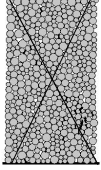


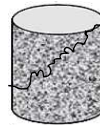
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	2.60		
	Description	Dark brown slightly gravelly slightly sandy clayey SILT		
	Type	B		
	Initial Sample Length	L_0	(mm)	70.6
	Initial Sample Diameter	D_0	(mm)	37.7
	Initial Sample Weight	W_0	(gr)	129.3
	Bulk Density	ρ_0	(Mg/m ³)	1.64
	Particle Density	ρ_s	(Mg/m ³)	2.65

Initial Conditions				
Initial Cell Pressure	σ_3	(kPa)	52	
Strain Rate	$\dot{\epsilon}$	(mm/min)	1.41220	
Membrane Thickness	m_b	(mm)	0.21	
Displacement Input	L_{IP}	(mm)	CH 2	
Load Input	N_{IP}	(N)	CH 1	
Initial Moisture	ω_i	(%)	27	
Initial Dry Density	ρ_{d0}	(Mg/m ³)	1.29	
Initial Voids Ratio	e_0	.	1.06	
Initial Degree of Saturation	S_o	(%)	69	

Final Conditions				
Max Deviator Stress	$(\sigma_1 - \sigma_3)_f$	(kPa)	181	
Membrane Correction	m_c	(kPa)	1.688	
Strain At Max Stress	ϵ_f	(%)	12.35	
Shear Strength	c_u	(kPa)	90	
Final Moisture	ω_f	(%)	27	
Final Dry Density	ρ_{df}	(Mg/m ³)	1.29	
Final Voids Ratio	e_f	.	1.06	
Final Degree of Saturation	S_f	(%)	68.6	
Notes				
Triaxial at over burden				
				Failure Sketch (surface inclination)

	Test Method		BS1377-7 : 1990 Clause 8		Test Name		712411				
	Database:		.\SQLEXPRESS \ 6171-I2 Analytical		Test Date		13/03/2017				
	Site Reference		Southall		Borehole		TP1				
	Jobfile		17-41710		Sample		2				
	Client		Card		Depth		2.60				
	Operator		palmowska		Checked		pytlikm		Approved		pytlikm

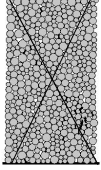
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Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	3.60		
	Description	Black slightly gravelly slightly sandy clayey SILT		
	Type	B		
	Initial Sample Length	L ₀	(mm)	70.3
	Initial Sample Diameter	D ₀	(mm)	37.5
	Initial Sample Weight	W ₀	(gr)	116.4
	Bulk Density	ρ ₀	(Mg/m ³)	1.50
	Particle Density	ρ _s	(Mg/m ³)	2.65

Initial Conditions				
Initial Cell Pressure	σ ₃	(kPa)	72	
Strain Rate	m _s	(mm/min)	1.40620	
Membrane Thickness	m _b	(mm)	0.24	
Displacement Input	L _{IP}	(mm)	CH 2	
Load Input	N _{IP}	(N)	CH 1	
Initial Moisture	ω _i %	(%)	46	
Initial Dry Density	ρ _{d0}	(Mg/m ³)	1.03	
Initial Voids Ratio	e ₀	.	1.58	
Initial Degree of Saturation	S _o	(%)	77	

Final Conditions			
Max Deviator Stress	$(\sigma_1 - \sigma_3)_f$ (kPa)		110
Membrane Correction	m_c (kPa)		1.464
Strain At Max Stress	$\epsilon_f\%$ (%)		9.12
Shear Strength	c_u (kPa)		55
Final Moisture	$\omega_f\%$ (%)		46
Final Dry Density	ρ_{df} (Mg/m ³)		1.03
Final Voids Ratio	e_f .		1.58
Final Degree of Saturation	S_f (%)		77.1
Notes			
Triaxial at over burden; unable to take a photo			
		Failure Sketch (surface inclination)	

	Test Method		BS1377-7 : 1990 Clause 8		Test Name		712415				
	Database:		. \SQLEXPRESS \ 6171-I2 Analytical		Test Date		13/03/2017				
	Site Reference		Southall		Borehole		TP2				
	Jobfile		17-41710		Sample		4				
	Client		Card		Depth		3.60				
	Operator		palmowska		Checked		pytlikm		Approved		pytlikm

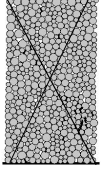
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Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	1.70		
	Description	Brown slightly gravelly slightly sandy clayey SILT		
	Type	B		
	Initial Sample Length	L ₀	(mm)	74.3
	Initial Sample Diameter	D ₀	(mm)	37.6
	Initial Sample Weight	W ₀	(gr)	130.1
	Bulk Density	ρ ₀	(Mg/m ³)	1.58
	Particle Density	ρ _s	(Mg/m ³)	2.65

Initial Conditions				
Initial Cell Pressure	σ ₃	(kPa)	34	
Strain Rate	m _s	(mm/min)	1.48560	
Membrane Thickness	m _b	(mm)	0.27	
Displacement Input	L _{IP}	(mm)	CH 2	
Load Input	N _{IP}	(N)	CH 1	
Initial Moisture	ω _i %	(%)	58	
Initial Dry Density	ρ _{d0}	(Mg/m ³)	1.00	
Initial Voids Ratio	e ₀	.	1.64	
Initial Degree of Saturation	S _o	(%)	93	

Final Conditions				
Max Deviator Stress	$(\sigma_1 - \sigma_3)_f$	(kPa)	47	
MembraneCorrection	m c	(kPa)	1.637	
Strain At Max Stress	$\epsilon_f\%$	(%)	8.91	
Shear Strength	c u	(kPa)	23	
Final Moisture	$\omega_f\%$	(%)	58	
Final Dry Density	ρ_{df}	(Mg/m3)	1.00	
Final Voids Ratio	e f	.	1.64	
Final Degree of Saturation	S f	(%)	92.8	
Notes				
Triaxial at over burden				
				
Failure Sketch (surface inclination)				

	Test Method		BS1377-7 : 1990 Clause 8		Test Name		712417				
	Database:		. \SQLEXPRESS \ 6171-I2 Analytical		Test Date		13/03/2017				
	Site Reference		Southall		Borehole		TP3				
	Jobfile		17-41710		Sample		3				
	Client		Card		Depth		1.70				
	Operator		palmowska		Checked		pytlikm		Approved		pytlikm

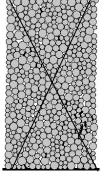
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Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	0.60		
	Description	Yellowish brown slightly gravelly silty CLAY		
	Type	B		
	Initial Sample Length	L_0	(mm)	78.3
	Initial Sample Diameter	D_0	(mm)	37.9
	Initial Sample Weight	W_0	(gr)	179.2
	Bulk Density	ρ_0	(Mg/m ³)	2.03
	Particle Density	ρ_s	(Mg/m ³)	2.65

Initial Conditions				
Initial Cell Pressure	σ_3	(kPa)	12	
Strain Rate	$\dot{\epsilon}_s$	(mm/min)	1.56520	
Membrane Thickness	m_b	(mm)	0.21	
Displacement Input	L_{IP}	(mm)	CH 2	
Load Input	N_{IP}	(N)	CH 1	
Initial Moisture	$\omega_i\%$	(%)	22	
Initial Dry Density	ρ_{d0}	(Mg/m ³)	1.66	
Initial Voids Ratio	e_0	.	0.59	
Initial Degree of Saturation	S_o	(%)	98	

Final Conditions			
Max Deviator Stress	$(\sigma_1 - \sigma_3)_f$ (kPa)	134	
Membrane Correction	m_c (kPa)	1.233	
Strain At Max Stress	$\epsilon_f\%$ (%)	7.54	
Shear Strength	c_u (kPa)	67	
Final Moisture	$\omega_f\%$ (%)	22	
Final Dry Density	ρ_{df} (Mg/m ³)	1.66	
Final Voids Ratio	e_f .	0.59	
Final Degree of Saturation	S_f (%)	98.2	
Notes			
Triaxial at over burden			
 Failure Sketch (surface inclination)			



Failure Sketch
(surface inclination)

	Test Method	BS1377-7 : 1990 Clause 8	Test Name	712419
	Database:	.\SQLEXPRESS \ 6171-I2 Analytical	Test Date	13/03/2017
	Site Reference	Southall	Borehole	TP4
	Jobfile	17-41710	Sample	2
	Client	Card	Depth	0.60
Operator		palmowska	Checked	pytlikm
		Approved		pytlikm

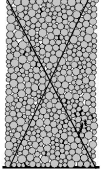
i2 Analytical Limited, 7 Woodshots Meadow, Croxley Green Business Park, Herts WD18 8YS

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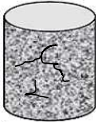
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	1.50		
	Description	Brown slightly sandy silty GRAVEL		
	Type	B		
	Initial Sample Length	L ₀	(mm)	70.6
	Initial Sample Diameter	D ₀	(mm)	37.6
	Initial Sample Weight	W ₀	(gr)	135.9
	Bulk Density	ρ ₀	(Mg/m ³)	1.73
	Particle Density	ρ _s	(Mg/m ³)	2.65

Initial Conditions				
Initial Cell Pressure	σ ₃	(kPa)	30	
Strain Rate	m _s	(mm/min)	1.41100	
Membrane Thickness	m _b	(mm)	0.22	
Displacement Input	L _{IP}	(mm)	CH 2	
Load Input	N _{IP}	(N)	CH 1	
Initial Moisture	ω _i %	(%)	16	
Initial Dry Density	ρ _{d0}	(Mg/m ³)	1.50	
Initial Voids Ratio	e ₀	.	0.77	
Initial Degree of Saturation	S _o	(%)	54	

Final Conditions			
Max Deviator Stress	$(\sigma_1 - \sigma_3)_f$ (kPa)	111	
MembraneCorrection	m_c (kPa)	1.089	
Strain At Max Stress	$\epsilon_f\%$ (%)	7.10	
Shear Strength	c_u (kPa)	56	
Final Moisture	$\omega_f\%$ (%)	15	
Final Dry Density	ρ_{df} (Mg/m3)	1.50	
Final Voids Ratio	e_f .	0.76	
Final Degree of Saturation	S_f (%)	53.5	
Notes			
Triaxial at over burden			
			Failure Sketch (surface inclination)

	Test Method	BS1377-7 : 1990 Clause 8		Test Name	712424	
	Database:	.\SQLEXPRESS \ 6171-I2 Analytical		Test Date	13/03/2017	
	Site Reference	Southall		Borehole	TP3B	
	Jobfile	17-41710		Sample	1	
	Client	Card		Depth	1.50	
	Operator	palmowska	Checked	pytlikm	Approved	pytlikm

i2 Analytical Limited, 7 Woodshots Meadow, Croxley Green Business Park, Herts WD18 8YS

i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

APPENDIX C

Chemical Test Results

**Owen Flowers**

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Analytical Report Number : 17-41233

Project / Site name:	Southall	Samples received on:	28/02/2017
Your job number:	CGN-3732D	Samples instructed on:	28/02/2017
Your order number:		Analysis completed by:	09/03/2017
Report Issue Number:	1	Report issued on:	09/03/2017
Samples Analysed:	17 soil samples		

Signed: _____

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Analytical Report Number: 17-41233

Project / Site name: Southall

Lab Sample Number				709459	709460	709461	709462	709463
Sample Reference				TP1	TP2	TP3	HP1	TP4
Sample Number				ES1	ES1	ES2	ES1	ES2
Depth (m)				2.60	0.60	1.50	0.00	1.30
Date Sampled				24/02/2017	24/02/2017	24/02/2017	24/02/2017	24/02/2017
Time Taken				None Supplied	None Supplied	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	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	23	25	36	16	19
Total mass of sample received	kg	0.001	NONE	0.44	0.42	0.40	0.44	0.45

Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.5	7.4	8.1	8.4	8.0
Total Cyanide	mg/kg	1	MCERTS	3	3	2	6	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	7300	4900	2200	2500	2500
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Organic Matter	%	0.1	MCERTS	3.3	5.7	4.5	2.9	0.7

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.23	0.24	0.20	< 0.05
Acenaphthylene	mg/kg	0.1	MCERTS	0.21	0.32	0.38	0.20	< 0.10
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	0.21	0.28	< 0.10	< 0.10
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	0.24	0.39	< 0.10
Phenanthrene	mg/kg	0.1	MCERTS	1.7	2.8	1.8	2.9	< 0.10
Anthracene	mg/kg	0.1	MCERTS	0.38	0.64	0.63	0.60	< 0.10
Fluoranthene	mg/kg	0.1	MCERTS	4.6	7.0	7.9	3.5	< 0.10
Pyrene	mg/kg	0.1	MCERTS	3.7	6.0	6.3	2.7	< 0.10
Benzo(a)anthracene	mg/kg	0.1	MCERTS	2.2	4.3	4.1	1.9	< 0.10
Chrysene	mg/kg	0.05	MCERTS	2.1	2.9	3.3	1.4	< 0.05
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	2.9	5.3	4.7	1.7	< 0.10
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	1.7	2.1	2.0	0.74	< 0.10
Benzo(a)pyrene	mg/kg	0.1	MCERTS	2.0	4.2	3.5	1.3	< 0.10
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	2.5	3.9	2.7	0.85	< 0.10
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.42	0.88	0.61	0.27	< 0.10
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.0	4.8	3.1	1.0	< 0.05
Coronene	mg/kg	0.05	NONE	1.8	2.5	1.4	0.50	< 0.05

Total PAH

Total WAC-17 PAHs	mg/kg	1.6	NONE	29	48	43	20	< 1.6
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	5.8	7.4	5.7	1.6	< 1.0
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	18	26	37	7.7	2.9
Barium (aqua regia extractable)	mg/kg	1	MCERTS	160	270	160	91	98
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.99	1.0	1.1	0.32	1.1
Boron (water soluble)	mg/kg	0.2	MCERTS	3.2	3.1	5.1	1.7	3.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	13	14	28	1.0	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	78	110	120	17	34
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	78	110	120	17	34
Copper (aqua regia extractable)	mg/kg	1	MCERTS	160	260	300	37	24
Lead (aqua regia extractable)	mg/kg	1	MCERTS	280	480	290	110	16
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	1.9	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	52	73	98	17	24
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	61	64	69	18	42
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	420	670	660	410	56

Analytical Report Number: 17-41233

Project / Site name: Southall

Lab Sample Number				709459	709460	709461	709462	709463
Sample Reference				TP1	TP2	TP3	HP1	TP4
Sample Number				ES1	ES1	ES2	ES1	ES2
Depth (m)				2.60	0.60	1.50	0.00	1.30
Date Sampled				24/02/2017	24/02/2017	24/02/2017	24/02/2017	24/02/2017
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	1.4	4.6	7.5	2.7	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	14	12	58	3.1	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	110	81	180	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	690	690	960	28	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	810	790	1200	38	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	1.6	2.5	3.1	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	12	8.8	17	9.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	52	65	110	29	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	370	520	500	53	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	430	600	630	91	< 10

Analytical Report Number: 17-41233

Project / Site name: Southall

Lab Sample Number				709464	709465	709466	711441	711442
Sample Reference				TP2B	TP3B	TP4B	TP1	TP2
Sample Number				ES1	ES1	ES1	B2	D2
Depth (m)				0.20	0.20	0.50	2.60	2.50
Date Sampled				24/02/2017	24/02/2017	24/02/2017	Deviating	Deviating
Time Taken				None Supplied	None Supplied	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	21	18
Moisture Content	%	N/A	NONE	16	16	11	14	33
Total mass of sample received	kg	0.001	NONE	0.43	0.44	0.45	0.39	0.34

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.4	8.3	7.9	-	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	1	-	-
Total Sulphate as SO ₄	mg/kg	50	MCERTS	2200	1000	920	-	-
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	1.12	0.888
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	2.0	1.7
Total Sulphur	%	0.005	MCERTS	-	-	-	0.426	0.396
Organic Matter	%	0.1	MCERTS	5.7	3.7	4.6	-	-

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	0.21	< 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	2.7	1.0	0.66	-	-
Anthracene	mg/kg	0.1	MCERTS	0.63	0.27	0.19	-	-
Fluoranthene	mg/kg	0.1	MCERTS	5.7	2.4	1.9	-	-
Pyrene	mg/kg	0.1	MCERTS	4.6	2.0	1.6	-	-
Benzo(a)anthracene	mg/kg	0.1	MCERTS	3.6	1.4	1.2	-	-
Chrysene	mg/kg	0.05	MCERTS	2.4	1.1	0.98	-	-
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	4.0	1.5	1.4	-	-
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	1.6	0.82	0.81	-	-
Benzo(a)pyrene	mg/kg	0.1	MCERTS	3.4	1.5	1.4	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	1.8	0.89	0.86	-	-
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.43	0.20	< 0.10	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.0	1.1	0.95	-	-
Coronene	mg/kg	0.05	NONE	0.94	0.58	0.43	-	-

Total PAH

Total WAC-17 PAHs	mg/kg	1.6	NONE	34	15	12	-	-
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	5.0	1.6	8.0	-	-
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	18	11	27	-	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	310	120	310	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.95	0.85	1.9	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	2.8	1.5	2.3	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	-	-
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	-	-
Chromium (III)	mg/kg	1	NONE	30	26	32	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	30	27	32	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	120	52	120	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	200	92	310	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	110	26	36	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	43	50	59	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	300	110	340	-	-

Analytical Report Number: 17-41233

Project / Site name: Southall

Lab Sample Number				709464	709465	709466	711441	711442
Sample Reference				TP2B	TP3B	TP4B	TP1	TP2
Sample Number				ES1	ES1	ES1	B2	D2
Depth (m)				0.20	0.20	0.50	2.60	2.50
Date Sampled				24/02/2017	24/02/2017	24/02/2017	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	1.8	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	2.3	4.1	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	40	52	40	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	46	61	53	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	5.0	< 1.0	< 1.0	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	6.6	< 2.0	5.4	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	33	10	15	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	150	81	64	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	190	92	86	-	-

Analytical Report Number: 17-41233

Project / Site name: Southall

Lab Sample Number				711443	711444	711445	711446	711447
Sample Reference				TP3B	TP3B	TP4B	TP2	TP3
Sample Number				B1	B2	B1	B4	B3
Depth (m)				1.50	2.70	1.50	3.60	1.70
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	52	58	44	24	< 0.1
Moisture Content	%	N/A	NONE	9.2	7.3	11	29	35
Total mass of sample received	kg	0.001	NONE	0.49	0.57	0.57	0.39	0.47

Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-	-	-	-
Total Cyanide	mg/kg	1	MCERTS	-	-	-	-	-
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	-	-	-	-
Total Sulphate as SO ₄	%	0.005	MCERTS	0.216	0.210	0.087	0.884	0.197
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.55	0.79	0.18	2.3	1.3
Total Sulphur	%	0.005	MCERTS	0.134	0.112	0.048	0.347	0.244
Organic Matter	%	0.1	MCERTS	-	-	-	-	-

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.1	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.1	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.1	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.1	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.1	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.1	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.1	MCERTS	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.1	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.1	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Coronene	mg/kg	0.05	NONE	-	-	-	-	-

Total PAH

Total WAC-17 PAHs	mg/kg	1.6	NONE	-	-	-	-	-
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	-	-	-	-	-
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	-
Chromium (hexavalent)	mg/kg	1.2	MCERTS	-	-	-	-	-
Chromium (III)	mg/kg	1	NONE	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-

Analytical Report Number: 17-41233

Project / Site name: Southall

Lab Sample Number				711443	711444	711445	711446	711447
Sample Reference				TP3B	TP3B	TP4B	TP2	TP3
Sample Number				B1	B2	B1	B4	B3
Depth (m)				1.50	2.70	1.50	3.60	1.70
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-	-	-	-
Toluene	ug/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	ug/kg	1	MCERTS	-	-	-	-	-
p & m-xylene	ug/kg	1	MCERTS	-	-	-	-	-
o-xylene	ug/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	-	-	-	-	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-

Analytical Report Number: 17-41233

Project / Site name: Southall

Lab Sample Number				711448	711449			
Sample Reference				TP4	TP2B			
Sample Number				B2	D1			
Depth (m)				0.60	0.20			
Date Sampled				Deviating	Deviating			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	4.9	40			
Moisture Content	%	N/A	NONE	20	21			
Total mass of sample received	kg	0.001	NONE	0.61	0.28			

Asbestos in Soil	Type	N/A	ISO 17025	-	-			
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-			
Total Cyanide	mg/kg	1	MCERTS	-	-			
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	-			
Total Sulphate as SO ₄	%	0.005	MCERTS	0.171	0.161			
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	1.0	0.51			
Total Sulphur	%	0.005	MCERTS	0.066	0.076			
Organic Matter	%	0.1	MCERTS	-	-			

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	-	-			
Acenaphthylene	mg/kg	0.1	MCERTS	-	-			
Acenaphthene	mg/kg	0.1	MCERTS	-	-			
Fluorene	mg/kg	0.1	MCERTS	-	-			
Phenanthrene	mg/kg	0.1	MCERTS	-	-			
Anthracene	mg/kg	0.1	MCERTS	-	-			
Fluoranthene	mg/kg	0.1	MCERTS	-	-			
Pyrene	mg/kg	0.1	MCERTS	-	-			
Benzo(a)anthracene	mg/kg	0.1	MCERTS	-	-			
Chrysene	mg/kg	0.05	MCERTS	-	-			
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	-	-			
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	-	-			
Benzo(a)pyrene	mg/kg	0.1	MCERTS	-	-			
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	-	-			
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	-	-			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-			
Coronene	mg/kg	0.05	NONE	-	-			

Total PAH

Total WAC-17 PAHs	mg/kg	1.6	NONE	-	-			
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	-	-			
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-			
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-			
Chromium (hexavalent)	mg/kg	1.2	MCERTS	-	-			
Chromium (III)	mg/kg	1	NONE	-	-			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-			

Analytical Report Number: 17-41233

Project / Site name: Southall

Lab Sample Number				711448	711449			
Sample Reference				TP4	TP2B			
Sample Number				B2	D1			
Depth (m)				0.60	0.20			
Date Sampled				Deviating	Deviating			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-			
Toluene	ug/kg	1	MCERTS	-	-			
Ethylbenzene	ug/kg	1	MCERTS	-	-			
p & m-xylene	ug/kg	1	MCERTS	-	-			
o-xylene	ug/kg	1	MCERTS	-	-			
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	-	-			
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-			
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-			
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-			
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-			
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-			
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-			

Analytical Report Number : 17-41233

Project / Site name: Southall

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
709459	TP1	ES1	2.60	Brown loam and clay with gravel.
709460	TP2	ES1	0.60	Brown loam and clay with gravel.
709461	TP3	ES2	1.50	Brown clay and sand with gravel.
709462	HP1	ES1	0.00	Brown loam and sand with gravel and vegetation.
709463	TP4	ES2	1.30	Brown clay and sand with gravel.
709464	TP2B	ES1	0.20	Brown loam and clay with gravel.
709465	TP3B	ES1	0.20	Brown loam and sand with gravel.
709466	TP4B	ES1	0.50	Brown loam and clay with gravel.
711441	TP1	B2	2.60	Brown loam and clay with gravel.
711442	TP2	D2	2.50	Brown clay and loam with gravel.
711443	TP3B	B1	1.50	Brown loam and clay with gravel.
711444	TP3B	B2	2.70	Brown loam and clay with gravel.
711445	TP4B	B1	1.50	Brown loam and clay with gravel.
711446	TP2	B4	3.60	Brown clay and loam with gravel.
711447	TP3	B3	1.70	Brown clay and sand.
711448	TP4	B2	0.60	Brown clay and sand with gravel.
711449	TP2B	D1	0.20	Brown clay and loam with gravel and vegetation.

Analytical Report Number : 17-41233

Project / Site name: Southall

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests"	L038	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038	W	MCERTS

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The results included within the report are representative of the samples submitted for analysis.

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Analytical Report Number : 17-41233

Project / Site name: Southall

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample Deviation Report



Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
TP1	B2	S	17-41233	711441	a			
TP2	B4	S	17-41233	711446	a			
TP2	D2	S	17-41233	711442	a			
TP2B	D1	S	17-41233	711449	a			
TP3	B3	S	17-41233	711447	a			
TP3B	B1	S	17-41233	711443	a			
TP3B	B2	S	17-41233	711444	a			
TP4	B2	S	17-41233	711448	a			
TP4B	B1	S	17-41233	711445	a			

APPENDIX D

WAC Test Results

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Analytical Report Number : 17-41236

Project / Site name:	Southall	Samples received on:	28/02/2017
Your job number:	CGN-3732D	Samples instructed on:	28/02/2017
Your order number:		Analysis completed by:	06/03/2017
Report Issue Number:	1	Report issued on:	06/03/2017
Samples Analysed:	3 10:1 WAC samples		

Signed:

Dr Irma Doyle
Senior Account Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Waste Acceptance Criteria Analytical Results

Report No:	17-41236									
					Client: CARDGEO					
					Landfill Waste Acceptance Criteria Limits <table><tr><td rowspan="4">Inert Waste Landfill</td><td rowspan="4">Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</td><td rowspan="4">Hazardous Waste Landfill</td></tr><tr></tr><tr></tr><tr></tr></table>			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill								
Location	Southall									
Lab Reference (Sample Number)	709470 / 709471									
Sampling Date	24/02/2017									
Sample ID	TP1 + TP2 + TP3									
Depth (m)	0.60-3.50									
Solid Waste Analysis										
TOC (%)**	3.8				3%	5%	6%			
Loss on Ignition (%) **	14				--	--	10%			
BTEX (µg/kg) **	< 10				6000	--	--			
Sum of PCBs (mg/kg) **	0.28				1	--	--			
Mineral Oil (mg/kg)	1100				500	--	--			
Total PAH (WAC-17) (mg/kg)	100				100	--	--			
pH (units)**	7.2				--	>6	--			
Acid Neutralisation Capacity (mol / kg)	1.7				--	To be evaluated	To be evaluated			
Eluate Analysis										
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1			10:01	Limit values for compliance leaching test					
	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)					
Arsenic *	< 0.0011			< 0.0110	0.5	2	25			
Barium *	0.0348			0.261	20	100	300			
Cadmium *	0.0024			0.0177	0.04	1	5			
Chromium *	0.0011			0.0081	0.5	10	70			
Copper *	0.025			0.19	2	50	100			
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2			
Molybdenum *	0.0013			0.0098	0.5	10	30			
Nickel *	0.0056			0.042	0.4	10	40			
Lead *	0.0025			0.019	0.5	10	50			
Antimony *	< 0.0017			< 0.017	0.06	0.7	5			
Selenium *	< 0.0040			< 0.040	0.1	0.5	7			
Zinc *	0.035			0.26	4	50	200			
Chloride *	0.98			7.3	800	4000	25000			
Fluoride	0.48			3.6	10	150	500			
Sulphate *	480			3600	1000	20000	50000			
TDS	560			4200	4000	60000	100000			
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-			
DOC	7.48			56.0	500	800	1000			
Leach Test Information										
Stone Content (%)	< 0.1									
Sample Mass (kg)	2.0									
Dry Matter (%)	72									
Moisture (%)	28									
Results are expressed on a dry weight basis, after correction for moisture content where applicable										
Stated limits are for guidance only and I2 cannot be held responsible for any discrepancies with current legislation										

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Waste Acceptance Criteria Analytical Results							
Report No:	17-41236						
					Client: CARDGEO		
Location	Southall						
Lab Reference (Sample Number)	709472 / 709473				Landfill Waste Acceptance Criteria		
					Limits		
Sampling Date	24/02/2017				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP3						
Depth (m)	1.50						
Solid Waste Analysis							
TOC (%)**	1.4				3%	5%	6%
Loss on Ignition (%) **	6.3				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	330				500	--	--
Total PAH (WAC-17) (mg/kg)	30				100	--	--
pH (units)**	7.8				--	>6	--
Acid Neutralisation Capacity (mol / kg)	6.4				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:01	Limit values for compliance leaching test		
	(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l		mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0047			0.0364	0.5	2	25
Barium *	0.0207			0.161	20	100	300
Cadmium *	0.0003			0.0020	0.04	1	5
Chromium *	0.0010			0.0075	0.5	10	70
Copper *	0.018			0.14	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0042			0.0325	0.5	10	30
Nickel *	0.0020			0.016	0.4	10	40
Lead *	0.0048			0.038	0.5	10	50
Antimony *	0.037			0.29	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.015			0.11	4	50	200
Chloride *	2.7			21	800	4000	25000
Fluoride	0.70			5.4	10	150	500
Sulphate *	33			260	1000	20000	50000
TDS	100			820	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	7.04			54.9	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	81						
Moisture (%)	19						
Results are expressed on a dry weight basis, after correction for moisture content where applicable							

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Waste Acceptance Criteria Analytical Results							
Report No:	17-41236						
					Client: CARDGEO		
Location	Southall						
Lab Reference (Sample Number)	709474 / 709475				Landfill Waste Acceptance Criteria		
Sampling Date	24/02/2017				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP2B + TP3B + TP4B						
Depth (m)	0.20-2.70						
Solid Waste Analysis							
TOC (%)**	1.8				3%	5%	6%
Loss on Ignition (%) **	6.2				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	64				500	--	--
Total PAH (WAC-17) (mg/kg)	7.4				100	--	--
pH (units)**	7.5				--	>6	--
Acid Neutralisation Capacity (mol / kg)	3.3				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:01	Limit values for compliance leaching test		
	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0050			0.0410	0.5	2	25
Barium *	0.0136			0.110	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0011			0.0090	0.5	10	70
Copper *	0.014			0.12	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	< 0.0004			< 0.0040	0.5	10	30
Nickel *	0.0003			< 0.0030	0.4	10	40
Lead *	0.0042			0.034	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0093			0.076	4	50	200
Chloride *	2.6			21	800	4000	25000
Fluoride	0.58			4.7	10	150	500
Sulphate *	16			130	1000	20000	50000
TDS	69			560	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	4.98			40.5	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	91						
Moisture (%)	9.0						
Results are expressed on a dry weight basis, after correction for moisture content where applicable Stated limits are for guidance only and IZ cannot be held responsible for any discrepancies with current legislation							

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

* = UKAS accredited (liquid eluate analysis only)

** = MCERTS accredited



Analytical Report Number : 17-41236

Project / Site name: Southall

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
709470	TP1 + TP2 + TP3	None Supplied	0.60-3.50	Brown loam and sand with gravel and vegetation.
709472	TP3	None Supplied	1.50	Brown loam and sand with gravel and vegetation.
709474	TP2B + TP3B + TP4B	None Supplied	0.20-2.70	Brown loam and sand with gravel and vegetation.

Analytical Report Number : 17-41236

Project / Site name: Southall

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance"	L046-UK	W	NONE
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L047-PL	D	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	NONE
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS

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Analytical Report Number : 17-41236

Project / Site name: Southall

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
----------------------	-------------------------------	-----------------------------	---------------	--------------------	----------------------

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



Clark Smith Partnership

Western Access, Southall
*Earthworks Material Acceptability
and Waste Characterisation
(Western Access Site)*

May, 2017



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Reference	CGN/03732E	Revision	0
		Issue Date	May 2017

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FIGURES

Figure 1 – Site location plan

Figure 2 – Trial pit location plan

APPENDICES

Appendix A – Trial pit logs

Appendix B – Geotechnical test results

Appendix C – Lime trial test results

Appendix D – Chemical test results

Appendix E – WAC test results

1. INTRODUCTION

Card Geotechnics Limited (CGL) has been instructed by Clark Smith Partnership (CSP) to undertake additional trial pitting and laboratory testing across the wider area of the Western Access site, in order to provide a preliminary assessment of material suitability for the direct transfer off-site or reuse on-site under the Materials Management Plan (MMP). The area of this investigation includes:

- the main Western Access road alignment;
- the Minet Tip Lagoon (referred to as 'Lagoon Bund' henceforth); and
- the area along the course of the River Crane towards the Flood Compensation Area.

Additionally, CGL have summarised the results of testing, undertaken by Beach Ground Engineering, of on-site won material which has been treated with lime and cement (for stabilisation) to identify the optimum treatment required to improve the suitability of these site won materials in reuse on site.

An overall site location plan is presented as Figure 1 and a trial pit location plan showing the site areas relevant to this report is presented as Figure 2.

This phase of trial pitting was completed between the 23rd and 27th March 2017. This report specifically details the findings from this recent investigation comprising the area shown in Figure 2, and will be referred to as 'the site' henceforth. This report aims to expand upon the findings of the Preliminary Geotechnical Design Report (PGDR) issued in December 2016¹ and the two earthworks material acceptability and waste characterisation reports previously issued^{2,3}.

¹ CGL (2016). *CGN/03732 Southall, Pump Lane Western Access*. Preliminary Geotechnical Design Report. Rev1. December 2016.

² CGL (2017). *CGN/03732C Southall advanced works*. Earthworks material acceptability and waste characterisation - Pump Lane Bund. Rev1. May 2017.

³ CGL (2017). *CGN/03732D Southall advanced works*. Earthworks material acceptability and waste characterisation – Bridge Bund and Lagoon Bund. Rev1. May 2017.

2. SITE DESCRIPTION

The Western Access area as a whole covers approximately 7.66Ha. The area encompassing all three permanent earthworks is centred approximately on National Grid Reference (NGR) 511254, 179810.

The site works have covered four main areas lying between the three main watercourses cutting the site; the River Crane, Yeading Brook and the Grand Union Canal.

- Area 1 - The largest area follows the course of the River Crane, oriented roughly south to north east and located east of Pump Lane, towards the Flood Compensation Area. The southernmost portion of this area relates to the proposed western road embankment, located between the River Crane and the Yeading Brook.
- Area 2 - The second area of investigation was along the proposed route for the western access road alignment, orientated west to east along the southern area of the site between the Yeading Brook and Grand Union canal. This area relates to the location of the proposed central road embankment.
- Area 3 - The Lagoon Bund is located on the north-eastern boundary of the site, and is located just west of the Grand Union Canal (oriented south west to north east). The Lagoon Bund comprises a roughly circular area of some 83m², and is understood to have been used as a dumping area for dredged materials from the Grand Union Canal.
- Area 4 - The area of the proposed road alignment located to the east of the Grand Union Canal, comprising a small area that lies adjacent to the main Southall Waterside development site, was not investigated during the same period as the above areas due to access constraints. The area was excavated to a depth of approximately 1m below ground level by the Contractor for the main development site. This was subsequently logged by CGL on 27th April 2017 as part of a separate investigation. No samples were taken and no results are presented within this report for this area.

For the purposes of this latest trial pit investigation the site areas detailed above have been delineated into a grid system, as shown in Figure 2, in order to provide a basis for earthworks verification activities at a later date.

3. INTRUSIVE INVESTIGATION

3.1 Summary of works

A total of 33nr. trial pits were excavated across the site within the Made Ground and underlying natural strata between the dates of 23rd March and 27th March 2017.

Representative samples were taken from each trial pit location for the purposes of geotechnical and chemical testing, which is shown on the trial pit logs presented as Appendix A. In-situ hand shear vane testing was undertaken within seven of the trial pits (where suitable strata was identified), to assist in the characterisation of the material for reuse on site. The results of these tests are summarised in Section 4.

3.2 Ground conditions

3.2.1 Area 1 – River Crane

A total of 22nr. trial pits were excavated within this area. For ease of analysis, the trial pits along the course of the River Crane have been divided into three sections, the southern, central and northern sections. These locations were undertaken to identify the strata at the proposed formation level of the road embankment, and to determine if the material from the northern section would be suitable for re-use elsewhere within the site.

3.2.1.1 Southern section (Western Embankment)

The trial pits taken along the southern stretch of the River Crane (TP1C to TP04C and TP10C) which comprised variable surface soils of Topsoil (TP2C and TP3C) or Made Ground (TP1C and TP4C) to a maximum depth of 0.9mbgl (TP1C), although depths of approximately 0.5m were more commonplace. Foreign materials of ceramic, clinker and plastic were identified within the granular components of the Made Ground.

River Terrace Deposits, predominately comprising a cohesive layer of sandy or silty sandy CLAY over a granular layer of clayey or silty GRAVEL were identified to be underlying the Topsoil and Made Ground layers. This cohesive layer was identified within TP2C, TP3C, TP4C, while TP1C comprised predominately granular materials beneath the Topsoil/Made Ground layer. The western most trial pit (TP10C) was excavated to a total depth of 1.4mbgl [25.28mOD] and comprised River Terrace Deposits consisting of orange brown very clayey GRAVEL. The three northern most trial pits (TP5C to TP7C) each terminated within the London Clay Formation, at depths ranging between 1.6mbgl (TP7C) and 2.3mbgl (TP5C).

3.2.1.2 Central section

The central section of the River Crane comprised nine trial pit locations, TP5C to TP9C and TP13C to TP16C. The surface material comprised Made Ground to a maximum depth of 2.3mbgl (TP9C), with no Topsoil material identified in any of the trial pits. The Made Ground layer predominately comprised of a predominately granular layer of clayey sandy gravel at surface (with the exception of TP9, which comprised a sandy clay layer at surface). Foreign materials of brick, concrete, metal, rubber, fabric and glass were identified within the granular components of the Made Ground. The locations TP9C and TP16C terminated within the Made Ground to avoid breaching the groundwater table.

River Terrace Deposits, predominately comprising of a granular layer of clayey or silty sandy GRAVEL was identified to be underlying the Made Ground layers. Four trial pits (TP5C to TP7C and TP14C) each terminated within the London Clay Formation, at depths ranging between 1.0mbgl (TP14C) and 2.3mbgl (TP5C).

3.2.1.3 Northern section (Flood Alleviation Area)

The northern section of the River Crane comprised eight trial pit locations, TP11C to TP12C, TP17C to TP18C and TP30C to TP33C. The surface material comprised Made Ground to a maximum depth of 1.5mbgl (TP32C), however Topsoil was identified as the surface material in two locations (TP30C and TP33C), and comprised layers of thickness in the order of 0.4m and 0.5m respectively. The Made Ground comprised a predominately granular layer at surface level consisting of a clayey sandy gravel or clayey gravelly sand, the one exception was TP18C where a predominately cohesive layer of Made Ground was identified. Foreign materials of brick, concrete, plastic, rubber, glass and asbestos containing material (TP31C only) were identified within the granular components of the Made Ground.

River Terrace Deposits were identified to underlie the Topsoil/Made Ground layer in each of the northern section trial pit locations. The River Terrace Deposits predominately comprised of a granular layer of clayey or silty sandy GRAVEL which were identified to be underlying the Made Ground layers. Only two of the trial pit locations (TP31C and TP33C) were underlain by predominately cohesive (gravelly clay) River Terrace Deposits, which were both also underlain by predominately granular deposits. Four of the trial pits (TP11C to TP12C, TP30C and TP33C), all to the east of the River Crane proved the London Clay Formation, at depths ranging between 0.7mbgl (TP11C) and 2.1m (TP30C and TP33C).

3.2.2 Area 2 - Central Embankment

A total of 5nr. trial pits were undertaken within this area (& TP19C to TP23C). These locations were undertaken to identify the strata at the proposed formation level of the road embankment, and to provide geotechnical data on the underlying soils.

The surface soils in this area comprised a layer of slightly sandy clayey silt (TP19C to TP23C) topsoil in each of the five trial pit locations. The thickness of the Topsoil varied in thickness to depths of between 0.3mbgl (TP22C) and 0.7mbgl (TP19C).

The five trial pits located to the east of the River Crane (TP19C to TP23C) were recorded to comprise River Terrace Deposits, consisting of a layer of firm to stiff dark brown to grey brown silty CLAY to depths of between 0.8mbgl (TP22C) and 2.1mbgl (TP21C).

Differential horizons were identified beneath the surface layer of the River Terrace Deposits in three of the trial pits (TP19C, TP22C and TP23C). These comprised a layer of orange brown silty sandy GRAVEL at a depth of 1.2mbgl and 2.2mbgl in TP19C, and a layer of firm orange brown gravelly CLAY at a depth of 0.8mbgl to 2.1mbgl in TP22C. The London Clay Formation was identified within TP23C at a depth of 1.2mbgl [26.67mOD], and consisted of a stiff brown to grey brown silty CLAY, becoming brown in colour with depth, suggesting this is the weathered horizon of the formation. The London Clay Formation was proven to a depth of 2.1mbgl [25.77mOD], however the base of the formation was not identified.

3.2.3 Area 3 - Lagoon Bund

A total of 6nr. trial pits were undertaken within this area (TP24C to TP29C). These were undertaken to determine the moisture content and organic matter content of the Lagoon Bund soils, and were predominately sampled to assess the potential for reuse of the material on other areas of the site.

The Lagoon Bund comprised Made Ground to a proven depth of 3.5mbgl (26.86m Ordnance Datum) [mOD] in TP26C, however natural ground was not encountered in the Lagoon Tip area. A surface layer of predominately granular Made Ground was identified in each of the six trial pit locations, which generally comprised a dark brown slightly gravelly clayey sand to depths of between 1.1mbgl (TP29C) and 2.3mbgl (TP25C). The gravel component of this layer comprised foreign materials including brick, concrete, ceramic, glass and tiles with occasional metal. A single piece of asbestos containing materials (ACMs) was identified at a depth of 0.5mbgl [21.34mOD] within TP25C.

A second layer of predominately cohesive Made Ground was identified in three of the trial pits (TP26C to TP28C) from depths of between 1.7mbgl (TP26C and TP28C) to 2.0mbgl (TP27C), and generally comprised a stiff black sandy gravelly clay with strong hydrocarbon odours. The gravel component of this layer comprised foreign materials including ceramic and glass. A predominately cohesive layer of Made Ground was also identified within TP29C from a depth of 1.1mbgl [29.2mOD], which comprised a soft black silty clay with lenses of blue silty sand and a very strong hydrocarbon and 'cyanide' odour. Spent oxide (Blue Billy) material was identified between 1.3mbgl and 1.35mbgl [29.0mOD and 28.95mOD].

It should be noted that the location of TP24C is also within the footprint of the proposed central embankment. However due to the higher existing ground level of the Lagoon Bund above that of the proposed formation, the materials encountered are not considered to be representative of the embankment formation.

3.3 Visual and olfactory indicators of contamination

Visual indicators of contamination were recorded within TP25C, in the form of a fragment of potentially asbestos containing material at a depth of 0.5mbgl. Additionally, a 50mm thick layer of spent oxide ('Blue Billy') was identified within TP29C at a depth of 1.3mbgl [29.0mOD], within a layer of hydrocarbon impacted blue silty sand. No other visual indicators of contamination were identified within the remaining trial pits (the presence of foreign material, such as brick and concrete is not considered as 'contamination' for the purpose of this assessment).

Olfactory indicators of potential contamination were recorded within four trial pit locations (TP26C to TP29C), and comprised a strong hydrocarbon odour in each location, with an additional 'cyanide' odour in TP29C.

No visual or olfactory indicators of contamination were identified within the trial pits along the proposed route of the western access road or within the trial pits along the course of the River Crane.

3.4 Environmental laboratory testing

A total of 53nr. soil samples and 8nr. leachate samples were sent for chemical testing. Of these samples, seven samples were retrieved from the Lagoon Bund and eight samples were taken from the proposed route of the western access road. The samples were scheduled for testing against a range of contaminants, including; heavy metals, polycyclic

aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), BTEX and asbestos identification. In addition to this testing, seven Waste Acceptance Criteria (WAC) tests were undertaken to assess the suitability of the material if disposal offsite to landfill is required.

3.5 Geotechnical laboratory testing

A number of samples were sent for geotechnical testing. Of these samples, 6nr. were from Area 3, a further 5nr. were taken from Area 2, with the remainder taken from Area 1. The samples were scheduled for a ranging of testing, including; Atterberg Limits, particle size distribution, moisture content, MCV, MCV/mc relationship, mc/MDD relationship, unconsolidated undrained triaxial and pH and sulphates.

4. MATERIAL CHARACTERISATION

CGL have compared the results of the geotechnical and chemical tests to the limiting criteria detailed in the Earthworks Specification contained within the PDGR¹ and have assessed each of the locations under each of the three headings below:

- *Material acceptability – compared against criteria within Appendix 6/1⁴.*

This indicates whether the material is acceptable for use in the earthworks based upon geotechnical properties. If the in-situ material is considered to be unacceptable, then the suitability for lime or cement stabilisation has been assessed;

- *Contamination concentrations – compared against limiting values within Appendix 6/14 and 6/15⁴.*

This indicates whether the material is acceptable for use in the earthworks based upon concentrations of contamination recorded within the in-situ materials. Where exceedances are noted, the material may be classified as Class U1B or U2 unacceptable material. However the risk to receptors from soil and leachate contaminants may be reduced following stabilisation of materials, subject to further testing to confirm;

- *Waste characterisation – compared against criteria outlined within WM3⁵.*

This indicates, for material that may be designated for direct transfer off-site, whether disposal at an inert, non-hazardous or hazardous waste facility would be required.

In order to assess the likely requirements for re-use and/or disposal off-site, CGL has reviewed the Morgan Tucker drawings (A720-E05-IW-MTU-EW-DR-0610 and A720-E05-IW-MTU-EW-DR-0600), which detail the proposed earthworks cut and fill volumes. Based upon a net cut of approximately 76,000m³ and a net fill of 80,400m³ across the development area, a deficit of approximately 4,300m³ of fill exists. The drawings indicate smaller zones of material balance across the site, however as these zones still generally cover larger areas than that sampled within this investigation, the volumes stated cannot be applied to these results.

⁴ Highways Agency Manual of Contract Documents for Highway Works (March 1998 with all current amendments to November 2009), *Volume 1: Specification for Highway Works*.

⁵ WM3 (2015). *Waste Classification: Guidance on the classification and assessment of waste* (1st Edition 2015).

4.1 Earthworks classification and acceptability testing

4.1.1 Sulfates

Testing was undertaken to TRL 477⁶ methods 1, 2 & 4 to determine the Total Potential Sulfate (TPS) within the 29 samples taken from the three different areas of investigation. The mean value of the two highest results has been reported in accordance with MCHW 1. The results are presented below in Table 1.

Table 1 - Summary of sulfate test results

Location	Total Potential Sulfate (%SO ₄) ¹	Acid Soluble Sulfate (%SO ₄) ²
Area 3 - Lagoon Bund	11.702	10.0
Area 2 - Central Embankment	0.149	0.12
Area 1 - River Crane	1.614	0.29
¹ Average of two highest recorded values		
² Maximum value across all samples		

The results indicate that Total Potential Sulfates (TPS) exceed the recommended limiting value of 0.25%⁷ for suitability for lime improvement and stabilisation in the Lagoon Bund and along the course of the River Crane. The tests from these two areas also exceed the upper boundary limit of 1.00%, which could result in a high risk of expansion of lime treated material. However, the average of the samples from along the course of the River Crane generally fall above the recommended limiting value of 0.25%, but are less than the upper boundary limit of 1.00%. The samples tested from within the proposed route of the western access road indicate that the material from this area are suitable for lime improvement and stabilisation treatment.

The risk of expansion will be related to the percentage addition of lime required to achieved the necessary properties and has been further assessed by undertaking trials on lime treated material.

4.1.2 Atterberg Limit & Moisture Content

A total of 12 samples were sent for Atterberg limits testing to establish the plasticity index and volume change potential of the underlying cohesive soils. Three samples from the central embankment (Area 2) were tested, as well as one sample from the Lagoon Bund (Area 3) and eight samples from along the course of the River Crane (Area 1). The testing was carried out in accordance with BS 1377 (1990), Part 2, Clause 5.3. Full laboratory

⁶ TRL Limited (2001). *Sulfate specification for structural backfills*. TRL Report TRL447.

⁷ Britpave (2005). *Stabilisation of sulfate-bearing soils- Technical Guidelines*. Britpave: Camberley.

testing data is provided in Appendix B, and a summary of the Plastic and Liquid Limits for the site won materials is set out below in Table 2.

Table 2 - Summary of Atterberg Limit test results

Atterberg Limits							
Sample Location	No. of tests	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	% material <425µm	I _p ²	Volume change potential
Area 3 - Lagoon Bund	1	65	89	47	99	42	High
Area 2 - Central Embankment	3	26 – 44	58 – 68	23 – 32	68 – 99	35 – 36	Medium
Area 1 - River Crane	8	18 – 32	45 – 83	20 – 29	70 – 100	25 – 55	Medium to High

The majority of the samples taken from the site have a natural moisture content of over 25%. This is likely to be above the upper acceptability limit for the material, based upon a limit of Optimum Moisture Content + 2%. However, drying or lime modification may be employed to reduce the natural moisture content to within acceptable limits, further to an assessment of suitability for lime improvement.

The materials in the Lagoon Bund and within the central embankment area classify as a clay of intermediate plasticity. The material from the course of the River Crane generally classifies as a material of low to intermediate plasticity, with three cases of high plasticity materials in TP6C at 1.85mbgl, TP11C at 1.5mbgl and TP14C at 1.2mbgl respectively.

4.1.3 Particle Size Distribution testing

A total of 25 samples from the three areas were tested for Particle Size Distribution (PSD) testing in accordance BS 1377:1990 Part 2:9.2. Full geotechnical laboratory testing data is provided in Appendix B. A summary of the testing results is presented in Table 3.

Table 3 - Summary of Particle Size Distribution testing results

Atterberg Limits				
Sample Location	No. of tests	Class 1B	Class 2A/B	Class 2C
Area 3 - Lagoon Bund	4	0	1	3
			TP27C – 2.5mbgl	TP24C – 1.0mbgl TP25C – 1.5mbgl TP27C – 0.5mbgl
Area 2 - Central Embankment	4	0	3	1
			TP20C – 1.4mbgl TP21C – 0.7mbgl TP23C – 0.4mbgl	TP22C – 0.4mbgl

Sample Location	No. of tests	Class 1B	Class 2A/B	Class 2C
Area 1 - River Crane	17	6	6	5
		TP3C – 1.7mbgl TP8C – 0.8mbgl TP12C – 0.5mbgl TP13C – 1.4mbgl TP30C – 1.0mbgl TP32C – 2.0mbgl	TP3C – 1.0mbgl TP4C – 0.4mbgl TP5C – 0.5mbgl TP6C – 0.5mbgl TP8C – 0.45mbgl TP16C – 1.5mbgl	TP1C – 1.0mbgl TP4C – 2.0mbgl TP6C – 0.4mbgl TP13C – 0.3mbgl TP32C – 1.0mbgl

Lagoon Bund

The results from the Lagoon Bund indicates that three the four samples tested all conform to Class 2C (stoney cohesive) material, with one sample conforming to Class 2A/B (TP27C at 2.5mbgl).

Central Embankment

The results from the proposed route of the western access road indicate that three of the four samples tested (TP20C at 1.4mbgl, TP21C at 0.7mbgl and TP23C 0.4mbgl) conform to Class 2A/B (dry/wet cohesive) material, while one sample (TP22C at 0.4mbgl) conforms to Class 2C (stoney cohesive) material.

River Crane

The results from the course of the River Crane indicate that six of the samples conform to Class 2A/B (dry/wet cohesive) material, five of the samples conform to Class 2C (stoney cohesive) material and six of the samples conform to Class 1B (uniformly graded granular) material.

4.1.4 Maximum dry density/moisture content relationship

A total of ten samples from the three areas were sampled and tested to determine the optimum moisture contents and maximum dry density of the soils in accordance with BS 1377 (1990), Part 4, Clause 3.3 using a 2.5kg proctor mould. Full laboratory testing data is provided in Appendix B, and a summary of the maximum dry densities for the site won materials is set out below in Table 4.

Table 4 - Summary of compaction test results (2.5kg hammer method)

Material	Number of tests	Maximum dry density for method compaction (Mg/m ³)	Optimum moisture content range (%)
Area 3 - Lagoon Bund	2	1.15 – 1.48	24 – 41
Area 2 – Central Embankment	2	1.61 – 1.67	20 – 22
Area 1 - River Crane	6	1.52 – 1.97	11 – 27

In Area 1, the material shows a wide range with regards to both the Moisture Content (MC) and Optimum Moisture Content (OMC), which suggest that the material may be close to OMC. However, careful site controls would be required to place this material in accordance with the specification. These controls would include segregation of similar materials and immediate placement to avoid wetting.

In Area 2 the material showed a wide variability for MC but a narrow range for OMC, which would therefore require preparation of the material on-site prior to re-use. An example of such preparation would be; mixing with coarse material (sand) to modify the MC, or mixing and drying on site. Careful controls would be required to ensure that the resulting material fell within the OMC range.

In Area 3 the Moisture Content is consistently high and wet of OMC, which would require mixing or stabilisation in order to be re-used.

4.1.5 Moisture Condition Value (MCV) and MCV/mc relationship

Six samples from across the three areas were tested to determine a single point Moisture Condition Value in accordance with BS 1377 (1990), Part 4. Full laboratory testing data is provided in Appendix B, and a summary of the undrained shear strength for the tested materials is set out below in Table 5.

Table 5 - Summary of MCV test results

Material	Material Class	Number of tests	Single point Moisture Condition Value (MCV)	Typical MCV Range
Area 3 - Lagoon Bund	2A	1	6.5	8 – 14
Area 2 – Central Embankment	2A	2	9.8 – 10.1	8 – 14
	2C	1	10.1	8 – 16
Area 1 - River Crane	1B	4	11.8 – 15.1	10 – 18
	2A	3	8 – 12.5	8 – 14
	2C	1	11.2	8 – 16

The Moisture Condition Value can provide a simple controlling value for a given soil to obtain near-full compaction. The results have been separated within the site areas into

further groups based upon their grading classification. In Area 1 the results show that the 3nr. samples graded as a Class 2A material have Moisture Condition Values within a range expected for that class. The single Class 2C sample also sits within the expected range. The 4nr. samples considered to be Class 1B material show higher MCV, which would be expected for this class. However PSD results are not available for the exact samples with MCV results, but rather grading has been extrapolated based on proximity to other Class 1B samples. Relationships of MCV/MC for those extrapolated Class 1B materials indicate that for a MCV range of 10 – 18, moisture content would need to be limited to between 15% to 30%, which is a broad range. It may however be preferable to control granular materials using MC rather than MCV, based upon +/- 2% of OMC. This has been shown in Section 4.1.4 to be achievable, providing good site controls are adopted to segregate similar materials.

In Area 2 the results show that the Class 2A and Class 2C samples are within the ranges expected. The MCV results for Area 1 and Area 2 samples indicate that the materials would be suitable for use, providing that strict site controls were employed to separate the classes of material encountered within each area. Additionally, as the MCV results are towards the lower end of the range, some may be considered to be wet of OMC and therefore would require drying on site.

In Area 3 the results show that the Class 2A sample is below the range expected, which correlates with the high Moisture Content values noted for samples within this area. This further shows that the material would require stabilisation to bring it within acceptable limits prior to placement and compaction.

4.1.6 Undrained Shear Strength

A total of six samples from the site were tested to determine the undrained shear strength in accordance with BS 1377 (1990), Part 7. Full laboratory testing data is provided in Appendix B, and a summary of the undrained shear strength for the tested materials is set out below in Table 6.

Table 6 - Summary of unconsolidated undrained triaxial test results

Material	Number of tests	Undrained Shear Strength (kN/m ²)
<i>Area 3 - Lagoon Bund</i>	1	31
<i>Area 2 – Central Embankment</i>	3	47 – 57
<i>Area 1 - River Crane</i>	2	47 – 77

The results indicate that each of the samples tested within Area 1 and Area 2 exceed the value of undrained shear strength that has been assumed within the PGDR¹ (40kN/m² for the cohesive River Terrace Deposits). One sample (TP27C at 2.5mbgl) relating to the Lagoon Bund material recorded an undrained shear strength of 31kN/m², which is below the minimum design value, therefore material from this area will require stabilisation to improve its strength, so that it might become reusable on other areas of the site.

4.1.7 Lime and cement stabilisation testing

As part of this summary report CGL has reviewed testing undertaken by Beach Ground Engineering, acting on behalf of FM Conway, to determine the optimum lime concentrations for material improvement. A total of eighteen samples were taken from across the Lagoon Bund and were submitted to M & H Testing Limited for treatment testing. The testing comprised mixing the samples with different concentrations of lime (CaO) and Ground Granulated Blast Furnace Slag (GGBS) to attempt to increase the quality of the site won soils for reuse across other parts of the site.

The initial eighteen tests were unable to provide sufficient quality results, as discussed below, when mixed with combinations of lime and GGBS in quantities of up to 5%. Only three of the tests were able to obtain a California Bearing Ratio (CBR) of above 2.5% (the minimum specified value for the proposed embankments as outlined in the PGDR¹). The highest recorded bearing capacity after treatment was recorded as a CBR value of 2.9%, with two values of 2.6% recorded. The first value of 2.6% was recorded using 1% lime and 2% GGBS, while the second was recorded without using any treatment. The CBR value of 2.9% was recorded using 1.5% lime and 3% GGBS in the treatment. These are considered to be poor results for a material treated with these proportions of binder.

M & H Testing Ltd reported that the main suspected reason for the generally high failure across the samples was due to the high natural moisture content and organic matter values of the underlying soils. The results indicate that these typical concentrations of lime and GGBS are insufficient in improving material with these properties. Additional testing on a composite sample that comprises 60% materials from the Lagoon Bund and 40% materials from within the embankment alignment was proposed. These samples were mixed with 3% lime and 5% GGBS and were cured for three days, and produced a CBR value of 14% when tested. However, it is considered that this approach is not the most economical approach in terms of cost or availability of higher quality site won soils to mix with the Lagoon Bund soils. Further testing is currently being undertaken to determine if

more efficient soil mixtures produced the required strength characteristics. All the results from the lime stabilisation testing (to date) are presented in Appendix C.

4.2 Contamination assessment - Risks to human health

A total of 15 chemical testing results from the topsoil/Made Ground horizons have been compared against the limiting values within Appendix 6/15 of the PGDR¹, which are based on Generic Assessment Criteria (GAC) for a “commercial” land-use based on Contaminated Land Exposure Assessment (CLEA) Soil Guideline Values (SGVs), published Category 4 Screening Levels and values derived in-house by CGL using the CLEA software. The values used are considered to be conservative, based on the proposed land use (an access roadway) and the data screen, therefore, provides a conservative assessment. A summary of the contamination assessment is outlined below, while the full laboratory testing results and assessment tables are presented in Appendix D.

Based on the initial screen, there were no exceedances recorded of the GAC for the contaminants analysed. Asbestos was positively identified within the Made Ground strata in three of the trial pit locations, TP23C at 0.2mbgl, TP25C at 1.0mbgl and TP33C at 0.3mbgl (grid references A5, B6 and K4 respectively). Each of the asbestos identifications related to fugitive Chrysotile fibres. Additionally, two samples recorded abnormal pH levels, TP29C at 1.3mbgl (pH of 2.7) and TP16C at 1.5mbgl (pH of 10.2), which will need to be considered carefully in terms of potential suitability for re-use and/or stabilisation. The sample taken from TP29C at 1.3mbgl relates to a layer of spent oxide (Blue Billy), which is the likely reason for the high pH level), and will likely require further treatment prior to reuse on other areas of the site.

From review of the spatial distribution of the contamination, the samples with the most elevated concentrations (though not exceeding the ‘commercial’ GAC criteria) were identified within the Lagoon Bund area (grid refs B5 to B7 and C5 to C7), with one sample from the topsoil horizon of the Central Embankment (TP23C at 0.2mbgl, grid reference A5) also having elevated concentrations of contaminants.

4.3 Contamination assessment – Risks to controlled waters

The leachate results have been compared against the limiting values within Appendix 6/14 of the PGDR¹, which are based on the Freshwater Environmental Quality Standards (EQS) and Drinking Water Values (DWV). Given the primary receptor of concern is the Yeading Brook, located directly west of the Lagoon Bund, the preferential screening values are the

EQS values. Of the eight samples tested, one sample was tested from the central alignment of the River Crane, three samples were tested from the central embankment close to the Lagoon Bund, and the remaining four samples were tested from the Lagoon Bund. All the samples were tested from the topsoil/Made Ground horizons. The testing fell within the grid references F4 for the sample from the River Crane, A4, A5 and B5 for the central embankment samples and B6, C6 and C7 for the Lagoon Bund samples.

Exceedances of the GAC were recorded within each of the eight samples tested. Three ecotoxic metals, copper, nickel and zinc were assessed against their bioavailable concentrations, as opposed to total concentrations present within the leachate. A summary of the contamination assessment is outlined below, while the full laboratory testing results and assessment tables are presented in Appendix D.

The exceedances of GAC from the four samples taken within the Lagoon Tip included sulfates, total phenols, metals, PAHs (TP28C at 1.8mbgl only) and pH (TP29C at 1.3mbgl only). A total of fourteen different contaminants exceeded the freshwater EQS criteria (considered to be the more applicable given the potential receptor of the Yeading Brook), while six metals / metalloids (arsenic, cadmium, chromium III, lead, nickel and zinc) and one PAH (anthracene) also failed against the DWV criteria. Generally, the highest concentrations were recorded within the leachate sample from TP29C, located within a layer of spent oxide material within the Lagoon Bund (grid reference C6).

The exceedances within the three samples taken from the proposed route of the western access road included sulfate, total phenols, and metals. A total of eight different contaminants exceeded the freshwater EQS criteria, while two metals (cadmium and lead) failed both the EQS and DWS criteria. Of these locations, TP20C (located the furthest from the Lagoon Tip) had the lowest overall concentrations of contamination (lead and total phenols), while TP23C, located close to the boundary of the Lagoon Tip was identified as having the most contaminated leachate.

From the single sample taken from the course of the River Crane (TP9C at 0.3mbgl), a single contaminant, lead failed against both the EQS and DWS criteria.

4.4 Waste characterisation

Waste characterisation of the sampled material was undertaken in accordance with the waste classification guidance document, WM3⁵ to determine its characterisation and

hazardous properties. The full laboratory results of the waste acceptance criteria (WAC) testing are presented in Appendix E.

It should be noted that in May/June 2012, HMR&C issued Briefs 15/12 and 18/12 clarifying how construction spoil and excess soils will be assessed for landfill tax purposes. Detailed accurate descriptions of waste are required for all wastes to support the landfill tax assessment. Uncontaminated naturally occurring soils will remain inert by default and eligible for the lower rate of landfill tax. Similarly, 'reworked soils' and demolition 'stone' comprising ONLY materials listed in the Schedule of the Landfill Tax (Qualifying Material) Order 2011 (SI 2011/1017) will also be eligible for the lower rate of landfill tax. However, Made Ground containing soil and foreign objects such as timber, plastic, rubber, metal, paper, plasterboard, asbestos etc., regardless of the results of chemical analysis for waste classification purposes, will be eligible for the standard (higher) rate of landfill tax. Therefore, to maximise eligibility for lower rate landfill tax on waste construction spoil/reworked ground, careful waste segregation and controls are necessary, and Made Ground recorded onsite will need sorting to remove foreign objects.

Two samples from the Lagoon Bund were tested, and the results indicate that the underlying soils are not suitable for disposal at a landfill that accepts hazardous waste, based on the loss on ignition exceeding the hazardous criteria of 10%. Therefore, the soils would require pre-treatment either on site or off-site to pass this criteria prior to disposal at a landfill that accepts hazardous waste. It is anticipated that the high organic contents causing the loss on ignition exceedance relate to the dredged material within the Lagoon Bund. Additionally, zinc and total organic carbon (TOC) exceeded the stable non-reactive waste criteria. Eight other contaminants, including mineral oil, antimony, cadmium, chromium (total), copper, nickel, sulfate and total dissolved solids (TDS) exceeded the inert waste criteria.

One sample from the Area 2 – central embankment was tested, and the results indicate that the underlying soils are also not suitable for disposal at a landfill that accepts hazardous waste based on the loss on ignition exceeding the hazardous criteria of 10%, unless the soils undergo pre-treatment to reduce its organic content. Four other contaminants, including; TOC, mineral oil, antimony and total PAH exceeded the inert landfill waste criteria.

The four WAC tests from the Western Embankment and Flood Alleviation Area indicate that the soils are suitable for disposal to a landfill that accepts inert landfill waste. As such soils from around these areas should be suitable for reuse across other areas of the site.

A summary of the WAC testing indicates that the soils from along the course of the River Crane are generally considered to be suitable for landfills that accept inert waste, and given the generally low results from the testing, may be suitable for reuse across other areas of the site. The results of the soils from the Lagoon Tip indicate that the materials are suitable for disposal at a landfill that accepts hazardous waste, and is therefore not considered suitable for reuse across other areas of the site without undertaking treatment first.

The soils tested from the eastern area of the proposed route of the western access road indicate that the materials are not suitable for disposal at a landfill that accepts hazardous waste based on the results of the loss of ignition testing (14%), and that pre-treatment to lower the organic content of these samples will be required. It is recommended that further WAC testing is undertaken along the Central Embankment area to confirm whether the organic content (i.e. loss on ignition %) is characteristic of the soils near the Lagoon Bund, or if the organic content is high across the proposed route as a whole. Additionally, early discussions with potential landfill operators may allow the acceptance of this material to a stable non-reactive waste accepting landfill with a hazardous waste cell, as the only exceedance was loss of ignition by a 4% threshold.

4.5 Groundwater and formation considerations

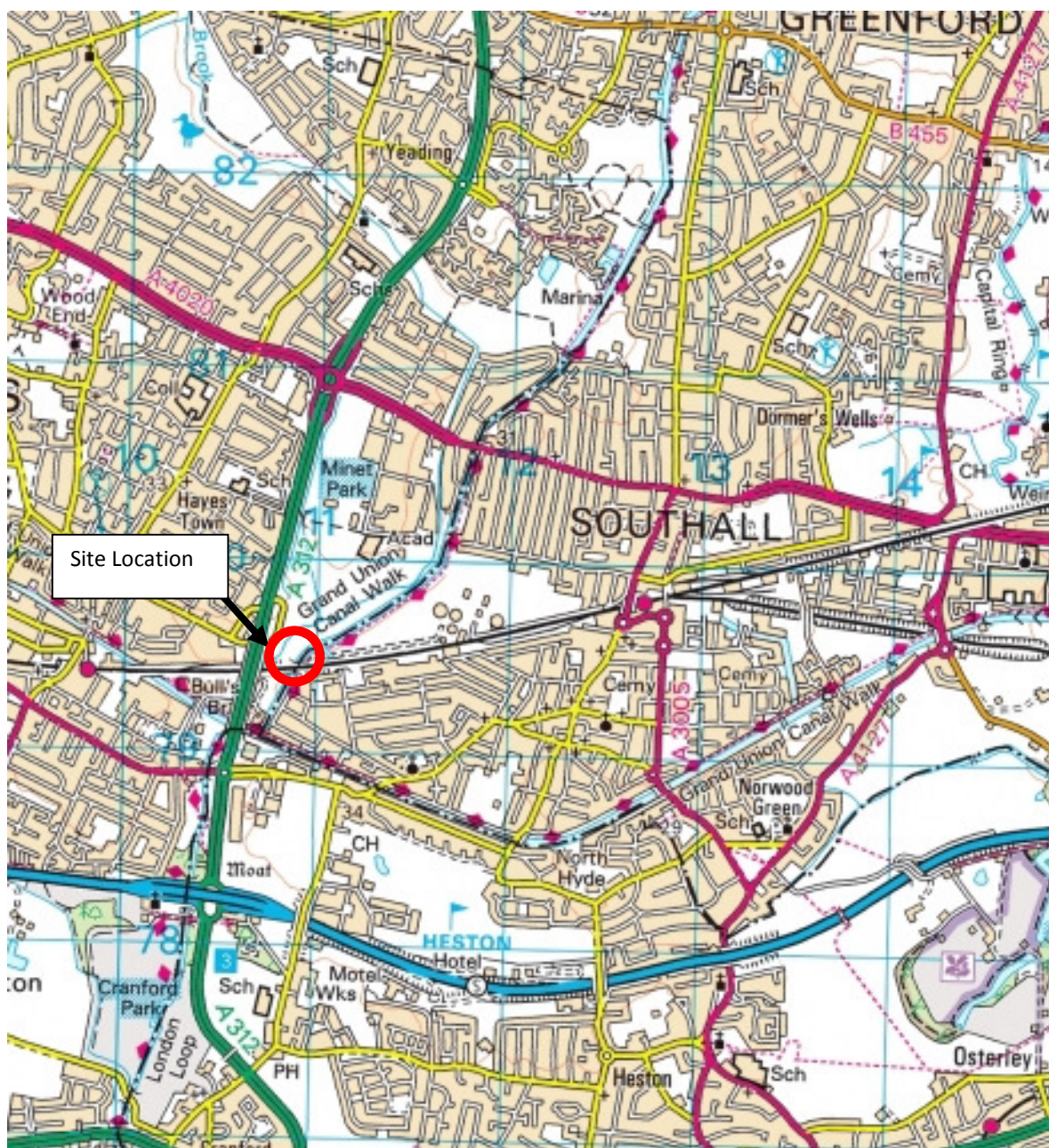
Groundwater was not identified within any of the 33 trial pits undertaken as part of this phase of investigation. The deepest trial pit excavation was to a depth of 3.6mbgl, and groundwater was not identified. The trial pits were deliberately terminated at shallow depths in a competent stratum to avoid breaching the groundwater table and risking potential cross contamination on the site.

Based on observations made during the site works that care will have to be given during strip and construction works to protect the formation level from softening and weakening the cohesive upper formation strata during site works and trafficking.

5. SUMMARY

This report provides the results of the final round of trial pitting and subsequent laboratory testing undertaken as part of the advanced works phase of the Western Access scheme. The results confirm the results of the previous investigations, that show material from the Lagoon Bund area to have large variability in its geotechnical properties and as a result may benefit from treatment with lime to stabilise the material. Additionally, natural material from other areas of the site have now been tested, which show more consistency in their geotechnical properties. Lime trials have been undertaken with the results indicating that stabilisation of the Lagoon Bund (Area 3) material alone, does not produce acceptable results. Further testing is ongoing to determine an efficient blend of site won materials from across the site, for subsequent stabilisation to achieve the required strength characteristics.

FIGURES



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Client	Project	Job No
CSP Limited	Southall Advanced Works	CGN/3732E
	Title	
	Site location plan	Figure 1