Appendix 5

Geotechnical Test Results

LABORATORY TEST RESULTS

CONTRACT 11 PORTLAND HILL, HAMPSTEAD, LONDON NW3

Borehole	Sample	Depth m	Classification				Density		Triaxial Compression					Subsidiary (SO_4)				Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Natural Moisture Content %	Dry Density Mg m^{-3}	Bulk Density Mg m^{-3}	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil		Water	pH	
														Total %	Aqueous Extract mg/l	mg/l		
BH1	U1A	1.80				34												
	U2A	2.10				32												
	U2B	2.40				31												
	U2C	2.70				30												
	U3A	3.00				27												
	U3B	3.30				30												
	U3C	3.60				31												
	U4A	4.00				28												
BH2	B3	2.00 - 2.50				28									3622		7.8	
	W1	2.91														3235	7.2	
	U1	3.00 - 3.50	96	25	59	33	1.95	1.46	D	128	50	64	0					SOIL CLASSIFICATION = CV 0% retained on 425µm sieve
	U4	3.50				30									5941		7.6	
	U2	4.00 - 4.40				34	1.93	1.44	D	137	70	69	0					
	U5	4.50				30												

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q - UNDRAINED
D.M. - UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

13469

LABORATORY TEST RESULTS

Contract: 11 ROSSLYN HILL, HAMPSTEAD, LONDON NW3

Borehole	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates SO_4				Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m³	Dry Mg/m³	Type	Intercept Shear Strength kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil % Dry Wt	Aqueous Extract mg/l	Water g/l	pH	
BH2	U3	5.00 - 5.40				34	1.90	1.42	Q	144	90	72	0					
	U7	6.00				30												
	U6	6.50 - 6.90				27	1.95	1.54	Q	233	120	102	0					
	U5	8.00 - 8.50				28	1.95	1.52	Q	145	140	72	0					
	U6	9.50 - 10.00				25	2.00	1.60	Q	182	170	91	0					
	U7	11.00 - 11.50				30	1.95	1.50	Q	158	200	79	0					
	U8	12.50 - 13.00				30	1.98	1.53	Q	184	220	92	0					
	U9	14.00 - 14.50				28	1.99	1.55	Q	260	250	130	0					
	U10	15.50 15.90				29	1.98	1.54	Q	222	280	111	0					
	U11	17.60 18.00				34	2.00	1.49	Q	361	320	81	0					
BH3	B2	1.20 - 1.70				33												

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - UNDRAINED
Q.M. - UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

GROUND ENGINEERING LIMITED

LABORATORY TEST RESULTS

CONTRACT 91 ROSSLYN HILL, HAMPSTEAD, LONDON NW3

Borehole	Sample	Depth m	Classification				Density		Triaxial Compression					Soil/Water Chemistry				Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m³	Dry Mg/m³	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil: Total Sulphate as SO4 % Dry Wt	Water: Aggressive CO2 Content mg/l	Water: Sulphate as SO4 mg/l	pH	
BH3	U1	1.90 - 2.40	80	27	53	35	1.87	1.39	Q	123	50	67	0					SOIL CLASSIFICATION = CV 0% retained on 425um sieve
	W1	2.11														5169	7.1	
	B4	2.40				31									3013		7.5	
	U2	3.00 - 3.50				30	1.96	1.51	Q	145	50	72	0					
	B5	3.50				29									3758		7.4	
	U3	4.00 - 4.50				32	1.95	1.47	Q	119	70	60	0					
	U4	4.00 - 4.50				30	1.97	1.51	Q	189	90	95	0					
	B6	4.50				29									4858		7.4	
	B8	6.00				29												
	U5	6.50 - 7.00				31	1.98	1.51	Q	153	115	76	0					
	U6	8.00 - 8.50				31	1.98	1.51	Q	199	140	100	0					
	U7	9.50 - 10.00				30	1.97	1.52	Q	151	170	76	0					

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

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LABORATORY TEST RESULTS

Contract 11 ROSSLYN HILL, HAMPSTEAD, LONDON NW3

Borehole	Sample	Depth m	Classification: Liquid Limit %	Classification: Plastic Limit %	Classification: Plasticity Index %	Classification: Moisture Content %	Density: Bulk Mg m⁻³	Density: Dry Mg m⁻³	Triaxial Compression: Type	Triaxial Compression: Deviator Stress Difference kPa	Triaxial Compression: Cell Pressure kPa	Triaxial Compression: Shear Strength kPa	Triaxial Compression: Angle of Shearing Resistance degrees	Sulphate (SO_4): Soil Total % Dry W	Sulphate (SO_4): Soil Aqueous Extract 2:1 Water/Soil	Sulphate (SO_4): Water g/l	pH	Remarks
BH5	U8	10.90 - 11.40				29	1.96	1.53	Q	205	200	107	0					
	U9	12.40 - 12.80				29	1.97	1.53	Q	202	220	101	0					
	U10	14.00 - 14.50				29	1.98	1.55	Q	115	250	58	0					
	U11	15.50 - 16.00				31	1.97	1.50	Q	157	280	79	0					
	U12	17.00 - 17.50				30	1.95	1.50	Q	227	310	114	0					
	U13	18.50 - 18.90				28	1.96	1.53	Q	279	350	140	0					
	U14	19.60 - 19.90				29	1.93	1.49	Q	151	350	75	0					

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

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LABORATORY TEST RESULTS

Project: 31 ROSSLYN HILL, HAMPSTEAD, LONDON NW3

Borehole	Sample	Depth m	Consistency				Density		Triaxial Compression					Soluble SO_4				Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m³	Dry Mg/m³	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	In Soil 2:1 Water/Soil Extract g/l		In Water mg/l	pH	
														Total % Dry Wt	Expressed as SO_3 g/l			
WS1	D3	0.90				33												
	D4	1.20				31												
	U1A	1.50				30												
	U1B	1.80				31												
	U2A	2.10				31												
	U2B	2.40				30												
	U2C	2.70				28												
	U3A	3.00				29												
	U3B	3.40				30												
	U3C	3.70				31												
	U4A	4.00				30												
	U4B	4.50				33												
WS2	D3	0.90				33												
	D4	1.20				29												
	U1A	1.50				30												
	U1B	1.80				35												

U - UNDISTURBED SAMPLE
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B - BULK SAMPLE
W - WATER SAMPLE

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C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

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LABORATORY TEST RESULTS

Contract: 18 ROSSLYN HILL, HAMPSTEAD, LONDON NW3

Borehole	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphate (SO_4)				Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m³	Dry Mg/m³	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil Total % Dry Wt	Soil Aqueous Extract mg/l	Water mg/l	pH	
WS2	L2A	2.10				34												
	L2B	2.40				29												
	L2C	2.70				33												
	U3A	3.00				29												
	U3B	3.40				34												
	L3C	3.70				32												
	L4A	4.00				34												
	L4B	4.50				31												
WS3	B4	1.20				36												
	L1A	1.50				28												
	L1B	1.80				29												
	L2A	2.10				30												
	L2B	2.40				30												
	L2C	2.70				32												
	U3A	3.00				29												
	U3B	3.40				31												

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
U. - UNDRAINED
U.M. - UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

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LABORATORY TEST RESULTS

CONTRACT: 1 ROSSLYN HILL, HAMPSTEAD, LONDON NW3

Borehole	Sample	Depth m	Classification: Liquid Limit %	Classification: Plastic Limit %	Classification: Plasticity Index %	Classification: Moisture Content %	Density: Bulk Mg/m³	Density: Dry Mg/m³	Triaxial Compression: Type	Triaxial Compression: Deviator Stress kPa	Triaxial Compression: Cell Pressure kPa	Triaxial Compression: Shear Strength kPa	Triaxial Compression: Angle of Shear Resistance degrees	Sulphates (SO_4): In Soil Total %	Sulphates (SO_4): In Groundwater Aqueous Extract mg/l	Sulphates (SO_4): Water g/l	Sulphates (SO_4): pH	Remarks
WS3	U3C	3.70				31												
	U4A	4.00				29												
	U4B	4.50				31												
WS4	U3A	3.40				35												
	U3B	3.70				36												
	U4A	4.00				25												
	U4B	4.50				27												
WS5	U2A	2.90				33												
WS6	U2A	2.95				34												
	U3A	3.30				35												
	U3B	3.60				31												
	U3C	3.90				31												
	U4A	4.20				33												
	U4B	4.40				32												
WS7	U2A	2.10				29												
	U2B	2.40				31												

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

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LABORATORY TEST RESULTS

CONTRACT 11 ROSSLYN HILL, HAMPSTEAD, LONDON NW3

Borehole	Sample	Depth m	Classification				Density		Triaxial Compression					Aqueous (SO_4^{2-})				Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m³	Dry Mg/m³	Type	Cell Pressure kPa	Cu kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil: Total % Dry Wt	Soil: Aqueous Extract mg/l	Water mg/l	pH	
WS7	U2C	2.70				31												
	U3A	3.00				28												
	U3B	5.30				31												
	U3C	3.60				32												
WS8	U3A	3.30				34												
	U3B	4.60				32												
	U3C	3.90				32												
WS9	D4	1.20				35												
	U1A	1.50				29												
	U1B	1.80				29												
	U2A	2.10				29												
	U2B	2.40				31												
	U2C	2.70				30												

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - UNDRAINED
Q.M. - UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

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LABORATORY TEST RESULTS

CONTRACT 1: ROSSLYN HILL, HAMPSTEAD, LONDON NW3

Trial-pit	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates (SO_3)			Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk $Mg\,m^{-3}$	Dry $Mg\,m^{-3}$	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil: Total % Dry Wt	Soil: Aqueous Extract mg/l	Water mg/l	pH	
TP1	M1	2.40														486	7.8	
	M10	2.50													2401		7.6	
TP5A	B7	2.20				30												
	B8	2.50				31												
	B9	2.80				31												
	B10	3.10				31												
TP4	B3	0.90													2004		7.2	
	B4	1.20	78	27	51													SOIL CLASSIFICATION = CV 3% retained on 425µm sieve
	W4	2.40														469	8.4	

U - UNDISTURBED SAMPLE
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C.D. - CONSOLIDATED DRAINED
Q. - UNCONFINED UNDRAINED
Q.M. - UNCONFINED UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

13469

GROUND ENGINEERING LIMITED
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GROUND ENGINEERING

Newark Road Peterborough

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e admin@groundengineering.co.uk

TEST CERTIFICATE

One-Dimensional Consolidation Properties

(Tested in accordance with BS1377 : Part 5 1990)

Client	Ground Engineering Ltd	Certificate Number:	PL4882-1-9/731
Client Address:	Newark Road	Client Reference Number:	C13469
	Peterborough	Date Sampled:	Unknown
	Cambridgeshire	Date Received:	16.01.2015
Postcode	PE1 5JA	Date Tested	19.01.2015
Contact:	Simon Weatherley	Sampling Certificate No:	N/A
Site Name	11 Rosslyn Hill	Certificate of Sampling:	N/A
Site Address	London NW3	Sampled By	Client

Test Details

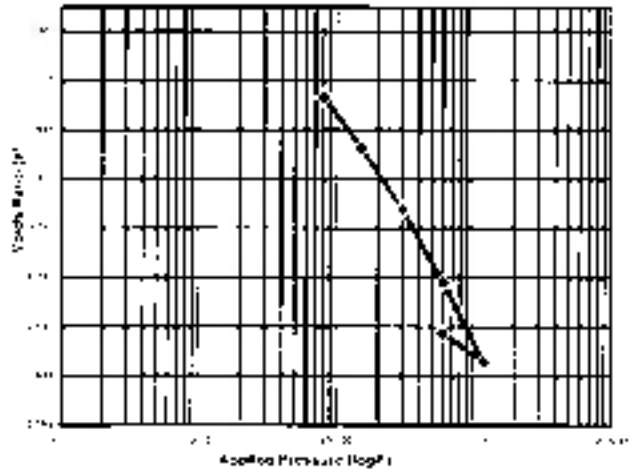
Location:	BH2
Sample Ref:	U1
Sample Description	Firm brown orange brown grey slightly silty CLAY with rare selenite crystals

Particle Density (Mg/m³):	2.74	Assumed
Mean Lab Temp. (°C):	22	
Variations from Standard:	None	
Lab Reference:	PL4882-1-9	
Depth (m):	3.00 m	

Specimen Details

	INITIAL	FINAL
Height (mm):	18.67	16.33
Bulk Density (Mg/m³):	1.87	2.08
Moisture Content (%):	31	27
Dry Density (Mg/m³):	1.43	1.64
Voids Ratio:	0.914	0.674
Degree of Saturation (%):	92.4	110.5
Diameter (mm):	74.98	N/A
Swelling Pressure (kPa):	80	N/A
Method of time fitting used:	Log Time	N/A

Voids Ratio against logarithm of Applied Pressure



Applied Pressure (kPa)	Coefficient of Compressibility m_v (m²/MN)	Coefficient of Consolidation c_v (m²/year)
80		
150	0.38	0.61
300	0.22	0.29
600	0.14	0.26
1200	0.08	0.29
600	0.03	---

Comments:

Approved Signatory: [x] V.Hannup - Laboratory Manager
[ ] L.Petch - Team Leader

Signed

for and on behalf of Ground Engineering Ltd

Date Reported: 30/01/2015

Registered in England Wales
Reg Number 632957a
Reg Office: Ground Engineering Ltd
Newark Rd
Peterborough PE1 5JA

GROUND ENGINEERING

Newark Road Peterborough
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e. admin@groundengineering.co.uk

TEST CERTIFICATE

One-Dimensional Consolidation Properties

(Tested in accordance with BS1377 : Part 5 :1990)

Client	Ground Engineering Ltd	Certificate Number	PL4682-1-11-731
Client Address:	Newark Road	Client Reference Number	C13469
	Peterborough	Date Sampled	Unknown
	Cambridgeshire	Date Received	16.01.2015
Postcode:	PE1 5DA	Date Tested:	19.01.2015
Contact:	Simon Weatherley	Sampling Certificate No:	N/A
Site Name:	11 Rosslyn Hill	Certificate of Sampling.	N/A
Site Address.	London NW3	Sampled By:	Client

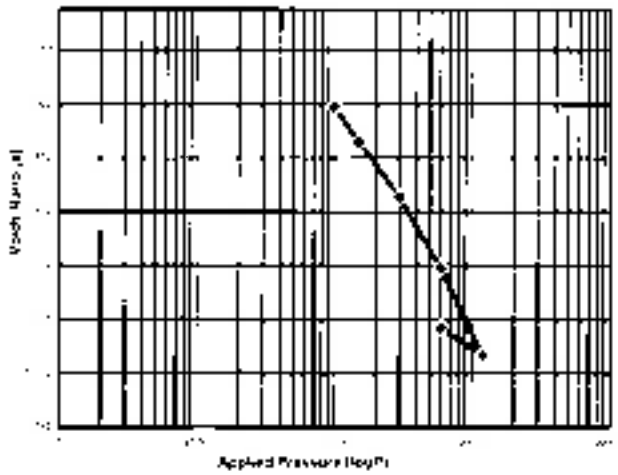
Test Details

Location:	BH2	
Sample Ref:	U2	
Sample Description:	Firm brown orange brown grey slightly silty CLAY with occasional fine selenite crystals	
Particle Density (Mg/m³)	2.74	Assumed
Mean Lab Temp (°C)	22	
Variations from Standard:	None	
Lab Reference:	PL4682-1-11	
Depth (m)	4.00 m	

Specimen Details

	INITIAL	FINAL
Height (mm)	18.94	16.90
Bulk Density (Mg/m³):	1.90	2.08
Moisture Content (%):	32	29
Dry Density (Mg/m³):	1.44	1.62
Voids Ratio:	0.900	0.699
Degree of Saturation (%):	96.2	113.9
Diameter (mm)	74.96	N/A
Swelling Pressure (kPa)	99	N/A
Method of time fitting used	Log T min	N/A

Voids Ratio against logarithm of Applied Pressure



Applied Pressure (kPa)	Coefficient of Compressibility m_v (m²/MN)	Coefficient of Consolidation c_v (m²/year)
99		
150	0.34	0.65
300	0.18	0.40
600	0.12	0.43
1200	0.08	0.44
600	0.03	—

Comments:

Approved Signatory: (x) M Hartrup - Laboratory Manager
( ) L.Peich - Team Leader

Signed

for and on behalf of Ground Engineering Ltd

Date Reported 30/01/2015

Registered in England Wales
Reg Number 6920574
Reg Office. Ground Engineering Ltd
Newark Rd
Peterborough PE1 5DA

GROUND ENGINEERING

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e admin@groundengineering.co.uk

TEST CERTIFICATE

One-Dimensional Consolidation Properties

(Tested in accordance with BS1377 Part 5 1990)

Client:	Ground Engineering Ltd	Certificate Number:	PL4862-1-13/731
Client Address:	Newark Road	Client Reference Number:	C13469
	Peterborough	Date Sampled:	Unknown
	Cambridgeshire	Date Received:	16.01.2015
Postcode:	PE1 5UA	Date Tested:	19.01.2015
Contact:	Simon Weatherley	Sampling Certificate No:	N/A
Site Name:	11 Rosslyn Hill	Certificate of Sampling:	N/A
Site Address:	London NW3	Sampled By:	Client

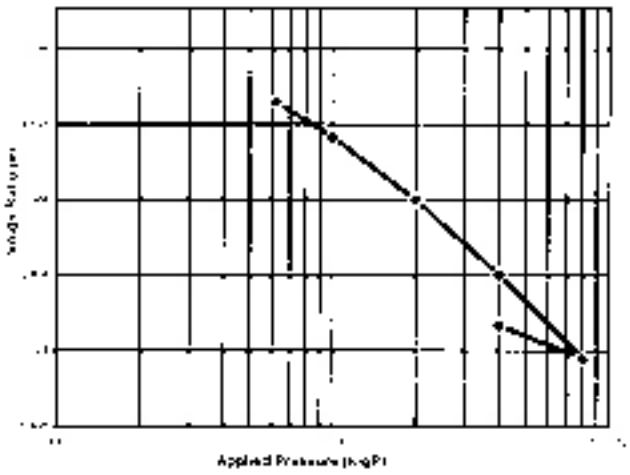
Test Details

Location:	BH2	
Sample Ref	U3	
Sample Description:	Firm brown orange-brown grey slightly silty CLAY with occasional selenite crystals	
Particle Density (Mg/m³):	2.74	Assumed
Mean Lab Temp (°C):	22	
Variations from Standard:	None	
Lab Reference	PL4862-1-13	
Depth (m)	5.00 m	

Specimen Details

	INITIAL	FINAL
Height (mm):	18.59	16.36
Bulk Density (Mg/m³):	1.83	2.07
Moisture Content (%):	33	32
Dry Density (Mg/m³):	1.38	1.56
Voids Ratio:	0.992	0.755
Degree of Saturation (%):	91.9	117.2
Diameter (mm):	75.06	N/A
Swelling Pressure (kPa):	62	N/A
Method of Inflection used	Log Time	N/A

Voids Ratio against logarithm of Applied Pressure



Applied Pressure (kPa)	Coefficient of Compressibility m_v (m²/MN)	Coefficient of Consolidation c_v (m²/year)
62		
100	0.48	0.52
200	0.34	0.51
400	0.21	0.33
800	0.12	0.22
400	0.05	--

Comments:

Approved Signatory: J(C M Hartnup - Laboratory Manager; C I I Petch - Team Leader

Signed.

for and on behalf of Ground Engineering Ltd

Date Reported: 29.01.2015

Registered in England Wales
Reg Number 6929574
Reg Office: Ground Engineering Ltd
Newark Rd
Peterborough PE1 5UA

GROUND ENGINEERING

TEST CERTIFICATE

One-Dimensional Consolidation Properties

(Tested in accordance with BS1377 : Part 5 : 1990)

Newark Road Peterborough
t:01733 566556 f:01733 315280
e: admin@groundengineering.co.uk

Client:	Ground Engineering Ltd	Certificate Number:	PL4882-1-25/731
Client Address:	Newark Road	Client Reference Number:	C13460
	Peterborough	Date Sampled:	Unknown
	Cambridgeshire	Date Received:	16.01.2015
Postcode:	PE1 5UA	Date Tested:	19.01.2015
Contact:	Simon Weatherley	Sampling Certificate No.:	N/A
Site Name:	11 Rosslyn Hill	Certificate of Sampling:	N/A
Site Address:	London NW3	Sampled By:	Client

Test Details

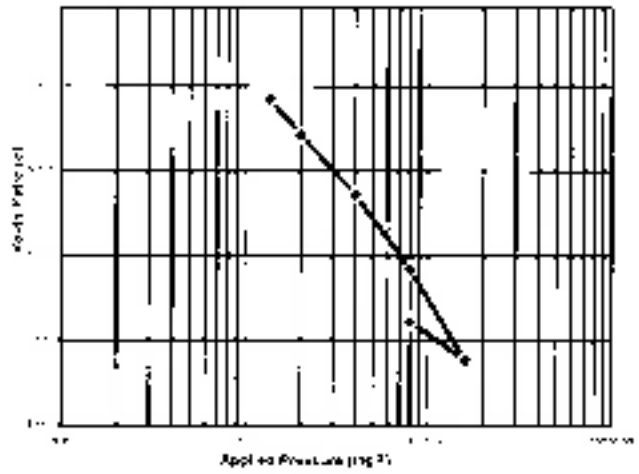
Location:	BH3
Sample Ref:	U
Sample Description:	Firm brown orange-brown grey slightly silty CLAY with rare selenite crystals

Particle Density (Mg/m³):	2.74	Assumed
Mean Lab Temp. (°C):	22	
Variations from Standard:	None	
Lab Reference:	PL4882-1-25	
Depth (m):	1.90 m	

Specimen Details

	INITIAL	FINAL
Height (mm):	18.69	16.59
Bulk Density (Mg/m³):	1.94	2.13
Moisture Content (%):	32	28
Dry Density (Mg/m³):	1.47	1.66
Voids Ratio:	0.855	0.655
Degree of Saturation (%):	101.5	118.9
Diameter (mm):	75.00	N/A
Swelling Pressure (kPa):	135	N/A
Method of time fitting used:	Log Time	N/A

Voids Ratio against logarithm of Applied Pressure



Applied Pressure (kPa)	Coefficient of Compressibility m_v (m²/MN)	Coefficient of Consolidation c_v (m²/year)
135		
200	0.28	0.29
400	0.15	0.25
800	0.10	0.24
1600	0.06	0.25
800	0.03	---

Comments

Approved Signatory: (x) M Hartnup - Laboratory Manager ( ) I. Peters - Team Leader

Signed

for and on behalf of Ground Engineering Ltd

Date Reported: 29/01/2015

Registered in England Wales
Reg Number 6923574
Reg Office: Ground Engineering Ltd
Newark Rd
Peterborough PE1 5UA

GROUND ENGINEERING

Newark Road Peterborough
t: 01733 566565 f: 01733 315280
e. admin@groundengineering.co.uk

TEST CERTIFICATE

One-Dimensional Consolidation Properties

(Tested in accordance with BS1377 Part 5:1990)

Client	Ground Engineering Ltd	Certificate Number:	PL4682-1-27/731
Client Address	Newark Road	Client Reference Number:	C13469
	Peterborough	Date Sampled:	Unknown
	Cambridgeshire	Date Received:	16.01.2015
Postcode:	PE1 5UA	Date Tested:	19.01.2015
Contact:	Simon Weatherley	Sampling Certificate No:	N/A
Site Name:	11 Rosslyn Hill	Certificate of Sampling:	N/A
Site Address:	London NW3	Sampled By:	Client

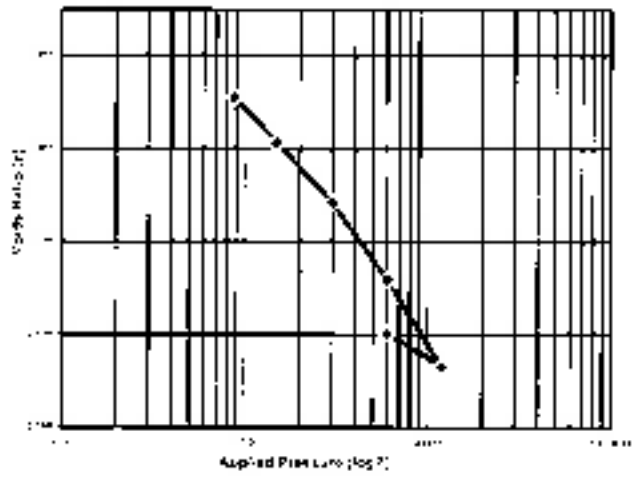
Test Details

Location:	BH3	
Sample Ref.	U2	
Sample Description:	Firm brown orange-brown grey slightly silty CLAY with occasional selenite crystals	
Particle Density (Mg/m³):	2.74	Assumed
Mean Lab Temp. (°C):	22	
Variations from Standard:	None	
Lab Reference:	PL4682-1-27	
Depth (m):	3.00 m	

Specimen Details

	INITIAL	FINAL
Height (mm):	18.90	16.06
Bulk Density (Mg/m³):	1.87	2.10
Moisture Content (%):	33	29
Dry Density (Mg/m³):	1.41	1.62
Voids Ratio:	0.943	0.689
Degree of Saturation (%):	94.8	117.3
Diameter (mm):	75.00	N/A
Swelling Pressure (kPa):	88	N/A
Method of time fitting used:	Log Time	N/A

Voids Ratio against logarithm of Applied Pressure



Applied Pressure (kPa)	Coefficient of Compressibility m_v (per MPa)	Coefficient of Consolidation c_v (m²/year)
88		
150	0.40	0.23
300	0.23	0.20
600	0.15	0.23
1200	0.09	0.20
600	0.04	—

Comments

Approved Signatory: [x] V Hartnup - Laboratory Manager
[ ] L.Petch - Team Leader

Signed:

for and on behalf of Ground Engineering Ltd

Date Recorded: 29/01/2015

Registered in England and Wales
Reg Number 0929570
Reg Office: Ground Engineering Ltd
Newark Rd
Peterborough PE1 5UA

GROUND ENGINEERING

Newark Road Peterborough

t:01733 566560 f:01733 315280

e. admin@groundengineering.co.uk

TEST CERTIFICATE

One-Dimensional Consolidation Properties

(Tested in accordance with BS1377 Part 5 1990)

Client:	Ground Engineering Ltd	Certificate Number:	PL4882-1-20/731
Client Address:	Newark Road	Client Reference Number:	C13459
	Peterborough	Date Sampled:	Unknown
	Cambridgeshire	Date Received:	16.01.2015
Postcode:	PE1 5JA	Date Tested:	19.01.2015
Contact:	Simon Weatherley	Sampling Certificate No:	N/A
Site Name:	11 Rosslyn Hill	Certificate of Sampling:	N/A
Site Address:	London NW3	Sampled By:	Client

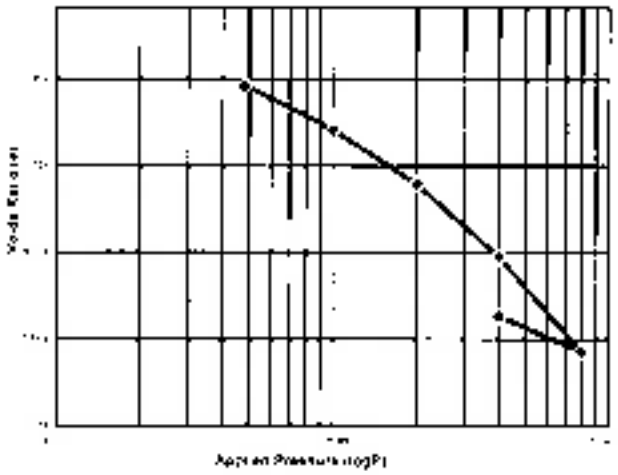
Test Details

Location:	BH3	
Sample Ref:	U3	
Sample Description:	Firm brown orange-brown grey slightly silty CLAY with occasional selenite crystals	
Particle Density (Mg/m³):	2.74	Assumed
Mean Lab Temp. (°C):	22	
Variations from Standard:	None	
Lab Reference:	PL4882-1-29	
Depth (m):	4.00 m	

Specimen Details

	INITIAL	FINAL
Height (mm):	18.93	16.84
Bulk Density (Mg/m³):	1.86	2.08
Moisture Content (%):	31	30
Dry Density (Mg/m³):	1.42	1.60
Voids Ratio:	0.929	0.715
Degree of Saturation (%):	91.5	115.0
Diameter (mm):	74.98	N/A
Swelling Pressure (kPa):	48	N/A
Method of time fitting used:	Log Time	N/A

Voids Ratio against logarithm of Applied Pressure



Applied Pressure (kPa)	Coefficient of Compressibility m_v (m²/kN)	Coefficient of Consolidation c_v (m²/year)
48		
100	0.41	0.52
200	0.27	0.55
400	0.18	0.51
800	0.12	0.34
400	0.05	—

Comments:

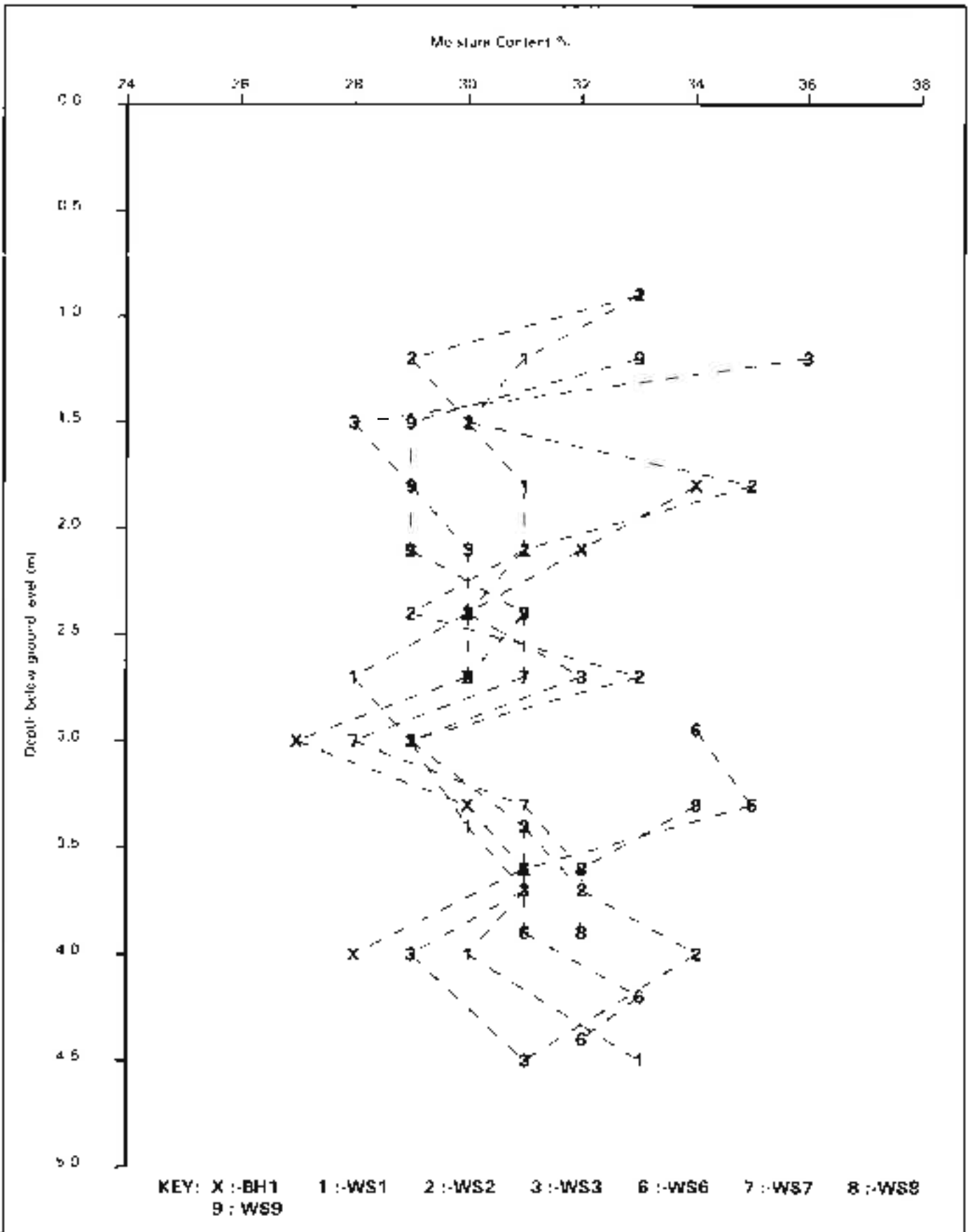
Approved Signatory: [x] V Hartnup - Laboratory Manager; [ ] L Patch - Team Leader

Signed:

for and on behalf of Ground Engineering Ltd

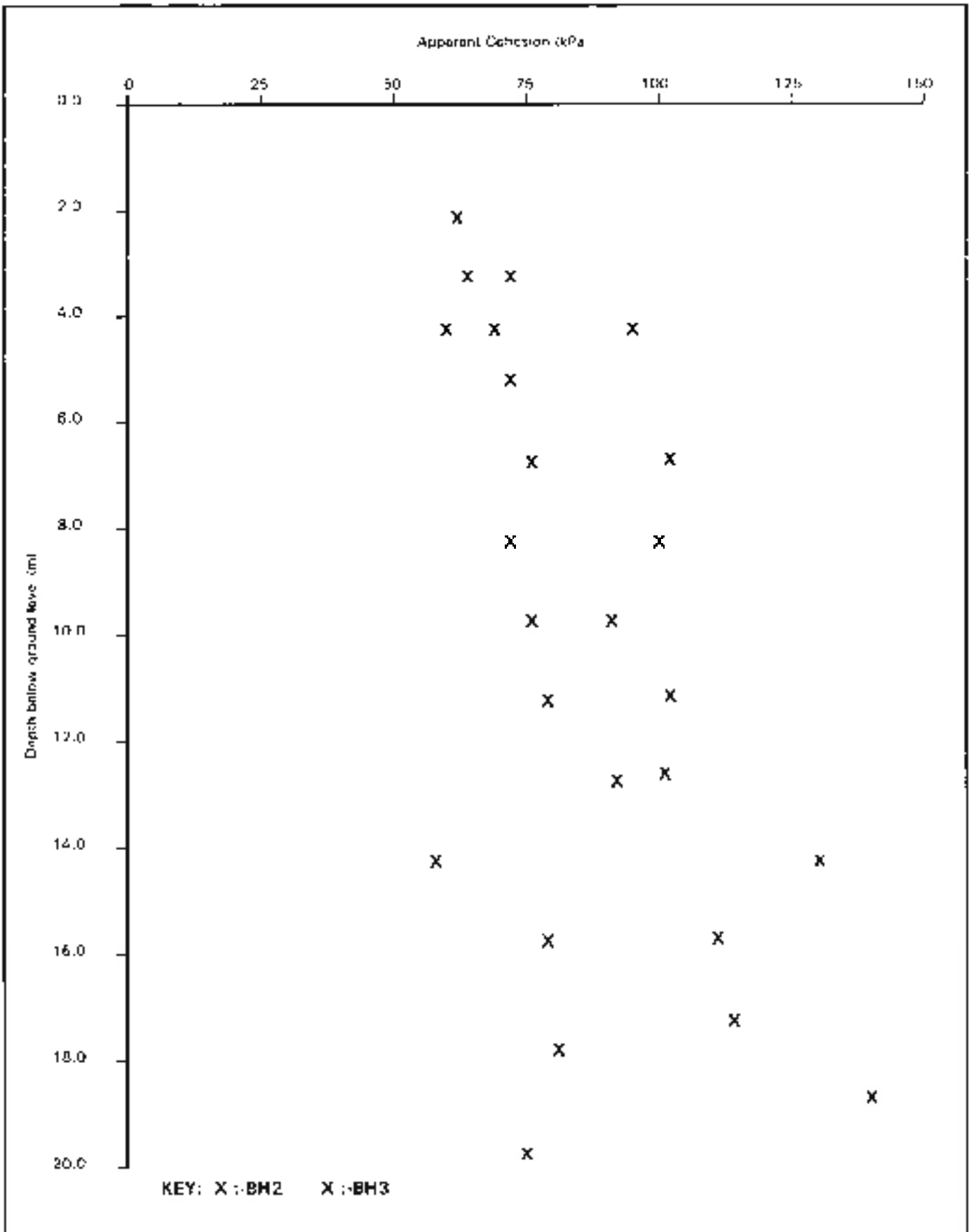
Date Reported: 29/01/2015

Registered in England Wales
Reg Number 6804574
Reg Office: Ground Engineering Ltd
Newark Rd
Peterborough PE1 5JA



Moisture Content % vs Depth below ground level (m).

SITE	11 ROSSLYN HILL, HAMPSTEAD. LONDON NW3		
CLIENT	ANDREW & ELIZABETH JEFFREYS	Contract Number	13469
GROUND ENGINEERING LTD		Date 11/03/15	Figure 1



Apparent Cohesion (kPa) vs Depth below ground level (m).

SITE	11 ROSSLYN HILL, HAMPSTEAD. LONDON NW3	
CLIENT	ANDREW & ELIZABETH JEFFREYS	Contract Number 3469
GROUND ENGINEERING LIMITED www.groundengineering.co.uk	Date 11/03/15	Figure 2

NORTH

SOUTH

BH2 TP1 TP4 TP5 BH3 WS3 WS2 WS1 TP3A TP3 WS1 WS7 BH1 WS9 WS8 WS4 WS5 WS6

0 -2 -4 -6 -8 -10 -12 -14 -16 -18 -20

KEY TO LEGENDS

- MADE GROUND
- MADE GROUND
- LONDON CLAY
- Groundwater Encountered
- Groundwater Rose
- Level on Completion
- Level Casing Withdrawn
- Standpipe Level

SITE	11 ROSSLYN HILL, HAMPSTEAD, LONDON NW3	Contract No	13465
CLIENT	ANDREW & ELIZABETH JEFFREYS	Soil Profile	Vertical Scale 1:100
GROUND ENGINEERING LIMITED, PETERBOROUGH Tel (01733) 566565		Date	Fig No 3

Appendix 6

Chemical Test Results

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Final Report

Report Number:	15-00688 Issue-1
Initial Date of Issue:	19-Jan-15
Client:	Ground Engineering Limited
Client Address:	Newark Road Peterborough Cambridgeshire PE1 5UA
Contact(s):	Simon Weatherley
Project:	SW/C13469 11 Rosslyn Hill, Hampstead

Quotation No.:		**Date Received:**	15-Jan-15
Order No.:	SW/C13469	**Date Instructed:**	15-Jan-15
No. of Samples:	10	**Results Due:**	19-Jan-15
Turnaround: (Weekdays)	3		
Date Approved:	19-Jan-15		

Approved By:

Details: Darrell Hall, Laboratory Director

Chemtest
The right chemistry to deliver results

Results Summary - Soil

Project: SW/C13469 11 Rosslyn Hill, Hampstead

Client: Ground Engineering (London)		Chemtest Job No.:	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688
Quotation No.:		Chemtest Sample ID.:	89173	89174	89175	89176	89177	89178	89179	89180	89181	89182
Order No.: SW/C13469		Client Sample Ref.:	D1	D2	D2	D2	D4	D2	D1	D1A	D2	
		Client Sample ID.:	BH1	BH2	BH3	WS3	WS5	WS6	WS7	WS8	WS9	
		Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):	0.20	1.20	0.40	0.60	1.20	0.60	0.20	1.80	0.60	
		Bottom Depth (m):										
		Date Sampled:	06-Jan-15	06-Jan-15	05-Jan-15	06-Jan-15	07-Jan-15	07-Jan-15	06-Jan-15	09-Jan-15	09-Jan-15	09-Jan-15

Determinand	Accred.	SOP	Units	LOD									
pH	U	2010			7.1	8.5	9.2	7.6	7.7	7.6	6.8	7.3	7.3
Moisture	N	2030	%	0.02	17	11	16	21	19	19	18	19	11
Stones	N	2030	%	0.02	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Boron (Hot Water Soluble)	U	2120	mg/kg	0.4	0.65	< 0.40	0.60	< 0.40	1.2	1.8	0.73	< 0.40	0.67
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.01	< 0.010	0.011	0.047	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (free)	U	2300	mg/kg	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	U	2325	mg/kg	0.5	2.6	3.0	2.3	0.78	1.5	0.93	1.1	0.78	0.93
Arsenic	U	2450	mg/kg	1	16	17	23	20	15	19	19	13	20
Cadmium	U	2450	mg/kg	0.1	0.19	< 0.10	0.20	0.20	< 0.10	0.16	0.19	0.14	0.13
Chromium	U	2450	mg/kg	1	28	27	41	52	31	29	36	43	36
Copper	U	2450	mg/kg	0.5	75	16	35	57	38	46	55	25	33
Mercury	U	2450	mg/kg	0.1	2.5	0.15	0.39	0.88	0.45	1.0	1.5	0.26	0.98
Nickel	U	2450	mg/kg	0.5	22	12	25	38	20	23	26	20	20
Lead	U	2450	mg/kg	0.5	400	38	220	330	170	290	490	53	640
Selenium	U	2450	mg/kg	0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.5	110	41	80	140	67	94	92	59	58
Chromium (Hexavalent)	N	2490	mg/kg	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.4	7.2	0.97	3.1	3.3	4.1	7.0	4.5	2.1	2.1
Acenaphthene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	0.44	< 0.10	0.75	0.40	< 0.10	0.32
Acenaphthylene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	0.16	< 0.10	0.25	0.17	< 0.10	0.15
Anthracene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	0.12	< 0.10	0.15	< 0.10	< 0.10	< 0.10
Benzo(a)anthracene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(a)pyrene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(b)fluoranthene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(g,h,i)perylene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(k)fluoranthene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenzo(a,h)anthracene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.1	0.24	< 0.10	0.12	0.15	< 0.10	0.19	0.39	< 0.10	0.14
Fluorene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	0.36	< 0.10	0.56	0.33	< 0.10	0.25
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Naphthalene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	2.4	< 0.10	3.1	2.1	< 0.10	1.8

Chemtest
The right chemistry to deliver results

Results Summary - Soil

Project: SWC13469 11 Rosslyn Hill, Hampstead

Client: Ground Engineering Limited				Chemtest Job No.:	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688	15-00688
Quotation No:				Chemtest Sample ID.:	89173	89174	89175	89176	89178	89179	89180	89181	89182
Order No: SWC13469				Client Sample No:	D1	D2	D3	D4	D6	D2	D1	D1A	D2
				Client Sample ID.:	BH1	BH2	BH3	WS3	WS5	WS6	WS7	WS8	WS9
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.20	0.20	0.40	0.60	1.20	0.60	0.20	1.80	0.60
				Bottom Depth (m):									
				Date Sampled:	06-Jan-15	06-Jan-15	05-Jan-15	06-Jan-15	07-Jan-15	07-Jan-15	09-Jan-15	09-Jan-15	09-Jan-15
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Phenanthrene	U	2700	mg/kg	0.1	< 0.10	< 0.10	< 0.10	0.46	< 0.10	0.87	0.44	< 0.10	0.23
Pyrene	U	2700	mg/kg	0.1	0.29	< 0.10	0.18	0.26	< 0.10	0.24	0.45	< 0.10	0.17
Total Of 16 PAH's	U	2700	mg/kg	2	< 2.0	< 2.0	< 2.0	4.4	< 2.0	5.9	4.3	< 2.0	3.1
Total Phenols	U	2920	mg/kg	0.3	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Chemtest
The right chem stry to deliver results

Results Summary - Water

Project: SW/C13469 11 Rosslyn Hill, Hampstead

Client: Geotrid Engineering Limited	Chemtest Job No.:	15-00688
Quotation No.:	Chemtest Sample ID.:	88177
Order No: SW/C13469	Client Sample Ref.:	WH
	Client Sample ID.:	WS5
	Sample Type:	WATER
	Top Depth(m):	3.50
	Bottom Depth(m):	
	Date Sampled:	07-Jan-15

Determinand	Accred.	SOP	Units	LOD	
pH	U	1010			7.6
Boron (Dissolved)	U	1450	µg/l	20	280
Sulphate	U	1220	mg/l	1	750
Cyanide (Free)	U	1300	mg/l	0.05	< 0.050
Cyanide (Total)	U	1300	mg/l	0.05	< 0.050
Sulphide	U	1325	mg/l	0.05	< 0.050
Arsenic (Dissolved)	U	1450	µg/l	1	2.8
Cadmium (Dissolved)	U	1450	µg/l	0.08	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1	5.3
Copper (Dissolved)	U	1450	µg/l	1	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.5	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1	11
Lead (Dissolved)	U	1450	µg/l	1	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1	2.0
Zinc (Dissolved)	U	1450	µg/l	1	57
Acenaphthene	N	1700	µg/l	0.01	< 0.010
Acenaphthylene	N	1700	µg/l	0.01	< 0.010
Anthracene	N	1700	µg/l	0.01	< 0.010
Benzo[a]anthracene	N	1700	µg/l	0.01	< 0.010
Benzo[a]pyrene	N	1700	µg/l	0.01	< 0.010
Benzo[b]fluoranthene	N	1700	µg/l	0.01	< 0.010
Benzo[g,h,i]perylene	N	1700	µg/l	0.01	< 0.010
Benzo[k]fluoranthene	N	1700	µg/l	0.01	< 0.010
Chrysene	N	1700	µg/l	0.01	< 0.010
Dibenz(a,h)anthracene	N	1700	µg/l	0.01	< 0.010
Fluoranthene	N	1700	µg/l	0.01	< 0.010
Fluorene	N	1700	µg/l	0.01	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1700	µg/l	0.01	< 0.010
Naphthalene	N	1700	µg/l	0.01	< 0.010
Phenanthrene	N	1700	µg/l	0.01	< 0.010
Pyrene	N	1700	µg/l	0.01	< 0.010
Total Of 16 PAH's	N	1700	µg/l	1.2	< 0.21
Total Phenols	U	1920	mg/l	0.03	< 0.030

Chemtest
The right chemistry to deliver results

Results Summary - Water

Project: SW/C13469 11 Rosslyn Hill, Hampstead

Client: Ground Engineering Limited			Chemtest Job No.:		15-00868
Quotation No:			Chemtest Sample ID.:		89177
Order No: SW/C13469			Client Sample Ref.:		W1
			Client Sample ID.:		WS5
			Sample Type:		WATER
			Top Depth (m):		0.80
			Bottom Depth(m):		
			Date Sampled:		07-Jun-15
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Hardness	U	1418	mg/l	15	1500

Chemtest
The right chemistry to deliver results

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37 C prior to analysis
All Asbestos testing is performed at our Coventry laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 60 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples please email your requirements to customerservices@chemtest.co.uk

Appendix 7

Classification of Aggressive Chemical Environment for Buried Concrete

TABLE C1 – AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) CLASSIFICATION FOR NATURAL GROUND LOCATIONS[a]

Sulfate Design Sulfate Class for location	2:1 water/soil extract[b]	Groundwater	Total potential sulfate[c]	Groundwater: Static water	Groundwater: Mobile water	ACEC Class for location
1	2 (SO_4 mg/l)	3 (SO_4 mg/l)	4 (SO_4 %)	5 (pH)	6 (pH)	7
DS-1	<500	<400	<0.24	≥2.5		AC-1s
					>5.5[d]	AC-1
					2.5–5.5	AC-2z
DS-2	500–1500	400–1400	0.24–0.6	>3.5		AC-1s
					>5.5	AC-2
				2.5–3.5		AC-2s
					2.5–5.5	AC-3z
DS-3	1600–3000	1500–3000	0.7–1.2	>3.5		AC-2s
					>5.5	AC-3
				2.5–3.5		AC-3s
					2.5–5.5	AC-4
DS-4	3100–6000	3100–6000	1.3–2.4	>3.5		AC-3s
					>5.5	AC-4
				2.5–3.5		AC-4s
					2.5–5.5	AC-5
DS-5	>6000	>6000	>2.4	>3.5		AC-4s
				2.5–3.5	≥2.5	AC-5

Notes

a [illegible]

b [illegible]

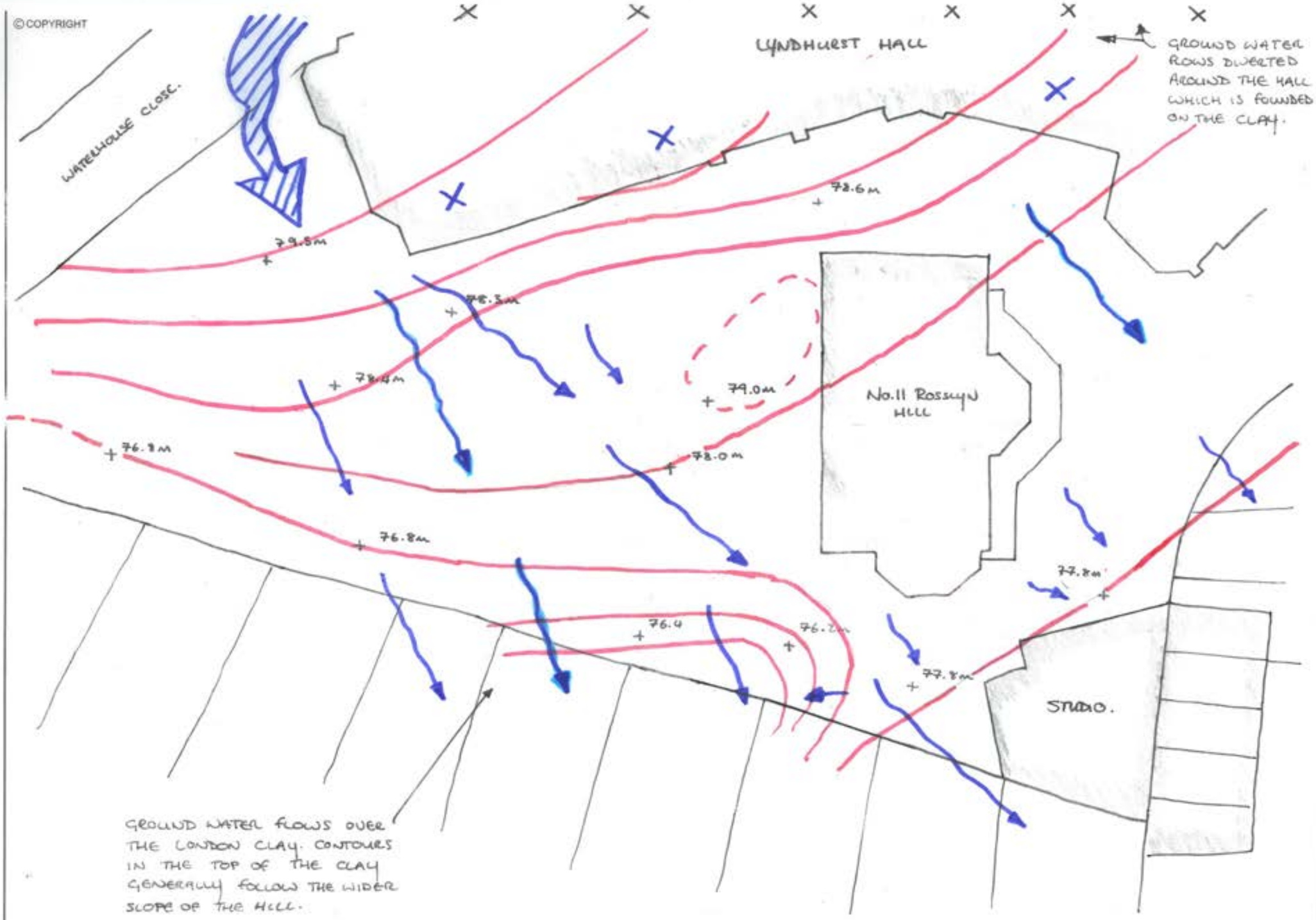
c [illegible]

d [illegible]

Explanation of suffix symbols to ACEC Class

- [illegible]
- [illegible]

Appendix F Existing groundwater flows



GROUND WATER FLOWS OVER THE LONDON CLAY. CONTOURS IN THE TOP OF THE CLAY GENERALLY FOLLOW THE WIDER SLOPE OF THE HILL.

EXISTING GROUND WATER FLOWS & CONTOUR MAP OF TOP OF CLAY

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND THE SPECIFICATION.

KEY.

CONTOUR IN TOP OF LONDON CLAY

GROUND WATER FLOWS.

-	24/3/15	ISSUED FOR PLANNING	FJ

NO.11 ROSSLYN HILL, NW3

EXISTING GROUND WATER FLOWS PLAN

drawn RWa | checked FJ

date MARCH 15 | scale (original) @A3 1:200

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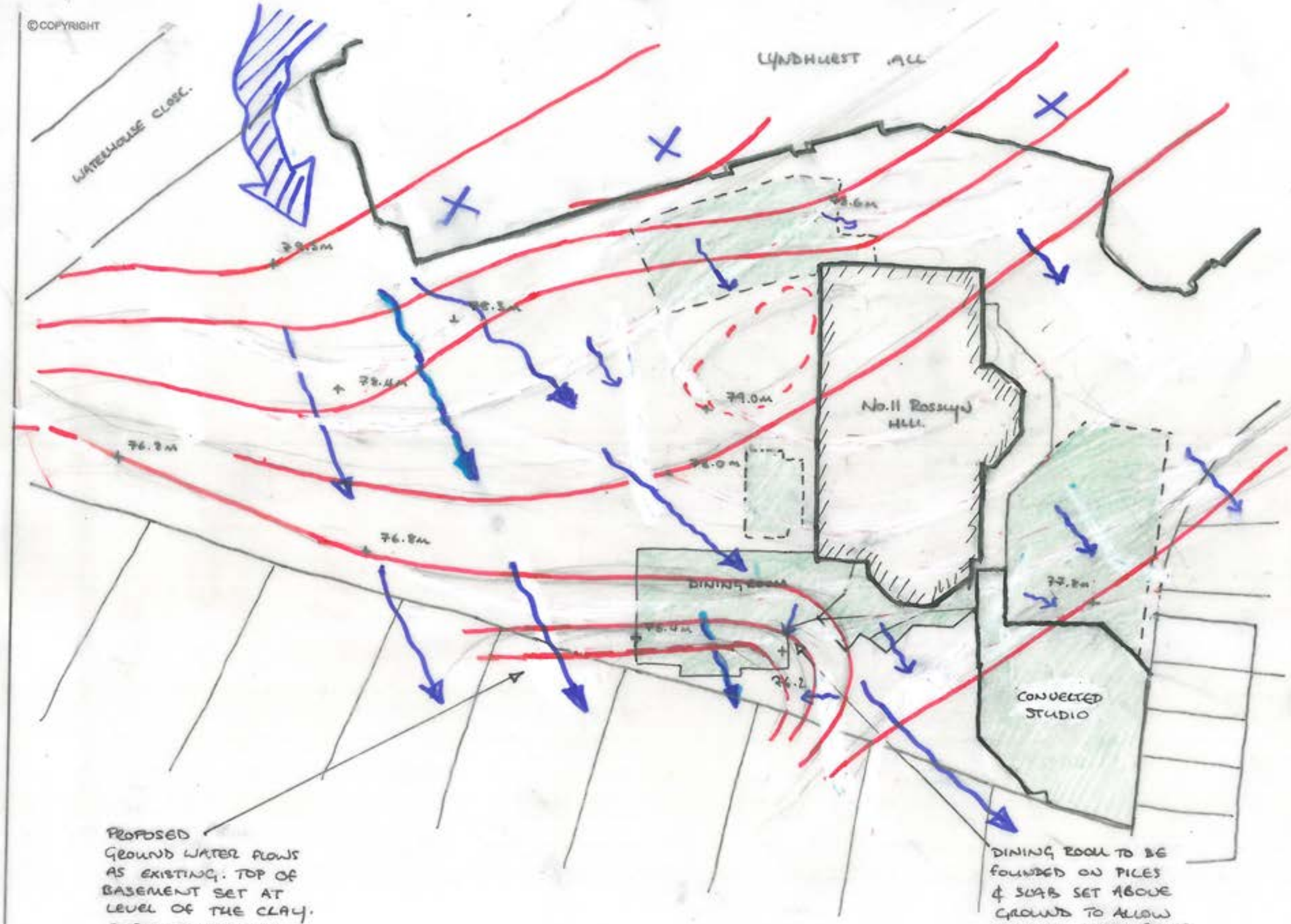
drg. no. 1693/01/SK03 | rev. -

Appendix G Proposed groundwater flows



PROPOSED GROUND WATER FLOWS AS EXISTING. TOP OF BASEMENT SET AT LEVEL OF THE CLAY. REFER TO DRAWING 1693/01/SK03 FOR DETAILS

DINING ROOM TO BE FOUNDED ON PILES & SLAB SET ABOVE GROUND TO ALLOW GROUND WATER FLOWS UNDER.

EXISTING GROUND WATER FLOWS & CONTOUR MAP OF TOP OF CLAY

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND THE SPECIFICATION.

KEY.

- CONTOUR IN TOP OF LONDON CLAY
- GROUND WATER FLOWS.
- PROPOSED DEVELOPMENT

-	24/3/15	ISSUED FOR PLANNING	FD

NO.11 ROSSLYN HILL, NW3

PROPOSED GROUND WATER FLOWS PLAN

drawn RWa | checked FD

date MARCH 15 | scale (original - A1) 1:200

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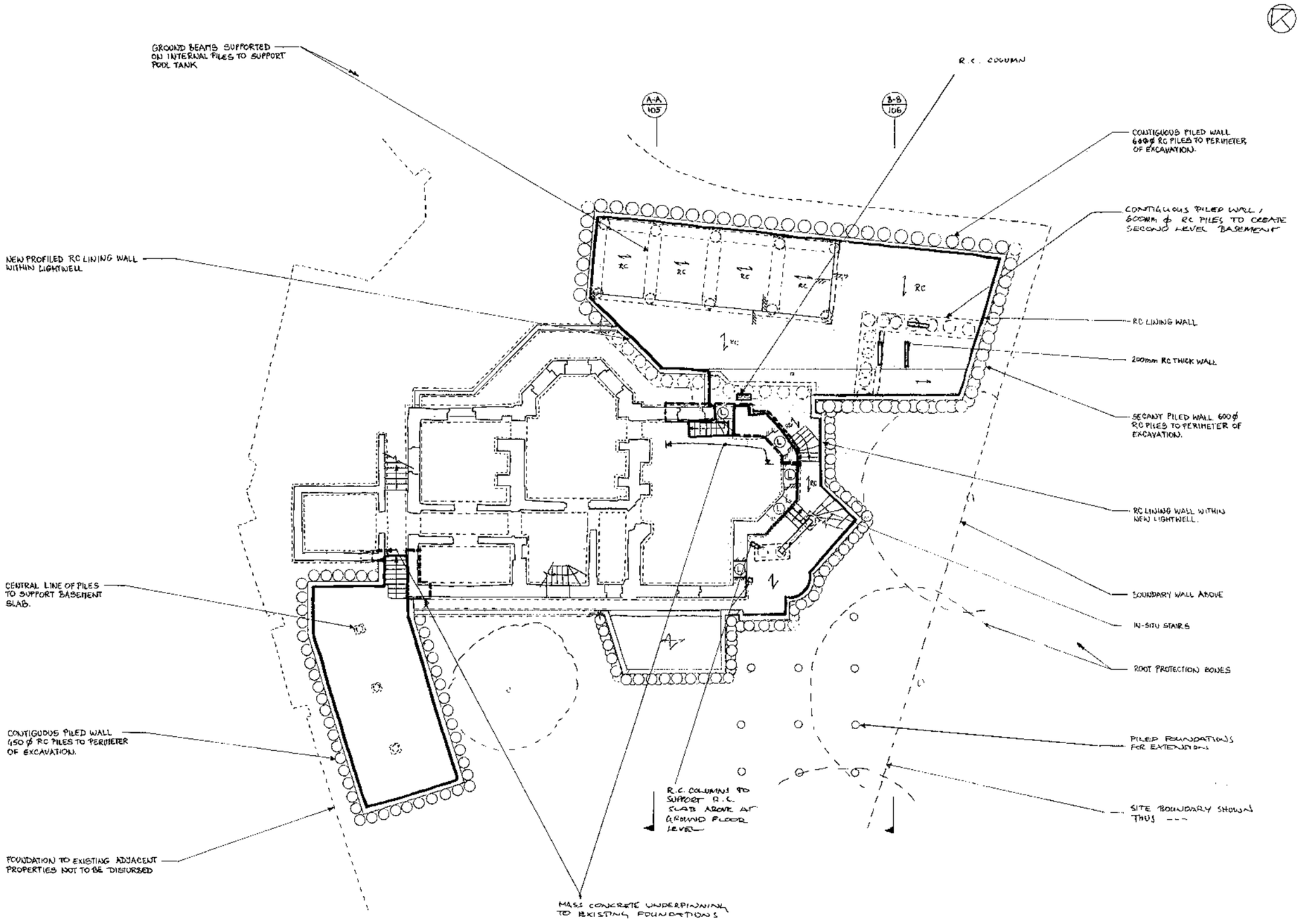
Fig. no. 1693/01/SK04 | rev. -

Appendix H Proposed structure drawings



NOTES:
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND THE SPECIFICATION.

A	24.3.15	ISSUED FOR INFORMATION.	RJ
-	19/2/15	ISSUED FOR COMMENT	RJ

job
11 ROSSLYN HILL, NW3

title
PROPOSED STRUCTURE BASEMENT PLAN

drawn: RG	checked: RJ
date: MAR'15	scale (original - A1): 1:100

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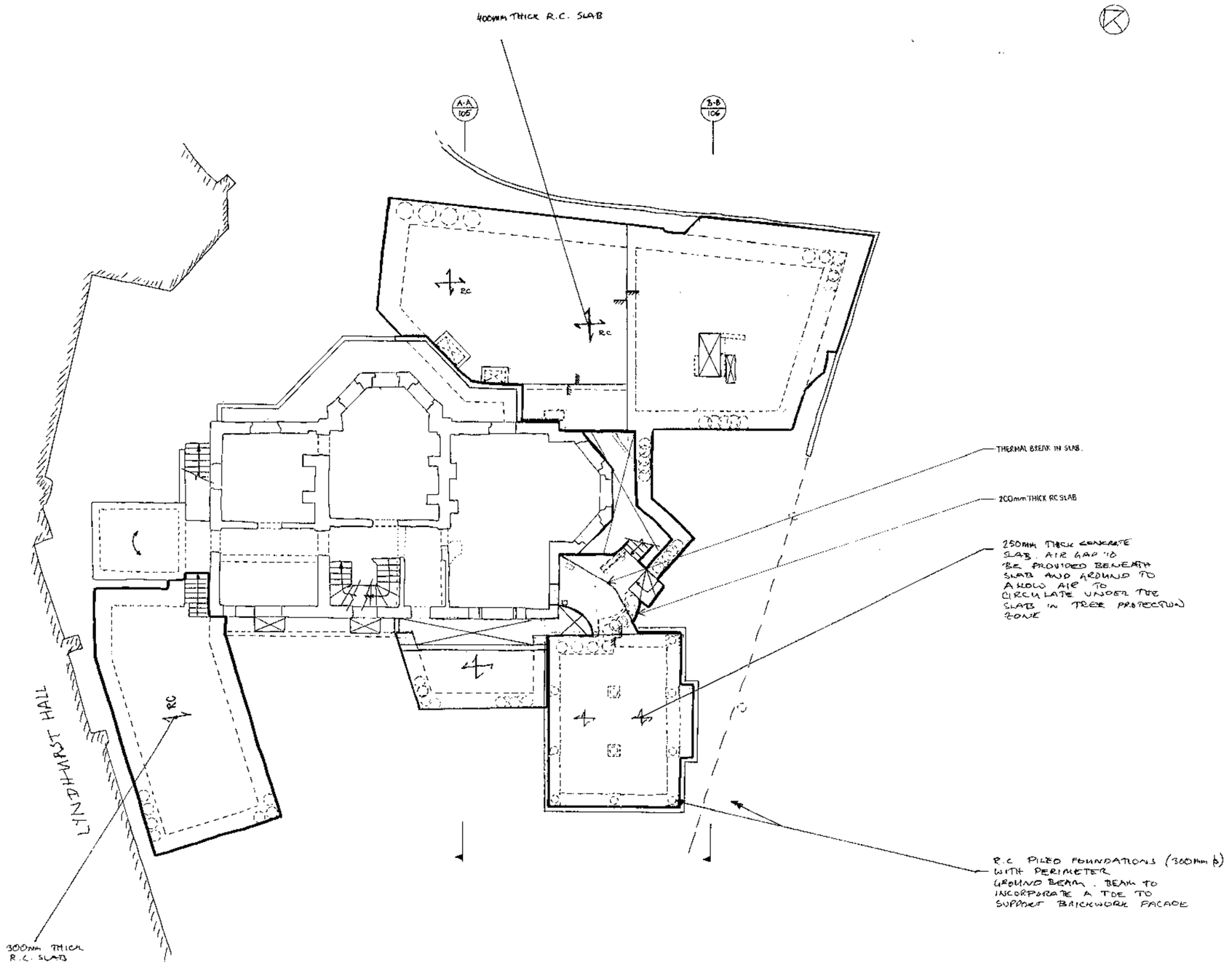
dwg no.
1693/01/100

rev.
A



notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND THE SPECIFICATION.

C	28.8.15	ISSUED FOR PLANNING. NOTES ADDED.	RWL
B	24.3.15	ISSUED FOR INFORMATION	FN
A	17.3.15	ISSUED FOR COMMENT. CPELINGS ADDED.	RWL
-	17/3/15	ISSUED FOR COMMENT	FN

job
11 ROSSLYN HILL, NW3

title
PROPOSED STRUCTURE
GROUND FLOOR PLAN

drawn	checked
RG	FN
date	scale (original - A1)
MAR'15	1:100

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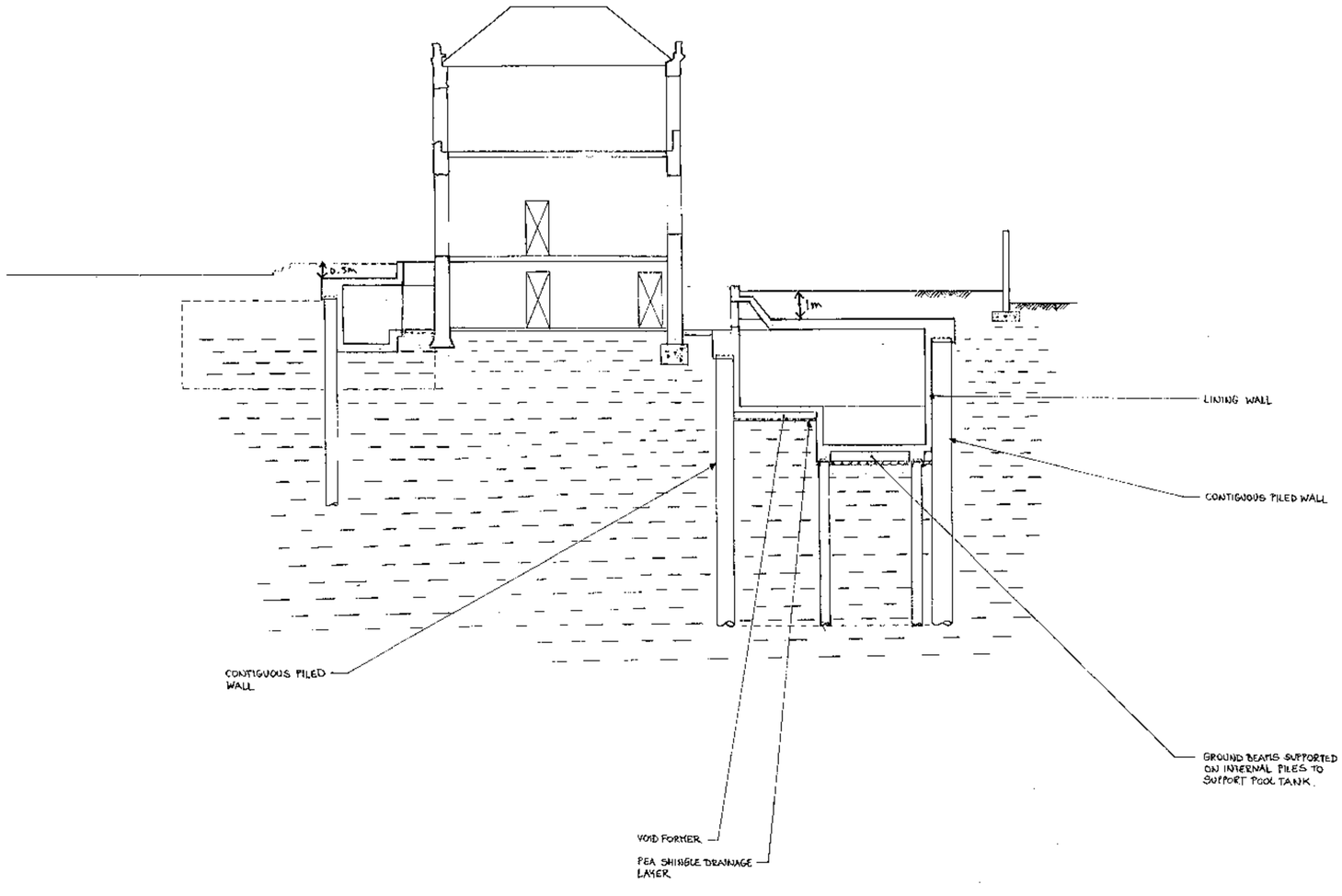
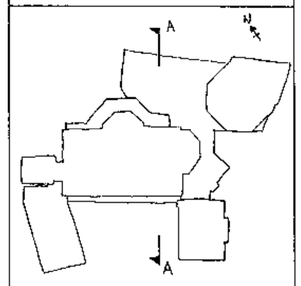
orig. no	rev.
1693/01/101	C



NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND THE SPECIFICATION.



KEY PLAN
N.T.S.

A	26.2.15	ISSUED FOR PLANNING	RG
-	9/3/15	ISSUED FOR COMMENT	RG

job
11 ROSSLYN HILL, NW3

title
PROPOSED STRUCTURE
SECTION A-A

drawn RG
checked FR
date MAR'15
scale (original - A1) 1:100

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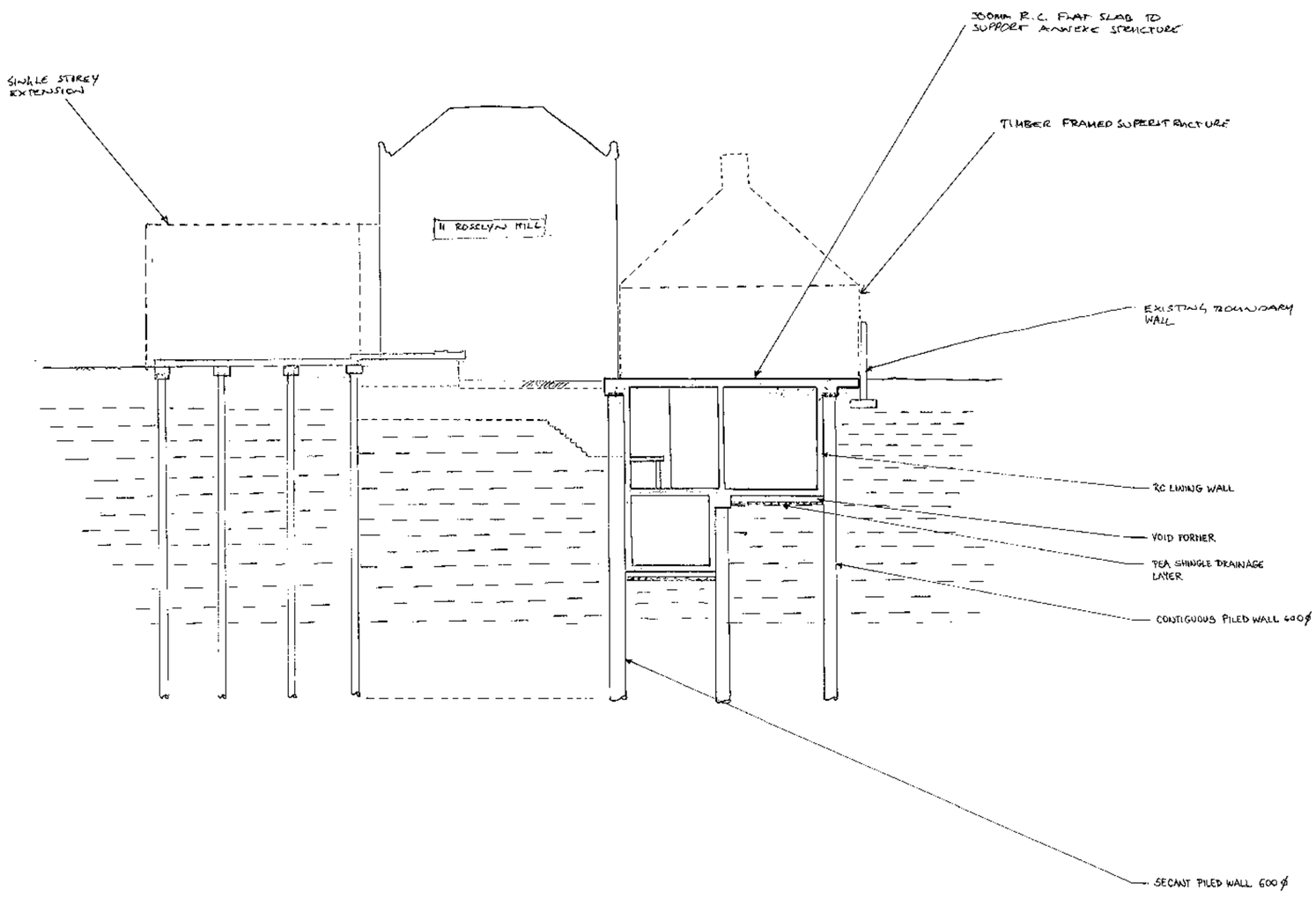
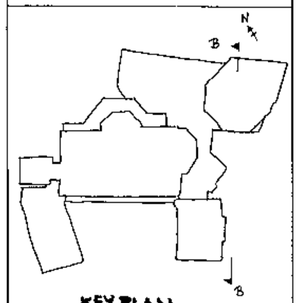
rev. A



notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND THE SPECIFICATION.



KEY PLAN
N.T.S.

B	26/3/15	ISSUED FOR PLANNING	
A	24/3/15	ISSUED FOR PLANNING	FN
-	18/3/15	ISSUED FOR COMMENT	FN

job
11 ROSSLYN HILL, NW3

title
PROPOSED STRUCTURE
SECTION B-B

drawn RG | checked FN

date MAR'15 | scale (original - A1) 1:100

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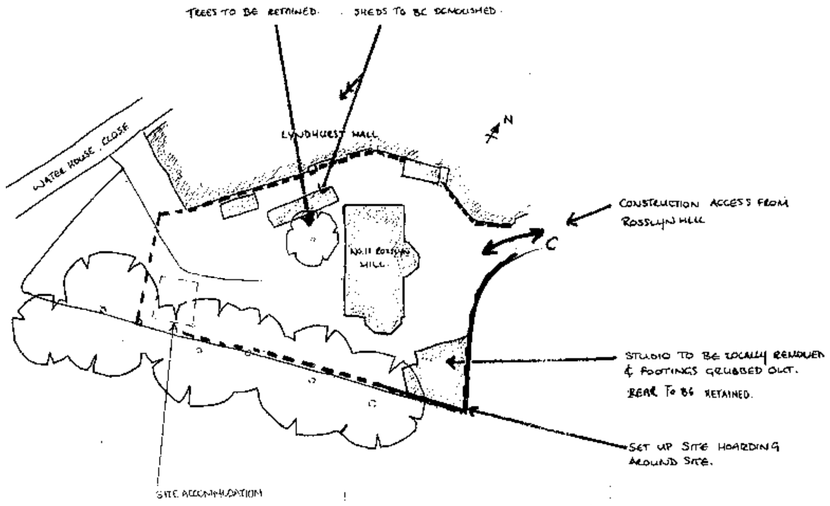
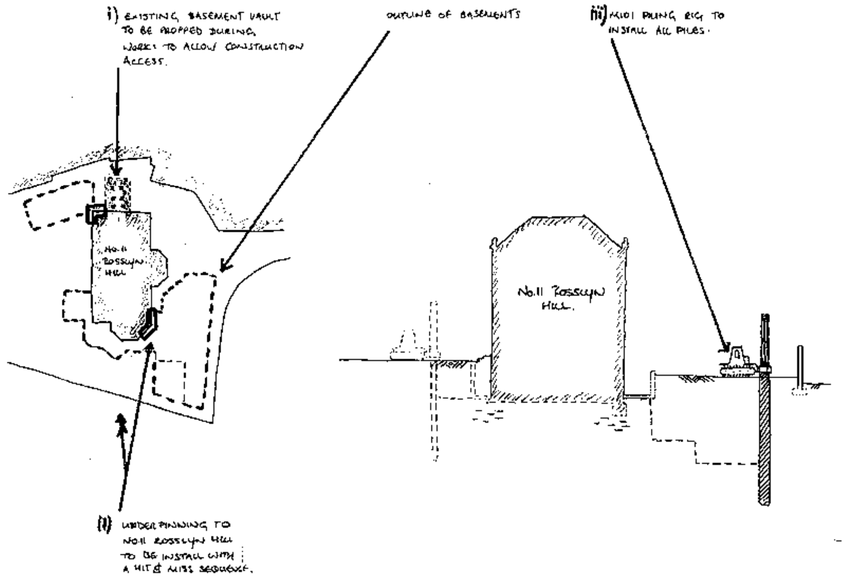
dwg no. **1693/01/106** | rev. B

Appendix I Sequence of construction drawings



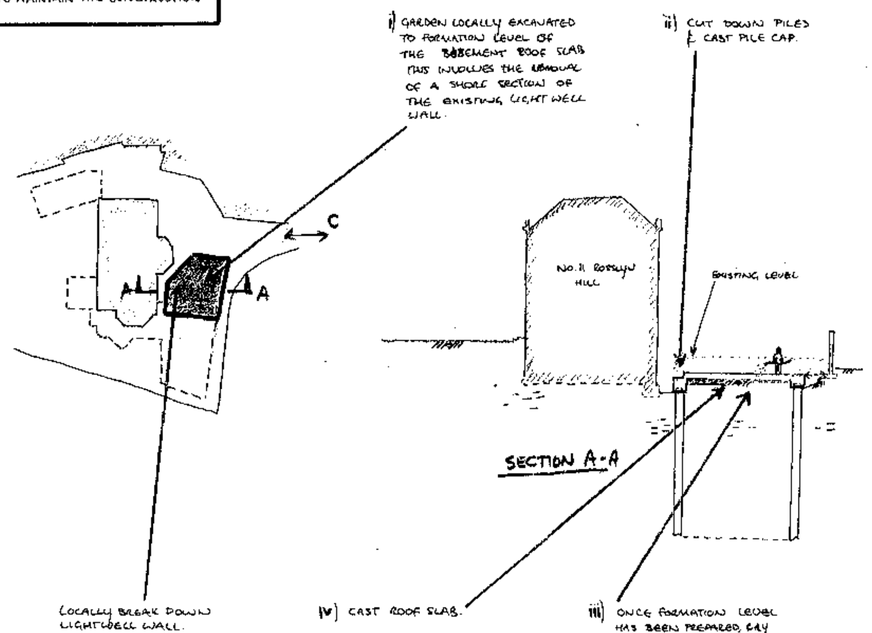
OCCUPANTS OF THE HOUSE WILL NOT BE IN RESIDENCE DURING THE WORKS.

① SITE SET UP

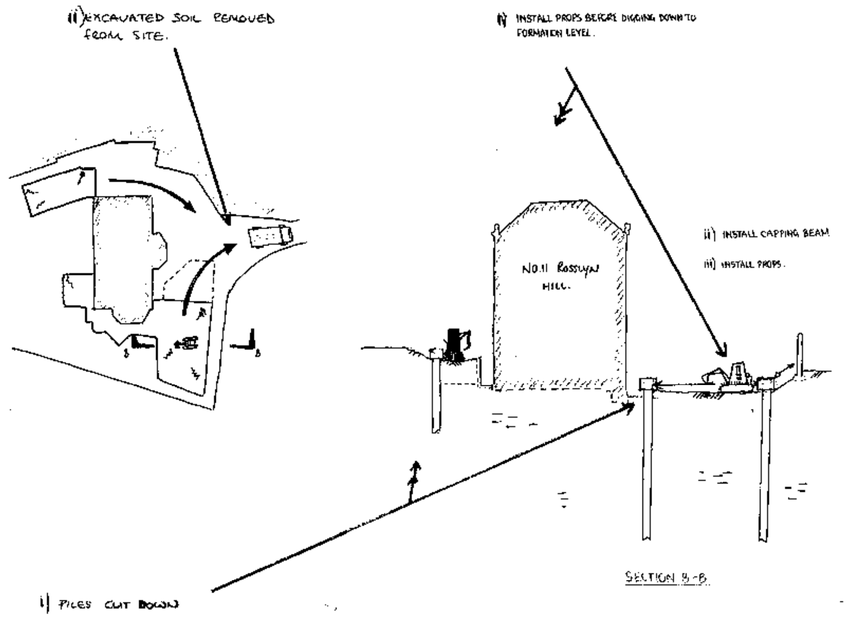


② PILING & UNDERPINNING

NOTE: THIS STEP ③ SHOWS A TOP-DOWN SEQUENCE FOR A SMALL SECTION OF THE EAST BASEMENT WHICH INVOLVES FORMING THE ROOF SLAB EARLY IN THE CONSTRUCTION STAGE TO MAINTAIN CONSTRUCTION ACCESS ONTO SITE.
ALTERNATIVELY, A BOTTOM-UP SEQUENCE CAN BE ADOPTED HERE. THIS MEANS THAT A TEMPORARY DECK WOULD BE NEEDED TO MAINTAIN THE CONSTRUCTION ACCESS INTO SITE.



③ FORM AREA OF ROOF SLAB



④ EXCAVATION

Notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND THE SPECIFICATION.
2. THE CONTRACTOR SHALL ENSURE THAT THE STABILITY OF THE BUILDING AND ADJOINING PREMISES IS MAINTAINED AT ALL STAGES OF CONSTRUCTION. HE SHALL DESIGN, INSTALL AND MAINTAIN ALL NECESSARY TEMPORARY WORKS AND PROGRAMME THE WORKS ACCORDINGLY.
3. THIS DRAWING SHOWS THE SEQUENCE OF CONSTRUCTION ASSUMED IN FORMULATING THE STRUCTURAL DESIGN. THE CONTRACTOR SHALL PREPARE HIS OWN PROPOSALS FOR SEQUENCE AND METHODOLOGY OF CONSTRUCTION, INCLUDING ALL TEMPORARY WORKS, FOR WHICH HE SHALL REMAIN ENTIRELY RESPONSIBLE. THESE PROPOSALS SHALL BE SUBMITTED TO THE CA PRIOR TO COMMENCEMENT OF WORK ON SITE.
4. WHERE THIS DRAWING SHOWS ITEMS OF STRUCTURE, EQUIPMENT OR PLANT WHICH DO NOT FORM PART OF THE PERMANENT STRUCTURE, THESE ARE ITEMS OF "TEMPORARY WORKS" OR "THINGS NOT FOR INCORPORATION IN THE WORKS". SUCH ITEMS ARE SHOWN PURELY TO INDICATE A POSSIBLE MEANS OF CONSTRUCTING SOME PARTS OF THE STRUCTURE AND MAKE NO REPRESENTATION AS TO THE AMOUNT AND/OR EXTENT OF SUCH WORKS OR ITEMS, NOR OF THE EQUIPMENT, PLANT OR MATERIALS NEEDED TO INSTALL AND MAINTAIN THEM.

C	30.3.15	STEP 3 ROOF SLAB UPDATED	FN
B	26.3.15	ISSUED FOR PLANNING. NOTES ADDED.	RWL
A	25.3.15	ISSUED FOR PLANNING. NOTE ADDED.	FN
—	24/3/15	ISSUED FOR PLANNING	FN

job
NO.11 ROSSLYN HILL
NW3.

title
ASSUMED SEQUENCE OF CONSTRUCTION.
SHEET 1 OF 2

drawn RWL checked FN
date MAR' 15 scale (original A1) 1:100 PLANS 1:100 SECTIONS

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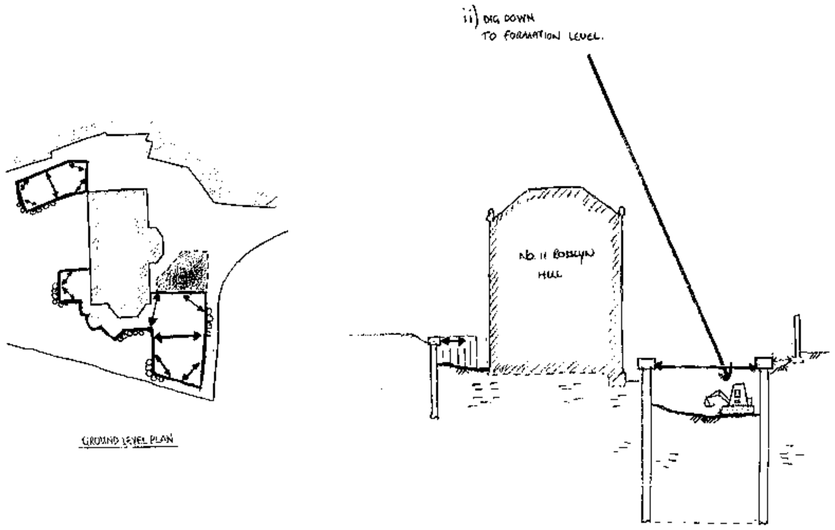
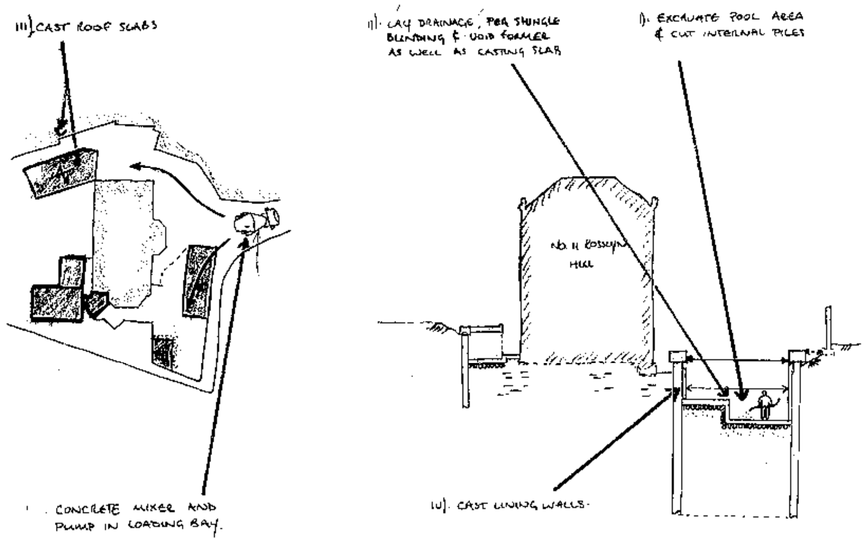
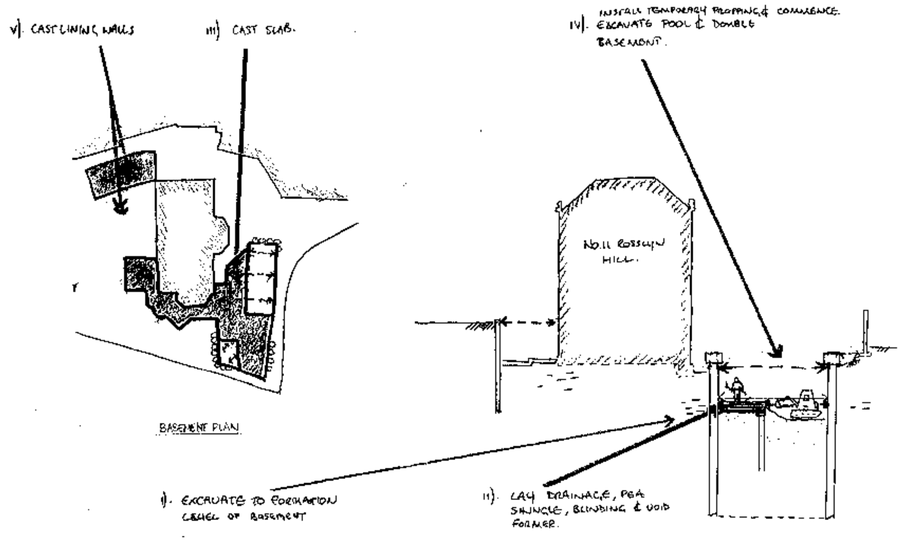
orig no. 1693/01/SK05 rev. C



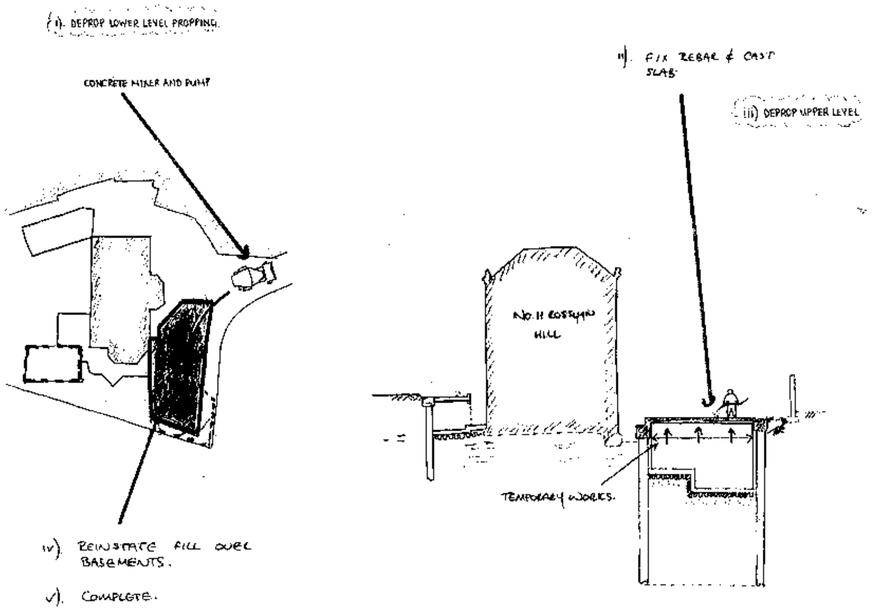
(5) EXCAVATION & PROPPING.



(7) EXCAVATE & CONSTRUCT POOL & DOUBLE BASEMENT.



(6) CONSTRUCTION OF BASEMENT SLAB.



(8) CONSTRUCTION OF TOP SLAB.

NOTES

1). REFER TO DRAWING 1693/01/SK05 FOR GENERAL NOTES.

A	26.03.15	ISSUED FOR PLANNING NOTES ADDED.	RWa
-	26.03.15	ISSUED FOR PLANNING.	FN

job
No. 11 Rosslyn Hill
NW3

title
Assumed Sequence of Construction
Sheet 2 of 2.

drawn RWa
checked FN
date MARCH '15
scale (original A1) PLAN 1:100 SECTION 1:100

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rev. A

Appendix J Calculations

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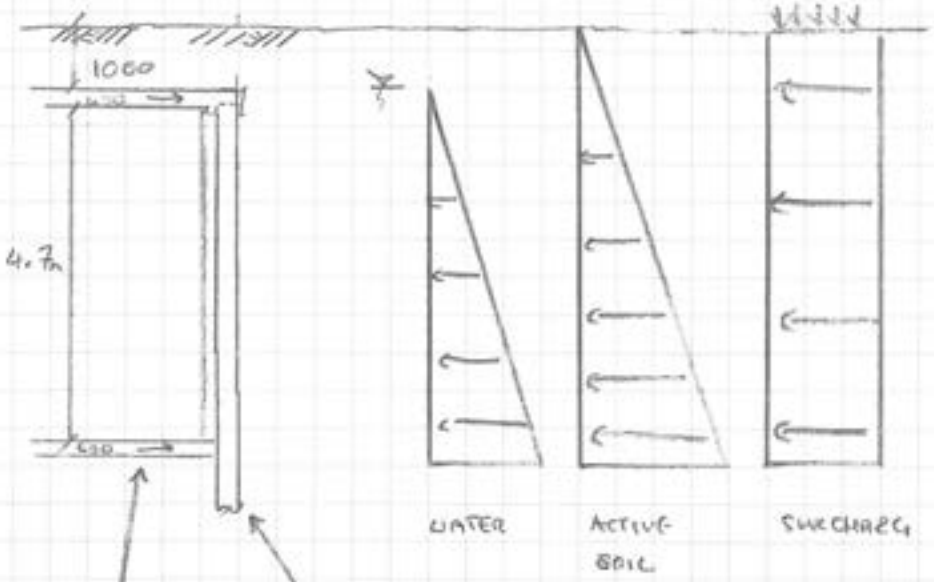
Date	Job no.	Sheet
MARCH 17	1693/01	A.1
Engineer RWa		
Checked by OF		
Project No.11 ROSSLYN HILL		

DESIGN OF A BASEMENT RETAINING WALL AT PLANNING STAGE TO BS8002.

PART OF THE RETAINING WALL STRUCTURE TO THE BASEMENT WILL BE AN RC BORED CONTIGUOUS PILED WALL WITH A LINING WALL, AND PART AN RC BORED SECANT PILED WALL. REFER TO DRAWING 1693/01/100 FOR LOCATIONS.

LOADING.

ACCIDENTAL LOADCASE – GROUND WATER 1m BELOW GROUND LEVEL



q = 10kN/m² (BS8002-1994 CLAUSE 3.3.4.1)

CONTIGUOUS PILED WALL WITH RC LINING WALL.

RETAINING WALL SPANS BETWEEN FLOOR SLABS

Active soil pressure
= Dry soil & dry soil overburden

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Date	Job no.	Sheet
MARCH 15	1693/01	A.2
Engineer RLWm.		
Checked by BF		

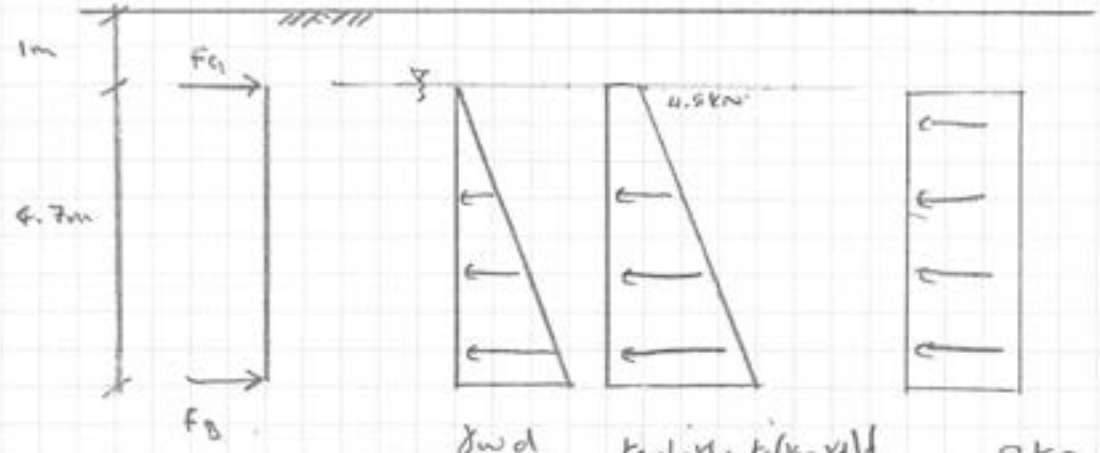
Project: No.11 Rosslyn Hill

SOIL PROPERTIES - BASED ON INFORMATION IN THE SI REPORT

- γ_s = 19 kN/m² γ_d = 15kN/m²
- $k_o = \frac{1 - \sin\phi}{\text{c.a}}$ where $\phi = 18°$

  ≈ 1.5 for normally consolidated clays
- $k_a = \frac{1-\sin\phi}{1+\sin\phi} = 0.52$ use k_a k_o over conservative

MODEL BASED ON RETAINING WALL SPANNING BETWEEN SLABS AND ACTING AS A SIMPLY SUPPORTED BEAM.



PRESSURE ACTING AT BASE OF WALL.

$\gamma_w d$ = 10 × 4.7 = 47 kN/m

$k_a x \gamma_d + k_a(\gamma_s - \gamma_d)d$ = 15 × 1 × 0.6 + 0.6 (18-15) 4.7 + 10 × 0.6 = 45 kN/m

$q k_a$ = 6 kN/m

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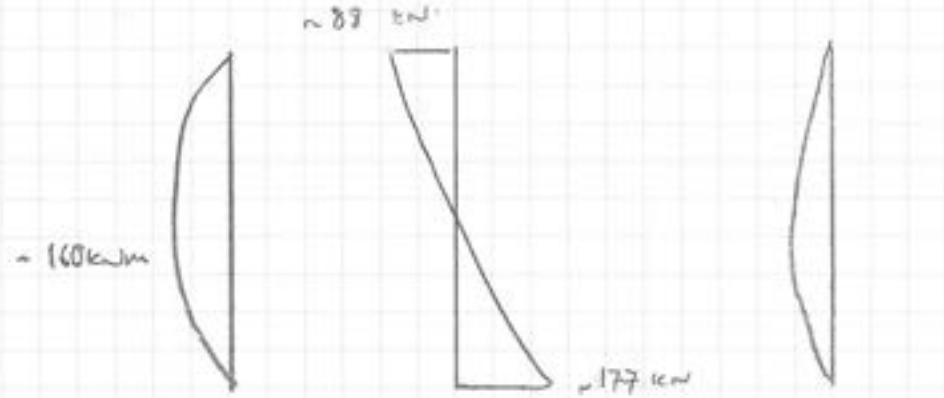
Date	Job no.	Sheet
MARCH 15	1693/01	9-3
Engineer PLA		
Checked by OF		
Project No.11 Rosslyn Hill		

QSE RESULTS.



BENDING MOMENTS | SHEAR FORCE | DEFLECTION

MAX BENDING MOMENT = kNM/M

MAX SHEAR FORCE = kN/M

FB = kN/M FORCE IN BASEMENT SLAB

FG = kN/M FORCE IN TOP SLAB

HAND CALCULATION CHECK.

MODEL TO LOADS AS A UDL OVER THE VEHICLE LENGTH

AVERAGE UDL = $\left(9 \times 4.5/2\right) + \left(0 \times 4.7/2\right) + 6 = 56.5$ kN/m

$M = \frac{WL^2}{8} = \frac{56.5 \times 4.7^2}{8} = 156$ kNm/m ✓ ∴ ok

DESIGN PILES FOR A MOMENT OF 160kNm/m.

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Date	Job no.	Sheet
MARCH 16	1693/01	A.4
Engineer RWJ.		
Checked by OF		
Project No. 11 ROSSLYN HILL		

PILE DESIGN TO BS8110

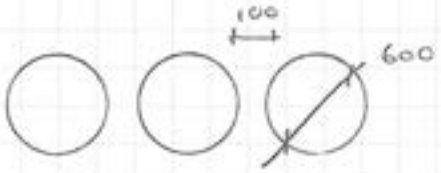
DESIGN PILES TO RESIST AN UNFACTORED MOMENT OF 160 kNm/m.

CHARACTERISTIC ANGLE OF FRICTION, $\phi' = 26°$ (SI REPORT)

USE A FACTOR OF SAFETY OF 1.6 (CONSERVATIVE AS CAN USE 1.2 FOR HYDROSTATIC PRESSURES)

DESIGN MOMENT = 120 × 1.6 = 192 kNm/m

TRY 600 ϕ PILE WITH 100mm GAPS BETWEEN.



DESIGN MOMENT/PILE = 162 × 700/1000 = 113.4 kNm

CHECKED BF A-5

Project	Spreadsheets to BS 8110	The Concrete Centre		
Client	Advisory Group	Made by: RMW	Date: 19-Mar-15	Page: 124
Location	Columns at A1, A2 etc	Checked: chg	Revision: -	Job No: R68

COLUMN CHART FOR CIRCULAR COLUMNS TO BS 8110:2005

Originated from 'RCC54.xls' v3.1 on CD

MATERIALS

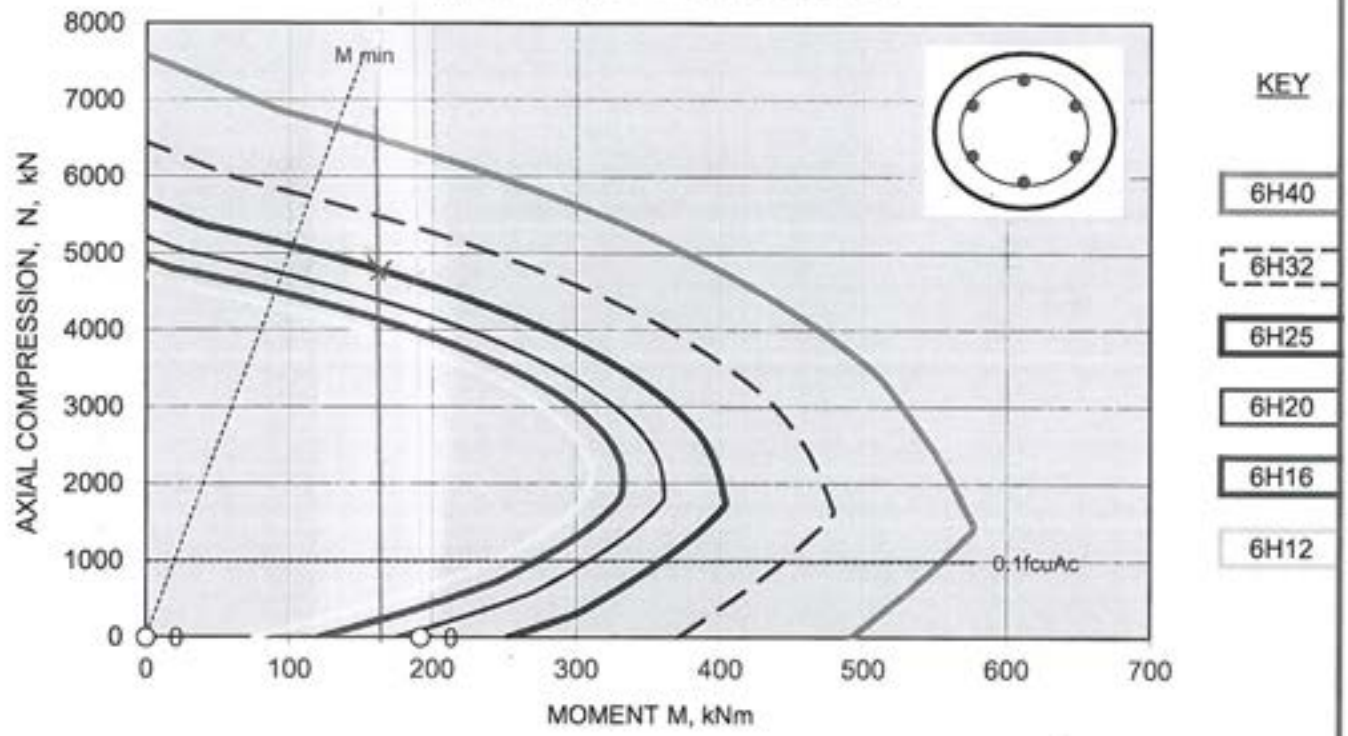
fcu	35	N/mm²	γm	1.15	steel	Cover	87	mm
fy	500	N/mm²	γm	1.5	concrete	h agg	20	mm
steel class	A							

SECTION 600 mm with 6 bars

BAR ARRANGEMENTS

Type	Bar Ø	Asc %	Link Ø	Bar c/c	Nbal (kN)	Nuz (kN)	Checks
H	40	2.67	10	191.6	1457	7581	ok
H	32	1.71	8	197.9	1638	6443	ok
H	25	1.04	8	201.6	1744	5655	ok
H	20	0.67	6	206.3	1805	5210	ok
H	16	0.43	6	208.4	2037	4926	ok
H	12	0.00	6	210.5			ok

N:M INTERACTION CHART for 600 diameter column, grade C35, 87 mm cover and 6 bars



LOADCASES

Load case	N (kN)	M (kNm)		Load case	N (kN)	M (kNm)	
1		192	6 H25	4			No Fit
2			No Fit	5			No Fit
3			No Fit	6			No Fit

PROVIDE 6H25

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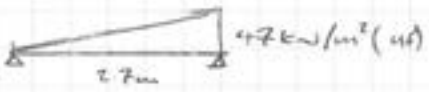
Date	Job no.	Sheet
MARCH 15	1693/01	A6
Engineer RWa		
Checked by BF		
Project No.11 ROSSLYN HILL		

RC WALL DESIGN TO BS 8110



DESIGN MOMENT 1m LENGTH OF WALL = 80.4(F) kNm/m

TRY 275mm THICK WALL.

$d = 275 - \underset{\text{INSIDE COVER}}{25} - 12 - \frac{20}{2} = 228\,mm$

$k = \frac{M}{f_{cu} b d^2} = \frac{80.4 \times 10^6}{35 \times 1000 \times 228^2} = 0.043 (ULS)\ 0.052\ (F)$

$z = 0.95d = 216\,mm$

$A_{srqd} = \frac{M}{0.87 f_y z} = \frac{80.4 \cdot 10^6}{0.87 \times 500 \times 216} = 852 (A)\ mm^2/m.$

PROVIDE

B12 @ 200 ctrs. = 1005 mm^2

DEFLECTION.

$\frac{SPAN}{d} = \frac{4700}{228} = 20 \rightarrow$ OK.

SHEAR

V = 60kN/m UNFACTORED ≈ 60 × 1.6 = 96 kN/m FACTORED (CONSERVATIVE)

$v = \frac{V}{bd} = \frac{62 \times 10^3}{1000 \times 228} = 0.27\ N/mm^2$

$\frac{100 A_s}{bd} = \frac{100 \times 2298}{1000 \times 228} \approx 1$

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Date	Job no.	Sheet
MAY 15	1693/01	A.7
Engineer RWH		
Checked by DF		
Project NO. 11 ROSSLYN HILL		

FROM TABLE 3.8 (BS8110) $v_c \geq 0.4\ N/mm^2$

NO SHEAR REINFORCEMENT REQD.

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Date	Job no	Sheet
MARCH 16	1693/31	A.8
Engineer KLWA		
Checked by OF		

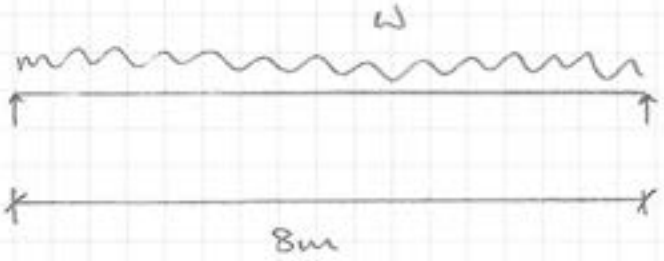
Project: No.11 ROSSLYN HILL

BASEMENT SLAB DESIGN TO BS8110.

MODEL AS SIMPLY SUPPORTED SPANNING BETWEEN BASEMENT WALLS

LOAD CASE

a) SURCHARGE = ALLOW FOR FIRE TENDER
b) HYDROSTATIC FORCES - ACCIDENTAL LOAD CASE (1m BELOW GL)
c) SOIL PRESSURES
d) Dead weight



$W = 10\,kN/m + (\ 0\ ) + (18 \times 1.25) + (0.6 \times 21) + (0.5) = 47.4\,kN/m^2$ nf

a b c d e $= 71\,kN/m^2$ f

NOTE TOP OF BASEMENT SET AT 1m BELOW GL.

e = ceiling finishes
d = concrete & levelling screed

DESIGN MOMENT FOR A m STRIP

$M = \frac{wL^2}{8} = 568\ kNm$

$d = 425 - 25 - \frac{20}{2} = 390\ mm$ (25 = cover)

$f_{cu} = 40\,N/mm^2$

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$K = \frac{M}{f_{cu} b d^2} = \frac{568 \times 10^6}{40 \times 1000 \times 390^2} = 0.09$

$z = 0.95d = 403$ mm

$A_s = \frac{M}{0.87 f_y z} = \frac{568 \times 10^6}{0.87 \times 500 \times 403} = 3240\ mm^2$

Provide T20 @ 200 c/c → 1577 mm^2/m

T25 @ 200 c/c → 2454 mm^2/m

4031 mm^2/m

SHEAR

$V = \frac{5K}{7} = 284$ kN

$100 \times A_s / bd = \frac{100 \times 4051}{1000 \times 390} = 1.0$

$v = \frac{V}{bd} = \frac{284 \times 10^3}{1000 \times 390} = 0.72\ N/mm^2$

$v_c = 0.62$. [TABLE 3.8]

$> v$ ∴ ok

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GROUND MOVEMENT PREDICTION IN ACCORDANCE WITH CIRIA C580

TO ACCOMPANY THE BIA FOR THE PROPOSED DEVELOPMENT

AT NO 11 ROSLYN HILL, HAMPSTEAD, LONDON

* See BELOW GROUND CONDITION = LONDON CLAY

ESTIMATE MOVEMENTS USING EMPIRICAL RELATIONSHIP AS PER

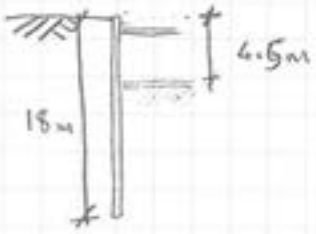
CIRIA C580 - EMBEDDED RETAINING WALLS.

MOVEMENT DUE TO THE PILE INSTALLATION.

(BASED ON FIGURE 2.8 - CIRIA C580)
ATTACHED ON FOLLOWING PAGE

WALL TYPE - CONTIGUOUS PILED WALL

PILE DEPTH ≈ 18m



DISTANCE FROM FACE OF WALL (m)	MOVEMENT DUE TO PILE INSTALLATION	
	HORIZONTAL (mm)	VERTICAL (mm)
0	7.2	7.2
1	7.2	7.02
5	5.4	6.3
10	3.6	3.4
15	2.7	3.0

THESE DISTANCES WILL ENABLE A CONTOUR PLOT TO BE ESTABLISHED TO DETERMINE THE GROUND MOVEMENTS OF THE SURROUNDING BUILDINGS. BUILDINGS BEYOND 30m NOT CONSIDED. SEE SHEET 3

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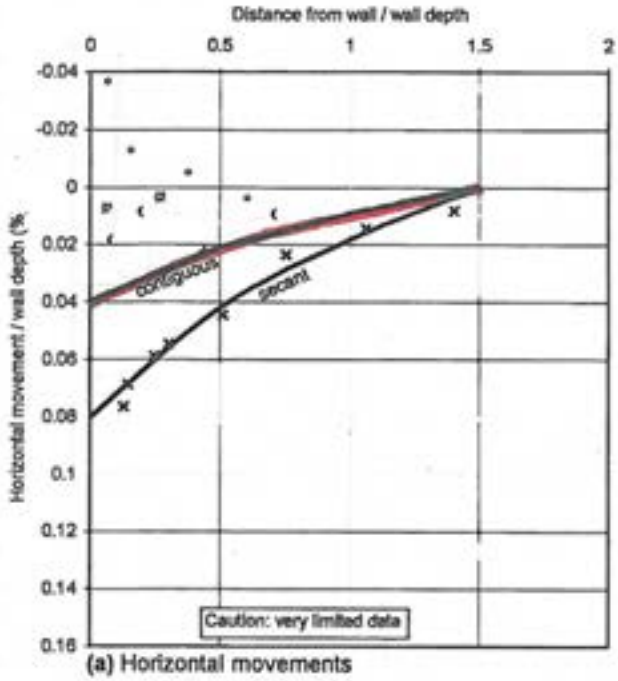
B1a



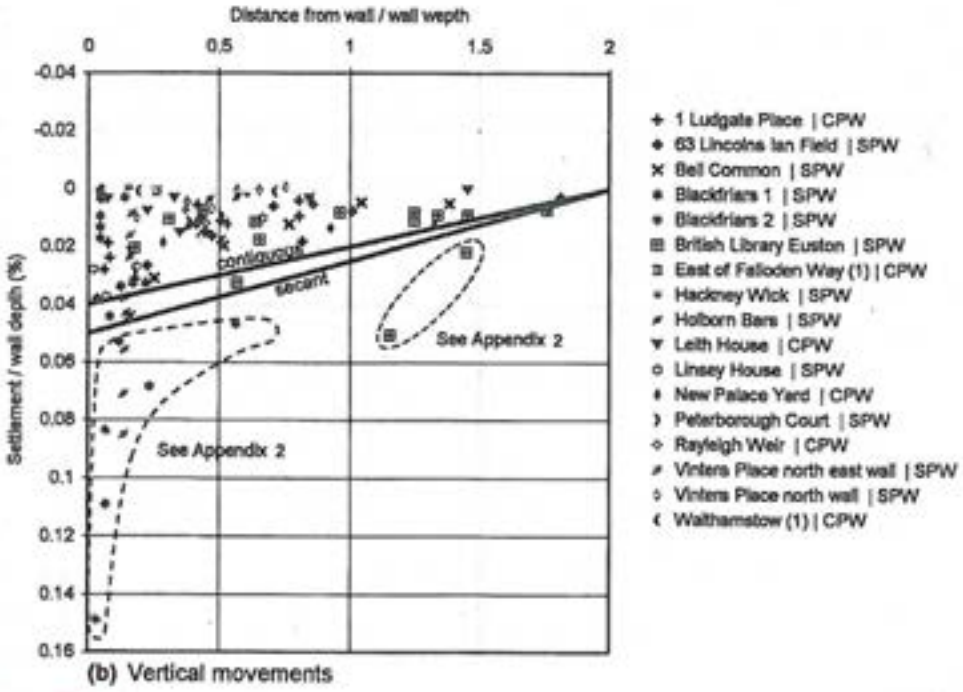


Figure 2.8 *Ground surface movements due to bored pile wall installation in stiff clay*

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DISTANCE BEHIND WALL TO NEGLIGIBLE HORIZONTAL MOVEMENT FROM TABLE 2.2 ATTACHED

= 1.5 x d = 1.5 x 18 = 27 m

DISTANCE BEHIND WALL TO NEGLIGIBLE VERTICAL MOVEMENT

= 2 x d = 2 x 18 = 36m. (NOTE BUILDINGS @ 5m, 15m AWAY NEXT CLOSEST + 30m)

THE BASEMENT WALL WILL BE FORMED IN PART BY RC CONTIG PILES WITH A LINING WALL & IN PART BY RC SECANT PILES WITH A LINING WALL. GROUND MOVEMENTS HAVE BE CONSIDED LOOKING AT THE CONTIG PILED WALL AS IT IS MORE CONSERVATIVE.

Table 2.2 *Ground surface movements due to bored pile and diaphragm wall installation in stiff clay*

Wall type	Horizontal movements		Vertical movements	
	Surface movement at wall (per cent of wall depth)	Distance behind wall to negligible movement (multiple of wall depth)	Surface movement at wall (per cent of wall depth)	Distance behind wall to negligible movement (multiple of wall depth)
Bored piles				
Contiguous	0.04	1.5	0.04	2
Secant	0.08	1.5	0.05	2
Diaphragm walls				
Planar	0.05	1.5	0.05	1.5
Counterfort	0.1	1.5	0.05	1.5

Notes

1. Maximum surface movement occurs close to the wall and is calculated as a percentage of the pile depth/diaphragm wall trench depth, as appropriate.
2. Extent of movement is calculated non-dimensionally by dividing by the pile depth/diaphragm wall trench depth, as appropriate

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FROM FIGURE 2.11 (USING HIGH STIFFNESS VALUES)

DISTANCE FROM FACE OF WALL (m)	MOVEMENT DUE TO EXCAVATION: HORIZONTAL (mm)	VERTICAL (mm)
0	8.25	1.65
1	7.7	3.3
5	6.05	4.4
10	4.95	2.2
15	2.75	1.65

TOTAL GROUND SURFACE MOVEMENTS DUE TO EXCAVATION:

COMBINE MOVEMENTS DUE TO WALL INSTALLATION & EXCAVATION

DISTANCE FROM FACE OF WALL	TOTAL MOVEMENT HORIZONTAL (mm)	VERTICAL (mm)
0	15.5	5.85
1	14.7	10.3
5	11.5	10.7
10	8.6	7.6
15	5.5	5.25

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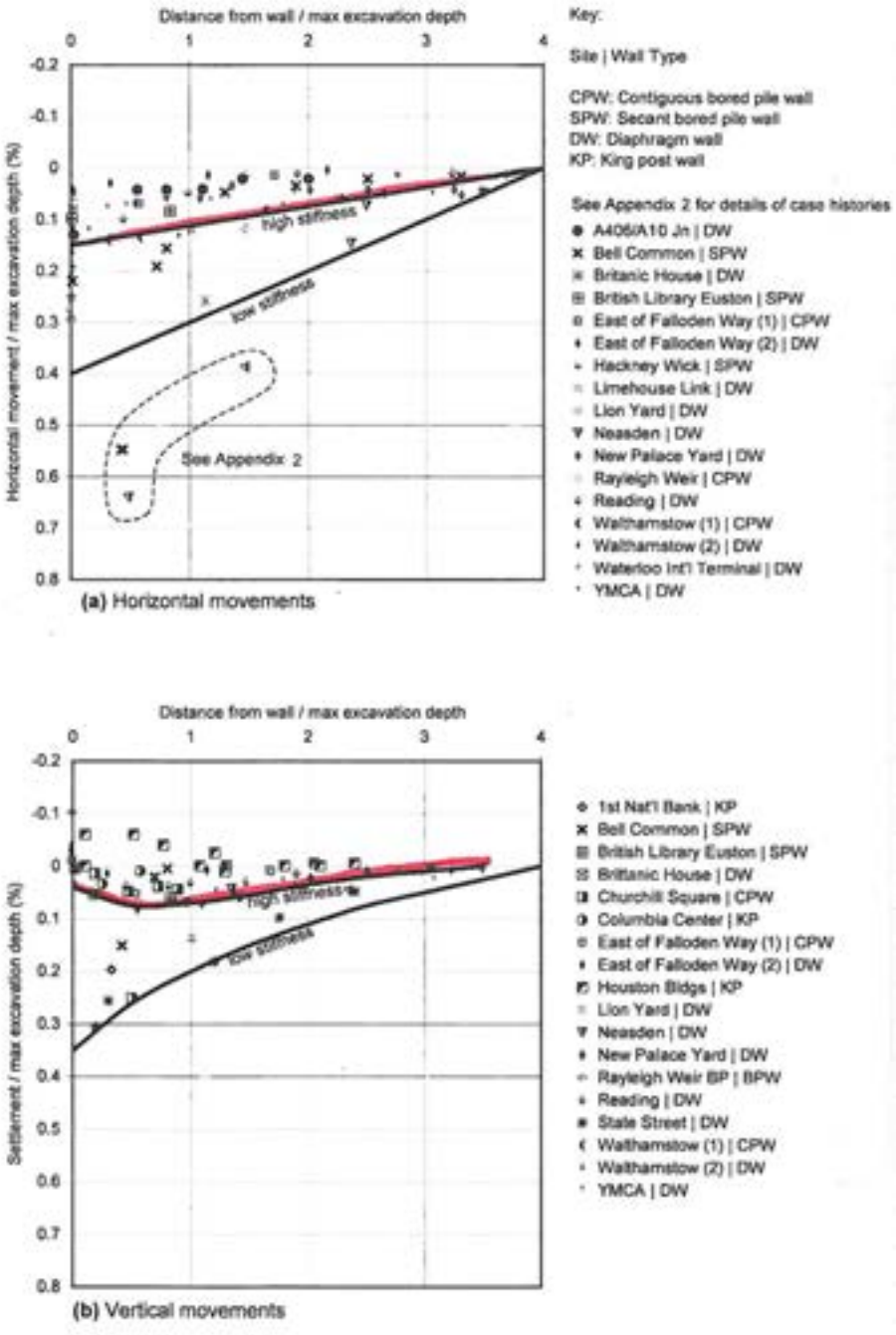

Figure 2.11 *Ground surface movements due to excavation in front of wall in stiff clay*

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ESTIMATE OF GROUND SURFACE MOVEMENTS DUE TO EXCAVATION:

FROM TABLE C3, THE BASEMENT WILL BE GENERALLY OF A HIGH SUPPORT STIFFNESS. TEMPORARY PROPS WILL BE INSTALLED BEFORE THE PERMANENT PROPS AT HIGH LEVELS.

DEPTH OF EXCAVATION = 5.5 m

FROM TABLE 2c: ATTACHED

DISTANCE BEHIND WALL TO NEGLIGIBLE HORIZONTAL MOVEMENT
= 4 x 5.5 = 22 m

DISTANCE BEHIND WALL TO NEGLIGIBLE VERTICAL MOVEMENT
= 3.5 x 5.5 = 19.25 m

NOTE THE INFORMATION GIVEN IN TABLE 2c IS COLLECTED FROM EMPIRICAL EVIDENCE FROM EXCAVATIONS 5-31 m DEEP. GIVEN THE PROPOSED BASEMENT IS ONLY 5.5 m DEEP THE CALCULATION IS CONSERVATIVE.

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Table 2.3 *Support stiffness categories (Carder, 1995)*

Support stiffness	Description/examples
High	*Top-down construction*, temporary props installed before permanent props at *high* level
Moderate	Temporary props of high stiffness installed before permanent props at *low* level
Low	*Cantilever walls*, temporary props of *low* stiffness or temporary props installed at low level

Table 2.4 summarises the magnitude and extent of the monitored ground surface movements due to excavation in front of bored pile, diaphragm and sheet pile walls wholly embedded in stiff clay under conditions of good workmanship. The case history data, upon which Table 2.4 is based, relate to excavations that range in depth from 8 m to 31 m, have a factor of safety against base heave in excess of 3 and where walls are wholly embedded in stiff clay.

Table 2.4 *Ground surface movements due to excavation in front of bored pile, diaphragm wall and sheet pile walls wholly embedded in stiff clays*

Movement type	**High support stiffness** (high propped wall, top-down construction)		**Low support stiffness** (cantilever or low-stiffness temporary props or temporary props installed at low level)	
	Surface movement at wall (per cent of max excavation depth)	**Distance behind wall to negligible movement** (multiple of max excavation depth)	**Surface movement at wall** (per cent of max excavation depth)	**Distance behind wall to negligible movement** (multiple of max excavation depth)
Horizontal	0.15	4	0.4	4
Vertical	0.1	3.5	0.35	4

Notes

1. Maximum surface movement occurs close to the wall and is expressed as a percentage of maximum excavation depth in front of the wall.
2. Extent of movement is calculated non-dimensionally by dividing by maximum excavation depth.
3. Movements exclude those arising from wall installation effects.
4. Movements correspond to good workmanship and to walls wholly embedded in stiff clays retaining stiff clays or competent soils.
5. Movements will be greater where soft soils are encountered at formation level; see Appendix 2.

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BUILDING DAMAGE ASSESSMENT

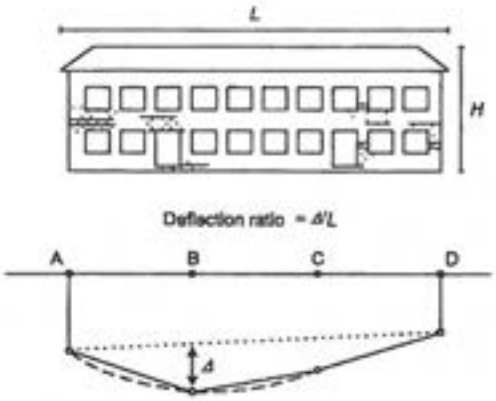
FOLLOW METHOD SET OUT IN THE FLOW CHARTS IN FIGURE 2.17.

DAMAGE TO ADJACENT BUILDINGS WILL BE DETERMINED BY CALCULATING THE STRAINS THE BUILDING WILL EXPERIENCE AS A RESULT OF THE MOVEMENTS. THIS IS IN ACCORDANCE WITH BOX 2.5 & 2.15 OF CIRIA C580.

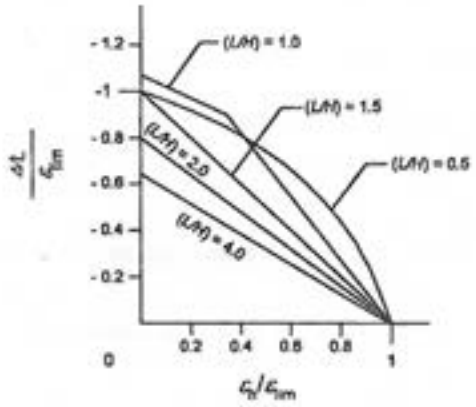
THE FOLLOWING STRUCTURES HAVE BEEN IDENTIFIED AS BEING WITHIN THE INFLUENCE ZONES. THE DIMENSIONS (LENGTH & HEIGHT) ARE SHOWN, AS SET OUT IN BOX 2.5.

CONTOUR

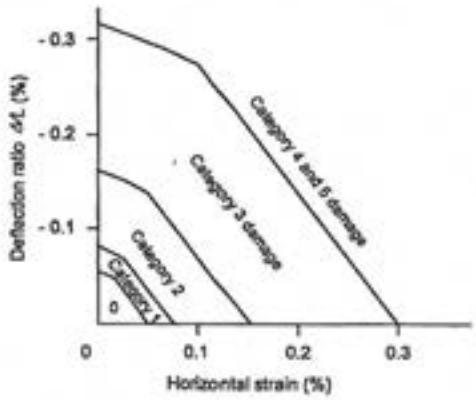
		L (m)	H (m)	L/H
Inc.	a) No 11 Rosslyn Hill	17	13	1.3
	b) Lyndhurst Hall	55	22	2.5
Sm	c) Garages off Hillersdon Hill	12	3	4
10m	N/A			
15m	N/A			



(a) Definition of deflection ratio.



(b) Influence of horizontal strain on $\Delta/L / \varepsilon_{lim}$ (after Burland, 2001)



(c) Relationship between damage category and deflection ratio and horizontal tensile strain for hogging for (L/H) = 1.0 (after Burland, 2001)

By adopting values of ε_{lim} associated with the various damage categories given in Table 2.5, Figure (b) can be developed into an interaction diagram showing the relationship between Δ/L and ε_h for a particular value of L/H. Figure (c) shows such a diagram for (L/H) = 1.0.

Figure 2.18 *Relationship between damage category, deflection ratio and horizontal tensile strain (after Burland, 2001)*

Reinforced concrete-framed structures are more flexible in shear than are masonry structures and are consequently less susceptible to damage. Nevertheless, for the purposes of a stage 2 assessment of potential damage, all structures should be treated as masonry structures.

Box 2.5 *Procedure for stage 2 damage category assessment*

The following steps should be undertaken in making a stage 2 assessment of the damage to a structure:

(i) establish L and H for the structure (see Figure 2.18(a) for definitions of L and H)

(ii) determine (L/H)

(iii) determine relationship between (Δ/L) and ε_h for the required (L/H) from Figure 2.18(b) for ε_{lim} values from Table 2.5

(iv) estimate vertical and horizontal ground surface movements in the vicinity of the structure from Figure 2.14

(v) determine (Δ/L) and ε_h $(= \delta_h/L)$ where δ_h is the horizontal movement

(vi) estimate damage category from the relationship between (Δ/L) and ε_h established from step (iii) above.

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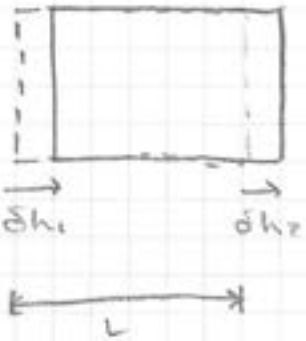
THE NEXT STAGE IS TO CALCULATE THE HORIZONTAL & VERTICAL STRAINS EXPERIENCED BY THE ADJACENT BUILDINGS.

HORIZONTAL STRAIN

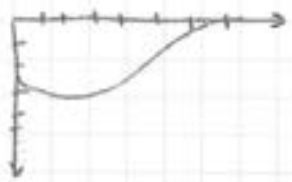


HORIZONTAL STRAIN

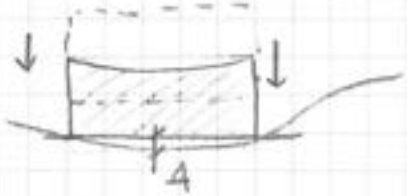
$$\varepsilon_h = \frac{\delta L_1 + \delta h_2}{L}$$

VERTICAL STRAINS

THE TOTAL VERTICAL DEFLECTION FOLLOWS THE FOLLOWING RELATIONSHIP



THE STRAINS CANNOT SIMPLY BE CALCULATED AS FOR THE HORIZONTAL STRAINS. THE BUILDING WILL DEFORM AS FOLLOWS



NOTE THE BUILDING IS ASSUMED TO DEFLECT TO FOLLOW THE SURFACE OF THE GROUND.

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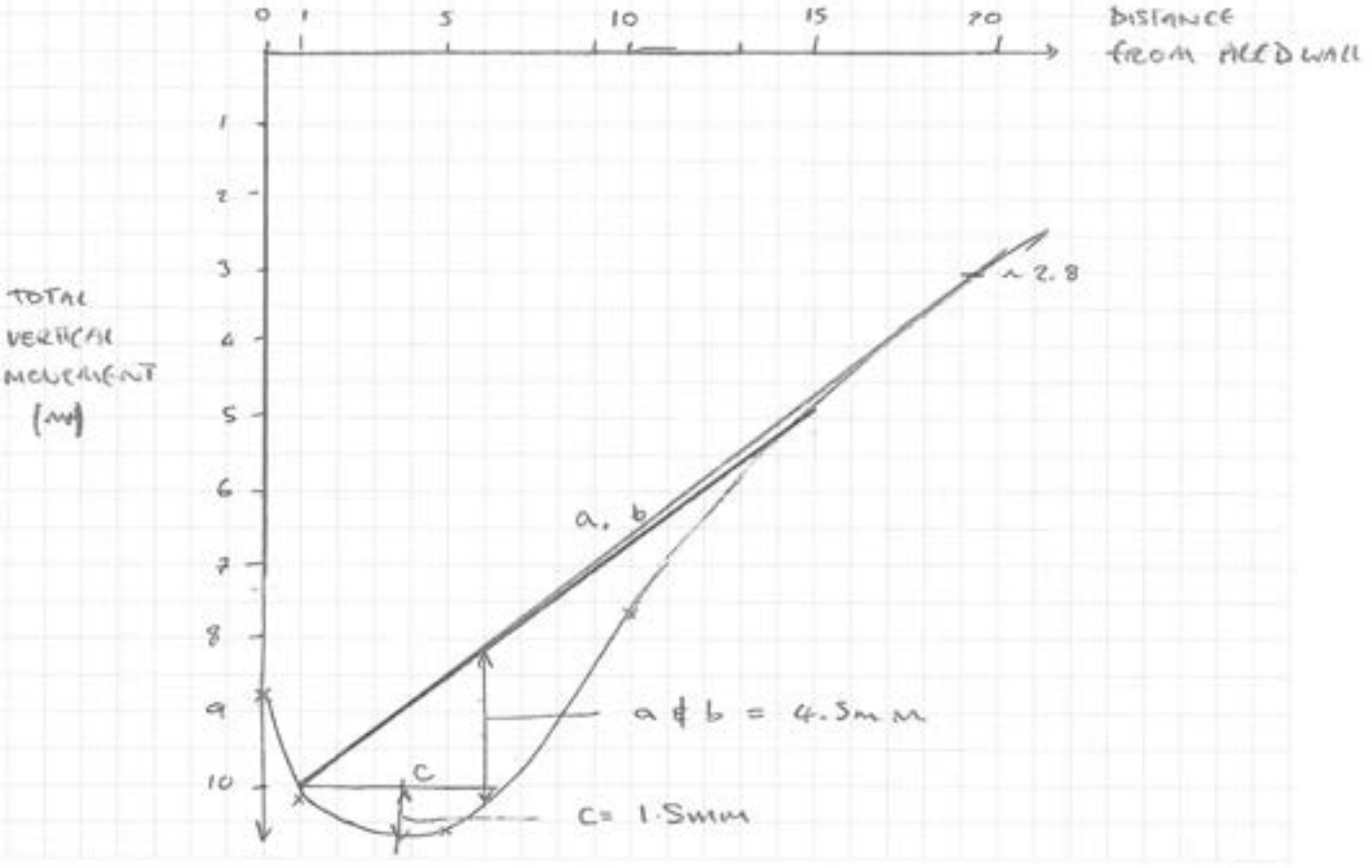
THE ABSOLUTE DEFLECTIONS HERE ARE NOT IMPORTANT. THE DIFFERENTIAL SETTLEMENT IS AS THIS CAN CAUSE CRACKING. STRAINS CAN BE RELATED TO Δ = GREATEST DIFFERENTIAL SETTLEMENT, AS SHOWN ON THE PREVIOUS PAGE.

THE FOLLOWING GRAPH SHOWS THE TOTAL VERTICAL DEFLECTIONS CALCULATED PREVIOUSLY. THE BUILDINGS HAVE BEEN DRAWN TO DETERMINE THEIR DIFFERENTIAL VERTICAL MOVEMENT. THEIR EXTENTS CLOSEST AND FURTHEST POSITIONS FROM THE EXCAVATION HAVE BEEN DETERMINED FROM THE CONTOUR MAP AND TABULATED ON THE FOLLOWING PAGE.



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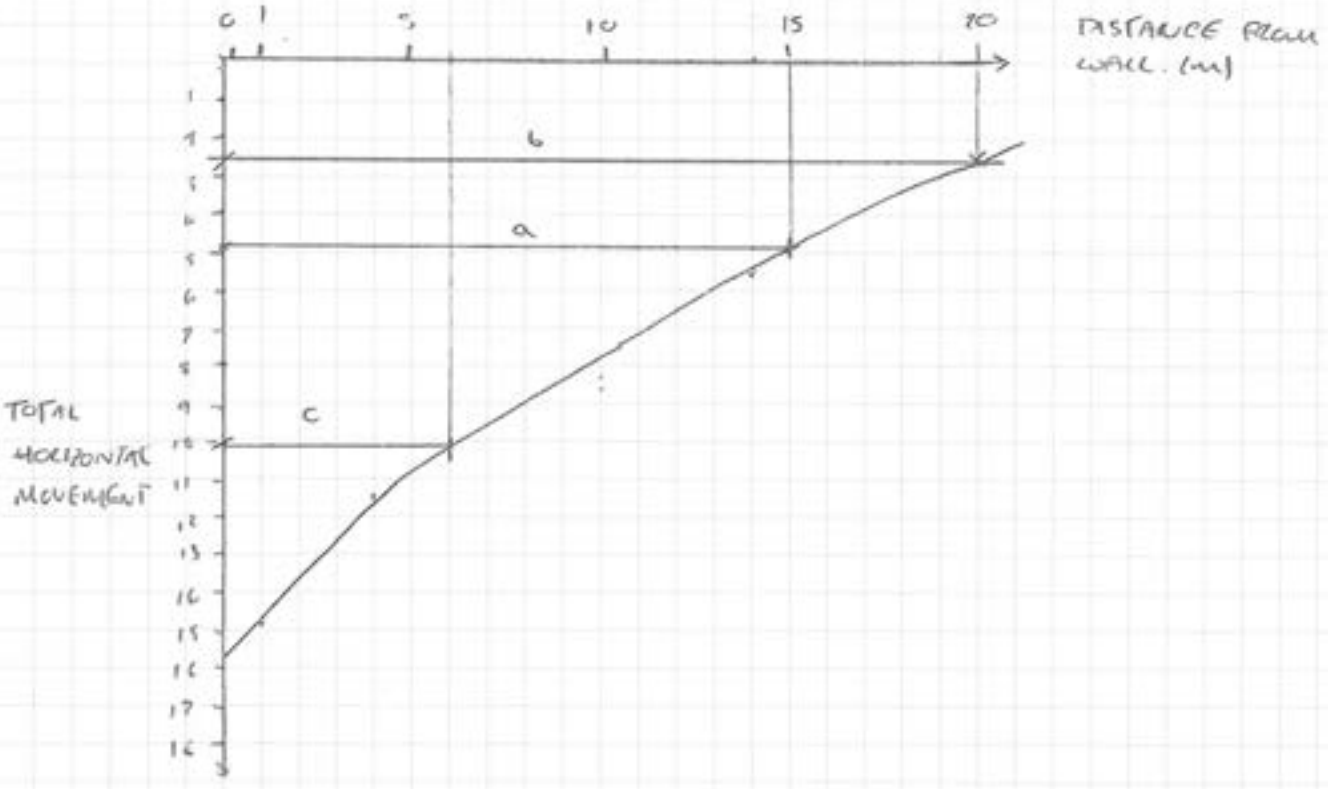
	STRUCTURE	CLOSEST ε CONTOUR (m)	FURTHEST CONTOUR (m)	Δ (mm)	L (m)	Δ/L %
a)	NO 11 ROSSLYN HILL	10	15	4.5	17	0.026
b)	LYNDHURST HALL	1	20+	7.2	55	0.013
c)	GARAGES ON HAVERSTOCK HILL	1.	6	1.5	12	0.012 5

HORIZONTAL STRAIN

GRAPH BELOW PROVIDED FROM TOTAL GROUND SURFACE MOVEMENT ON SHEET



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Project: No.11 ROSSLYN HILL

STRUCTURE	CLOSEST CONTOUR	δh_1 (mm)	FURTHEST CONTOUR	δh_2 (mm)
11 ROSSLYN HILL	1	14.5	15	~5
LYNDHURST HALL	1	14.5	20+	2.5
CHARGES ON HAVERSTOCK HILL	1	14.5	6	10

$\Delta \delta h_1 - \delta h_2$	L	Eh (%)
9.5	17	0.056
12	55	0.022
4.5	6	0.075

VALUES FOR δh_1 & δh_2 HAVE BEEN FOUND FROM THE GRAPH ON THE PREVIOUS PAGE

HORIZONTAL STRAINS = $\frac{\delta h_2 - \delta h_1}{L} \cdot \varepsilon_h$

DAMAGE ASSESSMENT

THE HORIZONTAL & VERTICAL STRAIN WILL BE USED TO ASSESS THE BURLAND DAMAGE CATEGORY FOR EACH STRUCTURE FOR EACH STRUCTURE IN ACCORDANCE WITH THE LIMITING STRAIN FOR EACH CATEGORY OUTLINED IN TABLE 2.5 ON THE FOLLOWING PAGE & THE GRAPH IN FIGURE 2.18:

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Table 2.5 *Classification of visible damage to walls (after Burland et al, 1977, Boscardin and Cording, 1989; and Burland, 2001)*

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain ε_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	≈ 1	0.05–0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	≈ 5	0.075–0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks ≥ 3	0.15–0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	≥ 0.3
5 Very severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually ≥ 25 but depends on number of cracks.	

Notes

1. In assessing the degree of damage, account must be taken of its location in the building or structure.
2. Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

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STRUCTURE	Δ/L %	Eh %	y/h	BUILDING CATEGORY OF DAMAGE.
a) No 11 Rosslyn Hill	0.026	0.06	1.3	(2)
b) CYNDHURST HALL	0.013	0.02	2.5	(1)
c) GARAGES ON HALEBECK HILL	0.0125	0.075	4	(2)

CALCULATIONS. LIMIT $\varepsilon_{lim} = 0.15\%$ SLIGHT

a) Rosslyn Hill.

$$\frac{\Delta/L}{\varepsilon_{lim}} = \frac{0.06}{0.15} = 0.4$$

$$\frac{\varepsilon_h}{\varepsilon_{lim}} = \frac{0.026}{0.15} = 0.173$$

FROM FIGURE 2.15 → OK.

CALCULATION LIMIT $\varepsilon_{lim} = 0.075\%$ VERY SLIGHT

b) CYNDHURST HALL

$$\frac{\Delta/L}{\varepsilon_{lim}} = \frac{0.013}{0.075} = 0.173$$

$$\frac{\varepsilon_h}{\varepsilon_{lim}} = \frac{0.02}{0.075} = 0.26$$

FROM FIGURE 2.15b → OK

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CALCULATION LIMIT $\varepsilon_{lim} = 0.15$ SLIGHT

c) GARAGES ON MAIDERSTOCK HILL

$$\frac{\Delta/L}{\varepsilon_{lim}} = \frac{0.075}{0.15} = 0.5$$

$$\frac{\varepsilon_h}{\varepsilon_{lim}} = \frac{0.0125}{0.075} = 0.16$$

FROM FIGURE 2.15b → OK

ALL STRUCTURAL DAMAGE IS LIMITED TO A MAXIMUM OF BURLAND CATEGORY 1 → SLIGHT ∴ OK.

Appendix K Arboriculturalist's Report

DRAFT 1 Airspade Root Investigation. 11 Rosslyn Hill.

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VAT Reg No. 718 0487 29
EMAIL: boward.ox@btopenworld.com

DOCUMENTS TO VIEW:

- LANDSCAPE TRENCHES JPEG.
- AIRSPADE INVESTIGATION – PHOTOGRAPHIC EVIDENCE & ROOTING ZONES.
- EXCAVATION BOUNDARY CONDITIONS.
- PLAN A, BS: 5837 2012, 11 Rosslyn Hill, London
- For root diameters in each rooting zone see table 1. In appendix.

This report is an extension of the BS: 5837 2012 arboricultural report and impact assessment which found that the root protection area (the area which is predicted to be in use by a tree based upon a calculation derived from the stem diameter) of several trees was found to extend into the proposed basement area at 11 Rosslyn Hill, where the light-well, stairs, store room and kitchen are to be located. This includes the RPA of two mature category B Horse Chestnuts (tagged 3778 & 3776) and also a mature category C Sycamore (tagged 3777). Of these only tree 3776 is growing from the grounds of number 11 (See Plan A, BS:5837 2012 11 Rosslyn Hill, London).

Airspade works were carried out by Mr Michael Boys, Geoffery Finnamore and Matthew Jellings between the 18th and 21st of June 2013. The weather during this period was dry and suitable for carrying out trench digging using compressed air blown through a hollow lance, a method which removes the soil but leaves the stronger roots intact. The positioning of the three trenches was recommended by Stuart Hookham of Alan Baxter & Associates LLP, although slight modifications were made where necessary due to the presence of a previously unknown layer of concrete and drainage inspection chamber (See 'Exact landscape trenches jpg.')

The turf over the trenches was carefully removed in sections to allow it to be laid back onto the lawn. Outside of the predicted root protection area the trenches were excavated 30-35cm wide and taken to a depth of 1m using a mini-digger to produce a steep vertical soil profile which made the use of the air-spade more efficient. Soil was blown along the trench until it could be removed with the mini-digger or by hand, until either a root of significant size or dense rooting mat of thinner roots was discovered. The location of any roots above 1cm was recorded, and these were covered in damp hessian material to protect from desiccation. Any damaged roots were severed using secateurs to give the cleanest possible wound and reduce the likelihood of future root decay.

Trench 1.

Soil Type: Under the lawn there is a brown earth soil roughly 20cm deep, below which is a mixture of semi-loose soil and builder's rubble, with a horizon of flint and pebbles embedded in thick grey clay emerging around 60-100cm.

Root Content: As predicted, within the RPA of tree 3776 there were a number of significant roots, with larger roots closer to the base of the tree. The majority of the roots over 1cm in diameter were found in the top 20cm of soil however one was found at a depth of 46cm. Two important roots 6cm in diameter were found at the southern corner of the trench, and these lead towards the Horse Chestnut tree 3776.

Key Points: We would recommend that the major roots located to the south east of trench 1 are avoided.

Trench 2.

Soil Type: The soil make up under the lawn is the same as trench 1. The soil composition changes below the gravel matting, where there is a concrete surface 10-15cm deep which is joined to the main house, extending outwards from the property SW by 2m. The trench was dug along the edge of this concrete. Outside of the concrete surface there is a small man-made sand layer below the ground sheet which is mixed with a small dirt surface layer 10-20cm deep. Below this the soil horizon turns to orange/brown clay. Some builder's rubble was found in the layer around 50cm down.

Root Investigation: A dense rooting matt of fine and coarse roots (>1cm) were discovered in the top 20cm of the soil under the lawn between trench 1 and the gravel area, proving the trees are utilising this area heavily for water/nutrient uptake. Boward did not excavate deeper in this section of the trench for fear of damaging these surface roots. In the trench underneath the

gravel a small rooting area was discovered parallel to the decking area spreading up to 5m away from the step between the lawn and gravel. The largest root in this section of the trench branched into two in a south westerly direction, presumably this root is growing from the young Wisteria rather than the mature trees to the south.

Key Points: Note the presence of the drains at either end of the trench, which are surrounded by concrete and 2.2m deep. An old drain pipe was found roughly 40-50cm down to the South West of the trench. Whether this is in service is not known.

Trench 3.

Soil Type: This trench was the most difficult to dig using the air-spade with the soil made up of a highly compacted mixture of grey clay, flint and rubble.

Root Investigation: No fine roots discovered, only a single main root which flared out to the NW of the existing guest house.

Key Points: It is possible that the hard condition of the ground here made it cost-ineffective for the trees to develop fine rooting system in this predicted rooting area. As such, although a significantly sized root was discovered here in general this trench is not being utilised by roots.

APPENDIX

Table 1. Diameter of significant roots found in airspade investigation.

Map Label	Trench	Diameter of root/roots/mm
A	1	10, 16, 12, 22
B	1	14
C	1	30
D	1	28, 18, 12
E	1	19
F	1	12, 13
G	1	60, 65
J	2	21
K	2	15, 14, 18
L	2	21
M	3	29

RECOMMENDATIONS:

BASEMENT DESIGN:

GROUND FLOOR DESIGN:

Air-spade Root Investigation. 11 Rosslyn Hill.

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DOCUMENTS TO VIEW:

- LANDSCAPE TRENCHES JPEG.
- AIRSPADE INVESTIGATION – PHOTOGRAPHIC EVIDENCE & LOCATIONS.
- EXCAVATION BOUNDARY CONDITIONS.
- PLAN A, BS: 5837 2012, 11 Rosslyn Hill, London
- For root diameters in each rooting zone see table 1. In appendix.

This report is an extension of the BS: 5837 2012 arboricultural report and impact assessment which found that the root protection area (RPA - the area which is predicted to be in use by a tree based upon a calculation derived from the stem diameter) of several trees was found to extend into the proposed basement area at 11 Rosslyn Hill, where the light-well, stairs, store room and kitchen are to be located. This includes the RPA of two mature category B Horse Chestnuts (tagged 3778 & 3776) and also a mature category C Sycamore (tagged 3777). Of these only tree 3776 is growing from the grounds of number 11 (See Plan A, BS:5837 2012 11 Rosslyn Hill, London).

Air-spade works were carried out by Mr Michael Boys, Geoffrey Finnimore and Matthew Jellings between the 18th and 21st of June 2013. The weather during this period was dry and suitable for carrying out trench digging using compressed air blown through a hollow lance, a method which removes the soil but leaves the root system intact. The positioning of the trenches was recommended by Stuart Hookham of Alan Baxter & Associates LLP, although slight modifications were necessary due to the presence of a previously unknown layer of concrete and a drainage inspection chamber (See 'Exact landscape trenches jpg.')

The turf over the trenches was carefully removed in sections to allow it to be laid back onto the lawn. Outside of the predicted root protection area the trenches were excavated 30-35cm wide and taken to a depth of 1m using a mini-digger to produce a steep vertical soil profile which made the use of the air-spade more efficient. Soil was blown along the trench until it could be removed with the mini-digger or by hand, until either a root of significant size or a dense rooting mat of thinner feeding roots was discovered. The location of any roots above 1cm in diameter was recorded, and were covered in damp hessian material to protect from desiccation. Any damaged roots were severed using secateurs to give the cleanest possible wound and reduce the likelihood of future root decay. After excavation, the soil was carefully placed back in to the trenches.

Trench 1

Soil Type: Under the lawn there is a brown earth soil roughly 20cm deep, below which is a mixture of semi-loose soil and rubble, with a horizon of flint and pebbles embedded in thick grey clay emerging around 60-100cm.

Root Content: As predicted, within the RPA of tree 3776 there were a number of significant roots, with larger roots closer to the base of the tree. The majority of the roots over 1cm in diameter were found in the top 20cm of soil however one was found at a depth of 46cm. Two important roots belonging to Horse Chestnut Tree 3776, of 6cm diameter were found at the southern corner of the trench.

Key Points: We would recommend that the existing RPA of tree 3776 is respected (see Excavation Boundary conditions).

Trench 2

Soil Type: Same as trench 1

Root Investigation: A dense rooting matt of fine and coarse roots (>1cm) were discovered in the top 20cm of the soil under the lawn between trench 1 and the gravel area, proving the trees are utilising this area for water/nutrient uptake. We did not excavate deeper in this section of the trench for fear of damaging these surface roots.

Key Points: Excavation around this part of the lawn should be avoided. It can be inferred that the roots discovered in this area could be attributed to the adjacent horse chestnut (3776), and hence the area located north of the trench line relating to the RPA of sycamore 3777 is potentially

negligible, however without an in-depth analysis of species identification on the roots, and an excavation to determine the depth of footing for the the patio, this hypothesis cannot be confirmed.

Trench 3

Soil Type: The soil composition changes below the gravel matting, where there is a concrete surface 10-15cm deep which is joined to the main house, extending outwards from the property SW by 2m. The trench was dug along the edge of this concrete. Outside of the concrete surface there is a small man-made sand layer below the ground sheet which is mixed with a small dirt surface layer 10-20cm deep. Below this the soil horizon turns to orange/brown clay. Some rubble was found in the layer around 50cm down.

Root Investigation: Underneath the gravel, some smaller roots were discovered parallel to the patio area spreading up to 5m away from the step between the lawn and gravel. The largest root in this section of the trench branched into two in a south westerly direction (K). The observed branching angles of this root suggest that this root is growing from the adjacent Wisteria rather than the mature trees to the south. Smaller roots were found at a depth just above the compacted clay at 40-50cm.

Key Points: Note the presence of the concrete drain access manholes at either end of the trench (See *Photographic Evidence and Locations*.) One was measured to an internal depth of 2.2m. An old drain pipe was found roughly 40-50cm down to the South West of the trench. Whether this is in service is not known. The RPA north of the trench is attributed to sycamore 3777. The north easterly side of the trench provided no evidence of root activity relating to the RPA's in question. No significant roots were discovered within this trench

Trench 4

Soil Type: This trench was the most difficult to dig using the air-spade with the soil made up of a highly compacted mixture of grey clay, flint and rubble.

Root Investigation: No fine roots discovered, only a single main root which flared out to the North of the existing guest house.

Key Points: It is possible that the hard condition of the ground here made it difficult for the adjacent tree (3778) to develop a fine rooting system in this predicted rooting area. As such, although a significant root was discovered here, in general this area is not being utilised by trees feeding roots.

RECOMMENDATIONS:

In light of the excavation, we suggest that the area marked for development to the south west of the main building is relocated outside of existing RPA's or otherwise removed from the development proposal. However the easterly proposed plans will not significantly affect existing root activity.

BS5837:2012 section 7.2.1 states in relation to RPA's that "Intrusion into the soil (other than for Piling), within the RPA is generally not acceptable", suggesting that with the assistance of a structural engineer, a development incorporating a 'no dig' strategy using pile foundations within the RPA may be approvable. However a basement level would requires a strip retaining wall and is as such unsuitable within an RPA.

In conjunction with the above paragraph, BS5837:2012 section 7.4.2.3 states that new permanent hard surfacing should not exceed 20% of any existing surfaced ground. Implying that a development could sit on top of the ground within the RPA, provided that no excavation was required and that it's total area of ground did not exceed 20% of the RPA.

The excavation highlighted areas that did not contain significant roots within the RPA. For a diagram showing zones within the nominal RPA that can and cannot be exploited for development See *Excavation Boundary Conditions.*

APPENDIX

Table 1; Diameter of significant roots found in air-spade investigation.

Map Label	Trench	Diameter of root/roots/mm
A	1	10, 16, 12, 22
B	1	14
C	1	30
D	1	28, 18, 12
E	1	19
F	1	12, 13
G	1	60, 65
J	3	21
K	3	60, branching to 30 and 25
L	3	20, 10, 23, 23, 10
M	4	29

3763

Initial proposed build plan

RPA with little evidence of root activity

RPA with evidence of root activity

RPA with no signs of significant root growth

Trench 1

Trench 2

Trench 3

Trench 4

3776

3777

3778

BOWARD OXFORD LTD.

11 Rosslyn Hill, Camden, Greater London, NW3 5UL

SCALE : 1 : 50

DATE : 25/06/2013

MAP FILENAME : EXCAVATION BOUNDARY CONDITIONS

N

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11 Rosslyn Hill, Camden, Greater London, NW3 5UL

SCALE : 1 : 50 at A1

DATE : 25/06/2013

MAP FILENAME :
AIRSPADE INVESTIGATION -
Photographic evidence and locations

Boward Oxford Ltd., The Log Quarry, Church Road, Long Hanborough,Witney, Oxfordshire, OX28 8JF Tel: 01993880500, email:Boward.ox@gmail.com

Maps based on Ordnance Survey MasterMap or 1:25000 Mid-scale data

N

Wisteria root

Wisteria

Drain access manhole

Trench 4

M

Weeping Mulberry

L

K

J

I

H

Trench 3

Drain access manhole

Old Services?

A B C D E F G

Trench 1

Dense root mat

Trench 2

11 Rosslyn Hill, Camden, Greater London, NW3 5UL

SCALE : 1 : 50 at A1

DATE : 25/06/2013

MAP FILENAME :
AIRSPADE INVESTIGATION -
Photographic evidence and locations

Boward Oxford Ltd., The Log Quarry, Church Road, Long Hanborough,Witney, Oxfordshire, OX28 8JF Tel: 01993880500, email:Boward.ox@gmail.com

Maps based on Ordnance Survey MasterMap or 1:25000 Mid-scale data

N

Wisteria root

Wisteria

Drain access manhole

Trench 4

M

Weeping Mulberry

L

K

J

I

H

Trench 3

Drain access manhole

Old Services?

A B C D E F G

Trench 1

Dense root mat

Trench 2

3763

Initial proposed build plan

RPA with little evidence of root activity

RPA with evidence of root activity

RPA with no signs of significant root growth

Trench 1

Trench 2

Trench 3

Trench 4

3776

3777

3778

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11 Rosslyn Hill, Camden, Greater London, NW3 5UL

SCALE : 1 : 50

DATE : 25/06/2013

MAP FILENAME : EXCAVATION BOUNDARY CONDITIONS

N

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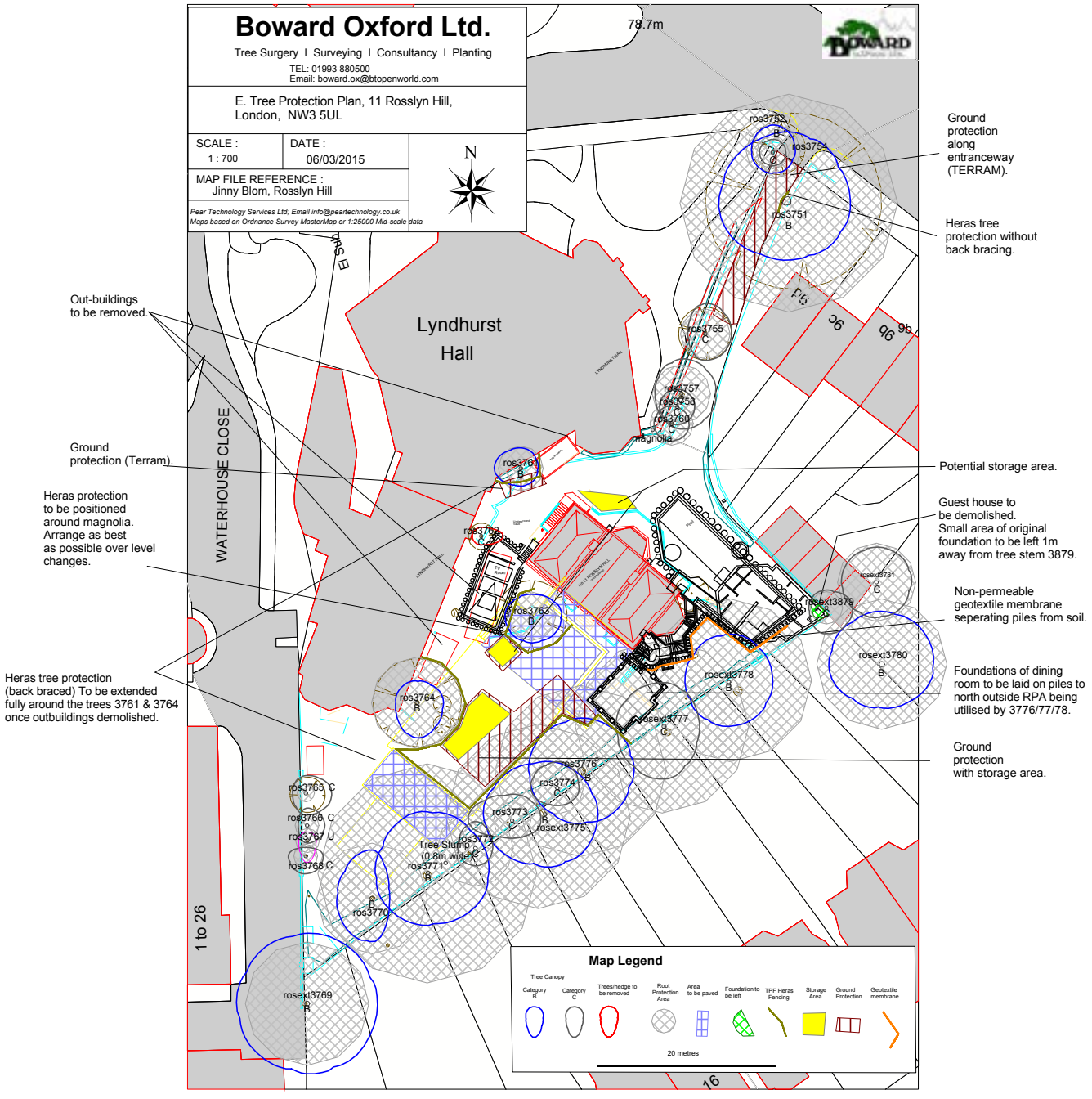
Boward Oxford Ltd.
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E. Tree Protection Plan, 11 Rosslyn Hill, London, NW3 5UL
SCALE : 1 : 700
DATE : 06/03/2015
MAP FILE REFERENCE : Jinny Blom, Rosslyn Hill
Pear Technology Services Ltd; Email info@peartechnology.co.uk
Maps based on Ordnance Survey MasterMap or 1:25000 Mid-scale data
N
78.7m
Lyndhurst Hall
WATERHOUSE CLOSE
1 to 26
Tree Stump (0.8m wide)
Map Legend
Tree Canopy
Category B
Category C
Trees/hedge to be removed
Root Protection Area
Area to be paved
Foundation to be left
TPF Heras Fencing
Storage Area
Ground Protection
Geotextile membrane
20 metres
Out-buildings to be removed.
Ground protection (Terram).
Heras protection to be positioned around magnolia. Arrange as best as possible over level changes.
Heras tree protection (back braced) To be extended fully around the trees 3761 & 3764 once outbuildings demolished.
Ground protection along entranceway (TERRAM).
Heras tree protection without back bracing.
Potential storage area.
Guest house to be demolished. Small area of original foundation to be left 1m away from tree stem 3879.
Non-permeable geotextile membrane seperating piles from soil.
Foundations of dining room to be laid on piles to north outside RPA being utilised by 3776/77/78.
Ground protection with storage area.

Boward Oxford Ltd.

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D Root Protection Area and Impact Map.
11 Rosslyn Hill, London, NW3 5UL

SCALE :	DATE :
1 : 500	03/04/2013

MAP FILE REFERENCE :
Jinny Blom, Rosslyn Hill

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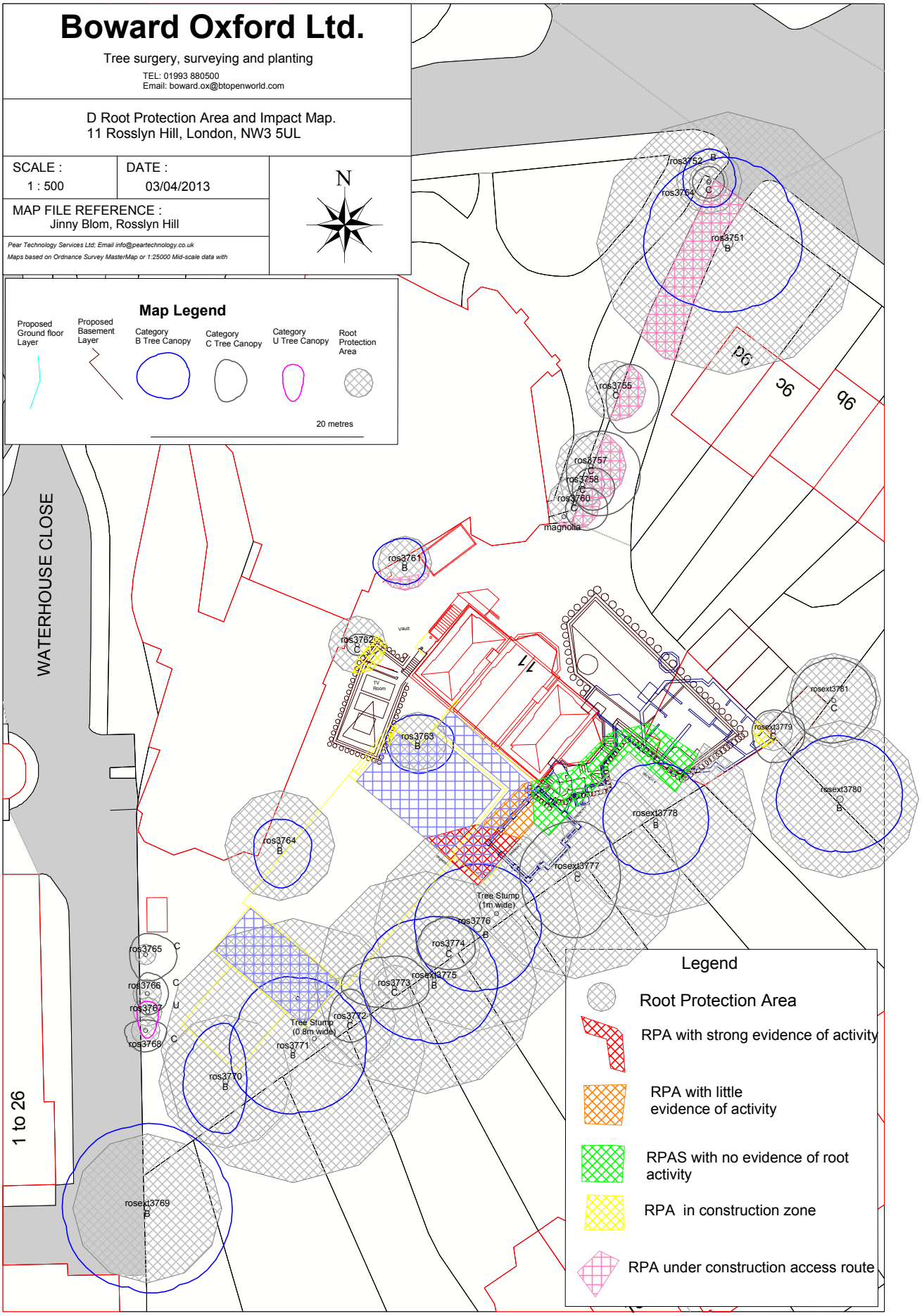
Maps based on Ordnance Survey MasterMap or 1:25000 Mid-scale data with



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C. Basement Layer, 11 Rosslyn Hill, London, NW3 5UL

SCALE :	DATE :
1 : 500	06/03/2015

MAP FILE REFERENCE : Jinny Blom, Rosslyn Hill

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Maps based on Ordnance Survey MasterMap or 1:25000 Mid-scale data

N

78.7m

Lyndhurst Hall

WATERHOUSE CLOSE

1 to 26

9a 9b 9c 9d 8 16

ros3752 B
ros3754 C
ros3751 B
ros3755 C
ros3757 C
ros3758 C
ros3760 C
magnolia
ros3761 B
ros3762 C
ros3763 B
ros3764 B
rosext3777 C
rosext3778 B
rosext3779 C
rosext3780 B
rosext3781 C
Tree Stump (1m wide)
ros3776 B
ros3774 C
rosext3775 B
ros3773 C
ros3772 C
Tree Stump (0.8m wide)
ros3771 B
ros3770 B
ros3765 C
ros3766 C
ros3767 U
ros3768 C
rosext3769 B

Map Legend

Proposed Basement Layer
Category B Tree Canopy
Category C Tree Canopy
Category U Tree Canopy
Root Protection Area
Pool

20 metres

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B. Ground Floor, 11 Rosslyn Hill, London, NW3 5UL

SCALE :	DATE :
1 : 500	06/03/2015

MAP FILE REFERENCE :
Jinny Blom, Rosslyn Hill

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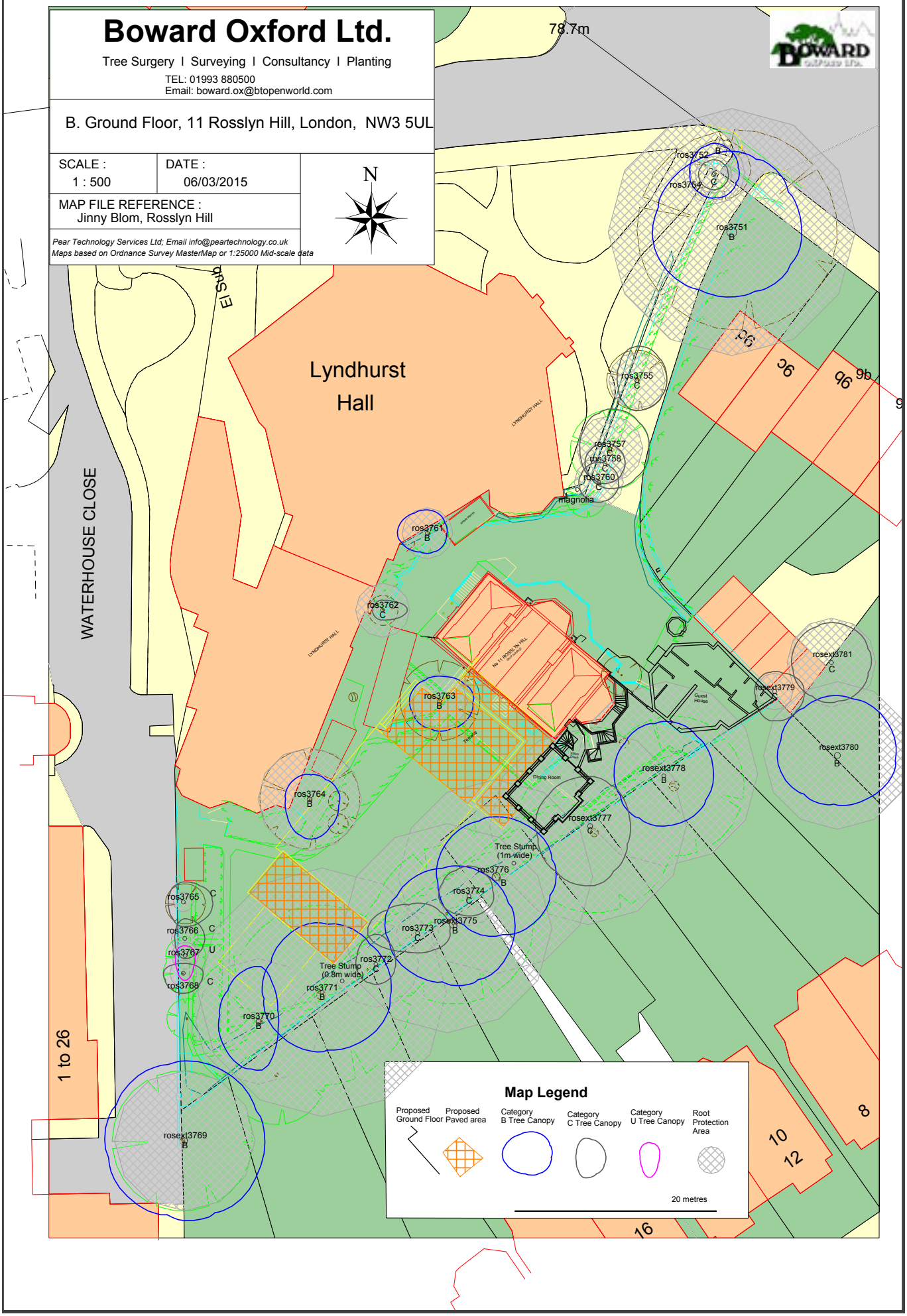
Maps based on Ordnance Survey MasterMap or 1:25000 Mid-scale data



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11 Rosslyn Hill
London
NW3 5UL

Impact Assessment

March 2015

Report compiled by:

Matthew Jellings
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4.0 Introduction

The purpose of this document is to provide details as to how any given proposed construction works will impact upon the existing treescape as shown in the attached arboricultural survey report.

The construction of a basement area is proposed to the East (front pool, sauna, toilet & stairs) and West (TV room) of the property. Further the guest house at the front is to be demolished and reconstructed, and the existing property is to be extended with a dining room to the south. Three outbuildings are to be removed, see **plan E**. These design proposals will impact on the local treescape.

An airspade investigation was carried out in the rear garden – see **Excavation boundary conditions** for a map highlighting rooting areas of different importance.

The impacts of the construction work at 11 Rosslyn Hill have been split into trees whose root protection area will be impacted, trees where crown lifting may be required, and trees which will need to be removed. There are two plans for the proposed construction works, see **plan B** for ground floor footprint and **plan C** for basement footprint. See **plan D** for where the construction will impact the trees on site.

ROOT PROTECTION AREAS

- There are a number of areas on the site where the proposed build will have a negative impact on the condition of the local trees unless protection measures are in place (see **plan D**).

- The root protection areas of 5 trees to be retained will be impacted (Table 2, see plan ***D***) :

Tree ID	Category	Proportion of root protection area effected (%)
3751	B	11 (construction traffic)
3763	B	Minor infringement by TV room (1-2%)
3777 & 3778	B	Minor infringement beyond trench 3 for mini piles and stairs/toilet (1-3% each). Note trench 3 found no evidence of rooting.
3779	C	25% infringement by foundations of new guest house (note – the original foundations would be expected to be excluding root development in this space, so the predicted RPA shape is likely redundant here). The tree base is not in the grounds of 11 Rosslyn Hill.

Table 2. RPAs infringed because of proposed development.

The foundations of the dining room are to be based on the minipiles (300mm diameter) and concrete slabs in the RPA of 3776-78. The impact of these piles is to be alleviated, see **arboricultural method statement**. There is very little root infringement (1-2%) by the basement stairs and toilet beyond trench 3 which showed no evidence of rooting.

CROWN LIFTING

Two trees require crown lifting in order to permit access by construction vehicles.
The necessity of these crown lifting works should be decided upon at a later date, only when it becomes clear their canopies are going to interfere with construction works.

	Possible crown lifting required for tarmac removal				
	A	B	C	U	Tag Number
Entrance/exit from junction. Holly trees.			2		3757, 3755

Table 3. Trees to be crown lifted where necessary.

TREE REMOVAL

The category C Laburnum tree '3762' will need to be removed to allow vehicular access to the rear garden and also permit building of the TV room.

5.0 Please see table **Full BS5837:2012 Tree Details, 11 Rosslyn Hill** for tree details**.**
6.0 See **arboricultural survey report, general comments** document for a brief overview of the arboricultural implications.
7.0 See **Arboriculutral Method statement** document which outlines the best mitigation to be used during the construction works on trees to be retained.

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11 Rosslyn Hill

Arboricultural Method Statement

March 2015

Report compiled by:

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Long Hanborough
Witney
Oxfordshire
OX29 8JF

Re: Construction of a basement TV room, pool, sauna and toilet and ground level dining room and new guest house.

Boward Tree Surgery (Oxford) Limited
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Telephone: 01993 880500
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Arboricultural Method Statement:

All persons involved in the proposed construction works to be made aware of the importance of the retained trees at this site and to be familiar with the requirements of the works Method Statement and Tree Protection Measures.

The site to be subject to a visit from the Retained Arborist who will inspect for Arboricultural Method Statement compliance and correct implementation of the Tree Protection Measures as well as recording findings by means of photographs.

Site Specific Method Statement

The first phase of tree protection will include all the pre-construction works, including the erection of the tree protection fencing and demolition of the present guesthouse and 3 garden outbuildings. As many prominent, mature and high value trees are on site a high level of protection is required during all phases. The next phase of tree protection will be needed for the construction works of the basement and ground level buildings. Landscaping the paved area will be the final phase of protection.

Phase 1: *Pre-Construction & Demolition* – See **plan E**.

TREEWORKS

1. Tree 3762 to be felled and removed providing council consent is given for this. The hedgeline along the right of the entranceway to be removed. The canopy of trees 3757 and 3755 may need lifting to 5 metres in order to provide good access to construction vehicles. The necessity of the lifting works is to be decided upon at a later date. All tree works to be carried out in accordance with BS: 3998 (2010) – Recommendations for Tree works, and to be done in such a way as that no damage is caused to any of the retained trees.

CONSTRUCTION EXCLUSION ZONE (CEZ)

2. Tree Protection Fencing (TPF) to be positioned as per **plan E**. This is to provide the upmost level of protection during the demolition phase. The fencing will exclude construction workers and machines from entering the Tree Protection Zone while removing the existing sheds. The type of fencing will be Heras supported with back braces where possible. Given the tight entrance way the fencing surrounding tree 3751 will have to be supported on blocks. The fencing around tree 3763 in the rear garden will have to be arranged as best as possible to protect the trees canopy and stay secure on the different garden levels. Please see Appendix 1 for Heras fencing details.

3. Tree protection fencing shall be maintained and retained for the full duration of the works, but can be removed for the soft landscaping workings on the paved area.

4. Potential areas for material storage are coloured yellow on **plan E,** and ground boards should be arranged under any area for material storage if on the grass area to the rear (can use plywood boards here for material storage)**.** No activities or storage of materials whatsoever shall take place within the construction exclusion zone without the prior written

agreement of the LPA. Ground protection also needs to be laid over the RPA of the category B tree at the entranceway to help alleviate soil compaction from construction plant, and tree 3761 for the same purpose. An example of the quality of ground protection expected over the RPAs on site is shown in the appendix (Terram geocells). In the rear garden ground protection is needed to protect the root protection areas of the line of trees to the SE. The ground protection over RPAs must stay in place for the duration of the works, with the exception of when the paving is to take place in the rear garden.

5. All demolition works to take place from outside the RPAs of any of the retained trees on site.

6. Where the lower garden shed is over the RPA of the category B Lime 3764 care must be taken not to damage the tree's canopy or RPA. Removing the foundations with a pneumatic drill is required when working in the RPA of the tree.

7. To benefit the rooting area of tree 3879 the existing foundation under the guest house could be left 1m from the base of the tree. This would prevent most of the disturbance or damage to the tree which is growing from land not owned by 11 Rosslyn Hill. This would reduce potential damage to the RPA of 3879 by 80% (see **plan E**).

8. Prestart meeting that includes the Retained Arborist, Architect and the designated construction company management team to explain the requirements of the Arboricultural Method Statement (AMS) and the Tree Protection Plan (TPP) measures.

Phase 2: Construction Works

1. Tree protection fencing to be moved to fully surround tree 3761, 3763 and 3764 once the timber lean to and shed is removed.

2. Where laying the foundation of the guest house may have a detrimental impact to the root system of tree 3779 the impact must be minimised (see below, section 3. i – iii). The full extent of rooting here will not be known until the foundations of the original guest house are taken up (leaving a 1m zone around the tree base). The magnolia tag number 3763 has most of it's RPA in the CEZ but the western edge of the RPA may be lightly effected by the TV basement room, and again the measures found in 3.i-iii should be followed when digging in the RPA here.

3. The exact location of 7 piles coloured red in **plan D** are beyond the scope of the airspade investigation and should be determined by hand digging the wells, if any roots are found greater than 25mm in diameter then another well should be dug until a clear spot is located for the pile. It is important no large diameter roots are severed close to the trees 3776-78, and so attention and care will be needed using spades/pick axes here. You may find this to be a very time consuming process if medium to large roots are common in the ground here, alternatively if no big roots are present then locating sites for piles will be simple. I would recommend hand digging to a depth of roughly 1m. The exterior walls of the mini piles will need a thin non-permeable geotextile to contain the cement. Concrete slabs will be laid on the mini piles and there will be an airgap between the concrete slabs and soil layer. The

exact size of the air gap is yet to be determined, we await to hear back from a tree officer, Chris Leyland, who has experience in these matters.

4. Where the RPAs are infringed specific measures are required to minimise disturbance to the trees root systems. These include;

    i. Only hand digging with minimal disturbance and soil level change to take place within RPAs.

    ii. Any roots that are uncovered up to 25mm in diameter to be chased back to a suitable root junction and severed by means of appropriate pruning tools.

    iii. Any roots that are uncovered above 25mm in diameter to be worked around in consultation with the retained arborist. While exposed any uncovered roots to be retained to be covered with a suitable hessian type material and kept moist.

5. Concrete and the run-off from it is particularly damaging to plant roots. A non-permeable geotextile barrier could be applied along the outer edge of the piling in the RPA of tree 3777 and 3778 to prevent future contamination of the soil here (see **plan E**). Care to be taken by construction personal to prevent any spillage. Any accidental spillage to be cleared immediately and the Retained Arborist notified.

Phase 3: Landscaping

1. On completion of all construction works to the basement layer and ground floor tree protection fencing and ground boards can be removed to allow the laying of the paving in the rear garden.

2. Slabs to be laid using the following method to avoid damage to tree roots:

    i. The ground layer to be removed using hand tools or plant with non-toothed bucket if such plant can be operated from outside of the root protection area and if there is no possibility of mechanical damage to lower canopy sections.

    ii. The design and construction will not involve any change in the existing ground levels other than the scraping off of grass sward and ground layer plants. Any works that require the removal of woody shrubs with significant root systems will require root systems to be removed by means of hand grubbing or careful root grinding. All construction to be above existing ground levels (once the grass sward and ground layer plants have been removed) and to include any required edging.

    iii. The design will be such as to resist deformation due to annular expansion of roots and stems and will provide a surface that will support the required loads without soil compaction or deformation.

iv. The design to be such as to allow for suitable gaseous exchange.

3. On completion of all works any trees that die, become seriously damaged, or die within 5 years of this development shall be replaced the following year by trees of the same size and species.

4. The hedgeline which was removed to allow access for vehicles to be replaced with similar species of hedging.

Appendix 1

Planning Category rating:

Category ratings are allocated based on the current condition of a tree in its current surroundings assuming the recommendations of this report are carried out. No consideration is given to any specific development proposal when allocating category ratings. For a full break down of tree categorisation see below:

Category A trees are those which have high visual amenity value, are in good structural and physiological condition and are expected to contribute for at least another 40 years.

Category B trees are those which would be considered as category A trees but which are of lower value, poorer structural condition, or which are expected to contribute for less than 40 years.

Category C trees are those which have low amenity value, are in poor condition, or are expected to contribute for less than 20 years.

Category U trees are those which are expected to contribute for less than 10 years due to serious defects. As is common in risk management, where there is doubt, the precautionary principal may be applied.

In certain circumstances trees may be considered of higher value due to cultural or ecological reasons. If this is the case it will be made clear in the tree data tables.

Sub-categories:

Sub- categories of 1, 2 or 3 are included in the tree data tables and are defined as follows:
Sub-category 1 trees are those with 'other arboricultural value'
Sub-category 2 trees are those with 'landscape value'
Sub-category 3 trees are those with 'cultural or conservation value'

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The Log Quarry, Church Road, Long Hanborough, near Witney, Oxfordshire OX29 8JF
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Suggested signage for tree protection fencing:

Required construction method of Tree Protection Fencing:

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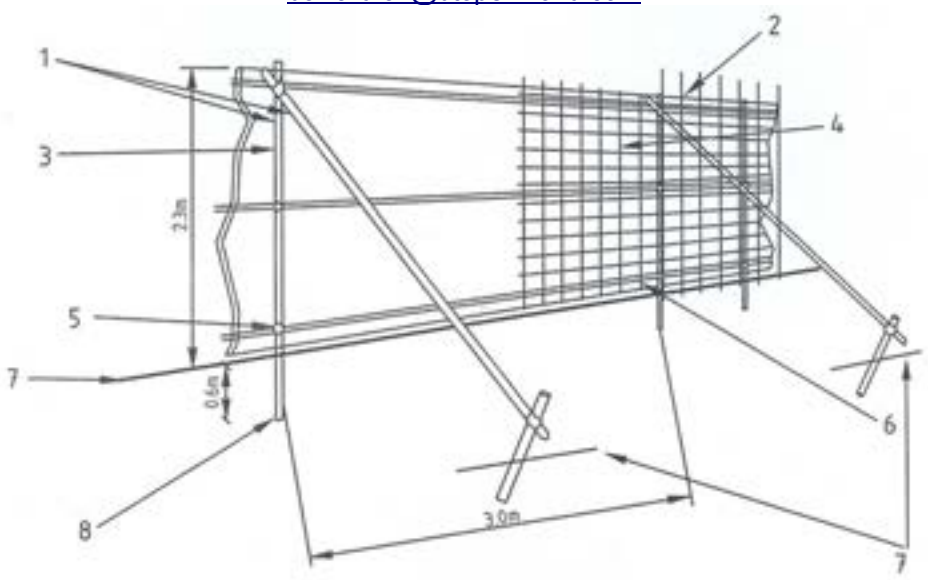

1 Standard scaffold poles
2 Uprights to be driven into the ground
3 Panels secured to uprights with wire ties and, where necessary, standard scaffold clamps
4 Weldmesh wired to the uprights and horizontals
5 Standard clamps
6 Wire twisted and secured on inside face of fencing to avoid easy dismantling
7 Ground level
8 Approx. 0.6m driven into the ground

An example of suitable ground protection within trees RPA would be the TERRAM Tree root protection geocell.

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