

APPENDIX VII

GEOTECHNICAL ANALYSIS RESULTS

**Kate Duggan**

Omnia Environmental Consulting
Office 25 Basepoint
Harts Farm Way
Portsmouth
PO9 1HS

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

e: kate.duggan@omnia-consulting.co.uk

t: 01923 225404
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e: reception@i2analytical.com

Analytical Report Number : 16-23398

Project / Site name:	Wessex Yard, Havant	Samples received on:	21/07/2016
Your job number:	A10708	Samples instructed on:	22/07/2016
Your order number:	GEO-2196	Analysis completed by:	05/08/2016
Report Issue Number:	1	Report issued on:	05/08/2016
Samples Analysed:	6 soil samples		

Signed:

Dr Claire Stone
Quality Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Dr Irma Doyle
Senior Account 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: 16-23398

Project / Site name: Wessex Yard, Havant

Your Order No: GEO-2196

Lab Sample Number				605527	605528	605529	605530	605531
Sample Reference				BH101 D5	BH102a D9	BH101 U15	BH101 D21	BH103 D24
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.00	6.00	8.00-8.45	11.10	14.00
Date Sampled				15/07/2016	13/07/2016	14/07/2016	15/07/2016	14/07/2016
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Geotechnical

Geotechnical Testing - Various		N/A	NONE	See attached	See attached	See attached	See attached	See attached
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Analytical Report Number: 16-23398

Project / Site name: Wessex Yard, Havant

Your Order No: GEO-2196

Lab Sample Number				605532				
Sample Reference				BH101 D17				
Sample Number				None Supplied				
Depth (m)				9.00				
Date Sampled				15/07/2016				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Geotechnical

Geotechnical Testing - Various		N/A	NONE	See attached				
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Analytical Report Number : 16-23398

Project / Site name: Wessex Yard, Havant

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
Geotechnical Testing in Soil	See attached geotechnical report	See attached geotechnical report		W	NONE

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.



Analytical Report Number : 16-23398

Project / Site name: Wessex Yard, Havant

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
Geotechnical Testing in Soil	See attached geotechnical report	See attached geotechnical report		W	NONE

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.



TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: OMNIA Environmental Consulting
Client Address: Office 25 Basepoint
Harts Farm Way
Portsmouth PO9 1HS
Contact: Kate Duggan
Site Name: Wessex Yard, Havant
Site Address: Not Given

Client Reference: A10708
Job Number: 16-23398
Date Sampled: 15/07/2016
Date Received: 22/07/2016
Date Tested: 02/08/2016
Sampled By: GL

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
605527	Not Given	BH101 D5	3	Not Given	B	Yellowish brown clayey silty sandy GRAVEL	14
605528	Not Given	BH102a D9	6	Not Given	B	Greyish brown CLAY with thin laminae of yellowish brown sand	26
605530	Not Given	BH101 D21	11.1	Not Given	B	Grey sandy GRAVEL	7.1
605531	Not Given	BH103 D24	14	Not Given	B	Greyish brown clayey silty SAND	23
605532	Not Given	BH101 D17	9	Not Given	B	Greyish brown CLAY	27

Comments:

Approved:

Mirosława Pytlík
PL Head of Geotechnical section
Date Reported: 05/08/2016

Signed:

Terry Stafford
Geotechnical Manager

for and on behalf of i2 Analytical Ltd

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This report may not be reproduced other than in full without the prior written approval of the issuing laboratory.
The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland."



TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

Client: OMNIA Environmental Consulting
Client Address: Office 25 Basepoint
Harts Farm Way
Portsmouth PO9 1HS
Contact: Kate Duggan
Site Name: Wessex Yard, Havant
Site Address: Not Given

Client Reference: A10708
Job Number: 16-23398
Date Sampled: 13/07/2016
Date Received: 22/07/2016
Date Tested: 02/08/2016
Sampled By: Not Given

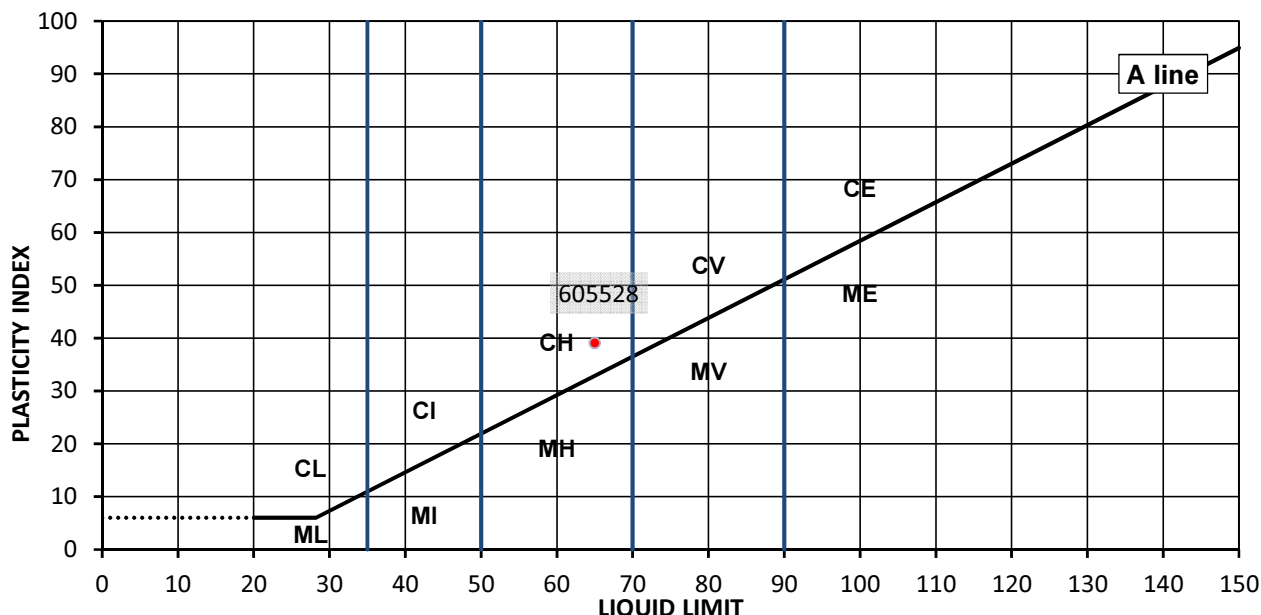
TEST RESULTS

Laboratory Reference: 605528
Sample Reference: Not Given

Description: Greyish brown CLAY with thin laminae of yellowish brown sand
Location: BH102a D9
Sample Preparation: Tested in natural condition

Sample Type: B
Depth Top [m]: 6
Depth Base [m]: Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	65	26	39	100



Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical section
Date Reported: 05/08/2016

Signed:

Terry Stafford
Geotechnical Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

4041

Client: OMNIA Environmental Consulting
Client Address: Office 25 Basepoint
Harts Farm Way
Portsmouth PO9 1HS

Client Reference: A10708
Job Number: 16-23398
Date Sampled: 15/07/2016
Date Received: 22/07/2016
Date Tested: 02/08/2016
Sampled By: Not Given

Contact: Kate Duggan
Site Name: Wessex Yard, Havant
Site Address: Not Given

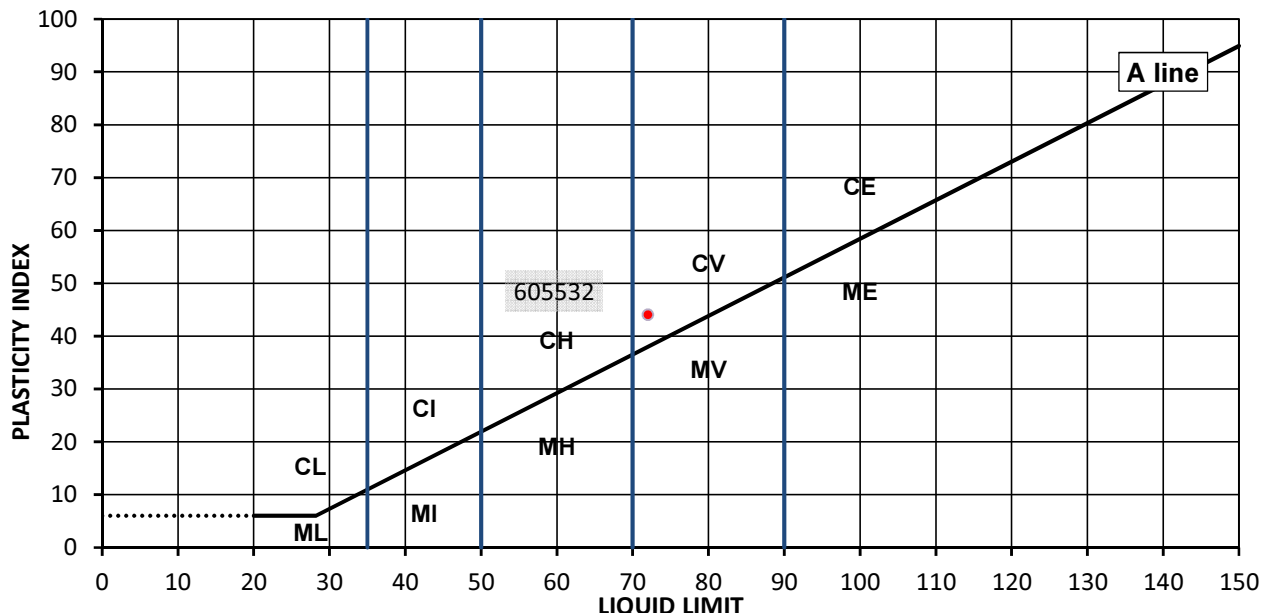
TEST RESULTS

Laboratory Reference: 605532
Sample Reference: Not Given

Description: Greyish brown CLAY
Location: BH101 D17
Sample Preparation: Tested in natural condition

Sample Type: B
Depth Top [m]: 9
Depth Base [m]: Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
27	72	28	44	100



Legend, based on BS 5930:1999 +A2: 2010 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
Organic	O	append to classification for organic material (eg CHO)

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical section
Date Reported: 05/08/2016

Signed:

Terry Stafford
Geotechnical Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



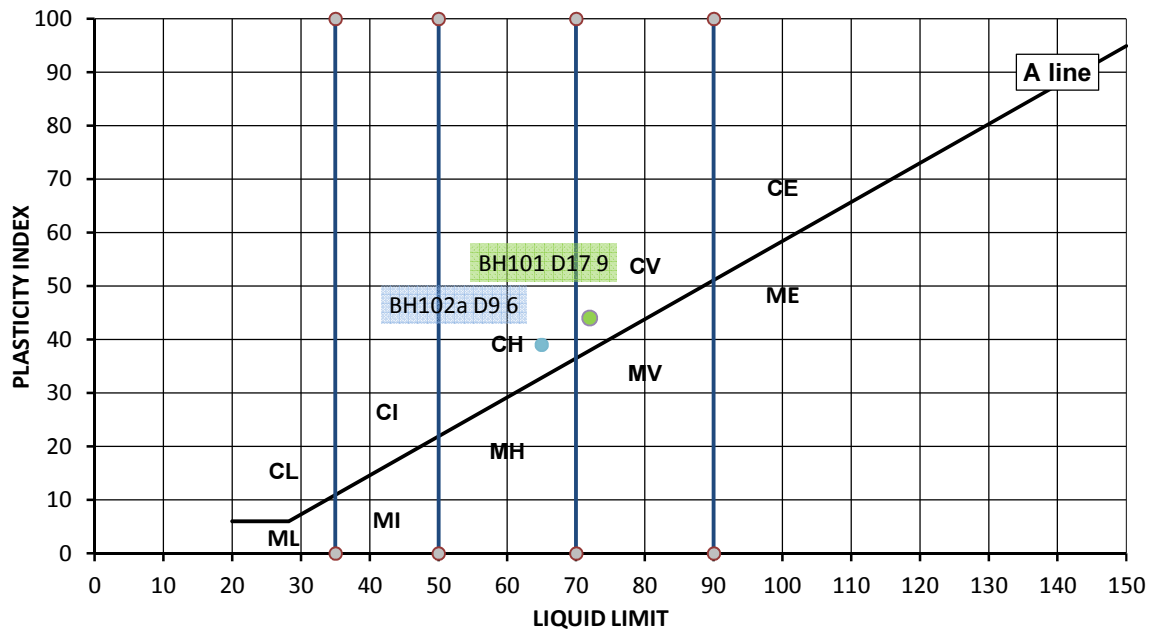
Tested in Accordance with BS1377-2: 1990: Clauses 4.4 & 5: One Point Method

Client: OMNIA Environmental Consulting
Client Address: Office 25 Basepoint
Harts Farm Way
Portsmouth PO9 1HS
Contact: Kate Duggan
Site Name: Wessex Yard, Havant
Site Address: Not Given

Client Reference: A10708
Job Number: 16-23398
Date Sampled: 15/07/2016
Date Received: 22/07/2016
Date Tested: 02/08/2016
Sampled By: Not Given

TEST RESULTS

Location	Depth [m]	As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
BH101 D17	9	27	72	28	44	100
BH102a D9	6	26	65	26	39	100



Legend, based on BS 5930:1999 +A2: 2010 Code of practice for site investigations

		Plasticity	Liquid Limit
C	Clay	L Low	below 35
M	Silt	I Medium	35 to 50
		H High	50 to 70
		V Very high	70 to 90
		E Extremely high	exceeding 90
Organic		O	append to classification for organic material (eg CHO)

Comments:

Approved: Mirosława Pytlík
PL Head of Geotechnical section

Signed: Terry Stafford
Geotechnical Manager

Date Reported: 05/08/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Determination of Particle Size Distribution**

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Environmental Science

Tested in Accordance with BS1377:Part 2:1990, clause 9.5

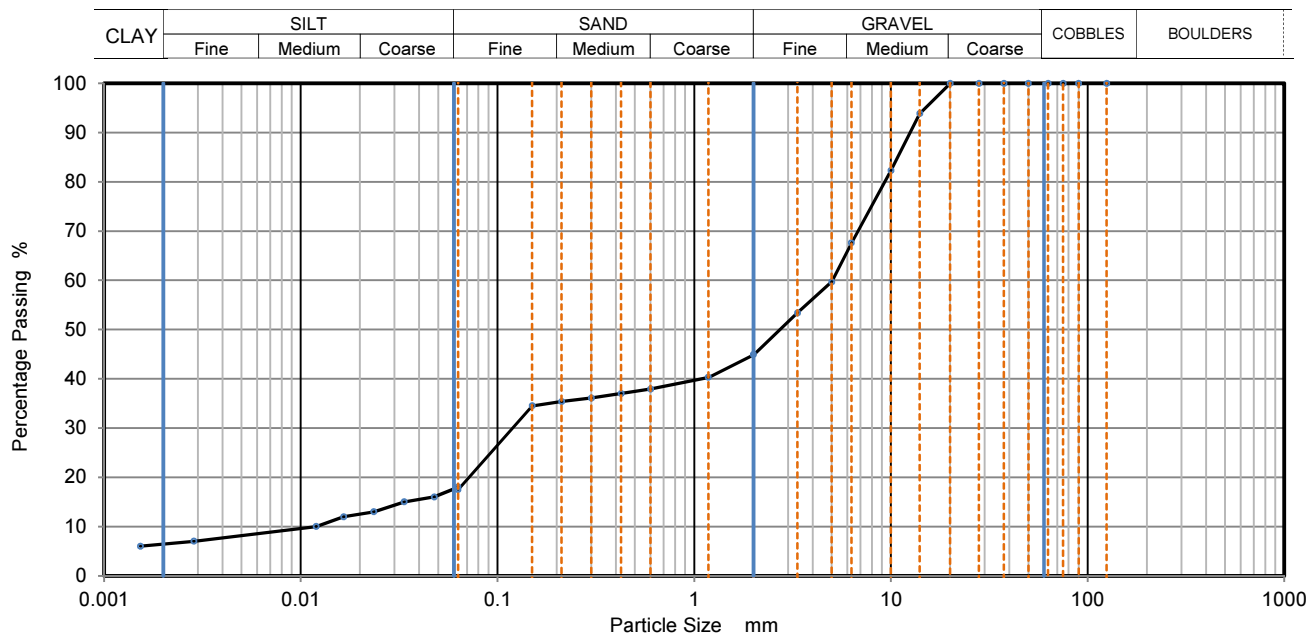
Client: OMNIA Environmental Consulting
Client Address: Office 25 Basepoint
Harts Farm Way
Portsmouth PO9 1HS

Client Reference: A10708
Job Number: 16-23398
Date Sampled: 15/07/2016
Date Received: 22/07/2016
Date Tested: 03/08/2016
Sampled By: GL

Contact: Kate Duggan
Site Name: Wessex Yard, Havant
Site Address: Not Given

TEST RESULTS
Laboratory Reference: 605527
Sample description: Yellowish brown clayey silty sandy GRAVEL
Location: BH101 D5
Supplier: Not Given

Sample Reference: Not Given
Sample Type: B
Depth Top [m]: 3
Depth Base [m]: Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	18
90	100	0.0477	16
75	100	0.0335	15
63	100	0.0235	13
50	100	0.0165	12
37.5	100	0.0120	10
28	100	0.0029	7
20	100	0.0015	6
14	94		
10	82		
6.3	68		
5	60		
3.35	53		
2	45		
1.18	40		
0.6	38	Particle density (assumed) 2.65 Mg/m ³	
0.425	37		
0.3	36		
0.212	35		
0.15	35		
0.063	18		

Dry Mass of sample [g]: 57

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	55.10
Sand	27.30
Silt	11.10
Clay	6.50

Grading Analysis		
D100	mm	20
D60	mm	5.04
D30	mm	0.119
D10	mm	0.0108
Uniformity Coefficient		470
Curvature Coefficient		0.26

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Mirosława Pytlik
PL Head of Geotechnical section
Date Reported: 05/08/2016

Signed:

Terry Stafford
Geotechnical Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Determination of Particle Size Distribution**

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



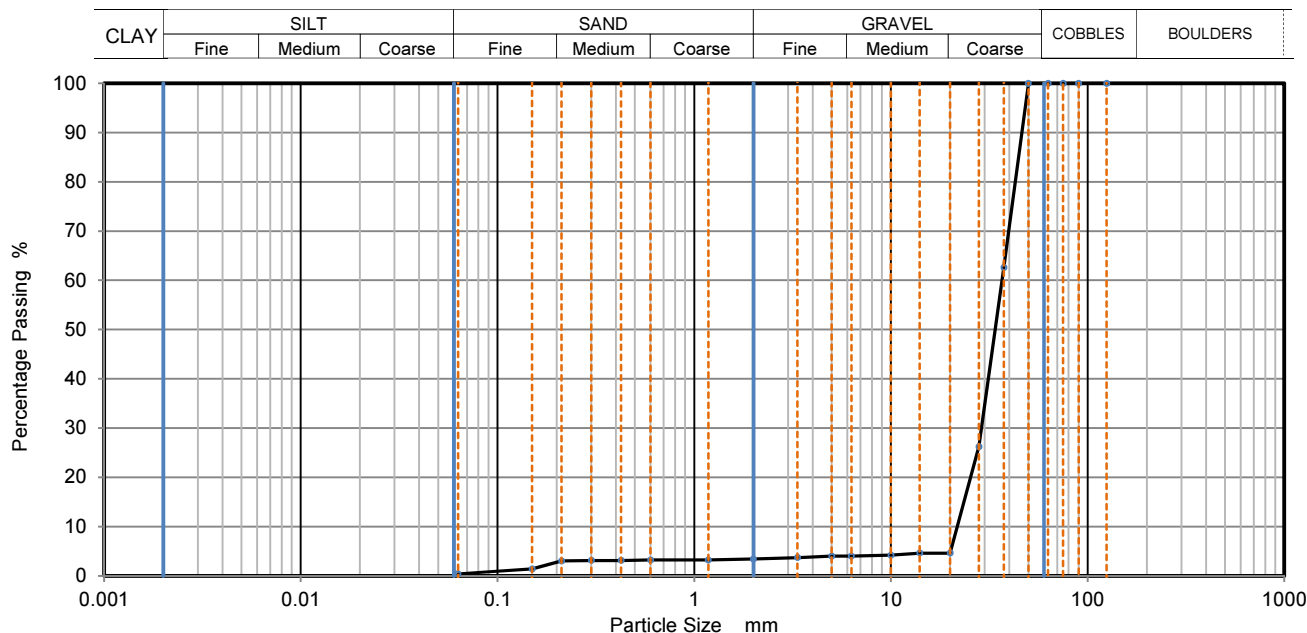
Environmental Science

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client: OMNIA Environmental Consulting
Client Address: Office 25 Basepoint
Harts Farm Way
Portsmouth PO9 1HS
Contact: Kate Duggan
Site Name: Wessex Yard, Havant
Site Address: Not Given

Client Reference: A10708
Job Number: 16-23398
Date Sampled: 15/07/2016
Date Received: 22/07/2016
Date Tested: 03/08/2016
Sampled By: GL

TEST RESULTS
Laboratory Reference: 605530
Sample description: Grey sandy GRAVEL
Location: BH101 D21
Supplier: Not Given
Sample Reference: Not Given
Sample Type: B
Depth Top [m]: 11.1
Depth Base [m]: Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	63		
28	26		
20	5		
14	5		
10	4		
6.3	4		
5	4		
3.35	4		
2	3		
1.18	3		
0.6	3		
0.425	3		
0.3	3		
0.212	3		
0.15	1		
0.063	0		

Dry Mass of sample [g]: 787

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	96.60
Sand	3.00
Fines <0.063mm	0.40

Grading Analysis	
D100	mm 50
D60	mm 36.7
D30	mm 28.9
D10	mm 21.7
Uniformity Coefficient	1.7
Curvature Coefficient	1

Remarks

Preparation and testing in accordance with BS1377 unless noted below
Insufficient material supplied to be representative in accordance with BS1377 requirements

Approved:

Mirosława Pytlik
PL Head of Geotechnical section
Date Reported: 05/08/2016

Signed:

Terry Stafford
Geotechnical Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Determination of Particle Size Distribution**

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



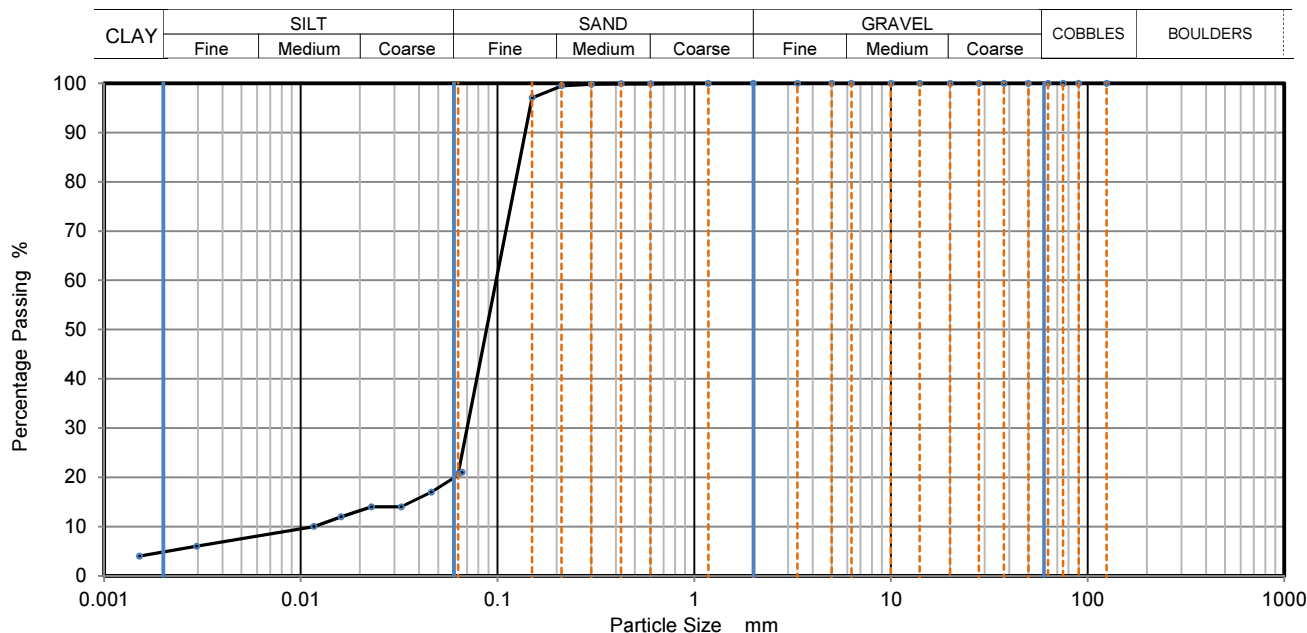
Environmental Science

Tested in Accordance with BS1377:Part 2:1990, clause 9.5

Client: OMNIA Environmental Consulting
Client Address: Office 25 Basepoint
Harts Farm Way
Portsmouth PO9 1HS
Contact: Kate Duggan
Site Name: Wessex Yard, Havant
Site Address: Not Given

Client Reference: A10708
Job Number: 16-23398
Date Sampled: 14/07/2016
Date Received: 22/07/2016
Date Tested: 03/08/2016
Sampled By: GL

TEST RESULTS Laboratory Reference: 605531 Sample Reference: Not Given
Sample description: Greyish brown clayey silty SAND Sample Type: B
Location: BH103 D24 Depth Top [m]: 14
Supplier: Not Given Depth Base [m]: Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0662	21
90	100	0.0461	17
75	100	0.0324	14
63	100	0.0229	14
50	100	0.0161	12
37.5	100	0.0116	10
28	100	0.0030	6
20	100	0.0015	4
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density (assumed) 2.65 Mg/m ³	
0.425	100		
0.3	100		
0.212	100		
0.15	97		
0.063	21		

Dry Mass of sample [g]: 49

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	79.30
Silt	15.70
Clay	5.00

Grading Analysis		
D100	mm	1.18
D60	mm	0.101
D30	mm	0.0731
D10	mm	0.0104
Uniformity Coefficient		9.7
Curvature Coefficient		5.1

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Mirosława Pytlik
PL Head of Geotechnical section
Date Reported: 05/08/2016

Signed:

Terry Stafford
Geotechnical Manager

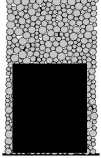
for and on behalf of i2 Analytical Ltd

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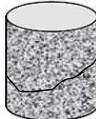
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	8.00 - 8.45		
	Description	Greyish brown CLAY		
	Type	U		
	Initial Sample Length	L ₀	(mm)	201.7
	Initial Sample Diameter	D ₀	(mm)	96.9
	Initial Sample Weight	W ₀	(gr)	3007.4
	Bulk Density	ρ ₀	(Mg/m ³)	2.02
	Particle Density	ρ _s	(Mg/m ³)	2.65

Initial Conditions				
Initial Cell Pressure	σ ₃	(kPa)	160	
Strain Rate	m _s	(mm/min)	4.00000	
Membrane Thickness	m _b	(mm)	0.29	
Displacement Input	L _{IP}	(mm)	CH 2	
Load Input	N _{IP}	(N)	CH 1	
Initial Moisture	ω _i %	(%)	28	
Initial Dry Density	ρ _{d0}	(Mg/m ³)	1.58	
Initial Voids Ratio	e ₀	.	0.68	
Initial Degree of Saturation	S _o	(%)	100	

Final Conditions			
Max Deviator Stress	$(\sigma_1 - \sigma_3)_f$ (kPa)	218	
Membrane Correction	m_c (kPa)	0.899	
Strain At Max Stress	ϵ_f (%)	11.18	
Shear Strength	c_u (kPa)	109	
Final Moisture	ω_f (%)	28	
Final Dry Density	ρ_{df} (Mg/m ³)	1.58	
Final Voids Ratio	e_f	0.68	
Final Degree of Saturation	S_f (%)	100.0	
Notes			
Triaxial at over burden			Failure Sketch (surface inclination)

	Test Method	BS1377-7 : 1900 Clause 8	Test Name	605529
	Database:	.\SQLEXPRESS \ 6171-I2 Analytical	Test Date	05/08/2016
	Site Reference	Wessex Yard, HaVant	Borehole	BH101
	Jobfile	16-23398	Sample	605529
	Client	OMNIA Environmental Consulting	Depth	8.00 - 8.45
Operator bielatowicz			Checked pytlík	Approved pytlík

i2 Analytical Limited, 7 Woodshots Meadow, Croxley Green Business Park, Herts WD18 8YS
i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland



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Kate Duggan

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PO9 1HS



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7 Woodshots Meadow,
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Watford,
Herts,
WD18 8YS

t: 01923 225404**f:** 01923 237404**e:** reception@i2analytical.com**e:** kate.duggan@omnia-consulting.co.uk

Analytical Report Number : 16-23400

Project / Site name:	Wessex Yard, Havant	Samples received on:	21/07/2016
Your job number:	A10708	Samples instructed on:	22/07/2016
Your order number:	GEO-2196	Analysis completed by:	29/07/2016
Report Issue Number:	1	Report issued on:	29/07/2016
Samples Analysed:	3 soil samples		

Signed:

Rexona Rahman
Reporting 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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Analytical Report Number: 16-23400

Project / Site name: Wessex Yard, Havant

Your Order No: GEO-2196

Lab Sample Number				605536	605537	605538		
Sample Reference				BH101 D5	BH102a D9	BH101 D17		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				3.00	6.00	9.00		
Date Sampled				15/07/2016	13/07/2016	15/07/2016		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1		
Moisture Content	%	N/A	NONE	7.1	17	17		
Total mass of sample received	kg	0.001	NONE	0.31	0.23	0.29		

General Inorganics

pH	pH Units	N/A	MCERTS	7.7	8.4	8.5		
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	1.4	0.45	0.40		



Analytical Report Number : 16-23400

Project / Site name: Wessex Yard, Havant

* 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 *
605536	BH101 D5	None Supplied	3.00	Light brown sandy clay with gravel.
605537	BH102a D9	None Supplied	6.00	Grey clay.
605538	BH101 D17	None Supplied	9.00	Grey clay.



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Environmental Science

Analytical Report Number : 16-23400

Project / Site name: Wessex Yard, Havant

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
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
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
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	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

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.

