM10
Benzene #	<0.003	-	-	-	-	-	<0.003	-	-	-	<0.003	mg/kg	TM15/PM10
Toluene #	<0.003	-	-	-	-	-	<0.003	-	-	-	<0.003	mg/kg	TM15/PM10
Ethylbenzene #	<0.003	-	-	-	-	-	<0.003	-	-	-	<0.003	mg/kg	TM15/PM10
m/p-Xylene #	<0.005	-	-	-	-	-	<0.005	-	-	-	<0.005	mg/kg	TM15/PM10

Client Name: Waterman Infrastructure & Environment Limited
Reference: WIE17125
Location: Trinity Academy, Barnsley
Contact: Andrew Mould
EMT Job No: 20/13332

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	4-6	7-9	10-12	13-15	31-33	37-39	46-48	58-60	61-63	79-81	LOD/LOR	Units	Method No.
Sample ID	TP101	TP101	TP102	TP102	TP104	TP105	TP106	TP107	TP108	TP110			
Depth	0.50	1.50	0.10	0.50	0.60	0.10	0.60	1.00	0.10	1.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	23/09/2020	23/09/2020	23/09/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020			
o-Xylene #	<0.003	-	-	-	-	-	<0.003	-	-	-	<0.003	mg/kg	TM15/PM10
Surrogate Recovery Toluene D8	86	-	-	-	-	-	102	-	-	-	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	66	-	-	-	-	-	84	-	-	-	<0	%	TM15/PM10
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	-	-	<0.2	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	-	-	<4	<4	<4	<4	-	-	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	-	-	<7	<7	<7	<7	-	-	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	-	-	<7	<7	<7	<7	-	-	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C44	<7	-	-	<7	<7	<7	<7	-	-	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44	<26	-	-	<26	<26	<26	<26	-	-	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Aromatics													
>C5-EC7 #	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	-	-	<0.2	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	-	-	<4	<4	<4	<4	-	-	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	-	-	<7	<7	<7	<7	-	-	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	-	-	<7	<7	<7	<7	-	-	<7	<7	mg/kg	TM5/PM8/PM16
>EC35-EC44	<7	-	-	<7	<7	<7	<7	-	-	<7	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44	<26	-	-	<26	<26	<26	<26	-	-	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-44)	<52	-	-	<52	<52	<52	<52	-	-	<52	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE #	-	-	-	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	mg/kg	TM36/PM12
Benzene #	-	-	-	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	mg/kg	TM36/PM12
Toluene #	-	-	-	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	mg/kg	TM36/PM12
Ethylbenzene #	-	-	-	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	mg/kg	TM36/PM12
m/p-Xylene #	-	-	-	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	mg/kg	TM36/PM12
o-Xylene #	-	-	-	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	mg/kg	TM36/PM12
PCB 28 #	<0.005	-	-	-	-	-	<0.005	-	-	-	<0.005	mg/kg	TM17/PM8
PCB 52 #	<0.005	-	-	-	-	-	<0.005	-	-	-	<0.005	mg/kg	TM17/PM8
PCB 101 #	<0.005	-	-	-	-	-	<0.005	-	-	-	<0.005	mg/kg	TM17/PM8
PCB 118 #	<0.005	-	-	-	-	-	<0.005	-	-	-	<0.005	mg/kg	TM17/PM8
PCB 138 #	<0.005	-	-	-	-	-	<0.005	-	-	-	<0.005	mg/kg	TM17/PM8
PCB 153 #	<0.005	-	-	-	-	-	<0.005	-	-	-	<0.005	mg/kg	TM17/PM8
PCB 180 #	<0.005	-	-	-	-	-	<0.005	-	-	-	<0.005	mg/kg	TM17/PM8
Total 7 PCBs #	<0.035	-	-	-	-	-	<0.035	-	-	-	<0.035	mg/kg	TM17/PM8
Natural Moisture Content	14.5	16.0	29.1	15.8	14.1	24.8	14.1	21.8	20.1	16.8	<0.1	%	PM4/PM0

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All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Waterman Infrastructure & Environment Limited
Reference: WIE17125
Location: Trinity Academy, Barnsley
Contact: Andrew Mould
EMT Job No: 20/13332

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	4-6	7-9	10-12	13-15	31-33	37-39	46-48	58-60	61-63	79-81			
Sample ID	TP101	TP101	TP102	TP102	TP104	TP105	TP106	TP107	TP108	TP110			
Depth	0.50	1.50	0.10	0.50	0.60	0.10	0.60	1.00	0.10	1.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	23/09/2020	23/09/2020	23/09/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020			
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Total Organic Carbon #	7.38	0.16	5.58	1.61	0.72	7.14	1.02	0.55	2.11	0.20	<0.02	%	TM21/PM24
Organic Matter	12.7	0.3	9.6	2.8	1.2	12.3	1.8	0.9	3.6	0.3	<0.2	%	TM21/PM24
pH #	6.58	7.67	5.70	8.00	8.27	7.37	7.93	7.80	7.43	7.22	<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Client Name:	Waterman Infrastructure & Environment Limited	**Report :**	**Solid**
Reference:	WIE17125		
Location:	Trinity Academy, Barnsley	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Andrew Mould		
EMT Job No:	20/13332		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	85-87	91-93											
Sample ID	TP111	TP112											
Depth	0.20	0.20											
COC No / misc													
Containers	V J T	V J T											
Sample Date	23/09/2020	23/09/2020											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	30/09/2020	30/09/2020									LOD/LOR	Units	Method No.
Arsenic#	25.4	28.0									<0.5	mg/kg	TM30/PM15
Barium#	102	125									<1	mg/kg	TM30/PM15
Beryllium	1.4	1.9									<0.5	mg/kg	TM30/PM15
Cadmium#	<0.1	<0.1									<0.1	mg/kg	TM30/PM15
Chromium#	34.4	174.6									<0.5	mg/kg	TM30/PM15
Cobalt#	12.4	17.7									<0.5	mg/kg	TM30/PM15
Copper#	44	43									<1	mg/kg	TM30/PM15
Iron	32510	44370									<20	mg/kg	TM30/PM15
Lead#	100	90									<5	mg/kg	TM30/PM15
Mercury#	0.3	0.1									<0.1	mg/kg	TM30/PM15
Molybdenum#	2.7	3.3									<0.1	mg/kg	TM30/PM15
Nickel#	20.8	24.4									<0.7	mg/kg	TM30/PM15
Selenium#	2	2									<1	mg/kg	TM30/PM15
Vanadium	36	38									<1	mg/kg	TM30/PM15
Water Soluble Boron#	2.0	1.4									<0.1	mg/kg	TM74/PM32
Zinc#	116	116									<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene#	0.08	0.30									<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.11	0.86									<0.03	mg/kg	TM4/PM8
Acenaphthene#	<0.05	0.10									<0.05	mg/kg	TM4/PM8
Fluorene#	<0.04	0.19									<0.04	mg/kg	TM4/PM8
Phenanthrene#	0.91	3.10									<0.03	mg/kg	TM4/PM8
Anthracene#	0.30	1.69									<0.04	mg/kg	TM4/PM8
Fluoranthene#	2.36	9.92									<0.03	mg/kg	TM4/PM8
Pyrene#	1.90	8.30									<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene#	1.15	5.45									<0.06	mg/kg	TM4/PM8
Chrysene#	1.18	4.98									<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene#	2.09	9.46									<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene#	1.12	5.32									<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	0.73	3.76									<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene#	0.14	0.72									<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene#	0.69	3.60									<0.04	mg/kg	TM4/PM8
Coronene	0.13	0.74									<0.04	mg/kg	TM4/PM8
PAH 17 Total	12.89	58.49									<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	1.50	6.81									<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.59	2.65									<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	91	97									<0	%	TM4/PM8
Methyl Tertiary Butyl Ether#	-	-									<0.002	mg/kg	TM15/PM10
Benzene#	-	-									<0.003	mg/kg	TM15/PM10
Toluene#	-	-									<0.003	mg/kg	TM15/PM10
Ethylbenzene#	-	-									<0.003	mg/kg	TM15/PM10
m/p-Xylene#	-	-									<0.005	mg/kg	TM15/PM10

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Client Name:	Waterman Infrastructure & Environment Limited	**Report :**	**Solid**
Reference:	WIE17125		
Location:	Trinity Academy, Barnsley	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Andrew Mould		
EMT Job No:	20/13332		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	85-87	91-93											
Sample ID	TP111	TP112											
Depth	0.20	0.20											
COC No / misc													
Containers	V J T	V J T											
Sample Date	23/09/2020	23/09/2020											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	30/09/2020	30/09/2020									LOD/LOR	Units	Method No.
o-Xylene $^{\#}$	-	-									<0.003	mg/kg	TM15/PM10
Surrogate Recovery Toluene D8	-	-									<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	-	-									<0	%	TM15/PM10
TPH CWG													
Aliphatics													
>C5-C6 $^{\#}$	<0.1^{SV}	-									<0.1	mg/kg	TM36/PM12
>C6-C8 $^{\#}$	<0.1^{SV}	-									<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1^{SV}	-									<0.1	mg/kg	TM36/PM12
>C10-C12 $^{\#}$	<0.2	-									<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 $^{\#}$	<4	-									<4	mg/kg	TM5/PM8/PM16
>C16-C21 $^{\#}$	<7	-									<7	mg/kg	TM5/PM8/PM16
>C21-C35 $^{\#}$	<7	-									<7	mg/kg	TM5/PM8/PM16
>C35-C44	<7	-									<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44	<26	-									<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Aromatics													
>C5-EC7 $^{\#}$	<0.1^{SV}	-									<0.1	mg/kg	TM36/PM12
>EC7-EC8 $^{\#}$	<0.1^{SV}	-									<0.1	mg/kg	TM36/PM12
>EC8-EC10 $^{\#}$	<0.1^{SV}	-									<0.1	mg/kg	TM36/PM12
>EC10-EC12 $^{\#}$	<0.2	-									<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 $^{\#}$	<4	-									<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 $^{\#}$	17	-									<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 $^{\#}$	98	-									<7	mg/kg	TM5/PM8/PM16
>EC35-EC44	<7	-									<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44	115	-									<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-44)	115	-									<52	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE $^{\#}$	<0.005^{SV}	-									<0.005	mg/kg	TM36/PM12
Benzene $^{\#}$	<0.005^{SV}	-									<0.005	mg/kg	TM36/PM12
Toluene $^{\#}$	<0.005^{SV}	-									<0.005	mg/kg	TM36/PM12
Ethylbenzene $^{\#}$	<0.005^{SV}	-									<0.005	mg/kg	TM36/PM12
m/p-Xylene $^{\#}$	<0.005^{SV}	-									<0.005	mg/kg	TM36/PM12
o-Xylene $^{\#}$	<0.005^{SV}	-									<0.005	mg/kg	TM36/PM12
PCB 28 $^{\#}$	-	-									<0.005	mg/kg	TM17/PM8
PCB 52 $^{\#}$	-	-									<0.005	mg/kg	TM17/PM8
PCB 101 $^{\#}$	-	-									<0.005	mg/kg	TM17/PM8
PCB 118 $^{\#}$	-	-									<0.005	mg/kg	TM17/PM8
PCB 138 $^{\#}$	-	-									<0.005	mg/kg	TM17/PM8
PCB 153 $^{\#}$	-	-									<0.005	mg/kg	TM17/PM8
PCB 180 $^{\#}$	-	-									<0.005	mg/kg	TM17/PM8
Total 7 PCBs $^{\#}$	-	-									<0.035	mg/kg	TM17/PM8
Natural Moisture Content	40.5	24.6									<0.1	%	PM4/PM0

Client Name: Waterman Infrastructure & Environment Limited
Reference: WIE17125
Location: Trinity Academy, Barnsley
Contact: Andrew Mould
EMT Job No: 20/13332

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	85-87	91-93											
Sample ID	TP111	TP112											
Depth	0.20	0.20											
COC No / misc													
Containers	V J T	V J T											
Sample Date	23/09/2020	23/09/2020											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	30/09/2020	30/09/2020									LOD/LOR	Units	Method No.
Hexavalent Chromium #	<0.3	<0.3									<0.3	mg/kg	TM38/PM20
Total Organic Carbon #	8.52	10.17									<0.02	%	TM21/PM24
Organic Matter	14.7	17.5									<0.2	%	TM21/PM24
pH #	6.41	7.01									<0.01	pH units	TM73/PM11

Client Name: Waterman Infrastructure & Environment Limited
Reference: WIE17125
Location: Trinity Academy, Barnsley
Contact: Andrew Mould
EMT Job No: 20/13332

SVOC Report : **Solid**

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	4-6	46-48										
Sample ID	TP101	TP106										
Depth	0.50	0.60										
COC No / misc												
Containers	V J T	V J T										
Sample Date	24/09/2020	24/09/2020										
Sample Type	Soil	Soil										
Batch Number	1	1										
Date of Receipt	30/09/2020	30/09/2020								LOD/LOR	Units	Method No.
SVOC MS												
Phenols												
2-Chlorophenol #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2-Methylphenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2-Nitrophenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2,4-Dichlorophenol #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2,4-Dimethylphenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2,4,5-Trichlorophenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2,4,6-Trichlorophenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
4-Chloro-3-methylphenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
4-Methylphenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
4-Nitrophenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Pentachlorophenol	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Phenol #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
PAHs												
2-Chloronaphthalene #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2-Methylnaphthalene #	0.07	<0.01								<0.01	mg/kg	TM16/PM8
Phthalates												
Bis(2-ethylhexyl) phthalate	<0.1	<0.1								<0.1	mg/kg	TM16/PM8
Butylbenzyl phthalate	<0.1	<0.1								<0.1	mg/kg	TM16/PM8
Di-n-butyl phthalate	<0.1	<0.1								<0.1	mg/kg	TM16/PM8
Di-n-Octyl phthalate	<0.1	<0.1								<0.1	mg/kg	TM16/PM8
Diethyl phthalate	<0.1	<0.1								<0.1	mg/kg	TM16/PM8
Dimethyl phthalate #	<0.1	<0.1								<0.1	mg/kg	TM16/PM8
Other SVOCs												
1,2-Dichlorobenzene	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
1,2,4-Trichlorobenzene #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
1,3-Dichlorobenzene	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
1,4-Dichlorobenzene	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2-Nitroaniline	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2,4-Dinitrotoluene	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
2,6-Dinitrotoluene	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
3-Nitroaniline	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
4-Bromophenylphenylether #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
4-Chloroaniline	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
4-Chlorophenylphenylether	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
4-Nitroaniline	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Azobenzene	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Bis(2-chloroethoxy)methane	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Bis(2-chloroethyl)ether	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Carbazole	0.03	<0.01								<0.01	mg/kg	TM16/PM8
Dibenzofuran #	0.07	<0.01								<0.01	mg/kg	TM16/PM8
Hexachlorobenzene	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Hexachlorobutadiene #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Hexachlorocyclopentadiene	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Hexachloroethane	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Isophorone #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
N-nitrosodi-n-propylamine #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Nitrobenzene #	<0.01	<0.01								<0.01	mg/kg	TM16/PM8
Surrogate Recovery 2-Fluorobiphenyl	122	120								<0	%	TM16/PM8
Surrogate Recovery p-Terphenyl-d14	129	127								<0	%	TM16/PM8

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Waterman Infrastructure & Environment Limited **VOC Report :** **Solid**
Reference: WIE17125
Location: Trinity Academy, Barnsley
Contact: Andrew Mould
EMT Job No: 20/13332

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	4-6	46-48											
Sample ID	TP101	TP106											
Depth	0.50	0.60											
COC No / misc													
Containers	V J T	V J T											
Sample Date	24/09/2020	24/09/2020											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	30/09/2020	30/09/2020									LOD/LOR	Units	Method No.
VOC MS													
Dichlorodifluoromethane	<0.002	<0.002									<0.002	mg/kg	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.002	<0.002									<0.002	mg/kg	TM15/PM10
Chloromethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Vinyl Chloride	<0.002	<0.002									<0.002	mg/kg	TM15_A/PM10
Bromomethane	<0.001	<0.001									<0.001	mg/kg	TM15/PM10
Chloroethane #	<0.002	<0.002									<0.002	mg/kg	TM15/PM10
Trichlorofluoromethane #	<0.002	<0.002									<0.002	mg/kg	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<0.006	<0.006									<0.006	mg/kg	TM15/PM10
Dichloromethane (DCM) #	<0.03	<0.03									<0.03	mg/kg	TM15/PM10
trans-1-2-Dichloroethene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,1-Dichloroethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
cis-1-2-Dichloroethene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
2,2-Dichloropropane	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
Bromochloromethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Chloroform #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,1,1-Trichloroethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,1-Dichloropropene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Carbon tetrachloride #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
1,2-Dichloroethane #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
Benzene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Trichloroethene (TCE) #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,2-Dichloropropane #	<0.006	<0.006									<0.006	mg/kg	TM15/PM10
Dibromomethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Bromodichloromethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
cis-1-3-Dichloropropene	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
Toluene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
trans-1-3-Dichloropropene	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,1,2-Trichloroethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Tetrachloroethene (PCE) #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,3-Dichloropropane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Dibromochloromethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,2-Dibromoethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Chlorobenzene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,1,1,2-Tetrachloroethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Ethylbenzene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
m/p-Xylene #	<0.005	<0.005									<0.005	mg/kg	TM15/PM10
o-Xylene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Styrene	<0.003	<0.003									<0.003	mg/kg	TM15_A/PM10
Bromoform	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Isopropylbenzene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,1,2,2-Tetrachloroethane #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
Bromobenzene	<0.002	<0.002									<0.002	mg/kg	TM15/PM10
1,2,3-Trichloropropane #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
Propylbenzene #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
2-Chlorotoluene	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
1,3,5-Trimethylbenzene #	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
4-Chlorotoluene	<0.003	<0.003									<0.003	mg/kg	TM15/PM10
tert-Butylbenzene #	<0.005	<0.005									<0.005	mg/kg	TM15/PM10
1,2,4-Trimethylbenzene #	<0.006	<0.006									<0.006	mg/kg	TM15/PM10
sec-Butylbenzene #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
4-Isopropyltoluene #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
1,3-Dichlorobenzene #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
1,4-Dichlorobenzene #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
n-Butylbenzene #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
1,2-Dichlorobenzene #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
1,2-Dibromo-3-chloropropane #	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
1,2,4-Trichlorobenzene #	<0.007	<0.007									<0.007	mg/kg	TM15/PM10
Hexachlorobutadiene	<0.004	<0.004									<0.004	mg/kg	TM15/PM10
Naphthalene	<0.027	<0.027									<0.027	mg/kg	TM15/PM10
1,2,3-Trichlorobenzene #	<0.007	<0.007									<0.007	mg/kg	TM15/PM10
Surrogate Recovery Toluene D8	86	102									<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	66	84									<0	%	TM15/PM10

Client Name:	Waterman Infrastructure & Environment Limited
Reference:	WIE17125
Location:	Trinity Academy, Barnsley
Contact:	Andrew Mould

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/13332	1	TP101	0.50	6	12/10/2020	**General Description (Bulk Analysis)**	Soil/Stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP102	0.10	12	12/10/2020	**General Description (Bulk Analysis)**	Soil/Stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP102	0.50	15	12/10/2020	**General Description (Bulk Analysis)**	Soil/Stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP104	0.60	33	12/10/2020	**General Description (Bulk Analysis)**	Soil/Stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP105	0.10	39	12/10/2020	**General Description (Bulk Analysis)**	Soil/Stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP106	0.60	48	12/10/2020	**General Description (Bulk Analysis)**	soil-stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP108	0.10	63	12/10/2020	**General Description (Bulk Analysis)**	soil.stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD

Client Name: Waterman Infrastructure & Environment Limited
Reference: WIE17125
Location: Trinity Academy, Barnsley
Contact: Andrew Mould

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/13332	1	TP108	0.10	63	12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP110	1.00	81	12/10/2020	**General Description (Bulk Analysis)**	soil.stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP111	0.20	87	12/10/2020	**General Description (Bulk Analysis)**	Soil/Stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD
20/13332	1	TP112	0.20	93	12/10/2020	**General Description (Bulk Analysis)**	soil-stones
					12/10/2020	**Asbestos Fibres**	NAD
					12/10/2020	**Asbestos ACM**	NAD
					12/10/2020	**Asbestos Type**	NAD
					12/10/2020	**Asbestos Level Screen**	NAD

Element Materials Technology

Notification of Deviating Samples

Client Name: Waterman Infrastructure & Environment Limited

Reference: WIE17125

Location: Trinity Academy, Barnsley

Contact: Andrew Mould

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
20/13332	1	TP107	1.00	58-60	PAH	Sample holding time exceeded
20/13332	1	TP108	0.10	61-63	PAH	Sample holding time exceeded
20/13332	1	TP110	1.00	79-81	PAH	Sample holding time exceeded
20/13332	1	TP111	0.20	85-87	PAH	Sample holding time exceeded
20/13332	1	TP112	0.20	91-93	PAH	Sample holding time exceeded

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/13332

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution

EMT Job No: 20/13332

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes

EMT Job No: 20/13332

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

EMT Job No: 20/13332

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM15_A	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds, Vinyl Chloride & Styrene by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

P: +44 (0) 1244 833780
F: +44 (0) 1244 833781

W: www.element.com

Waterman Infrastructure & Environment Limited
11 Peter Street
Manchester
M2 5QR

Attention : Andrew Mould

Date : 27th October, 2020

Your reference : WIE17125

Our reference : Test Report 20/13332 Batch 1 Schedule B

Location : Trinity Academy, Barnsley

Date samples received : 30th September, 2020

Status : Final report

Issue : 1

Thirty nine samples were received for analysis on 30th September, 2020 of which eight were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Simon Gomery BSc
Project Manager

Client Name: Waterman Infrastructure & Environment Limited
Reference: WIE17125
Location: Trinity Academy, Barnsley
Contact: Andrew Mould
EMT Job No: 20/13332

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	4-6	10-12	13-15	31-33	37-39	46-48	79-81	91-93					
Sample ID	TP101	TP102	TP102	TP104	TP105	TP106	TP110	TP112					
Depth	0.50	0.10	0.50	0.60	0.10	0.60	1.00	0.20					
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T					
Sample Date	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020	23/09/2020	23/09/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1			LOD/LOR	Units	Method No.
Date of Receipt	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020					
Gross Calorific Value*	2746	1808	1869	<100	1418	113	<100	1427				kJ/kg	Subcontracted

Notification of Deviating Samples

Client Name: Waterman Infrastructure & Environment Limited
Reference: WIE17125
Location: Trinity Academy, Barnsley
Contact: Andrew Mould

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/13332						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/13332

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 20/13332

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
Subcontracted	See attached subcontractor report for accreditation status and provider.						

Job No	WIE17125-100
Site Name	Trinity Academy, Barnsley

END USE SCENARIO

			Residential without plant uptake (1% SOM)	Sample I.D	4-6	7-9	10-12	13-15	31-33	37-39	46-48	58-60	61-63	79-81	85-87	91-93
					TP101	TP101	TP102	TP102	TP104	TP105	TP106	TP107	TP108	TP110	TP111	TP112
				Depth	0.50	1.50	0.10	0.50	0.60	0.10	0.60	1.00	0.10	1.00	0.20	0.20
				Strata	MG	Glacial Till	MG	MG	MG	MG	MG	Glacial Till	MG	MG	MG	MG
In-organics	**Metals**	Arsenic	**40.00**	mg/kg	20.00	3.00	19.20	8.30	9.60	24.00	9.10	9.50	14.40	7.80	25.40	28.00
		Barium		mg/kg	82.00	52.00	82.00	62.00	62.00	114.00	56.00	86.00	79.00	60.00	102.00	125.00
		Beryllium	**1.70**	mg/kg	1.50	1.20	1.30	1.30	1.50	1.70	1.50	1.30	1.50	**2.30**	1.40	**1.90**
		Boron (Water Soluble)	**11000.00**	mg/kg	0.60	0.40	0.80	0.40	0.70	0.80	0.60	0.50	0.60	0.70	2.00	1.40
		Cadmium	**150.00**	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
		Chromium (Total)	**910.00**	mg/kg	27.80	39.90	250.60	22.60	56.00	29.50	76.00	46.60	29.10	33.90	34.40	174.60
		Chromium (VI)	**21.00**	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
		Cobalt	**0.00**	mg/kg	16.00	9.30	15.10	14.30	14.40	18.90	18.40	22.80	26.50	14.00	12.40	17.70
		Copper	**7100.00**	mg/kg	34.00	26.00	36.00	24.00	34.00	43.00	23.00	22.00	26.00	31.00	44.00	43.00
		Iron		mg/kg	41560.00	35020.00	33750.00	42240.00	43570.00	44710.00	49180.00	47860.00	43170.00	69690.00	32510.00	44370.00
		Lead	**310.00**	mg/kg	71.00	16.00	72.00	24.00	24.00	67.00	22.00	24.00	47.00	27.00	100.00	90.00
		Mercury	**1.20**	mg/kg	0.10	<0.1	0.20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.30	0.10
		Molybdenum		mg/kg	1.70	1.20	2.90	0.50	0.50	1.90	0.50	2.30	1.10	0.30	2.70	3.30
		Nickel	**180.00**	mg/kg	22.20	23.20	27.00	24.60	30.70	25.20	27.00	25.00	25.70	27.90	20.80	24.40
		Selenium	**430.00**	mg/kg	2.00	<1	2.00	<1	1.00	2.00	2.00	2.00	1.00	1.00	2.00	2.00
		Vanadium	**1200.00**	mg/kg	33.00	24.00	34.00	26.00	29.00	39.00	30.00	34.00	34.00	38.00	36.00	38.00
		Zinc	**40000.00**	mg/kg	106.00	81.00	107.00	98.00	112.00	128.00	105.00	95.00	104.00	93.00	116.00	116.00
	Non-metals	Cyanide (Free)	**0.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Complex Cyanide	**0.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Total Cyanide		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Thiocyanate	**0.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Elemental Sulphur		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sulphate (total) / Acid Soluble Sulphate		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Water Soluble Sulphate (SO4)		mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sulphide		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Chloride		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Exchangeable Ammonium2		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Nitrate		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organics	**TPH**	TPH (C8-C40)		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		EPH (DRO) C10-C24		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C8-C10		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C10-C12		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C12-C16		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C16-C21		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C21-C35		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		TPH description / Interpretation		N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TPH CWG	Aliphatic EC5 - EC6	**42.00**	mg/kg	<0.1	0.00	0.00	<0.1	<0.1	<0.1	<0.1	0.00	0.00	<0.1	<0.1	0.00
		Aliphatic EC6 - EC8	**100.00**	mg/kg	<0.1	0.00	0.00	<0.1	<0.1	<0.1	<0.1	0.00	0.00	<0.1	<0.1	0.00
		Aliphatic EC8-EC10	**27.00**	mg/kg	<0.1	0.00	0.00	<0.1	<0.1	<0.1	<0.1	0.00	0.00	<0.1	<0.1	0.00
		Aliphatic EC10-EC12	**130.00**	mg/kg	<0.2	0.00	0.00	<0.2	<0.2	<0.2	<0.2	0.00	0.00	<0.2	<0.2	0.00
		Aliphatic EC12-EC16	**1100.00**	mg/kg	<4	0.00	0.00	<4	<4	<4	<4	0.00	0.00	<4	<4	0.00
		Aliphatic EC16-EC21	**65000.00**	mg/kg	<7	0.00	0.00	<7	<7	<7	<7	0.00	0.00	<7	<7	0.00
		Aliphatic EC21-EC35	**65000.00**	mg/kg	<7	0.00	0.00	<7	<7	<7	<7	0.00	0.00	<7	<7	0.00
		Aliphatic EC35-EC44		mg/kg	<7	0.00	0.00	<7	<7	<7	<7	0.00	0.00	<7	<7	0.00
		Total Aliphatics (EC5 - EC44)		mg/kg	<26	0.00	0.00	<26	<26	<26	<26	0.00	0.00	<26	<26	0.00
		Aromatic EC5-EC7	**370.00**	mg/kg	<0.1	0.00	0.00	<0.1	<0.1	<0.1	<0.1	0.00	0.00	<0.1	<0.1	0.00
		Aromatic EC7-EC8	**860.00**	mg/kg	<0.1	0.00	0.00	<0.1	<0.1	<0.1	<0.1	0.00	0.00	<0.1	<0.1	0.00
		Aromatic EC8-EC10	**47.00**	mg/kg	<0.1	0.00	0.00	<0.1	<0.1	<0.1	<0.1	0.00	0.00	<0.1	<0.1	0.00
		Aromatic EC10-EC12	**250.00**	mg/kg	<0.2	0.00	0.00	<0.2	<0.2	<0.2	<0.2	0.00	0.00	<0.2	<0.2	0.00
		Aromatic EC12-EC16	**1800.00**	mg/kg	<4	0.00	0.00	<4	<4	<4	<4	0.00	0.00	<4	<4	0.00
		Aromatic EC16-EC21	**1900.00**	mg/kg	<7	0.00	0.00	<7	<7	<7	<7	0.00	0.00	<7	17.00	0.00
		Aromatic EC21-EC35	**1900.00**	mg/kg	<7	0.00	0.00	<7	<7	<7	<7	0.00	0.00	<7	98.00	0.00
		Aromatic EC35-EC44	**1900.00**	mg/kg	<7	0.00	0.00	<7	<7	<7	<7	0.00	0.00	<7	<7	0.00
		Total Aromatics (EC5-EC44)		mg/kg	<26	0.00	0.00	<26	<26	<26	<26	0.00	0.00	<26	115.00	0.00
		Total Aliphatics and Aromatics (EC5-EC35)		mg/kg	<52	0.00	0.00	<52	<52	<52	<52	0.00	0.00	<52	115.00	0.00
	BTEX	GRO (C5-C10)		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		GRO (C10-C12)		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Benzene	**0.38**	mg/kg	<0.003	0.00	0.00	<0.005	<0.005	<0.005	0.00	0.00	0.00	<0.005	<0.005	0.00
		Toluene	**880.00**	mg/kg	<0.003	0.00	0.00	<0.005	<0.005	<0.005	0.00	0.00	0.00	<0.005	<0.005	0.00
		Ethyl Benzene	**83.00**	mg/kg	<0.003	0.00	0.00	<0.005	<0.005	<0.005	0.00	0.00	0.00	<0.005	<0.005	0.00
		Xylene - m	**82.00**	mg/kg	<0.005	0.00	0.00	<0.005	<0.005	<0.005	0.00	0.00	0.00	<0.005	<0.005	0.00
		Xylene - o	**88.00**	mg/kg	<0.003	0.00	0.00	<0.005	<0.005	<0.005	0.00	0.00	0.00	<0.005	<0.005	0.00
		Xylene - p	**79.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		MTBE	**0.00**	mg/kg	<0.002	0.00	0.00	<0.005	<0.005	<0.005	0.00	0.00	0.00	<0.005	<0.005	0.00
	16 US EPA PAHs (GCMS)	Naphthalene	**2.30**	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.08	0.30
		Acenaphthylene	**2900.00**	mg/kg	0.05	<0.03	<0.03	<0.03	<0.03	0.24	<0.03	<0.03	0.06	<0.03	0.11	0.86
		Acenaphthene	**3000.00**	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.10
		Fluorene	**2800.00**	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.19
		Phenanthrene	**1300.00**	mg/kg	0.18	<0.03	0.13	0.03	<0.03	0.37	<0.03	<0.03	0.29	<0.03	0.91	3.10
		Anthracene	**31000.00**	mg/kg	0.06	<0.04	<0.04	<0.04	<0.04	0.31	<0.04	<0.04	0.12	<0.04	0.30	1.69
		Fluoranthene	**1500.00**	mg/kg	0.37	<0.03	0.30	0.06	<0.03	1.47	<0.03	<0.03	0.77	<0.03	2.36	9.92
		Pyrene	**3700.00**	mg/kg	0.31	<0.03	0.25	0.06	<0.03	1.34	<0.03	<0.03	0.64	<0.03	1.90	8.30
		Benzo(a)anthracene	**11.00**	mg/kg	0.24	<0.06	0.19	<0.06	<0.06	1.01	<0.06	<0.06	0.46	<0.06	1.15	5.45
		Chrysene	**30.00**	mg/kg	0.23	<0.02	0.17	0.05	<0.02	1.02	<0.02	<0.02	0.42	<0.02	1.18	4.98
		Benzo(b)fluoranthene	**3.90**	mg/kg	0.28	<0.05	0.22	0.06	<0.05	1.38	<0.05	<0.05	0.53	<0.05	1.50	**6.81**
		Benzo(k)fluoranthene	**110.00**	mg/kg	0.11	<0.02	0.08	0.02	<0.02	0.53	<0.02	<0.02	0.20	<0.02	0.59	2.65
		Benzo(a)pyrene	**3.20**	mg/kg	0.21	<0.04	0.17	0.05	<0.04	1.09	<0.04	<0.04	0.38	<0.04	1.12	**5.32**
		Indeno(1,2,3-cd)pyrene	**45.00**	mg/kg	0.16	<0.04	0.12	<0.04	<0.04	0.64	<0.04	<0.04	0.25	<0.04	0.73	3.76
		Di-benzo(a.h.)anthracene	**0.31**	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	0.11	<0.04	<0.04	0.05	<0.04	0.14	**0.72**
		Benzo(g.h.i.) Perylene	**360.00**	mg/kg	0.15	<0.04	0.10	<0.04	<0.04	0.64	<0.04	<0.04	0.25	<0.04	0.69	3.60
	Phenols	Phenols		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Phenol	**750.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Pentachlorophenol (PCP)	**27.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		2,4-Dimethylphenol		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Total Cresols (2-, 3- and 4-methylphenol)		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Chlorinated Aliphatics	1,1,2,2 Tetrachloroethane	**3.90**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1,1,1,2 Tetrachloroethane	**1.50**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1,1,1 Trichloroethane	**9.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Trichloroethane		mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Tetrachloromethane (Carbon Tetrachloride)	**0.03**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1,2- Dichloroethane	**0.01**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Chloroethene (Vinyl chloride)	**0.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Trichloroethene	**0.02**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Tetrachloroethene	**0.00**	mg/kg	0.00	#REF!	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Trichloromethane (Chloroform)	**1.20**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of PCDDs, PCDFs and dioxins like PCBs	**0.18**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Hydrocarbons	Isopropylbenzene	**12.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Propylbenzene	**40.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Styrene	**35.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Bromobenzene	**0.91**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Halogenated Organics	1,1,2 Trichloroethane	**0.88**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1,1-Dichloroethane	**2.50**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1,1-Dichloroethene	**0.23**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1,2,4-Trimethylbenzene	**0.41**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1,2-Dichloropropane	**0.02**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		2-Chloronaphthalene	**3.80**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Bromodichloromethane	**0.02**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Bromoform	**5.20**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Chloroethane	**8.40**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Chloromethane	**0.01**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Cis 1,2 Dichloroethene	**0.12**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Dichloromethane	**2.10**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Hexachloroethane	**0.22**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Trans 1,2 Dichloroethene	**0.19**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Phthalates	Bis (2-ethylhexyl) phthalate	**2700.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Butyl benzyl phthalate	**42000.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Diethyl Phthalate	**1800.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Di-n-butyl phthalate	**450.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Di-n-octyl phthalate	**3400.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Other Organics	Biphenyl	**220.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		2,4-Dinitrotoluene	**170.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		2,6-Dinitrotoluene	**78.00**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Tributyl tin oxide	**1.40**	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
General	**Soil Properties**	S.O.M % (Calc)		%	12.70	0.30	9.60	2.80	1.20	12.30	1.80	0.90	3.60	0.30	14.70	17.50
		Total Organic Carbon		% M/M	7.38	0.16	5.58	1.61	0.72	7.14	1.02	0.55	2.11	0.20	8.52	10.17
		pH		pH units	6.58	7.67	5.70	8.00	8.27	7.37	7.93	7.80	7.43	7.22	6.41	7.01
		Moisture Content		%	14.50	16.00	29.10	15.80	14.10	24.80	14.10	21.80	20.10	16.80	40.50	24.60
		Loss on Ignition		%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Calorific Value	**2.00**	MJ/kg	**2.75**	0.00	1.81	1.87	<0.1	1.42	0.11	0.00	0.00	<0.1	0.00	1.43
	Soil Screens	Asbestos (screening)	**0.00**	Visual	NAD	0.00	NAD	NAD	NAD	NAD	NAD	0.00	NAD	NAD	NAD	NAD

Appendix F Environmental Receptors

The Contaminated Land Statutory Guidance has a four category system that considers harm to human health, controlled waters, flora and fauna, property, livestock and crops. The Categories are broadly defined as follows:

1 Contaminated Land – similar to land where it is known that significant harm has been caused or significant harm is being caused

2 Contaminated Land – no significant harm being caused but there is a significant possibility for significant harm to be caused in the future

3 Not Contaminated Land – there may be harm being caused but no significant possibility for significant harm to be caused in the future

4 Not Contaminated Land – no contaminant linkage, normal levels of contaminants and no significant harm being caused and no significant possibility for significant harm to be caused in the future.

Table F.1: Significant pollution to controlled waters

Pollution of controlled waters

Under Section 78A(9) of Part 2A the term “pollution of controlled waters means the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter. The term “controlled waters” in relation to England has the same meaning as in Part 3 of the Water Resources Act 1991, except that “ground waters” does not include water contained in underground strata but above the saturation zones. (Paragraph 4.36)

Given that the Part 2A regime seeks to identify and deal with significant pollution (rather than lesser levels of pollution), the local authority should seek to focus on pollution which: (i) may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems; (ii) which may result in damage to material property; or (iii) which may impair or interfere with amenities and other legitimate uses of the environment. (Paragraph 4.37)

Significant pollution of controlled waters

Paragraph 4.38 states that “The following types of pollution should be considered to constitute significant pollution of controlled waters:

(a) Pollution equivalent to “environmental damage” to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation) Regulations 2009, but which cannot be dealt with under those Regulations.

(b) Inputs resulting in deterioration of the quality of water abstracted, or intended to be used in the future, for human consumption such that additional treatment would be required to enable that use.

(c) A breach of a statutory surface water Environment Quality Standard, either directly or via a groundwater pathway.

(d) Input of a substance into groundwater resulting in a significant and sustained upward trend in concentration of contaminants (as defined in Article 2(3) of the Groundwater Daughter Directive (2006/118/EC)5)”.

Paragraph 4.39 states that “In some circumstances, the local authority may consider that the following types of pollution may constitute significant pollution: (a) significant concentrations6 of hazardous substances or non-hazardous pollutants in groundwater; or (b) significant concentrations of priority hazardous substances, priority substances or other specific polluting substances in surface water; at an appropriate, risk based compliance point. The local authority should only conclude that pollution is significant if it considers that treating the land as contaminated land would be in accordance with the broad objectives of the regime as described in Section 1 (of the Contaminated Land Statutory Guidance). This would normally mean that the authority should conclude that less serious forms of pollution are not significant. In such cases the authority should consult the Environment Agency”.

The following types of circumstance should not be considered to be contaminated land on water pollution grounds:

(a) The fact that substances are merely entering water and none of the conditions for considering that significant pollution is being caused set out in paragraphs 4.38 and 4.39 above are being met.

(b) The fact that land is causing a discharge that is not discernible at a location immediately downstream or down-gradient of the land (when compared to upstream or up-gradient concentrations).

(c) Substances entering water in compliance with a discharge authorised under the Environmental Permitting Regulations.

Significant pollution of controlled waters is being caused

In deciding whether significant pollution of controlled waters is being caused, the local authority should consider that this test is only met where it is satisfied that the substances in question are continuing to enter controlled waters; or that they have already entered the waters and are likely to do so again in such a manner that past and likely future entry in effect constitutes ongoing pollution. For these purposes, the local authority should:

(a) Regard substances as having entered controlled waters where they are dissolved or suspended in those waters, or (if they are immiscible with water) they have direct contact with those waters on or beneath the surface of the water.

(b) Take the term “continuing to enter” to mean any measurable entry of the substance(s) into controlled waters additional to any which has already occurred.

(c) Take the term “likely to do so again” to mean more likely than not to occur again.

Land should not be determined as contaminated land on grounds that significant pollution of controlled waters is being caused where: (a) the relevant substance(s) are already present in controlled waters; (b) entry into controlled waters of the substance(s) from land has ceased; and (c) it is not likely that further entry will take place.

Significant Possibility of Significant Pollution of Controlled Waters

In deciding whether or not a significant possibility of significant pollution of controlled waters exists, the local authority should first understand the possibility of significant pollution of controlled waters posed by the land, and the levels of certainty/uncertainty attached to that understanding, before it goes on to decide whether or not that possibility is significant. The term “possibility of significant pollution of controlled waters” means the estimated likelihood that significant pollution of controlled waters might occur. In assessing the possibility of significant pollution of controlled waters from land, the local authority should act in accordance with the advice on risk assessment in Section 3 and the guidance in this sub-section.

In deciding whether the possibility of significant pollution of controlled waters is significant the local authority should bear in mind that Part 2A makes the decision a positive legal test. In other words, for particular land to meet the test the authority needs reasonably to believe that there is a significant possibility of such pollution, rather than to demonstrate that there is not.

Before making its decision on whether a given possibility of significant pollution of controlled waters is significant, the local authority should consider:

(a) The estimated likelihood that the potential significant pollution of controlled waters would become manifest; the strength of evidence underlying the estimate; and the level of uncertainty underlying the estimate.

(b) The estimated impact of the potential significant pollution if it did occur. This should include consideration of whether the pollution would be likely to cause a breach of European water legislation, or make a major contribution to such a breach.

(c) The estimated timescale over which the significant pollution might become manifest.

(d) The authority's initial estimate of whether remediation is feasible, and if so what it would involve and the extent to which it might provide a solution to the problem; how long it would take; what benefit it would be likely to bring; and whether the benefits would outweigh the costs and any impacts on local society or the environment from taking action

Reproduced from DEFRA (2012) Contaminated Land Statutory Guidance pursuant to section 78YA of the Environmental Protection Act 1990 as amended by Section 57 of the Environment Act 1995.

Table F.2: Significant harm to human health, ecological systems and property

Relevant types of receptor	Significant harm	Significant possibility of significant harm
Human beings	The following health effects should always be considered to constitute significant harm to human health: death; life threatening diseases (eg cancers); other diseases likely to have serious impacts on health; serious injury; birth defects; and impairment of reproductive functions. Other health effects may be considered by the local authority to constitute significant harm. For example, a wide range of conditions may or may not constitute significant harm (alone or in combination) including: physical injury; gastrointestinal disturbances; respiratory tract effects; cardio-vascular effects; central nervous system effects; skin ailments; effects on organs such as the liver or kidneys; or a wide range of other health impacts. In deciding whether or not a particular form of harm is significant harm, the local authority should consider the seriousness of the	The risk posed by one or more relevant contaminant linkage(s) relating to the land comprises: (a) The estimated likelihood that significant harm might occur to an identified receptor, taking account of the current use of the land in question. (b) The estimated impact if the significant harm did occur – i.e. the nature of the harm, the seriousness of the harm to any person who might suffer it, and (where relevant) the extent of the harm in terms of how many people might suffer it. In estimating the likelihood that a specific form of significant harm might occur the local authority should, among other things, consider: (a) The estimated probability that

Relevant types of receptor	Significant harm	Significant possibility of significant harm
	harm in question: including the impact on the health, and quality of life, of any person suffering the harm; and the scale of the harm. The authority should only conclude that harm is significant if it considers that treating the land as contaminated land would be in accordance with the broad objectives of the regime as described in Section 1 of the Contaminated Land Statutory Guidance.	the significant harm might occur: (i) if the land continues to be used as it is currently being used; and (ii) where relevant, if the land were to be used in a different way (or ways) in the future having regard to the guidance on "current use" in Section 3 of the Contaminated Land Statutory Guidance. (b) The strength of evidence underlying the risk estimate. It should also consider the key assumptions on which the estimate of likelihood is based, and the level of uncertainty underlying the estimate.
Any ecological system, or living organism forming part of such a system, within a location which is: • a site of special scientific interest (under section 28 of the Wildlife and Countryside Act (WCA) 1981 (as amended) and Part 4 of the Natural Environment and Rural Communitites Act 2006 (as amended)); • a national nature reserve (under Section 35 of the WCA 1981 (as amended)); • a marine nature reserve (under Section 36 of the WCA 1981 (as amended)); • an area of special protection for birds (under Section 3 of the WCA 1981 (as amended)); • a "European site" within the meaning of regulation 8 of the Conservation of Habitats and Species Regulations 2010 (as amended); • any habitat or site afforded policy protection under Section 11 of The National Planning Policy Framework (NPPF) on conserving and enhancing the natural environment (i.e. possible Special Areas of Conservation, potential Special	The following types of harm should be considered to be significant harm: • harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or • harm which significantly affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location. In the case of European sites, harm should also be considered to be significant harm if it endangers the favourable conservation status of natural habitats at such locations or species typically found there. In deciding what constitutes such harm, the local authority should have regard to the advice of Natural England and to the requirements of the Conservation of Habitats and Species Regulations 2010 (as amended).	Conditions would exist for considering that a significant possibility of significant harm exists to a relevant ecological receptor where the local authority considers that: • significant harm of that description is more likely than not to result from the contaminant linkage in question; or • there is a reasonable possibility of significant harm of that description being caused, and if that harm were to occur, it would result in such a degree of damage to features of special interest at the location in question that they would be beyond any practicable possibility of restoration. Any assessment made for these purposes should take into account relevant information for that type of contaminant linkage, particularly in relation to the ecotoxicological effects of the contaminant.

Relevant types of receptor	Significant harm	Significant possibility of significant harm
Protection Areas and listed or proposed Ramsar sites); or - any nature reserve established under Section 21 of the National Parks and Access to the Countryside Act 1949.		
Property in the form of: - crops, including timber - produce grown domestically, or on allotments, for consumption - livestock - other owned or domesticated animals; - wild animals which are the subject of shooting or fishing rights.	For crops, a substantial diminution in yield or other substantial loss in their value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage. The local authority should regard a substantial loss in value as occurring only when a substantial proportion of the animals or crops are dead or otherwise no longer fit for their intended purpose. Food should be regarded as being no longer fit for purpose when it fails to comply with the provisions of the Food Safety Act 1990. Where a diminution in yield or loss in value is caused by a contaminant linkage, a 20% diminution or loss should be regarded as a benchmark for what constitutes a substantial diminution or loss. In the Guidance states that this description of significant harm is referred to as an “animal or crop effect”.	Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question, taking into account relevant information for that type of contaminant linkage, particularly in relation to the ecotoxicological effects of the contaminant.
Property in the form of buildings. For this purpose 'building' means any structure or erection and any part of a building, including any part below ground level, but does not include plant or machinery comprised in a building, or buried services such as sewers, water pipes or electricity cables.	Structural failure, substantial damage or substantial interference with any right of occupation. The local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended. In the case of a scheduled Ancient Monument, substantial damage should be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled.	Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question during the expected economic life of the building (or in the case of a scheduled Ancient Monument the foreseeable future), taking into account relevant information for that type of contaminant linkage.

Relevant types of receptor	Significant harm	Significant possibility of significant harm
	The Guidance states that this description of significant harm is referred to as a 'building effect'.	

Reproduced from DEFRA (2012) Contaminated Land Statutory Guidance pursuant to section 78YA of the Environmental Protection Act 1990 as amended by Section 57 of the Environment Act 1995.

Appendix G Generic Assessment Criteria

Human Health Generic Assessment Criteria

Background

In order to be able to make inference on whether the results obtained during the site investigation (e.g. chemical concentrations in soils, waters and gas) point to the presence of a potential hazard to human health, it is necessary to distinguish between the results, reflecting background and/or insignificantly elevated levels of contamination (i.e. with negligible potential to cause harm or pollution) and the results with significantly elevated concentrations (i.e. with significant potential to cause harm or pollution).

The approach to risk assessment with respect to risks to human health from contaminated land in the UK is set out in the publication Model Procedures for the Management of Land Contamination (CLR11) Environment Agency (2004).

This sets out a tiered approach:

- Preliminary Risk Assessment (e.g. establishing potential contaminant linkages);
- Generic Quantitative Risk Assessment (GQRA) (e.g. comparison of site contaminant concentrations against generic standards and compliance criteria e.g. Soil Guideline Values (SGV) or other Generic Assessment Criteria including an assessment of risk using the source pathway target model); and
- Detailed Quantitative Risk Assessment (DQRA) (e.g. the comparison of contaminant concentrations against site specific assessment criteria).

Preliminary Risk Assessment

This typically encompasses a desk based generation of a conceptual model to establish the potential contaminant linkages associated with the site and any proposed development. Works would typically involve:

- Evaluation of the potential sources of contamination on the site and in the locality and from both a current and historical perspective
- Statutory Consultation;
- Evaluation of a sites geology, hydrology and hydrogeology;
- Site inspection;
- Additional pertinent information as necessary on a site by site basis.

Where works indicate the presence of a potential contaminant linkage further evaluation and potentially site investigation works are necessary to determine the significance of the linkage.

Generic Quantitative Risk Assessment (GQRA)

In August 2008 the Environment Agency (EA) and Department of Environment Food and Rural Affairs (DEFRA) announced the withdrawal of the Contaminated Land Reports CLR7 – 10, CLEA UK (beta) and existing SGV reports as they no-longer fully reflected the revised approach to human health risk assessment.

New partial guidance (in particular Science Reports SR2, SR3 and SR7) and new risk assessment tools (CLEA model version v1.04, v1.05 and currently v1.06) were published in 2009 and these allow environmental practitioners to derive generic and site specific Soil Assessment Criteria (GAC and SAC).

Soil Guideline Values (SGVs)

The EA and DEFRA updated the TOX reports and Soil Guideline Values (SGVs) to reflect the guidance documents published in 2009. SGVs for arsenic, cadmium, nickel, mercury, selenium, BTEX compounds (benzene, toluene, ethylbenzene and xylenes), dioxins, furans and dioxin like PCBs and phenol have been made available.

Since publishing the revised SGVs the CLEA model was updated to version v1.06. The Environment Agency has however confirmed that v1.05 has only a “minor effect on assessment criteria calculated using the CLEA software 1.04” and consequently the GACs derived are considered to remain valid. Environment Agency SGVs generated using v1.04 have also not been updated. Software version v1.06 is identical to v1.05 with some password protection enhancements that in no way affect the GAC values generated.

Owing to the scientific advances since 2009 and in particular toxicological research outputs, less significance is now placed on the SGVs in the hierarchy outlined below.

Category 4 Screening Levels (C4SLs)

Category 4 Screening Levels were generated by Contaminated Land: Applications in Real Environments (CL:AIRE) on behalf of DEFRA and made available to the public in April 2014. Category 4 Screening Levels were derived in response to policy changes outlined in the recently revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A). Part 2A was originally introduced to ensure that the risks from land contamination to human health, property and the environment are managed appropriately, with the revised SG being designed to address concerns regarding its real-world application. The revised SG presents a new four category system for classifying land under Part 2A, ranging from Category 4, where the level of risk posed is acceptably low, to Category 1, where the level of risk is clearly unacceptable.

The document SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document (March 2014) states that:

The Impact Assessment that accompanied the revised Part 2A Statutory Guidance identified a potential role for new ‘Category 4 Screening Levels’ in providing a simple test for deciding when land is suitable for use and definitely not contaminated land. It was envisaged that these new screening levels would allow ‘low-risk’ land to be dismissed from the need for further risk assessment more quickly and easily and allow regulators to focus efforts on the highest-risk land. The C4SLs were proposed to be more pragmatic (whilst still strongly precautionary) compared to existing generic screening levels. It is anticipated that, where they exist, C4SLs will be used as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the currently or previously available SGVs.

Suitable For Use Screening Levels (S4USLs)

In January 2015, Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) have published updated screening criteria that were derived in line with UK guidance on risk assessment (SR2 and SR3). The resultant screening criteria reflect the industries greater knowledge of the relevant toxicology and further consideration of exposure scenarios as set out in SP1010.

Waterman's Generic Assessment Criteria (GACs)

Waterman have used the following hierarchy for the generic assessment of soils to evaluate Human Health.

- Published Category 4 Screening Values (C4SLs) derived by CL:AIRE on behalf of DEFRA; or in their absence;
- Suitable 4 Use Screening Levels (S4USLs) derived by LQM/CIEH; or in their absence;
- Published Soil Guideline Values (SGVs);
- GAC prepared in accordance with the CLEA v1.04 / v1.06 model by authoritative bodies (e.g. Contaminated Land Applications in Real Environments (CL:AIRE) 2009; and
- Waterman in-house GAC prepared in accordance with the CLEA V1.06 model and associated documents.

Tabulated values of the GACs used are presented overleaf. The references of the sources quoted in the table are:-

- Environment Agency, 2009. CLEA Software, version 1.06;
- DEFRA, Environment Agency, 2004. Model Procedures for the Management of Land Contamination, Contaminated Land Report 11;
- DEFRA, 2014, SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document and appendices;
- LQM / CIEH, 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment;
- Environment Agency, 2009. Human health toxicological assessment of contaminants in soil. Report SC050021/SR2;
- Environment Agency, 2009. Updated technical background to the CLEA model. Report SC050021/SR3;
- Environment Agency, 2008. Compilation of chemical data for priority organic pollutants for derivation of Soil Guideline Values. Report SC050021/SR7; and
- EIC / CL:AIRE, 2010. Soil generic assessment criteria for human health risk assessment.

Detailed Quantitative Risk Assessment (DQRA)

Detailed Quantitative Risk Assessments are undertaken on a site specific basis and full details of the alterations to the CLEA model and generic land use scenarios will be described within the specific reports.

Benzo(a)pyrene Surrogate Marker (SM) Approach

The DEFRA Category 4 Screening Level for B(a)P is based on the surrogate marker approach. In order to utilise the GAC or others based on this approach, the sample assessed must exhibit certain properties that comply with underlying assumptions.

SP1010, Appendix E states:

"The SM approach estimates the toxicity of a mixture of PAHs in an environmental matrix by using toxicity data for a PAH mixture for which the composition is known. Exposure to the SM is assumed to represent exposure to all PAHs in that matrix therefore the toxicity of the SM represents the toxicity of the mixture. In most cases, BaP is chosen as the SM due to its ubiquitous nature and the vast amount of data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food (EFSA 2008). However, RIVM considered that 'it would not be suitable to use BaP as a SM for carcinogenic risk assessment of PAH mixtures in soil due to the wide variety in composition of PAH mixtures in Dutch land contamination sites', although little data was provided in the report to support this statement (RIVM 2001). Similarly, the Canadian Council of Ministers of the Environment (CCME) also stated that contaminated soil is likely to contain a diverse range of carcinogenic and non-carcinogenic PAH of varying potency (CCME, 2008).

The SM approach relies on a number of assumptions (HPA 2010).

- *The SM (BaP) must be present in all soil samples.*
- *The profile of the different PAH relative to BaP should be similar in all samples.*
- *The PAH profile in the soil samples should be similar to that used in the pivotal toxicity study on which HBGV was based i.e. the Culp study.*

[sic] To assess the PAH profile in the test soil sample [complies with the assumptions above], the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated to ensure it is similar to the test material used in the Culp study (HPA 2010). To be considered sufficiently similar, the ratio relative to BaP should fit within the upper and lower limits (representing an order of magnitude above and below the mean ratio to BaP of test material used in the Culp study). In such cases BaP is considered an adequate SM and the LLTC for BaP may be used in the risk assessment.

If the site falls outside the order of magnitude limits, it may be appropriate to considering a LLTC for groups of surrogate markers, such as groups of 2, 4 or 8 PAHs, as used by EFSA for the evaluation of PAHs in food (EFSA 2008). Expert judgement should be sought in such situations where there is uncertainty as to whether BaP is sufficiently representative (HPA 2010)."

The ratios of the seven genotoxic PAHs relative to B(a)P can be calculated 'by hand' or using LQM's PAH profiling tool.

Generic Quantitative Risk Assessment Criteria

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Arsenic	mg/kg	37	37	37	40	40	40	49	49	49	DEFRA C4SLs
Antimony	mg/kg				550	550	550				CL:AIRE 2009
Barium	mg/kg				1300	1300	1300				CL:AIRE 2009
Beryllium	mg/kg	1.7	1.7	1.7	1.7	1.7	1.7	35	35	35	LQM S4ULs 2015
Boron (Water Soluble)	mg/kg	290	290	290	11000	11000	11000	45	45	45	LQM S4ULs 2015
Cadmium	mg/kg	22	22	22	150	150	150	3.9	3.9	3.9	DEFRA C4SLs
Chromium (Total)	mg/kg	910	910	910	910	910	910	18000	18000	18000	LQM S4ULs 2015
Chromium (VI)	mg/kg	21	21	21	21	21	21	170	170	170	DEFRA C4SLs
Copper	mg/kg	2400	2400	2400	7100	7100	7100	520	520	520	LQM S4ULs 2015
Lead	mg/kg	200	200	200	310	310	310	80	80	80	DEFRA C4SLs
Mercury	mg/kg	1.2	1.2	1.2	1.2	1.2	1.2	21	21	21	LQM S4ULs 2015
Molybdenum	mg/kg				670	670	670				CL:AIRE 2009
Nickel	mg/kg	130	130	130	180	180	180	53	53	53	LQM S4ULs 2015
Selenium	mg/kg	250	250	250	430	430	430	88	88	88	LQM S4ULs 2015
Vanadium*	mg/kg	410	410	410	1200	1200	1200	91	91	91	LQM S4ULs 2015
Zinc	mg/kg	3700	3700	3700	40000	40000	40000	620	620	620	LQM S4ULs 2015

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	**%**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	
Cyanide (Free)	mg/kg	26	26	26				4.1	4.1	4.1	Waterman GAC - CLEA v1.06
Complex Cyanide	mg/kg	63000	63000	63000				1200	1200	1200	Waterman GAC - CLEA v1.06
Thiocyanate	mg/kg	230	230	230				46	46	46	Waterman GAC - CLEA v1.06
Aliphatic EC5 - EC6	mg/kg	42	78	160	42	78	160	730	1700	3900	LQM S4ULs 2015
Aliphatic EC6 - EC8	mg/kg	100	230	530	100	230	530	2300	5600	13000	LQM S4ULs 2015
Aliphatic EC8-EC10	mg/kg	27	65	150	27	65	150	320	770	1700	LQM S4ULs 2015
Aliphatic EC10-EC12	mg/kg	130	330	760	130	330	770	2200	4400	7300	LQM S4ULs 2015
Aliphatic EC12-EC16	mg/kg	1100	2400	4300	1100	2400	4400	11000	13000	13000	LQM S4ULs 2015
Aliphatic EC16-EC35	mg/kg	65000	92000	110000	65000	92000	110000	260000	270000	270000	LQM S4ULs 2015
Aliphatic EC35-EC44	mg/kg	65000	92000	110000	65000	92000	110000	260000	270000	270000	LQM S4ULs 2015
Aromatic C5-C7	mg/kg	70	140	300	370	690	1400	13	27	57	LQM S4ULs 2015
Aromatic C7-C8	mg/kg	130	290	660	860	1800	3900	22	51	120	LQM S4ULs 2015
Aromatic C8-C10	mg/kg	34	83	190	47	110	270	8.6	21	51	LQM S4ULs 2015
Aromatic C10-C12	mg/kg	74	180	380	250	590	1200	13	31	74	LQM S4ULs 2015
Aromatic C12-C16	mg/kg	140	330	660	1800	2300	2500	23	57	130	LQM S4ULs 2015
Aromatic C16-C21	mg/kg	260	540	930	1900	1900	1900	46	110	260	LQM S4ULs 2015

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	**%**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	
Aromatic C21-C35	mg/kg	1100	1500	1700	1900	1900	1900	370	820	1600	LQM S4ULs 2015
Aromatic C35-C44	mg/kg	1100	1500	1700	1900	1900	1900	370	820	1600	LQM S4ULs 2015
Benzene	mg/kg	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	LQM S4ULs 2015
Toluene	mg/kg	130	290	660	880	1900	3900	22	51	120	LQM S4ULs 2015
Ethyl Benzene	mg/kg	47	110	260	83	190	440	16	39	91	LQM S4ULs 2015
Xylene - m	mg/kg	59	140	320	82	190	450	31	74	170	LQM S4ULs 2015
Xylene - o	mg/kg	60	140	330	88	210	480	28	67	160	LQM S4ULs 2015
Xylene - p	mg/kg	56	130	310	79	180	430	29	69	160	LQM S4ULs 2015
MTBE (Methyl tert-butyl ether)	mg/kg	49	84	160				23	44	90	CL:AIRE 2009
Naphthalene	mg/kg	2.3	5.6	13	2.3	5.6	13	4.1	10	24	LQM S4ULs 2015
Acenaphthylene	mg/kg	170	420	920	2900	4600	6000	28	69	160	LQM S4ULs 2015
Acenaphthene	mg/kg	210	510	1100	3000	4700	6000	34	85	200	LQM S4ULs 2015
Fluorene	mg/kg	170	400	860	2800	3800	4500	27	67	160	LQM S4ULs 2015
Phenanthrene	mg/kg	95	220	440	1300	1500	1500	15	38	90	LQM S4ULs 2015
Anthracene	mg/kg	2400	5400	11000	31000	35000	37000	380	950	2200	LQM S4ULs 2015
Fluoranthene	mg/kg	280	560	890	1500	1600	1600	52	130	290	LQM S4ULs 2015
Pyrene	mg/kg	620	1200	2000	3700	3800	3800	110	270	620	LQM S4ULs 2015

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Benzo(a)anthracene	mg/kg	7.2	11	13	11	14	15	2.9	6.5	13	LQM S4ULs 2015
Chrysene	mg/kg	15	22	27	30	31	32	4.1	9.4	19	LQM S4ULs 2015
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	3.9	4	4	0.99	2.1	3.9	LQM S4ULs 2015
Benzo(k)fluoranthene	mg/kg	77	93	100	110	110	110	37	75	130	LQM S4ULs 2015
Benzo(a)pyrene	mg/kg	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	LQM S4ULs 2015
Indeno(1,2,3-cd)pyrene	mg/kg	27	36	41	45	46	46	9.5	21	39	LQM S4ULs 2015
Di-benzo(a.h.)anthracene	mg/kg	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	LQM S4ULs 2015
Benzo(g.h.i.) Perylene	mg/kg	320	340	350	360	360	360	290	470	640	LQM S4ULs 2015
Phenol	mg/kg	280	550	1100	750	1300	2300	66	140	280	LQM S4ULs 2015
Pentachlorophenol (PCP)	mg/kg	0.22	0.52	1.2	27	29	31	0.03	0.08	0.19	LQM S4ULs 2015
1,1,2,2 Tetrachloroethane	mg/kg	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	LQM S4ULs 2015
1,1,1,2 Tetrachloroethane	mg/kg	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	LQM S4ULs 2015
1,1,1 Trichloroethane	mg/kg	8.8	18	39	9	18	40	48	110	240	LQM S4ULs 2015
Trichloroethene	mg/kg	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	LQM S4ULs 2015
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	LQM S4ULs 2015
1,2- Dichloroethane	mg/kg	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	LQM S4ULs 2015
Chloroethene (Vinyl chloride)	mg/kg	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	LQM S4ULs 2015

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	**%**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	
Trichloroethene	mg/kg	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	LQM S4ULs 2015
Tetrachloroethene	mg/kg	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	LQM S4ULs 2015
Trichloromethane (Chloroform)	mg/kg	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	LQM S4ULs 2015
Sum of PCDDs, PCDFs and dioxins like PCBs	ug/kg			8						8	CLEA SGVs 2009
Isopropylbenzene	mg/kg	11	27	64	12	28	67	32	79	190	CL:AIRE 2009
Propylbenzene	mg/kg	34	82	190	40	97	230	34	83	200	CL:AIRE 2009
Styrene	mg/kg	8.1	19	43	35	78	170	1.6	3.7	8.7	CL:AIRE 2009
Bromobenzene	mg/kg	0.87	2	4.7	0.91	2.1	4.9	3.2	7.6	18	CL:AIRE 2009
1,1,2 Trichloroethane	mg/kg	0.6	1.2	2.7	0.88	1.8	3.9	0.28	0.61	1.4	CL:AIRE 2009
1,1-Dichloroethane	mg/kg	2.4	3.9	7.4	2.5	4.1	7.7	9.2	17	35	CL:AIRE 2009
1,1-Dichloroethene	mg/kg	0.23	0.4	0.82	0.23	0.41	0.82	2.8	5.6	12	CL:AIRE 2009
1,2,4-Trimethylbenzene	mg/kg	0.35	0.85	2	0.41	0.99	2.3	0.38	0.93	2.2	CL:AIRE 2009
1,2-Dichloropropane	mg/kg	0.024	0.042	0.084	0.024	0.042	0.085	0.62	1.2	2.6	CL:AIRE 2009
2-Chloronaphthalene	mg/kg	3.7	9.2	22	3.8	9.3	22	40	98	230	CL:AIRE 2009
Bromodichloromethane	mg/kg	0.016	0.03	0.061	0.019	0.034	0.07	0.016	0.032	0.068	CL:AIRE 2009
Bromoform	mg/kg	2.8	5.9	13	5.2	11	23	0.95	2.1	4.6	CL:AIRE 2009
Chloroethane	mg/kg	8.3	11	18	8.4	11	18	110	200	380	CL:AIRE 2009

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	**%**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	
Chloromethane	mg/kg	0.0083	0.0098	0.013	0.0085	0.0099	0.013	0.066	0.13	0.23	CL:AIRE 2009
Cis 1,2 Dichloroethene	mg/kg	0.11	0.19	0.37	0.12	0.2	0.39	0.26	0.5	1	CL:AIRE 2009
Dichloromethane	mg/kg	0.58	0.98	1.7	2.1	2.8	4.5	0.1	0.19	0.34	CL:AIRE 2009
Hexachloroethane	mg/kg	0.2	0.48	1.1	0.22	0.54	1.3	0.27	0.67	1.6	CL:AIRE 2009
Trans 1,2 Dichloroethene	mg/kg	0.19	0.34	0.7	0.19	0.35	0.71	0.93	1.9	4	CL:AIRE 2009
Bis (2-ethylhexyl) phthalate	mg/kg	280	610	1100	2700	2800	2800	47	120	280	CL:AIRE 2009
Butyl benzyl phthalate	mg/kg	1400	3300	7200	42000	44000	44000	220	550	1300	CL:AIRE 2009
Diethyl Phthalate	mg/kg	120	260	570	1800	3500	6300	19	41	94	CL:AIRE 2009
Di-n-butyl phthalate	mg/kg	13	31	67	450	450	450	2	5	12	CL:AIRE 2009
Di-n-octyl phthalate	mg/kg	2300	2800	3100	3400	3400	3400	940	2100	3900	CL:AIRE 2009
Biphenyl	mg/kg	66	160	360	220	500	980	14	35	83	CL:AIRE 2009
2,4-Dinitrotoluene	mg/kg	1.5	3.2	7.2	170	170	170	0.22	0.49	1.1	CL:AIRE 2009
2,6-Dinitrotoluene	mg/kg	0.78	1.7	3.9	78	84	87	0.12	0.27	0.61	CL:AIRE 2009
Tributyl tin oxide	mg/kg	0.25	0.59	1.3	1.4	3.1	0.24	0.042	0.1	0.24	CL:AIRE 2009

Soil Contamination – Risk of Harm to Property

Structures and Underground Services

Buried Concrete

BRE Special Digest 1 (2005), 3rd Edition, entitled *Concrete in aggressive ground*, provides guidance on the specification for concrete for installation in natural ground and in brownfield locations. The procedures given for the ground assessment and concrete specification cover the fairly common occurrences of sulfates, sulfides and acids, and the more rarely occurring aggressive carbon dioxide found in some ground and surface waters, which affects concrete foundations and sub-structures. It gives procedures for specification of concrete and applies to both buildings and civil engineering construction.

Water Supply Pipes

Guidance is provided in the UK Water Industry Research (UKWIR) report entitled *"Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites"* Report Ref. No. 10/WM/03/21, 2010.

Guidance is provided in the November 2010 Q&A Update and the Questions and Answers Sheet dated 4 May 2011 included at the back of the UKWIR report. Item 3 has been reproduced here:

Item	Question	Answer
3	Following the flow chart in Figure 1.1, **would it be acceptable to not undertake a site investigation and specify the use of barrier pipes** (these seem to be suitable for all conditions)? Would it be acceptable to adopt the blanket approach of always using barrier pipes at Brownfield sites, negating the need for a desk study or intrusive investigation?	The UKWIR project steering group decided that barrier pipes would provide sufficient protection for the supply of drinking water in all Brownfield site conditions. It is therefore reasonable to expect that water companies will accept the use of barrier pipe in all situations as a blanket approach

Soil Contamination – Risk of Combustion

The combustibility of soils is a complex function of soil type, energy content, and availability of oxygen. The Building Research Establishment (BRE) has published guidance based on Calorific Value (i.e. energy content, alone), namely *IP 2/87, Fire and explosion hazards associated with the redevelopment of contaminated land*. This document provides a level below which combustibility is unlikely (2MJ/kg) and a level above which combustibility is likely (10MJ/kg). In the range between these two values combustibility is uncertain. Therefore, where the lower value is exceeded, the other key factors mentioned above need to be considered.

Soil Contamination – Risk of Harm to Vegetation

Where there is topsoil present on Site and it is being considered for reuse in landscaped areas then it needs to be assessed for its suitability for use by an appropriately qualified specialist. Topsoil can be both naturally-occurring and manufactured. The requirements for topsoil that is to be reused on site are specified in BS3882:2007 and cover a range of properties including texture, organic matter content, grading, pH, nutrients and phytotoxic contaminants. The specification for phytotoxic contaminants is reproduced in the table below:

Phytotoxic Contaminants (by soil pH) for Topsoil

Contaminant*	**pH** **<6**	**6.0 to 7.0**	**>7**
Zinc (Nitric acid extractable**)	<200mg/kg	<200mg/kg	<300mg/kg
Copper (Nitric acid extractable**)	<100mg/kg	<135mg/kg	<200mg/kg
Nickel (Nitric acid extractable**)	<60mg/kg	<75mg/kg	<110mg.kg

Footnotes: * The lower of the Generic Assessment Criteria for chemical contaminants (human health and the environment) and phytotoxicity shall be used for topsoil

** The method of testing is given in Annex D to BS3882:2007 Specification for topsoil and requirements for use.

The risk to human health and the environment needs to be considered as well as phytotoxicity and this will be carried out using the Generic Assessment Criteria selected for these risks as described elsewhere in this appendix and this report.

In order to assess the suitability of topsoil to be reused the full range of testing specified needs to be carried out and assessed by an appropriately qualified specialist.

Controlled Waters Generic Assessment Criteria

The Screening Values adopted by Waterman for ground and surface water quality have been selected on the basis of the water quality standards that apply at the controlled water receptor considered to be at potential risk of harm.

Surface Waters

The Water Framework Directive (WFD) (2000/60/EC) was originally introduced in 2000, however a raft of Daughter Directives have been brought in to address the objectives the WFD originally set out. Over time the WFD and its Daughter Directives have gradually replaced number of the existing Directives including the Dangerous Substances Directive (DSD) and Surface Water Directive (SWD).

The WFD identifies 'Priority' and 'Priority Hazardous Substances', to which Environmental Quality Standards (EQS) have been determined. The WFD EQS do not provide a full complement of applicable values to adopt. In the absence of an EQS, values under the replaced Surface Water Directive have been used as a guide.

Groundwater

The EU Drinking Water Directive (DWD) (98/83/EC) lays out the standards for drinking water EU wide. The UK have followed the EU regulations and translated the Directive into the Water Supply (Water Quality) Regulations England 2000. The UK Drinking Water Standards are the most relevant criteria to use for the assessment of risks to water destined for potable sources.

The WFD, to date, have not set threshold values for groundwater on a river basin basis.

TPH and PAHs

A suitable risk based assessment criteria for risks from TPH in both surface waters and groundwater are not available in the UK. The WHO have produced a health based risk assessment for drinking waters with regard to TPH “Petroleum Products in Drinking Waters, Background document for development of WHO Guidelines for Drinking-water Quality. Ref. WHO/SDE/WSH/05.08/123”.

The WHO Guideline values have been amended for the UK standard body weight and behaviour to derive a UK guideline for DWS of TPH (70kg body weight and 2l of water consumed per day).

A complete list of assessment criteria for PAHs is absent from the UK (benzo(a)pyrene is available). However, the risk from PAHs should be considered. The theory presented in the WHO document "Petroleum Products in Drinking Waters, Background document for development of WHO Guidelines for Drinking-water Quality. Ref. WHO/SDE/WSH/05.08/123" has been applied to provide indicative screening values for PAHS with regard to drinking water. Published TDI and ID effects have been amended for the UK standard body weight and behaviour to derive a UK guideline for DWS of PAHs (70kg body weight and 2l of water consumed per day).

The derived TPH and PAH screening values are used as an indication of the risks from TPH and PAHs to human health through drinking water only.

The standards for the substances tested for in this investigation are provided in Table G3 and G4 below.

Table G3 - Screening Values – Water Quality Standards

	Concentration (µg/l)		
Determinand	**Surface Water - EQS Freshwater (DEFRA Directions 2015)**	**UK Drinking Water Standard (DWS)**	**WHO Drinking Water Standard**
Metals			
Arsenic	50	10	-
Barium	-	-	700
Beryllium	-	-	12
Boron	-	1000	-
Cadmium	0.25*	5	-
Copper	1 (bioavailable)	2000	-
Chromium (total)	4.7	50	-
Chromium (VI)	3.4	-	-
Chromium (III)	4.7	-	-
Iron	1000	200	-
Lead	1.2 (partial bioavailable)	10	-
Manganese	123 (bioavailable)	50	-
Mercury	0.07	1	-
Nickel	4 (bioavailable)	20	-
Selenium	-	10	-
Zinc	10.9+X** (bioavailable X is catchment related)	-	-

Non-Metals			
Cyanide	1	50	-
Chloride	-	250,000	-
Nitrate	-	50,000	-
Sulphate	-	250,000	-
Ammonia (total)	-	500	-
Nitrite	-	500	-
BTEX			
Benzene	10	1	-
Ethyl Benzene	-	-	300
Toluene	74	-	-
Xylene (p+m)	30	-	500
MTBE	-	-	15***
Phenol	7.7	-	-
Petroleum Hydrocarbons			
Aliphatic EC5 - EC6	-	-	15,000
Aliphatic EC6 - EC8	-	-	15,000
Aliphatic EC8-EC10	-	-	300
Aliphatic EC10-EC12	-	-	300
Aliphatic EC12-EC16	-	-	300
Aromatic EC6-EC7 (Benzene)	10	1	
Aromatic EC7-EC8 (Toluene)	74	-	700
Aromatic EC8-EC10	-	-	300****
Aromatic EC10-EC12	-	-	90
Aromatic EC12-EC16	-	-	90
Aromatic EC16-EC21	-	-	90
Aromatic EC21-EC35	-	-	90
Polycyclic Aromatic Hydrocarbons			
Anthracene	0.1	-	1050
Acenaphthene	-	-	210*****
Acenaphthylene	-	-	210*****

Chrysene	-	-	1.085*****
Di-benzo(a.h.)anthracene	-	-	0.01085*****
Phenanthrene	-	-	43.75*****
Benzo(a)pyrene	0.00017	0.01	-
Benzo(b)fluoranthene	0.00017	0.1b	-
Benzo(g.h.i.) Perylene	0.00017	0.1	-
Benzo(k)fluoranthene	0.00017	0.1	-
Fluoranthene	0.0063	-	-
Indeno(1,2,3-cd)pyrene	0.00017	0.1	-
Naphthalene	2	-	70
Fluorene	-	-	140*****
Benzo(a)anthracene	-	-	0.543*****
Pyrene	-	-	105*****
Volatile Organic Compounds			
Vinyl Chloride	-	0.5	-
1,1-dichloroethene	-	-	30
Trans 1,2-Dichloroethene	-	-	0.3
Chloroform	-	100c	-
1,2-Dichloroethane	10	3	-
Trichloroethene (TCE)	-	10	-
Bromodichloromethane	-	100	-
Tetrachloroethene (PCE)	-	10	-
1,3-Dichloropropane	-	100	40
Bromoform	-	100	-
1,4-Dichlorobenzene	-	-	300
1,2-Dichlorobenzene	-	-	1000
1,2-Dibromo-3-chloropropane	-	-	1

* Value for Class 5 water, assumes >200mg$CaCO_3$/L

** 10.9 + 2.9 (ambient background concentration for Humber catchment)

*** Odour and taste threshold

**** Value for ethylbenzene

***** Waterman-derived criteria based on guidance in WHO document and UK background data

b - Sum of 4 PAHs

c - sum of 4 trichlorohalides – Chloroform, bromoform, dibromoform and bromodichloromethane

Bioavailability based Environmental Quality Standards

Under the Water Framework Directive, originally introduced in 2000, and transposed into the UK regulatory framework via the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015, we are now required take account of the bioavailability when assessing the toxicity of heavy metal contamination in the freshwater environment.

What is Bioavailability and Why Account for it?

It is widely accepted that the total concentration of certain metals in freshwater often has limited relevance to potential environmental risk, but it is the 'bioavailable' fraction that is likely to result in toxic effects to aquatic organisms. Effectively, it's the bioavailability of a metal which reflects the actual metal concentration that the organism will be exposed to, and thus is the relevant concentration that we are interested in when assessing risk.

EQS developed under previous legislation (including the Dangerous Substances Directive (76/464/EEC)) were expressed as total concentration relative to hardness bandings to reflect the indications that toxicity to aquatic life was influenced by water hardness. Scientific knowledge and understanding on the impact of metals has since developed, and metal bioavailability in aquatic systems is now understood to be influenced by several site-specific physio-chemical factors including the pH, calcium content and the level of dissolved organic carbon (DOC) present within the water body under consideration.

Taking bioavailability into account as part of the risk assessment process is now considered best practice and will enable more accurate estimation of metal toxicity and the risks posed to the freshwater environment.

How to Account for Metal Bioavailability

The increased understanding of the impact of certain metals on the aquatic environment has enabled EQSs to be published by the UK Secretary of State for a number of metals based on their bioavailable concentration. These are referred to as EQSbioavailable and are listed in the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

It is very difficult to measure the bioavailable concentration of a metal directly. We therefore have to rely on models to predict the bioavailable concentration from dissolved concentrations. In the UK, a simple predictive tool has been developed that can take account of water quality parameters such as pH, and calcium to determine the amount of bioavailable metal present in the freshwater environment.

The tool is called the Metal Bioavailability Assessment Tool (M-BAT) and is acceptable for use under the UK regulatory framework.

Use of Background Concentrations for the Assessment of Zinc.

Metals occur naturally in the aquatic environment due to weathering of surface geology, and under the EQS Directive (2008/105/EEC) background concentrations for metals can be considered when assessing compliance against the respective EQS.

The situation for Zinc is now slightly different, and consideration of background concentration is now an explicit part of the zinc EQS released under the WFD and needs to be taken into account as part of the initial compliance assessment.

Using this approach, a local background concentration should be subtracted from the monitoring data before the bioavailability estimate is performed using M-BAT. Under the WFD, catchment specific background values have been defined for England and Wales to be used in conjunction with the EQSbioavailable. The background values are listed within the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 Schedule 3, Part 2, Table 2, and also reproduced in Appendix A of the M-BAT user guide available here.

Lead

Lead is not included in the M-BAT tool (referred to above) as it is not a full bioavailable EQS. The EQS for lead is an EU standard under WFD. It takes into account the influence of DOC on the toxicity of lead but, unlike the full bioavailable standards for zinc, copper, manganese and nickel which are included in M-BAT, it only considered the influence of DOC, and does not require the consideration of calcium or pH.

Ground Gas and Volatile Organic Compounds Generic Assessment Criteria

Ground Gas

Current UK guidance has been produced by CIRIA, the British Standards Institution (BSI) and CL:AIRE. The following relevant documents have been prepared to date:

- CIRIA C665 – Assessing the risks posed by hazardous ground gases to buildings, 2007;
  - Aims to consolidate good practice in investigation, facilitate the collection of relevant data, instigate appropriate monitoring programmes, all in a risk based approach to gas contaminated land.
- BS 8576 – Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs), 2013;
  - Provides guidance on the monitoring and sampling of ground gases, including methane, carbon dioxide, oxygen, and VOCs. Guidance is not provided on the risk evaluation and characterisation of site's, the selection and design of protective measures, verification of protective measures, sampling of atmospheric gases, and the monitoring and sampling of radon.
- CIRIA C735 – Good practice on the testing and verification of protection systems for buildings against hazardous ground gases, 2014; and
  - Sets out the good practice guidance for the designer, installer, verifier, and regulator on the verification and integrity testing of gas protection systems.
- BS 8485 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, 2015.
  - Provides guidance on the appropriate ground gas parameters that can be used to identify a range of possible design solutions for protection against methane and carbon dioxide on a development.
- CL:AIRE - Technical Bulletin (TB 17), August 2018
  - The bulletin provides guidance on assessing ground gas monitoring data to ensure that sufficient data has been collected to cover critical variations in barometric pressure

Both the CIRIA and BSI publications have been prepared to be generally consistent with CLR11, *Model Procedures for the management of land contamination,* (Defra and the Environment Agency, 2004a) and follow a step by step approach summarised below:

1. Desk Study and Site Walkover.
2. Development of a Preliminary Conceptual Model and Risk Assessment.
3. Site Investigation (If deemed necessary from stage 2).
4. Risk Assessment and Site Characterisation.

5. Recommendation and Mitigation.

Where the preliminary conceptual model has deemed further investigation necessary to characterise the ground gas regime, an appropriate site investigation and monitoring regime should be designed and undertaken. In-depth guidance to assist in the design of the investigation is provided within C665 and BS 8576, which describes intrusive investigation techniques and provides guidance on selecting the number and location of monitoring wells based on the site specific conceptual model.

Waterman has generally followed the approach recommended in CIRIA C665, BS 8576, and BS 8485 with respect to characterising a site and determining the levels of gas protection methods required. Where deviations from the methodology detailed within above guidance occurs, the reasoning behind the deviation and implication of the analysis of the results has been included within the report.

Risk Assessment

In accordance with C665, to assess the ground gas regime at a site, the ground gas monitoring data should be assessed by determining the Gas Screening Value (GSV) (ℓ/hr). BS 8485 details further guidance on which GSV can be adopted based on a number of modifiers.

GSV = (Measured Maximum CO_2 or CH_4 Gas Concentration (%) / 100) x Maximum Measured Gas Flow Rate from boreholes (ℓ/hr).

Both C665 and BS 8485 dictate where the gas flow has been measured as less than the detection limit of the instrument used (typically <0.1ℓ/hr), the limit of detection of the instrumented should be used as the gas flow rate.

As per the guidance given in BS 8485 where a negative flow has been recorded, and there is an absence of a positive flow, a qualitative assessment has been undertaken into whether under different temporal conditions, a similar positive flow could occur. When the cause for negative flow is reasonably understood, it has been possible to rule out a corresponding credible positive flow and discount the negative flow.

The Gas Screening Value is used to classify the site, subject to the proposed end use of the site.

The Modified Wilson and Card classification system is used to attribute a Characteristic Situation (CS) value to the site/zone depending upon the calculated GSV. When attributing a CS, additional factors including the maximum recorded gas concentration and the maximum recorded gas flow rate should also be taken into account and may result in an increase in the CS value. Table G5 below, outlines the CS values associated GSV's and additional factors which must be taken into account.

Table G5 Modified Wilson and Card Classification

Characteristic Situation (CIRIA 149)	**Risk Classification**	**Gas screening value (CH_4 CO_2) l/hr**	**Additional Factors**	**Typical source of generation**
1	**Very low risk**	**<0.07**	Typically methane ≤1% and / or carbon dioxide ≤5%. Otherwise consider increase to CS 2.	Natural soils with low organic content 'Typical' made ground
2	**Low risk**	**<0.7**	Borehole air flow rate not to exceed 70 l/hr.	Natural soil, high peat/organic content. 'Typical' made ground

			Otherwise consider increase to CS 3.	
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

Notes:

1) Gas screening value: litres of gas / hour is calculated by multiplying the gas concentration (%) by the measured borehole flow rate (l/hr)
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.

Following determination of the site's CS, the requirements and scope of gas protection measures can be prescribed based on the guidance given in BS 8485:2015.

BS 8485 details the required ground gas protection measures for a development using a points-based system, whereby a certain number of points must be accumulated through the installation of various protection measures to mitigate the risk to structures or buildings from the accumulation of methane or carbon dioxide. The number of points assigned will be dependent on the building type and the CS.

Table G6 Building types are separated into four distinct scenarios.

Kj,f Modifier	**Building Type**			
	Type A	**Type B**	**Type C**	**Type D**
Ownership	Private	Private or commercial / public, possible multiple	Commercial / public	Commercial / industrial
Control (change of use, structural alterations, ventilation)	None	Some but not all	Full	Full
Room sizes	Small	Small / medium	Small to large	Large industrial / retail park style

Further details on the description of the building types, along with examples are included in BS 8485.

Following identification of the appropriate Building Type and CS, the minimum gas protection score can be determined through the use of the following table.

Table G7 Gas Protection Score

Characteristic Situation	Minimum Gas Protection Score			
	Type A	Type B	Type C	Type D
1	0	0	0	0
2	3.5	3.5	2.5	1.5
3	4.5	4	3	2.5
4	6.5[A]	5.5[A]	4.5	3.5
5	N/A[B]	6[A]	5.5	4.5
6	N/A[B]	N/A[B]	N/A[B]	6

[A] Residential buildings should not be built on CS4 or higher sites 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.

[B] The gas hazard is too high for this empirical method to be used to define the gas protection measures.

Post determination of the minimum gas protection score, a combination of two or more of the following three types of protection measures should be used to achieve the score:

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present;
- Ventilation measures; and
- Gas resistant measures.

Through combining at least two ground gas protection measures, the lack of redundancy in the use of a single protection measure approach is negated. The ground gas protection measures should work independently and collaboratively.

The tables below detail the specific ground gas protection measures and their associated scores.

Structural Barrier

Table G8

Floor and substructure design	Score[A]
Precast suspended segmental subfloor (I.e. beam and block)	0
Cast in-situ ground bearing floor slab (with only nominal mesh reinforcement)	0.5
Cast in-situ monolithic ground bearing raft or reinforced cast in-situ suspended floor slab with minimal penetrations	1 or 1.5[B]
Basement floor and slab conforming to BS 8102:2009, Grade 2 waterproofing[C, D]	2
Basement floor and walls conforming to BS 1802:2009, Grade 3 waterproofing[C, D]	2.5

[A] The scores are conditional on breaches of floor slabs, etc., being effectively sealed.

[B] To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast.

[C] The score is conditional on the waterproofing not being based on the use of a geosynthetic clay liner waterproofing product.

Ventilation Measures

Table G9

Protection element / system	Score	Comments
Pressure relief pathway (usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building.	0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measure systems. If the layer has a low permeability and / or is not terminated in a venting trench or similar, then the score is zero.
Passive sub floor dispersal layer:		The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing, and type and thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B of BS 8485 2015. Passive ventilation should be designed to meet at least good performance, see in Annex B of BS 8485 2015.
Very good performance:	2.5	
Good performance:	1.5	
Media used to provide the dispersal layer are; • Clear void; • Polystyrene void former blanket; • Geocomposite void former blanket • No-fines gravel layer with gas drains; • No-fines gravel layer.		
Active dispersal layer, usually comprising fans with active abstraction (suction) from a subfloor dilution layer, with roof level vents. The dilution layer may compromise a clear void or be formed of geocomposite or polystyrene void formers.	1.5 to 2.5	This system relies on continues serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system including pumps and vents. Active ventilation should always be designed to meet at least good performance as described in in Annex B of BS 8485 2015.
Active positive pressurization by the creation of a blanket of external fresh air beneath the floor slabs by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.	1.5 to 2.5	This system relies on continues serviceability of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient coverage of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least good performance.
Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park).	4	Assumes that the car fumes is vented to deal with exhaust fumes designed to *Buildings Regulations 2000, Approved Document F.*

It should be noted that for Type A Buildings active ventilation systems are inappropriate.

Membrane

Table G10

Protection element / system	Score	Comments
Gas resistant membrane meeting all of the following criteria;	2	The performance of membranes is heavily dependent on the quality

Sufficiently impervious both in the sheet material [A] and in the sealing of sheets and sealing around sheet penetrations, to prevent any significant passage of methane and / or carbon dioxide through the membrane; Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; Sufficiently strong [B] to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc.); and to withstand in-service stresses (e.g settlement if placed below a floor slab); Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and Verified in accordance with CIRIA C735.	and design of the installation, resistance to damage after installation and integrity of joints. If a membrane is installed that does not meet the all the criteria in column 1 then the score is zero.

A gas protection score should only be assigned to a membrane which is formed of a material with suitably low gas permeability and which has been installed so it completely seals the foundation (including effective seals around all penetrations) and does not sustain damage from in-service stresses.

Volatile Organic Compounds (VOCs)

The Building Regulations 2000 Approved Document C (2004 Edition) also refers to volatile organic carbons (VOCs). These are primarily assessed by examination of the VOC content of site soils. Further guidance on VOCs is provided in *"The VOCs Handbook; Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination"*, CIRIA Report C682, 2009.

For former landfill sites the risk from a wider range of trace gases are considered on a site specific basis when appropriate.

VOCs in groundwater

Under the Environmental Protect Act 1990, Building Regulations Approved Document C 2004 and the National Planning Policy Framework there is a requirement to ensure that Volatile Organic Compounds (VOC) are considered on a risk assessment basis.

VOCs are organic compounds that are volatile under normal atmospheric conditions. However, they may be found in the solid, liquid, and the dissolved phase as well as in the gaseous phase. VOCs are typically found in the following contaminants:

- Petroleum (non-halogenated) hydrocarbons (e.g. benzene, toluene, and butylbenzenes);
- Halogenated hydrocarbons (e.g. chlorinated ethenes and ethanes (dry cleaning fluids or degreasers) or chlorofluorocarbons (freons)); and
- Organic compounds containing nitrogen, sulphur, and oxygen (e.g. tetrahydrofuran).

The likely sources of the above contaminants include:

- Spills, leaks, and discharges from industries;

- Landfills;
- Buildings, furnishings, and common household products;
- Vehicle emissions;
- Marshland; and
- Uncontrolled waste disposal.

The risk to receptors from VOC occur from inhalation (acute and chronic), and a flammable / explosive risk when present at high concentrations in confined spaces.

Current UK guidance for VOCs are limited in comparison to ground gas, and is primarily given in the *"The VOCs Handbook; Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination"*, CIRIA Report C682, 2009.

Additional guidance was published in 2017 by the Society of Brownfield Risk Assessments (SoBRA) *'Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile contaminants in Groundwater*', February 2017. The 2017 SoBRA document provided a set of Generic Assessment Criteria (GAC) to allow the risk to a residential/commercial premise to be assessed quantitatively using the contamination concentrations recorded in the groundwater. The GAC were generated using the CLEA model, with each GAC being the theoretical concentration in groundwater/perched water beneath a property that is modelled as resulting in estimated average daily exposure (ADE) to the critical receptor that is equal to the Health Criteria Value (HCV).

The GAC were designed to incorporate several precautionary assumptions, these conservatisms include;

- The assumption that the impacted groundwater/perched water is directly beneath the building, when it may instead be offset from the receptor;
- The assumption that there is an infinite source term, when in fact the source may be finite;
- The assumption that there is no biodegradation between the source term and the receptor;
- The assumption that the groundwater source is at a depth of 0.65m bgl;
- The use of sand soil type for both the saturated and unsaturated zone.
- The omission of a capillary zone between the saturated and unsaturated zone.

These GAC are detailed in the Tables below.

Table G11 Petroleum Hydrocarbons

Chemical	**CAS**	**GACgwvap (µg/l) 1,2**		**Aqueous Solubility (µg/l)**
		Residential	**Commercial**	
1,2,4-Trimethylbenzene	95-63-6	24	2,200	559,000
Benzene 3	71-43-2	210	20,000	1,780,000
Ethylbenzene 3	100-41-4	10,000	*960,000 (sol)*	180,000
Isopropylbenzene	98-82-8	850	*86,000 (sol)*	56,000
Propylbenzene	103-65-1	2,700	*240,000 (sol)*	54,100
Styrene	100-42-5	8,800	*810,000 (sol)*	290,000

Toluene 3	108-88-3	230,000	*21,000,000 (sol)*	590,000
TPH Aliphatic EC5-EC6 3		1,900	*190,000 (sol)*	35,900
TPH Aliphatic >EC6-EC8 3		1,500	*150,000 (sol)*	5,370
TPH Aliphatic >EC8-EC10 3		57	*5,700 (sol)*	427
TPH Aliphatic >EC10-EC12 3		37	*3,600 (sol)*	34
TPH Aromatic >EC5-EC7 2,3		210,000	*20,000,000 (sol)*	1,780,000
TPH Aromatic >EC7-EC8 3		220,000	*21,000,000 (sol)*	590,000
TPH Aromatic >EC8-EC10 3		1,900	*190,000 (sol)*	64,600
TPH Aromatic >EC10-EC 12 3		6,800	*660,000 (sol)*	24,500
TPH Aromatic >EC12-EC16 3		39,000	*3,700,000 (sol)*	5,750
meta-Xylene 3,5	108-38-3	9,500	*940,000 (sol)*	200,000
ortho-Xylene 3,5	95-47-6	12,000	*1,100,000 (sol)*	173,000
para-Xylene 3,5	106-42-3	9,900	*980,000 (sol)*	200,000

Table G12 Polycyclic Aromatic Hydrocarbons

Chemical	**CAS**	**GAC gw vap (µg/l) 1,2**		**Aqueous Solubility (µg/l)**
		Residential	**Commercial**	
Acenaphthene	83-32-9	*170,000 (sol)*	*15,000,000 (sol)*	4,110
Acenaphthylene	208-96-8	*220,000 (sol)*	*20,000,000 (sol)*	7,950
Fluorene	86-73-7	*210,000 (sol)*	*18,000,000 (sol)*	1,860
Naphthalene	91-20-3	220	*23,000 (sol)*	19,000

Table G13 Pesticides

Chemical	**CAS**	**GACgwvap (µg/l) 1,2**		**Aqueous Solubility (µg/l)**
		Residential	**Commercial**	
Aldrin	309-00-2	*47 (sol)*	*3,700 (sol)*	20
alpha-Endosulfan	959-98-8	*7,400 (sol)*	*590,000 (sol)*	530
beta-Endosulfan	33213-65-9	*7,500 (sol)*	*600,000 (sol)*	280

Table G14 Halogenated Organics

Chemical	**CAS**	**GACgwvap (µg/l) 1,2**		**Aqueous Solubility (µg/l)**
		Residential	**Commercial**	
1,1,1,2-Tetrachloroethane	79-34-5	240	22,000	1,110,000
1,1,1-Trichloroethane	71-55-6	3,000	290,000	1,300,000
1,1,2,2-Tetrachloroethane	79-35-4	1,600	150,000	2,930,000

Chemical	CAS	GACgwvap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
1,1,2-Trichloroethane	79-00-5	520	49,000	4,491,000
1,1-Dichloroethane	75-34-3	2,700	260,000	3,666,000
1,1-Dichloroethene	75-35-4	160	16,000	3,100,000
1,2,3,4-Tetrachlorobenzene	634-66-2	240	*31,000 (sol)*	7,800
1,2,3,5-Tetrachlorobenzene	634-90-2	7.0	600	3,500
1,2,3-Trichlorobenzene	87-61-7	35	3,100	21,000
1,2,4,5-Tetrachlorobenzene	95-94-3	8.1	*700 (sol)*	600
1,2,4-Trichlorobenzene	120-82-1	68	7,200	41,400
1,2-Dichlorobenzene	95-50-1	2,000	*220,000 (sol)*	133,000
1,2-Dichloroethane	107-06-2	8.9	850	8,680,000
1,2-Dichloropropane	78-87-5	22	2,600	2,050,000
1,3,5-Trichlorobenzene	108-70-3	7.4	660	6,000
1,3-Dichlorobenzene	541-73-1	31	2,800	103,000
1,4-Dichlorobenzene	106-46-7	5,000	460,000 (sol)	51,200
Bromobenzene	108-86-1	220	20,000	388,040
Bromodichloromethane	75-27-4	17	1,600	3,000,000
Bromoform (Tribromomethane)	75-25-2	3,100	400,000	3,000,000
Chlorobenzene	108-90-7	98	15,000	387,000
Chloroethane	75-00-3	10,000	1,000,000	5,742,000
Chloroethene (Vinyl Chloride)	75-01-4	0.62	63	2,760,000
Chloromethane	74-87-3	14	1,400	5,350,000
cis-1,2-Dichloroethene	156-59-2	130	13,000	7,550,000
Dichloromethane	75-09-2	3,300	370,000	20,080,000
Hexachlorobenzene	118-74-1	16 (sol)	1,400 (sol)	10
Hexachlorobutadiene	87-68-3	1.7	230	4,800
Hexachloroethane	67-72-1	8.5	740	49,900
Pentachlorobenzene	608-93-5	140	12,000 (sol)	500
Tetrachloroethene	127-18-4	34	4,600	225,000
Tetrachloromethane (Carbon Tetrachloride)	56-23-5	5.3	770	846,000
trans-1,2-Dichloroethene	156-60-5	160	16,000	5,250,000
Trichloroethene	79-01-6	5.7	530	1,370,000
Trichloromethane (Chloroform)	67-66-3	790	85,000	8,950,000

Table G15 Others (Organic and Inorganic)

Chemical	CAS	GACgwvap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
2-Chloronaphthalene	91-58-7	160	*14,000 (sol)*	11,700
Biphenyl (Lemonene)	92-52-4	*15,000 (sol)*	*1,300,000 (sol)*	4,060
Carbon disulphide	75-15-0	56	5,600	2,100,000
Mercury, elemental	7439-97-6	1.1	*95 (sol)*	56
Methyl tertiary butyl ether (MTBE)	1634-04-4	83,000	7,800,000	48,000,000

The risks to receptors from vapours will be assessed through assessment of the volatile contaminant concentrations recorded in groundwater samples against the SoBRA derived GAC. Where an exceedance is recorded, a qualitative assessment will be made, given the conservative approach of the SoBRA derived GAC as to whether a significant vapour regime is present on-site and possible risk to receptors exists. The vapour concentration recorded during headspace analysis of soils, SVOC / VOC contaminant concentration within soil samples, and the vapour concentration within installed boreholes will also be considered qualitatively during this assessment.

Where a significant vapour regime is present and a risk to receptors exists, further assessment will be required, this may include, vapour sampling, further intrusive investigations, or a Detailed Quantitative Risk Assessment (DQRA). Dependent on the results of the further assessment, remedial measures will be required to mitigate the risk to receptors.

UK and Ireland Office Locations