



Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure Summary of Results

Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test

Job No. 22153	Project Name RADA 16 & 18 Chenies Street, London WC1E 7EX	Programme	
		Samples received	03/01/2017
		Schedule received	06/01/2017
Project No. J15215A	Client GEA	Project started	09/01/2017
		Testing Started	25/01/2017

Hole No.	Sample				Soil Description	Test Type	Density		w %	Length mm	Diameter mm	σ_3 kPa	At failure				Remarks
	Ref	Top	Base	Type			bulk Mg/m ³	dry					$\sigma_1 - \sigma_3$ kPa	cu kPa	Mode		
																Axial strain %	
BH106	13	10.50	-	U	High strength fissured dark grey silty CLAY	UU	1.99	1.55	28	198	102	210	11	222	111	C	
BH106	17	13.50	-	U	Very high strength fissured dark grey silty CLAY	UU	1.99	1.56	28	198	102	270	5.6	343	172	B	
BH106	21	16.50	-	U	Very high strength slightly fissured dark grey slightly sandy silty CLAY	UU	1.99	1.62	23	198	103	330	8.6	344	172	B	
BH106	25	19.50	-	U	Very high strength slightly fissured dark grey slightly sandy silty CLAY	UU	1.96	1.62	21	198	102	390	15	479	240	C	Disturbed in middle
BH106	29	22.50	-	U	High strength slightly fissured dark grey slightly sandy silty CLAY	UU	2.01	1.61	25	198	102	450	4.5	255	127	B	

Legend	UU - single stage test (single and multiple specimens)	σ_3	Cell pressure	Mode of failure ;	B - Brittle
	UUM - Multistage test on a single specimen	$\sigma_1 - \sigma_3$	Maximum corrected deviator stress		P - Plastic
	suffix R - remoulded or recompacted	cu	Undrained shear strength, $\frac{1}{2}(\sigma_1 - \sigma_3)$		C - Compound



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Checked and Approved
 Initials: J.P
 Date: 27/01/2017

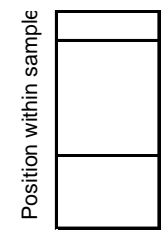


**Unconsolidated Undrained Triaxial
Compression Test without measurement of
pore pressure - single specimen**

Job Ref	22153	
Borehole/Pit No.	BH106	
Sample No.	13	
Depth	10.50	m
Sample Type	U	
Samples received	03/01/2017	
Schedules received	06/01/2017	
Date of test	25/01/2017	

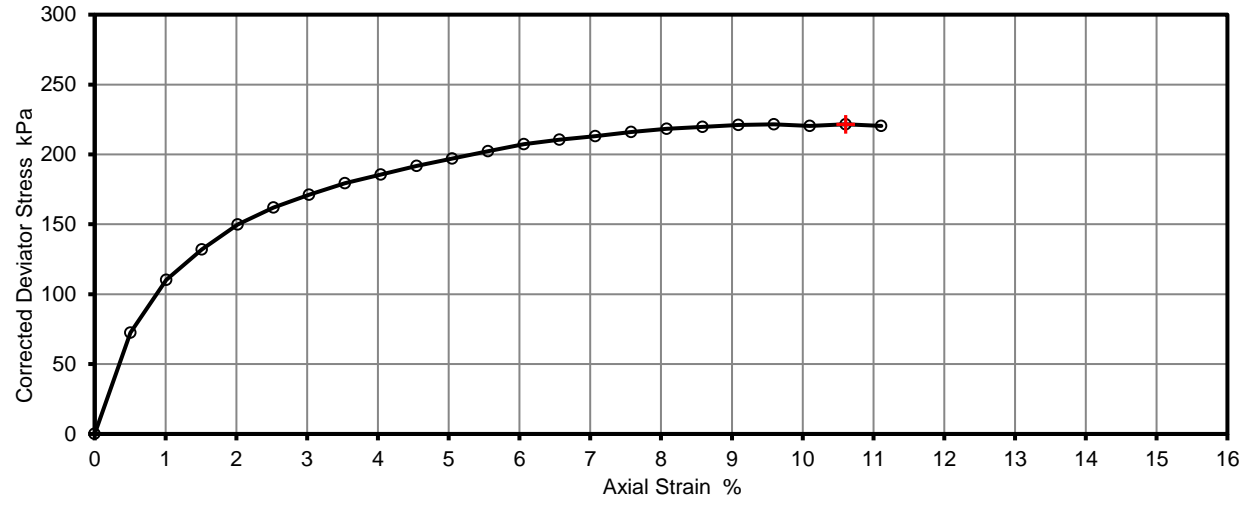
Site Name	RADA 16 & 18 Chenies Street, London WC1E 7EX		
Project No.	J15215A	Client	GEA
Soil Description	High strength fissured dark grey silty CLAY		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Remarks

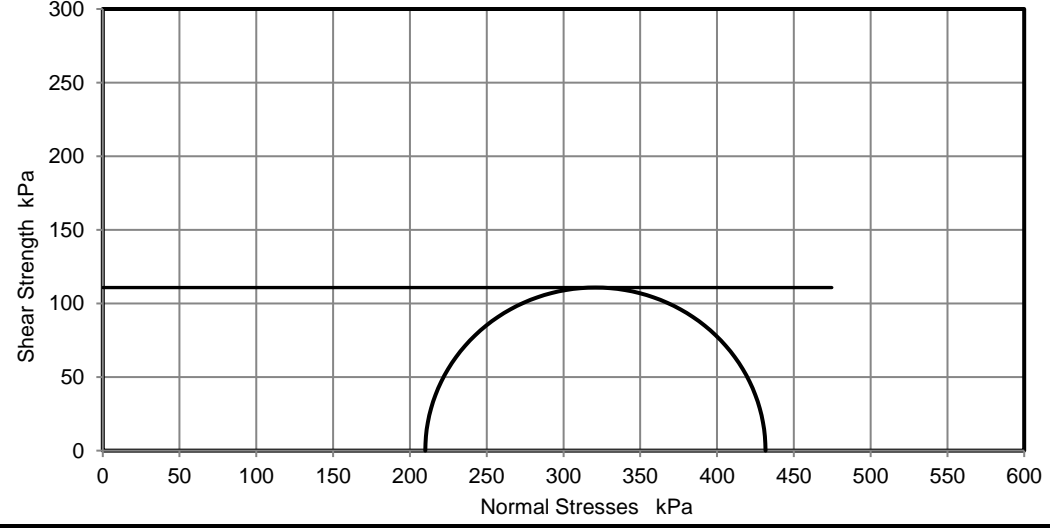


Test Number	1	
Length	198.0	mm
Diameter	102.3	mm
Bulk Density	1.99	Mg/m3
Moisture Content	28	%
Dry Density	1.55	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	210	kPa
Axial Strain	10.6	%
Deviator Stress, ($\sigma_1 - \sigma_3$) f	222	kPa
Undrained Shear Strength, cu	111	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Compound	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.



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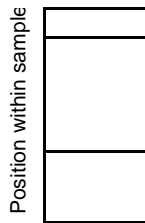
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 MSF-5 R7



Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

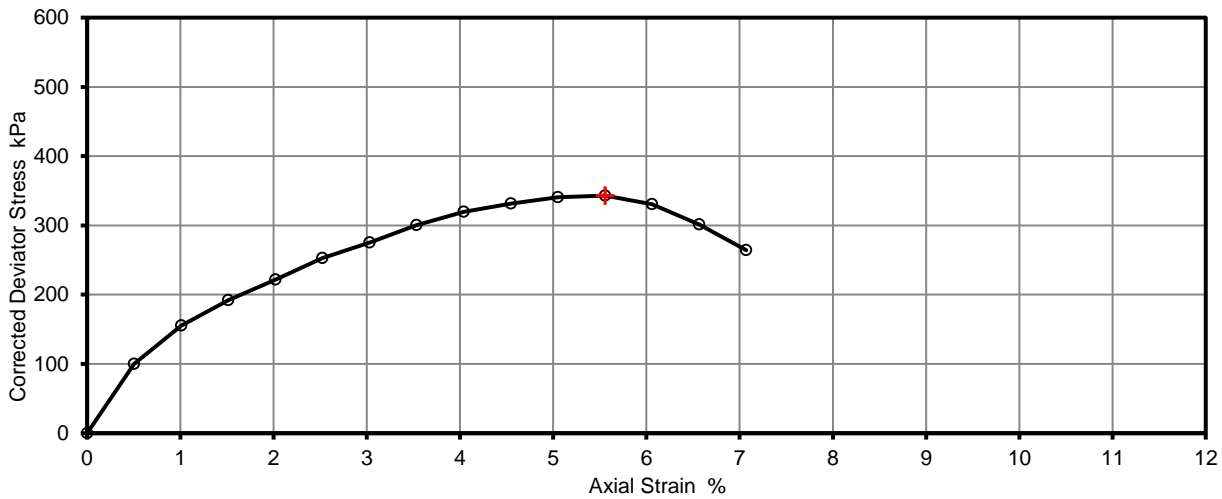
Job Ref	22153				
Borehole/Pit No.	BH106				
Site Name	RADA 16 & 18 Chenies Street, London WC1E 7EX				
Sample No.	17				
Project No.	J15215A	Client	GEA		
Depth	13.50	m			
Soil Description	Very high strength fissured dark grey silty CLAY				
				Sample Type	U
				Samples received	03/01/2017
Schedules received	06/01/2017				
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		Date of test	25/01/2017	

Remarks

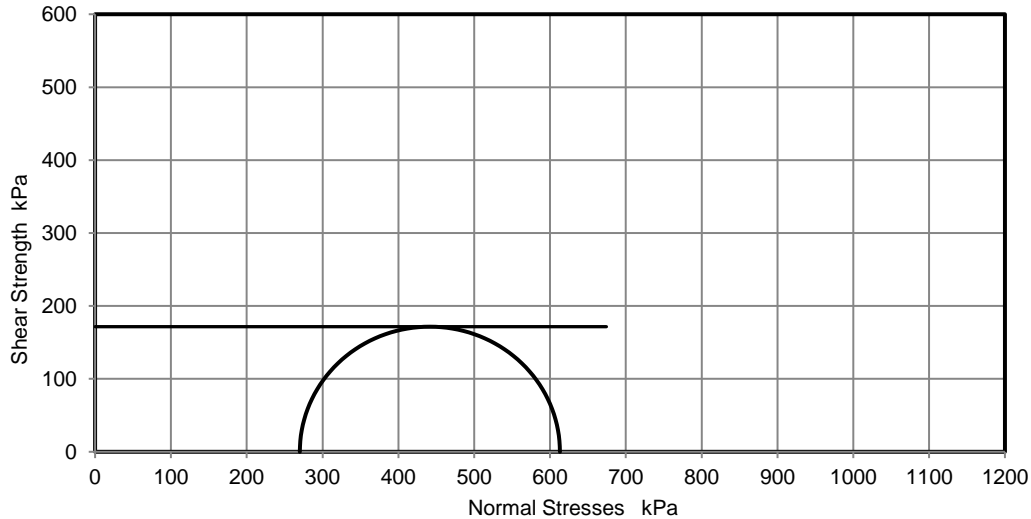


Test Number	1
Length	198.0 mm
Diameter	102.2 mm
Bulk Density	1.99 Mg/m ³
Moisture Content	28 %
Dry Density	1.56 Mg/m ³
Rate of Strain	2.0 %/min
Cell Pressure	270 kPa
Axial Strain	5.6 %
Deviator Stress, ($\sigma_1 - \sigma_3$)f	343 kPa
Undrained Shear Strength, cu	172 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Brittle

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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

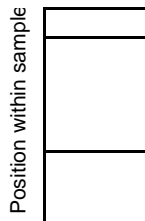


**Unconsolidated Undrained Triaxial
Compression Test without measurement of
pore pressure - single specimen**

Job Ref	22153
Borehole/Pit No.	BH106
Sample No.	21
Depth	16.50 m
Sample Type	U
Samples received	03/01/2017
Schedules received	06/01/2017
Date of test	25/01/2017

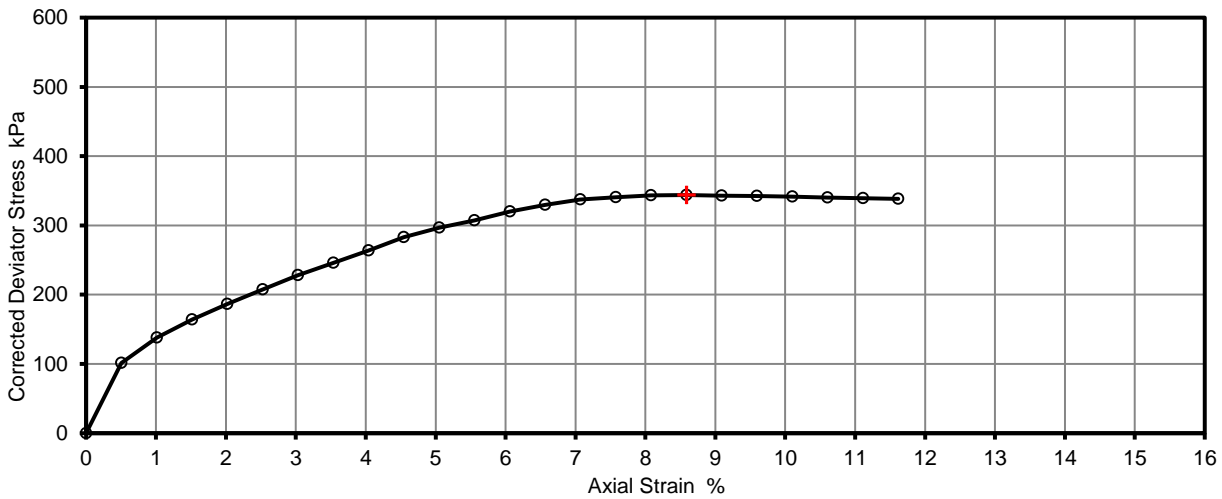
Site Name	RADA 16 & 18 Chenies Street, London WC1E 7EX		
Project No.	J15215A	Client	GEA
Soil Description	Very high strength slightly fissured dark grey slightly sandy silty CLAY		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

Remarks

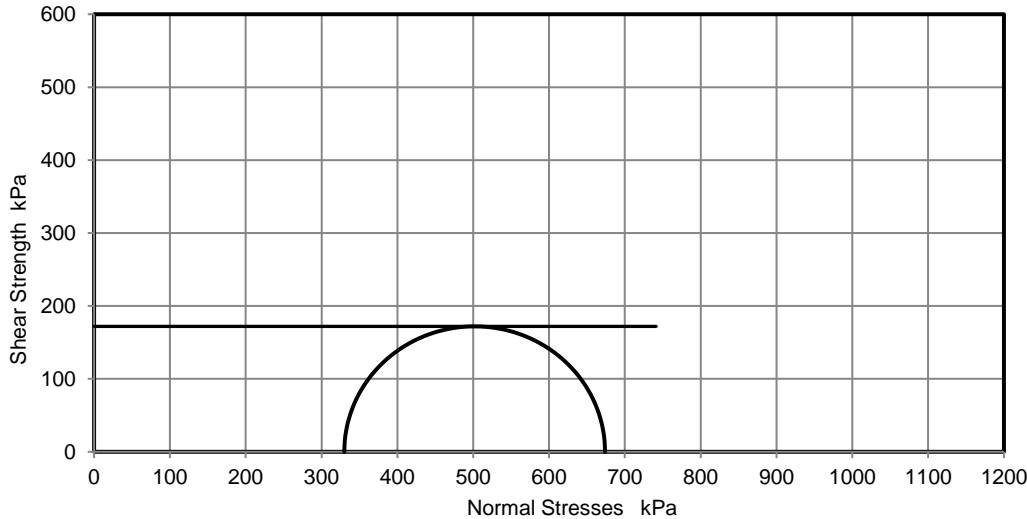


Test Number	1
Length	198.0 mm
Diameter	102.5 mm
Bulk Density	1.99 Mg/m3
Moisture Content	23 %
Dry Density	1.62 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	330 kPa
Axial Strain	8.6 %
Deviator Stress, $(\sigma_1 - \sigma_3) f$	344 kPa
Undrained Shear Strength, c_u	172 kPa $\frac{1}{2}(\sigma_1 - \sigma_3) f$
Mode of Failure	Brittle

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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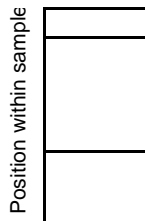
**Unconsolidated Undrained Triaxial
Compression Test without measurement of
pore pressure - single specimen**

Job Ref	22153	
Borehole/Pit No.	BH106	
Sample No.	25	
Depth	19.50	m
Sample Type	U	
Samples received	03/01/2017	
Schedules received	06/01/2017	
Date of test	25/01/2017	

Site Name	RADA 16 & 18 Chenies Street, London WC1E 7EX		
Project No.	J15215A	Client	GEA
Soil Description	Very high strength slightly fissured dark grey slightly sandy silty CLAY		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

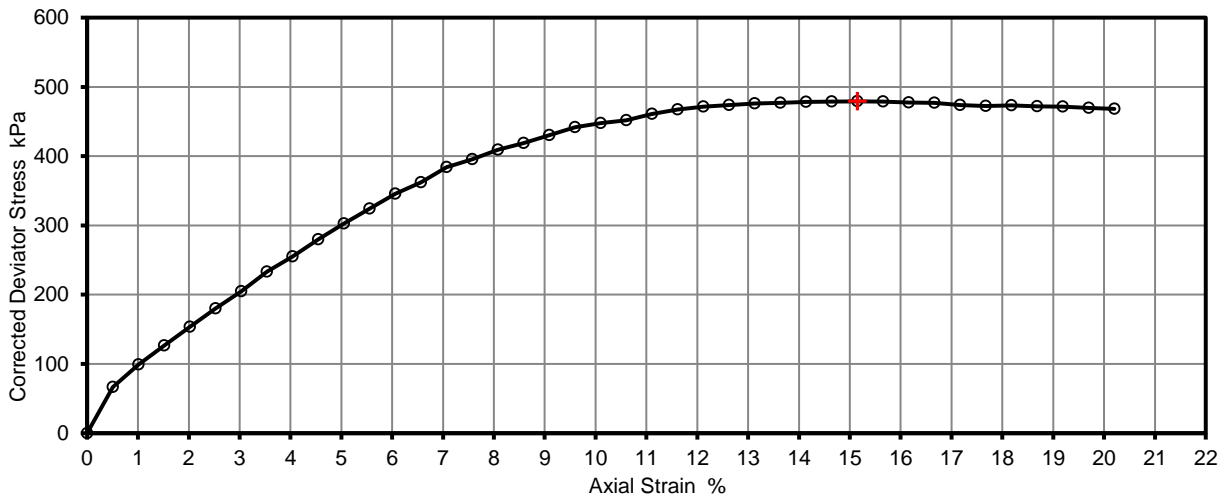
Remarks

Disturbed in middle

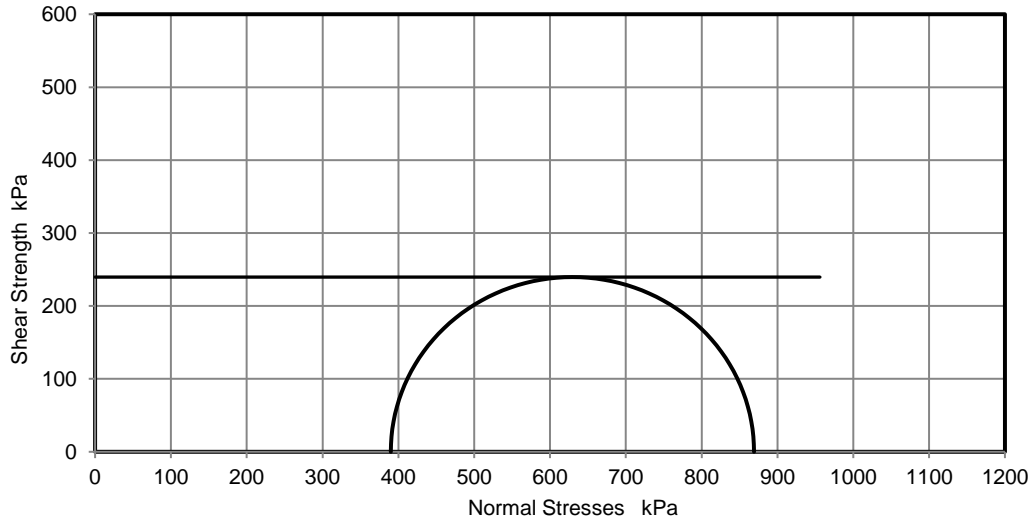


Test Number	1	
Length	198.0	mm
Diameter	102.4	mm
Bulk Density	1.96	Mg/m3
Moisture Content	21	%
Dry Density	1.62	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	390	kPa
Axial Strain	15.2	%
Deviator Stress, ($\sigma_1 - \sigma_3$)f	479	kPa
Undrained Shear Strength, cu	240	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Compound	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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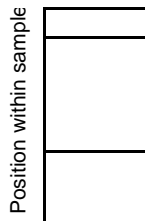
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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

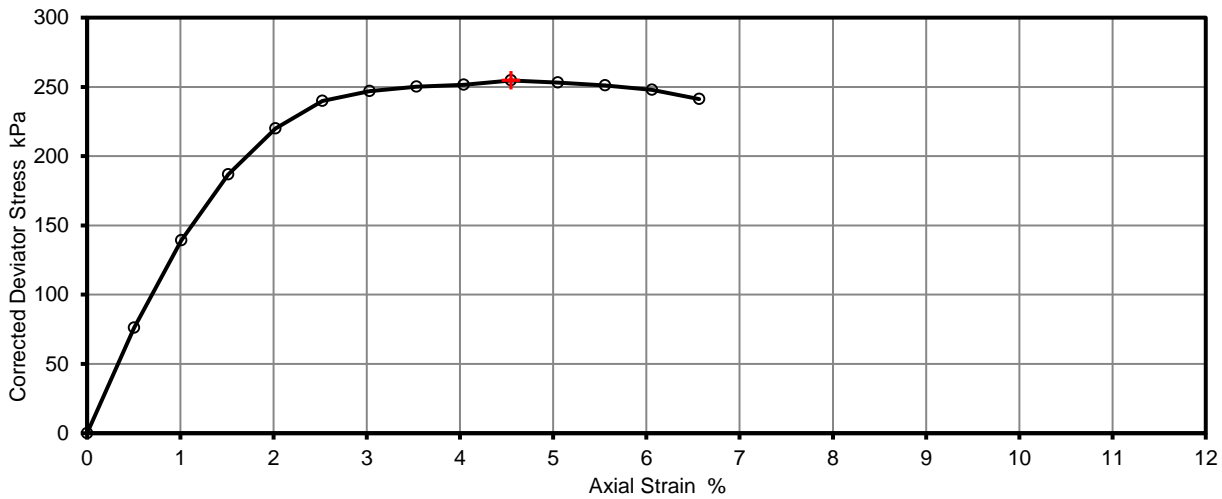
Job Ref	22153				
Borehole/Pit No.	BH106				
Site Name	RADA 16 & 18 Chenies Street, London WC1E 7EX				
Sample No.	29				
Project No.	J15215A	Client	GEA		
Depth	22.50	m			
Soil Description	High strength slightly fissured dark grey slightly sandy silty CLAY				
				Sample Type	U
				Samples received	03/01/2017
Schedules received	06/01/2017				
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		Date of test	25/01/2017	

Remarks

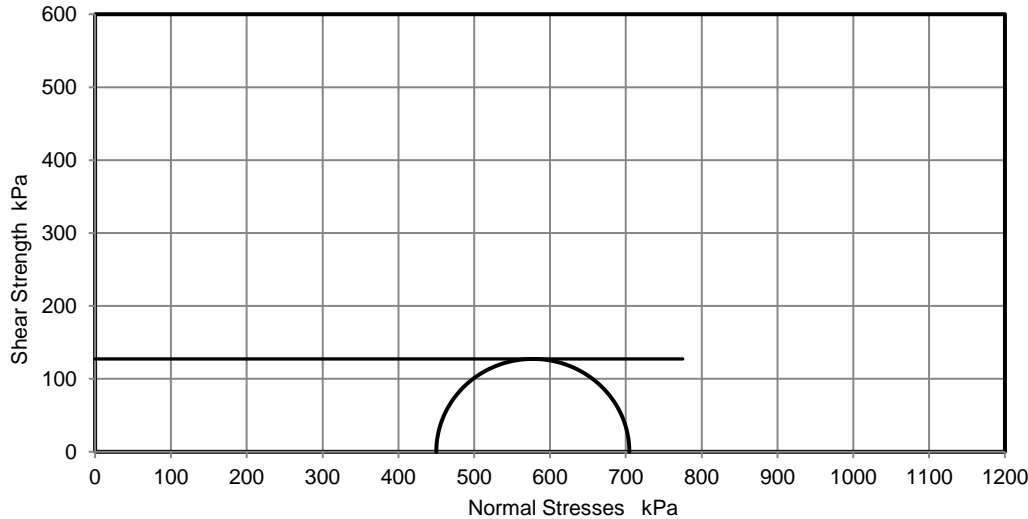


Test Number	1
Length	198.0 mm
Diameter	102.4 mm
Bulk Density	2.01 Mg/m ³
Moisture Content	24 %
Dry Density	1.61 Mg/m ³
Rate of Strain	2.0 %/min
Cell Pressure	450 kPa
Axial Strain	4.5 %
Deviator Stress, (σ ₁ - σ ₃) _f	255 kPa
Undrained Shear Strength, c _u	127 kPa ½(σ ₁ - σ ₃) _f
Mode of Failure	Brittle

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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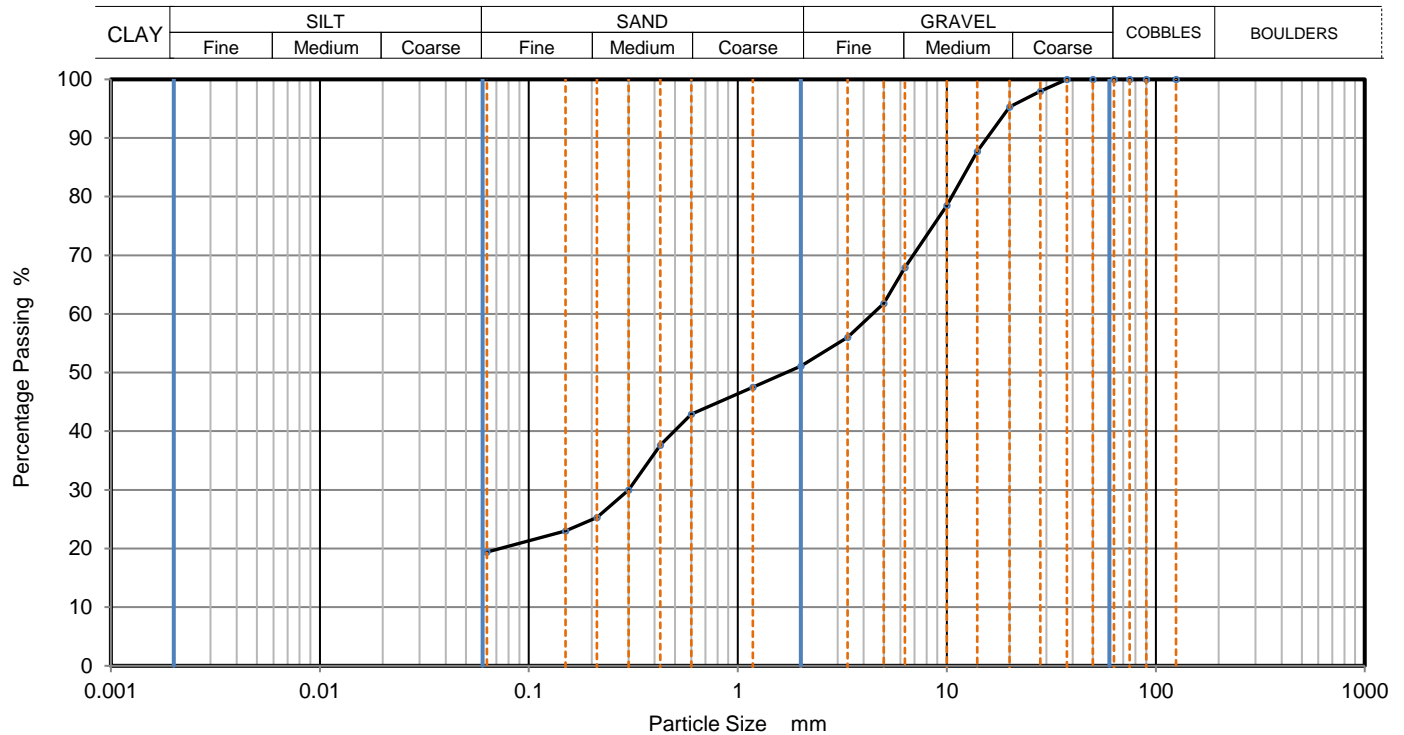
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Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)



PARTICLE SIZE DISTRIBUTION

				Job Ref	22153
				Borehole/Pit No.	BH106
Site Name	RADA 16 & 18 Chenies Street, London WC1E 7EX			Sample No.	6
Project No.	J15215A	Client	GEA	Depth	6.00 m
Soil Description	Brown clayey very sandy GRAVEL with occasional lumps of dark grey silty clay (gravel is fmc and sub-angular to rounded)			Sample Type	B
				Samples received	03/01/2017
				Schedules received	06/01/2017
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	09/01/2017
				Date tested	20/01/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	95		
14	88		
10	79		
6.3	68		
5	62		
3.35	56		
2	51		
1.18	48		
0.6	43		
0.425	38		
0.3	30		
0.212	25		
0.15	23		
0.063	19		

Dry Mass of sample, g 3471

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	48.9
Sand	31.7
Fines <0.063mm	19.4

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below



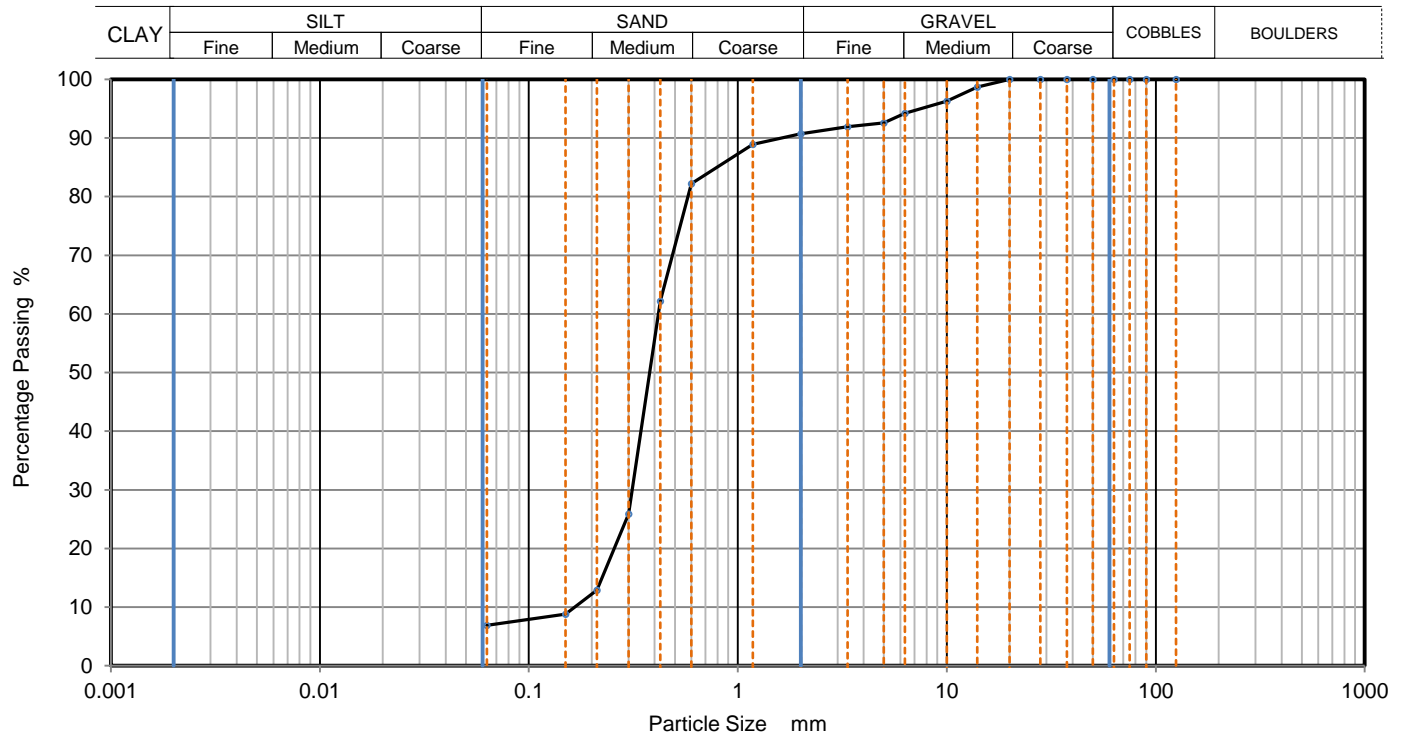
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 Date: 27/01/2017



PARTICLE SIZE DISTRIBUTION

		Job Ref		22153			
		Borehole/Pit No.		BH106			
Site Name		RADA 16 & 18 Chenies Street, London WC1E 7EX		Sample No.		9	
Project No.		J15215A		Client		GEA	
Soil Description		Brown gravelly SAND with rare grey silty clay lumps (gravel is fm and angular to rounded)		Depth		8.00 m	
				Sample Type		B	
				Samples received		03/01/2017	
Test Method		BS1377:Part 2: 1990, clause 9.0		Schedules received		06/01/2017	
				Project started		09/01/2017	
				Date tested		20/01/2017	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	96		
6.3	94		
5	93		
3.35	92		
2	91		
1.18	89		
0.6	82		
0.425	62		
0.3	26		
0.212	13		
0.15	9		
0.063	7		

Dry Mass of sample, g 1452

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	9.3
Sand	83.8
Fines <0.063mm	6.9

Grading Analysis		
D100	mm	
D60	mm	0.416
D30	mm	0.312
D10	mm	0.166
Uniformity Coefficient	2.5	
Curvature Coefficient	1.4	

Remarks
Preparation and testing in accordance with BS1377 unless noted below



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 Date: 27/01/2017



Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results
Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No. 22153	Project Name RADA 16 & 18 Chenies Street, London WC1E 7EX	Programme	
		Samples received	03/01/2017
Project No. J15215A	Client GEA	Schedule received	06/01/2017
		Project started	09/01/2017
		Testing Started	19/01/2017

Hole No.	Sample				Soil description	Dry Mass passing 2mm %	SO3 Content g/l	SO4 Content g/l	pH	Remarks
	Ref	Top	Base	Type						
BH106	4	5.00	-	B	MADE GROUND (brown and dark grey gravelly sandy clay with occasional fm brick and ash fragments (gravel is fmc and sub-angular to sub-rounded))	74	0.18	0.21	7.33	
BH106	17	13.50	-	U	Very high strength fissured dark grey silty CLAY	100	0.71	0.85	7.78	
BH106	32	25.00	-	D	Dark grey, pale grey and reddish brown silty CLAY	100	0.12	0.15	7.40	

	Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Tel: 01923 711 288 Email: James@k4soils.com	Checked and Approved Initials J.P Date: 27/01/2017
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)	MSF-5-R29



GEA

Widbury Barn
Widbury Hill
Ware
Herts SG12 7QE

SPT & Cohesion / Depth & Level Graph

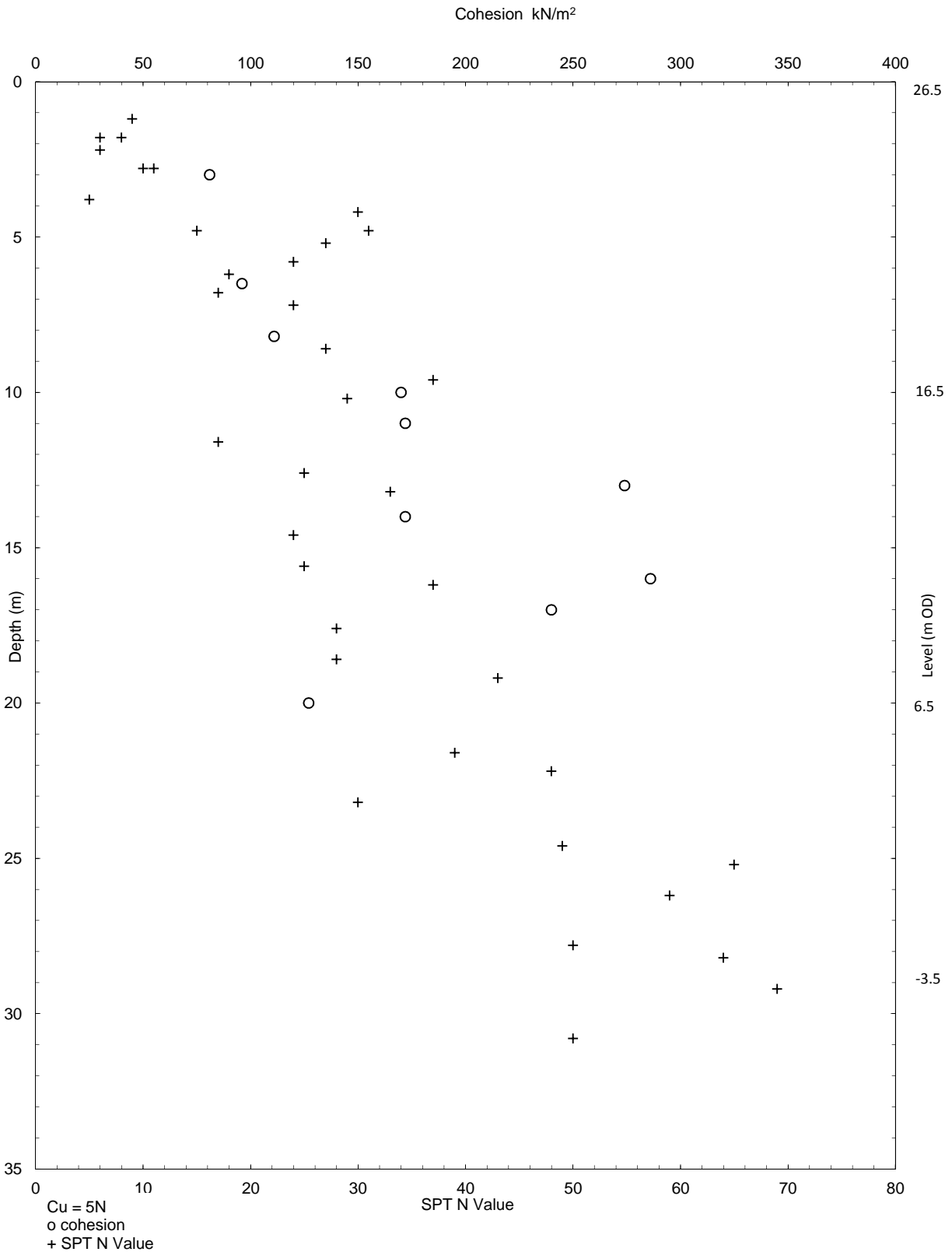
Site Royal Academy of Dramatic Arts, 16 - 18 Chenies Street, London WC1E 7EX

Job Number
J15215A

Client Royal Academy of Dramatic Arts

Sheet
1 / 1

Engineer Sinclair Johnston



Analytical Report Number: 16-31161

Project / Site name: RADA

Your Order No: J15215A

Lab Sample Number				649267	649268	649269	
Sample Reference				TP05	TP07	TP08	
Sample Number				None Supplied	None Supplied	None Supplied	
Depth (m)				0.25	1.00	0.50	
Date Sampled				24/10/2016	25/11/2006	24/10/2016	
Time Taken				None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	23	14	18	
Total mass of sample received	kg	0.001	NONE	1.3	1.6	1.5	

General Inorganics

Parameter	Units	Limit of detection	Accreditation Status	7.6	8.0	8.2	
pH - Automated	pH Units	N/A	MCERTS	7.6	8.0	8.2	
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	
Total Sulphate as SO ₄	mg/kg	50	MCERTS	960	5000	1600	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.17	1.6	0.18	
Sulphide	mg/kg	1	MCERTS	< 1.0	6.6	1.5	
Water Soluble Chloride (2:1)	mg/kg	1	MCERTS	29	19	16	
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.5	0.6	0.9	

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	< 1.60	< 1.60	< 1.60	
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	14	15	
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	32	20	15	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	83	94	88	
Lead (aqua regia extractable)	mg/kg	1	MCERTS	210	680	610	
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.7	1.9	3.0	
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	26	18	16	
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	81	55	55	

Petroleum Hydrocarbons

TPH (C8 - C10)	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	
TPH (C10 - C12)	mg/kg	2	ISO 17025	< 2.0	< 2.0	< 2.0	
TPH (C12 - C16)	mg/kg	4	ISO 17025	< 4.0	< 4.0	< 4.0	
TPH (C16 - C21)	mg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	
TPH (C21 - C35)	mg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	

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Client	RADA	
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Proposed End Use Commercial

Soil pH 8

Soil Organic Matter content % 2.5

Contaminant	Screening Value mg/kg	Data Source
Metals		
Arsenic	640	C4SL
Cadmium	410	C4SL
Chromium (III)	30400	LQM/CIEH
Chromium (VI)	49	C4SL
Copper	71,700	LQM/CIEH
Lead	2330	C4SL
Elemental Mercury	170	SGV
Inorganic Mercury	3600	SGV
Nickel	1350	LQM/CIEH
Selenium	13000	SGV
Zinc	665,000	LQM/CIEH
Hydrocarbons		
Benzene	50	C4SL
Toluene	2200	SGV
Ethyl Benzene	48000	SGV
Xylene	1300	SGV
Aliphatic C5-C6	6200	LQM/CIEH
Aliphatic C6-C8	18000	LQM/CIEH
Aliphatic C8-C10	5100	LQM/CIEH
Aliphatic C10-C12	24000	LQM/CIEH
Aliphatic C12-C16	83000	LQM/CIEH
Aliphatic C16-C35	1,800,000	LQM/CIEH
Aromatic C6-C7	See Benzene	LQM/CIEH
Aromatic C7-C8	See Toluene	LQM/CIEH
Aromatic C8-C10	8600	LQM/CIEH
Aromatic C10-C12	29000	LQM/CIEH
Aromatic C12-C16	37000	LQM/CIEH
Aromatic C16-C21	28000	LQM/CIEH
Aromatic C21-C35	28000	LQM/CIEH
PRO (C ₅ -C ₁₀)	40150	Calc
DRO (C ₁₂ -C ₂₈)	1,948,000	Calc
Lube Oil (C ₂₈ -C ₄₄)	1,828,000	Calc
TPH	1000	Trigger for speciated testing

Contaminant	Screening Value mg/kg	Data Source
Anions		
Soluble Sulphate	500 mg/l	Structures
Sulphide	50	Structures
Chloride	400	Structures
Others		
Organic Carbon (%)	10	Methanogenic potential
Total Cyanide	12000	WRAS
Total Mono Phenols	3200	SGV
PAH		
Naphthalene	480.00	C4SL exp & LQM/CIEH
Acenaphthylene	97,000	LQM/CIEH
Acenaphthene	98,000	LQM/CIEH
Fluorene	69,000	LQM/CIEH
Phenanthrene	22,000	LQM/CIEH
Anthracene	540,000	LQM/CIEH
Fluoranthene	23,000	LQM/CIEH
Pyrene	54,000	LQM/CIEH
Benzo(a) Anthracene	95.0	C4SL exp & LQM/CIEH
Chrysene	140	C4SL exp & LQM/CIEH
Benzo(b) Fluoranthene	100.0	C4SL exp & LQM/CIEH
Benzo(k) Fluoranthene	140.0	C4SL exp & LQM/CIEH
Benzo(a) pyrene	42.40	C4SL
Indeno(1 2 3 cd) Pyrene	61.0	C4SL exp & LQM/CIEH
Dibenzo(a h) Anthracene	13.00	C4SL exp & LQM/CIEH
Benzo (g h i) Perylene	660	C4SL exp & LQM/CIEH
Screening value for PAH	605.7	B(a)P / 0.15
Chlorinated Solvents		
1,1,1 trichloroethane (TCA)	1280	LQM/CIEH
tetrachloroethane (PCA)	332	LQM/CIEH
tetrachloroethene (PCE)	146	LQM/CIEH
trichloroethene (TCE)	14.8	LQM/CIEH
1,2-dichloroethane (DCA)	1	LQM/CIEH
vinyl chloride (Chloroethene)	0.113	LQM/CIEH
tetrachloromethane (Carbon tetra	6.6	LQM/CIEH
trichloromethane (Chloroform)	180	LQM/CIEH

Notes

Concentrations measured below the above values may be considered to represent 'uncontaminated conditions' which pose 'LOW' risk to human health. Concentrations measured in excess of these values indicate a potential risk which require further, site specific risk assessment.

SGV - Soil Guideline Value, derived from the CLEA model and published by Environment Agency 2009

LQM/CIEH - Generic Assessment Criteria for Human Health Risk Assessment 2nd edition (2009) derived using CLEA 1.04 model 2009

C4SL - Defra Category 4 Screening value based on Low Level of Toxicological Risk

C4SL exp & LQM/CIEH calculated using C4SL revisions to exposure assessment but LQM/CIEH health criteria values

Calc - sum of nearest available carbon range specified including BTEX for PRO fraction

B(a)P / 0.15 - GEA experience indicates that Benzo(a) pyrene (one of the most common and most carcinogenic of the PAHs) rarely exceeds 15% of the total PAH concentration, hence this Total PAH threshold is regarded as being conservative



GEA

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Ground Floor

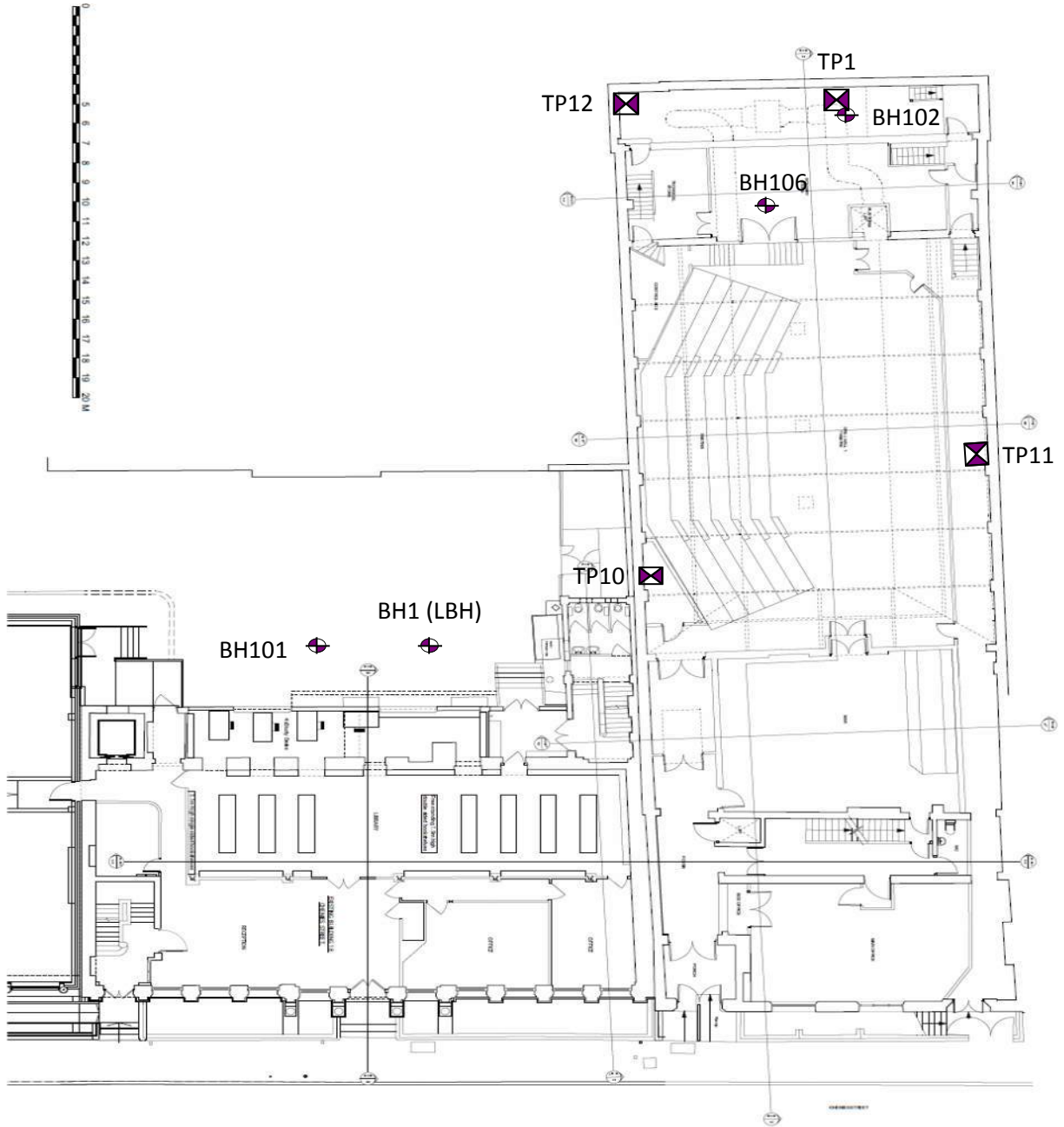
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Client RADA

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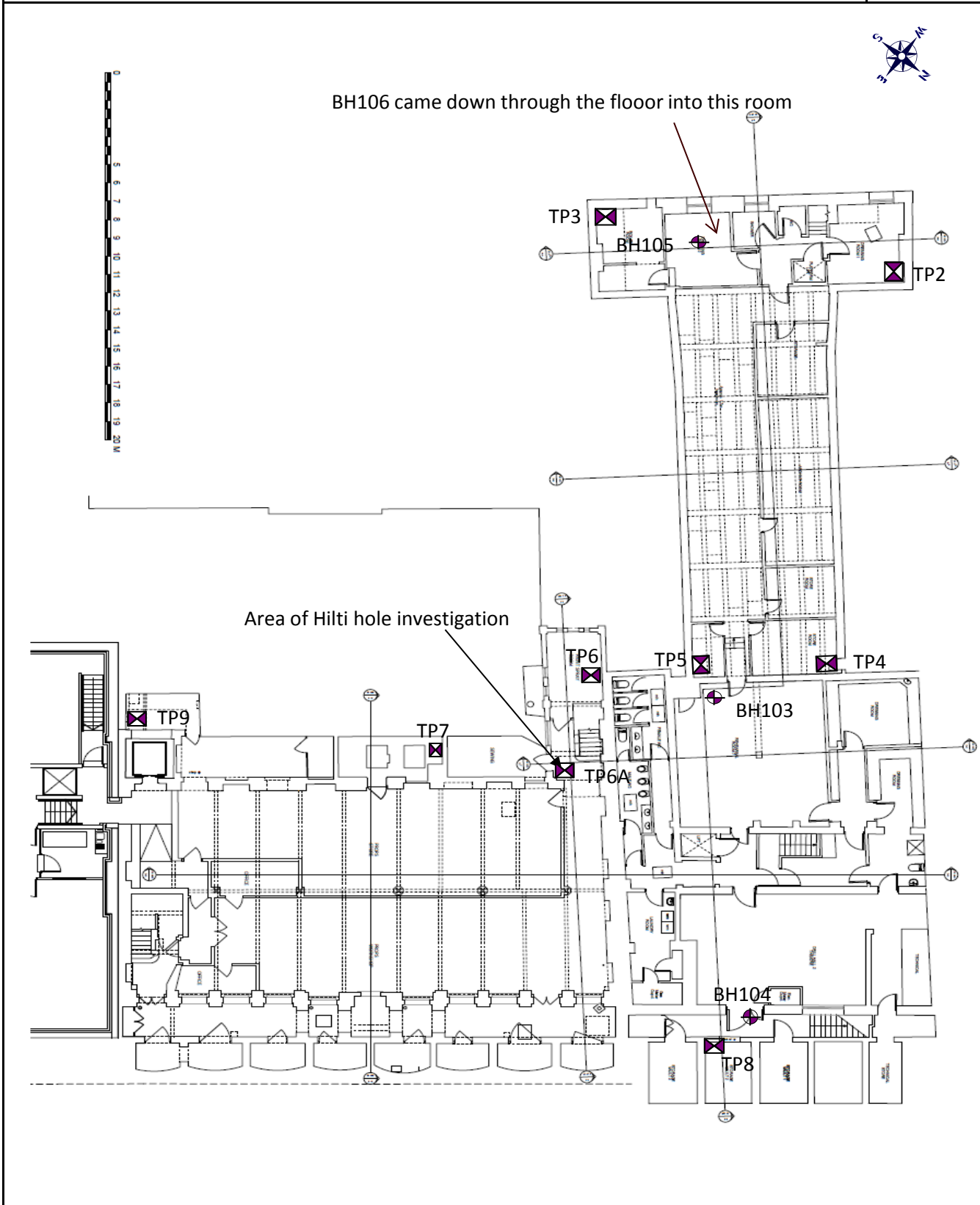
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Geotechnical & Environmental Associates (GEA) is an engineer-led and client-focused independent specialist providing a complete range of geotechnical and contaminated land investigation, analytical and consultancy services to the property and construction industries.

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