AP GEOTECHNICS
a ground investigation and consultancy service

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KING'S COLLEGE HAMPSTEAD CAMPUS KIDDERPORE AVENUE LONDON NW3
Block B

Phase III

Client
Barratt West London

Consulting Engineer
Gravity Consulting Engineers

Report No. 3648

26 September 2011

CONTENTS

KING'S COLLEGE HAMPSTEAD CAMPUS, KIDDERPORE AVENUE, LONDON NW3

Block B

Synopsis

A further investigation has been carried out within the King's College Hampstead campus on the instructions of Barratt West London. Technical direction was provided by Gravity Consulting Engineers. A Desk Study[1] and previous general intrusive investigation[2] has been prepared for the site and should be read in conjunction with this report.

The purpose of this investigation was to confirm the ground conditions beneath the existing building and to provide recommendations in respect of foundation design and other geoenvironmental matters for the proposed redevelopment.

Two boreholes, three continuous open drive (window) samplers were undertaken through the existing floor slab. In addition two trial pits to expose existing foundation construction were carried out, all supported by a programme of in situ and laboratory testing.

It is proposed to reuse the existing raft, but to install a new building core which will be carried on piled foundations.

1
Site description

The area of investigation is around the former library building a six to seven storey building with a semi basement cut into the sloping ground. A full site description is contained within the Desk Study to which the reader is referred.

2
Development proposals

It is proposed to strip the existing building back to the frame and reconstruct it with two additional floors. The existing lower ground floor is to be used for car parking.
We understand that the building utilises a raft foundation of approximate size 28m by 28m and loading are as follows:-

Existing:	Dead load 55kPa	Live load 32kPa
Proposed:	Dead load 69kPa	Live load 26kPa

In addition the new core will be constructed on 300mm diameter piled foundations, ideally carrying 650kN each.

3
Geology

Published records of the British Geological Survey (BGS) indicate the site to lie on the Claygate Member of the London Clay formation underlain by London Clay.

4
Field work

The extent of this phase of field work was agreed with the client and comprised two additional boreholes within the building advanced by light percussive techniques to a maximum depth of 15 m and one further borehole around the perimeter to 25m. In addition, three window samplers were carried out. All through diamond cored holes through the raft. In addition two external trial pits were excavated by hand to expose the existing foundation construction. The location of all exploratory positions is shown on Figure 1 at Appendix D.

Representative soil and water samples were recovered from the boreholes for subsequent laboratory examination and testing; whilst Standard Penetration Tests (SPT) were carried out as appropriate. Details of the strata encountered are provided on the Borehole and Trial Pit Records at Appendix A; together with particulars of the samples recovered, groundwater observations, SPT results and section through existing foundation where appropriate. The profile of SPT with level is presented at Figure 2 of Appendix D.

Standpipes were installed in BHs 51 & 52 to permit monitoring of water levels with the results to date presented at Appendix B.

5
Laboratory testing

The following laboratory tests were conducted on samples recovered during the field work:-

- Natural moisture content: to assess the in situ condition of the soil.
- Liquid and Plastic Limits: to classify cohesive soil into behavioural groups.
- Unconsolidated undrained triaxial compression: to determine the shear strength of cohesive material and thus to assess its load bearing capacity.
- One-dimensional consolidation: to determine the deformation characteristics of clay under applied loading and unloading.
- Soluble sulphate concentration and pH value: for the specification of buried concrete.

Results of these tests are presented at Appendix C. The variation of shear strength with level is presented at Figure 3 of Appendix D.

6
Ground conditions

6.1
Stratigraphy

The stratigraphy of the site as revealed by the investigation is described in detail at Appendix A and confirms that previously encountered at this site.

6.2
Groundwater

Groundwater inflows were noted in all of the cable percussive boreholes. The strikes in the boreholes were limited to the Claygate Member of the London Clay formation with the unweathered London Clay at depth not recording any groundwater strikes.

Numerous slow inflows and seepage's were recorded at various depths in the boreholes. However, the speed of drilling and use of casing to support the bore may have masked inflows.

Details of all groundwater observations during drilling are provided on the appropriate Borehole Record.

Subsequent monitoring of the standpipes indicates water to be between some 0.4 & 0.8m below top of basement slab level. i.e. Within the thickness of the concrete but the level recorded is not above the top of the concrete.

7
Discussion

7.1
General

The site has evidently already carried development and the investigation has revealed fill material to be present. It is possible that other pockets of fill material may also be present; perhaps deeper, of different character or associated with the remains of underground construction; even though not detected by this investigation.

All remnants of previous construction should be removed prior to redevelopment to enable the proposals to be constructed without hindrance and to perform satisfactorily.

We understand that the library was constructed in the early 1970's and thus settlement from the existing loading is expected to be sensibly complete. As part of the new works the existing building will be stripped back to the frame prior to reconstruction. The loading associated with this condition is 49 kPa and therefore some relaxation of the building will occur. This is expected to be minimal and will be taken up by reconsolidation under the new loading.

7.2
Anecdotal information

It is understood from an Architect who was studying at the college in the mid 1970's that there were problems with movement of the library building for some time after it was built. He understands that it was "sliding down the hill". There is no information relating to if and when the movement stopped, how much it moved or the reason that it moved.

There are various possible geotechnical (possible structural reasons will not be discussed here) reasons associated with a building sliding down the hill. The two main reasons are that the whole of the hill is moving and the building is moving with it. The other being that local slippage has occurred caused by or causing the building to move. Both of these could be restarted/ exacerbated by the new works and loading.

Assuming that the architect was correct. (and being a professional within the construction industry we have no reason to doubt him) Until the reason for the movement has been established remedial design cannot be undertaken or designed for. The following discussion is based on the assumption that no movement occurred in the soil that caused the "sliding" and that the slope is stable.

It is recommended that investigation is undertaken into the possible reasons for the "sliding down the hill" so that remedial measures and/ or appropriate design can be undertaken to counteract it.

7.2
Existing Raft foundation

It has been assumed that the existing raft is functioning as a rigid structure and the settlement from the existing loading is sensibly complete. This is a reasonable conclusion since the building has been completed for in excess of 40 years. There is expected to be a small amount of swelling associated with the unloading of the building, but this will be taken up after the new construction has been completed.

Based on the test results, the additional settlement calculated for the new loadings is anticipated to be in the order of 15mm, based on conventional analysis techniques and full dead load and two thirds of live load being used in the analysis.

Groundwater monitoring indicates that the water is some ½m above the formation level of the raft and thus the raft is undergoing hydrostatic uplift. The dead weight of the building is sufficient to counteract this force.

7.4
Piled foundations

Either driven or bored piles would be suitable in the ground conditions found at this site. However, compared with bored piling, construction of driven piles generates greater noise and vibration which will not be acceptable in this environment. It is expected that conventional bored piled will be required within the existing building due to restricted headroom available, although casing through the Claygate Member will be needed to control groundwater inflows. Bored piles constructed by conventional means are therefore recommended and parameters for their preliminary design are provided in Tables 1 & 2.

Table 1: Design parameters for Site A; CFA piles - Shaft friction

Stratum	Typical level, mOD	Ultimate unit shaft friction
All material	<86.5	Ignore
Claygate Member	86.5 - 78.0	Increases linearly from 30 to 65 kPa
London Clay	78.0 - 67.0	Increases linearly from 50 to 85 kPa

Tables 1 and 2 have been derived in conjunction with an adhesion factor of 0.60 in the Claygate Member and 0.45 in the unweathered London Clay a higher adhesion factor has not been assumed due to the time delay is forming piles in the restrict headroom of the site.

Table 2: Design parameters for Site A; CFA piles - End bearing capacity

Stratum	Level, mOD	Ultimate unit end bearing capacity
London Clay	78.0 - 67.0	Increases linearly from 970 to 1665 kPa

A factor of safety must be applied to derive the allowable working load from the ultimate values obtained from Tables 1 to 4. An overall value of 2.5 is commonly employed as it is expected that load tests would be carried out to verify the chosen value on a development of this scale.

Tables 1 and 2 predict that a CFA pile of 300 mm diameter, bored to 71 mOD depth, will have an allowable load capacity of approximately 325 kN under an overall factor of safety of 2.5. Two such piles will be required to carry the anticipated loads.

Settlement at the toe of a single pile is not expected to exceed some 3 - 5 mm since the working load will be carried wholly in shaft friction.

Evidently it would be possible to utilise other pile types and different geometries. Further advice could be given on the load capacity for any other configuration which may be under consideration.

The actual load capacity achieved in practice depends upon the precise installation procedures. Advice should therefore be sought from specialist contractors to verify the load capacity and settlement characteristics of their particular piles in the ground conditions revealed by this investigation. In any event, it is recommended that the chosen pile configuration be confirmed by load tests conducted at an early stage in the development, preferably before installation of the contract piles.

It should be ensured that new piled foundation to not provide a pathways for upward water seepage into the building and water levels should be carefully monitored to ensure that they do not rise such that they come above the basement slab level.

7.5

Buried concrete

Laboratory tests on soil samples from site A yielded a maximum soluble sulphate concentration of 1.20 g/l which results in a Design Sulphate Class[3] of DS-2. These conditions also prevail at site B.

The groundwater is considered to be mobile at both sites and all pH determinations were in excess of 5.5. Therefore the Aggressive Chemical Environment for Concrete, ACEC, is classed as AC-2.

A M Smith
AP GEOTECHNICS LTD
26 September 2011

PROCEDURAL NOTES for GROUND INVESTIGATIONS

General

This report is based upon data obtained from field descriptions of the strata and examination of the samples by an engineer, together with the results of in situ and laboratory tests as appropriate. Responsibility cannot be accepted for variations in ground conditions between and around any of the exploratory points that is not revealed by the data. Whilst the report may offer an opinion on the ground conditions between exploratory points and below the depth of investigation, this is for guidance only and no liability is accepted for its accuracy.

Drilling procedure

Boring by light cable percussion drilling allows the ground conditions to be reasonably well established. However, a certain amount of disturbance is inevitable and some mixing of soils can occur.

Sampling procedure

"Undisturbed" samples of predominantly cohesive soils are taken with a 100mm diameter open tube sampler, generally in accordance with BS 5930: 1999.

Where appropriate, or where an undisturbed sample is unsuccessful, disturbed samples are recovered and sealed into polythene bags.

Groundwater samples are taken when water is encountered in sufficient quantity.

Standard penetration tests

The test is conducted generally in accordance with BS 1377: Part 9: 1990. The sampler tube is subject to a seating drive of 150mm into the soil at the base of the borehole. Results are given on the Borehole Records as the number of blows required to drive the sampler tube a further 300mm and this is known as the "N" value. Where the driving resistance is such that full penetration is not achieved, the test is generally terminated after 50 blows and the actual distance penetrated is recorded.

Groundwater

Groundwater observations necessarily reflect the conditions encountered at the time of the exploratory work. Long term monitoring of standpipes is usually required to establish an equilibrium water level since the normal rate of boring is too fast to permit steady state conditions to be achieved.

Groundwater levels are subject to variations caused by changes in drainage conditions and seasonal climatic changes.

Water may necessarily be added to advance the bore whilst casing may be required to maintain an open hole. These can both mask subsequent groundwater observations and are therefore noted on the individual Borehole Record.

APPENDICES

APPENDIX A

BOREHOLE and TRIAL PIT RECORDS

SYMBOLS and ABBREVIATIONS

Samples

Undisturbed

U	Standard open drive "undisturbed" 102mm dia. in boreholes 38mm dia. in trial pits, window sampler and hand auger
T	Thin wall open drive
P	Piston
C	CBR mould

Disturbed

D	Small
B	Bulk
C	Contaminants: plastic tub
J	brown glass jar
W	Water

In situ tests

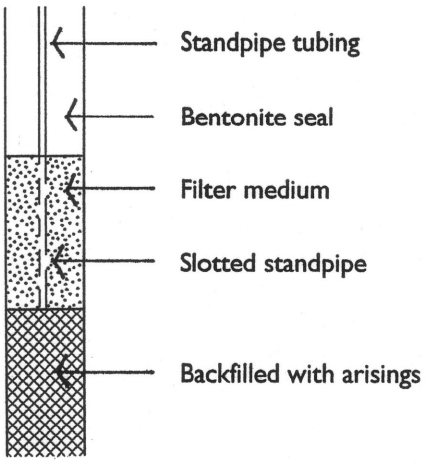
SPT	Standard Penetration Test, open shoe
CPT	solid cone
	N value is number of blows for 300mm penetration. Blow count also given as seating drive followed by four increments of 75mm.
V ( )	Vane test (c_u kPa)
P ( )	Hand penetrometer (c_u kg/cm^2)
M ( )	Mexe probe (CBR %)

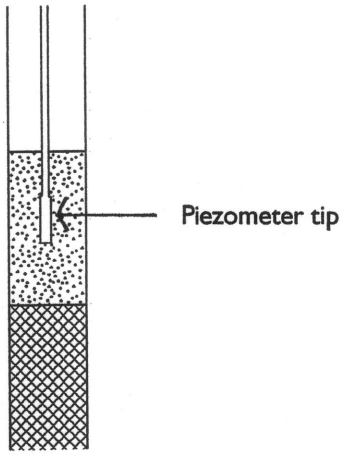
Water records

$\blacktriangledown_1$	Standing level
$\triangledown_1$	Depth encountered

suffix identifies separate strikes

Standpipes





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Site	Borehole Number
KIDDERPORE AVENUE - PHASE II	BH51

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 4.50m 150mm cased to 16.50m	91.40	Barratt West London	3648
	Location	**Dates**	**Engineer**	**Sheet**
	See Site Plan	15/08/2011- 17/08/2011	Gravity Consulting Engineers	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				15/08/2011:	91.23	(0.17)	CONCRETE floor		
				16/08/2011:DRY 16/08/2011:16.30m		0.17	Basement - void		
				17/08/2011:3.80m 17/08/2011:		(2.88)			
					88.35	3.05	CONCRETE		
3.80	W19	12.10	3.80			(0.95)			
4.00-4.50	B1	4.10	DRY		87.40	4.00	Firm brown mottled orange and light brown very silty CLAY. Silt is iron stained		
4.50-4.95	U2	4.10	DRY	25 blows					
4.95	C3					(1.95)			
5.50-5.95	U4	4.60	5.90	25 blows					▽1
5.95	C5			constant(1) at 5.90m, fell to 12.10m in 20 mins.	85.45	5.95	Firm brown mottled orange and light brown very silty CLAY. Silt is iron stained		
6.50-6.95	U6	6.20	DRY	20 blows					
6.95	C7								
7.50-7.95	U8	7.40	DRY	40 blows					
7.95	C9					(4.10)			
8.50-8.95	SPT N=14	8.35	DAMP	2,2/3,3,4,4		(4.10)			
8.50-9.00	B10	8.35	DAMP						
					81.35	10.05			

Remarks
Chiselling from 3.80m to 4.10m for .50 hours.

Scale (approx)	Logged By
1:50	MM

Figure No.
3648.BH51

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Site	Borehole Number
KIDDERPORE AVENUE - PHASE II	BH51

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 4.50m 150mm cased to 16.50m	91.40	Barratt West London	3648
	Location	**Dates**	**Engineer**	**Sheet**
	See Site Plan	15/08/2011- 17/08/2011	Gravity Consulting Engineers	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00-10.45	U11	9.60	DAMP	30 blows	81.35	(4.10) 10.05	Firm dark greyish brown mottled light grey silty CLAY becoming less silty with depth. Contains rare shell fragments		
10.45	C12								
						(1.95)			▽2
				Water strike(2) at 11.20m.					
11.50-11.95	SPT N=19	11.50	DRY	3,3/4,4,5,6					
11.50-12.00	B13	11.50	DRY						
					79.40	12.00	Firm to stiff dark greyish brown slightly silty CLAY becoming less silty with depth. Contains shell fragments.		▼1
13.00-13.45	U14	12.00	DRY	35 blows					
13.45	C15								
						(4.45)			
14.50-14.95	SPT N=23	12.00	DRY	2,3/4,5,6,8					
14.50-15.00	B16	12.00	DRY						
16.00-16.45	U17	12.00	DAMP	60 blows					
					74.95	16.45			
16.45	C18						Complete at 16.45m		

Remarks

Scale (approx)	Logged By
1:50	MM

Figure No. 3648.BH51

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Site	Borehole Number
KIDDERPORE AVENUE - PHASE II	BH52

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 8.30m	91.40	Barratt West London	3648
	Location	**Dates**	**Engineer**	**Sheet**
	See Site Plan	12/08/2011-15/08/2011	Gravity Consulting Engineers	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				13/08/2011:DAMP	91.23	(0.17) 0.17	CONCRETE		
							Basement - void		
						(2.88)			
					88.35	3.05	CONCRETE		
						(1.10)			
4.07-4.50	B1				87.25	4.15	Firm brown mottled orange and grey silty CLAY. Silt is iron stained		
4.50-4.95	U2	4.50	DAMP	20 blows					▼1
4.95	C3			slow(1) at 5.00m, rose to 4.80m in 20 mins, sealed at 8.30m.		(1.85)			▽1
5.00	W11								
5.50-5.95	U4	5.50	DAMP	20 blows					
5.95	C5				85.40	6.00	Firm dark grey very silty CLAY becoming less silty with depth. Contains rare shell fragments. Silt is iron stained		
6.50-6.95	U6	6.00	DRY	20 blows		(1.20)			
6.95	C7								
7.20	J8				84.20	7.20	Firm dark brownish grey silty CLAY		
7.50-7.95	U9	7.50	DAMP	25 blows					
7.95	C10								
9.00-9.45	U12	8.30	DRY	20 blows					
9.45	C13								▼2

Remarks

Scale (approx)	Logged By
1:50	MM

Figure No. 3648.BH52

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Site	Borehole Number
KIDDERPORE AVENUE - PHASE II	BH52

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 8.30m	91.40	Barratt West London	3648
	Location	**Dates**	**Engineer**	**Sheet**
	See Site Plan	12/08/2011-15/08/2011	Gravity Consulting Engineers	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							Firm dark brownish grey silty CLAY		
10.30	W20			slow/medium(2) at 10.30m, rose to 9.60m in 20 mins, sealed at 10.60m.					▽2
10.50-10.95	U14								
10.95	C15								
12.00-12.45 12.00-12.50	SPT N=16 B16	10.60	DRY	2,3/3,5,3,3,5		(8.30)			
13.50-13.95	U17	10.60	DRY	25 blows					
13.95	C18								
15.00-15.45 15.00-15.50	SPT N=19 B19	10.60	DRY	2,3/4,4,5,6					
					75.90	15.50	Complete at 15.50m		

Remarks

Scale (approx)	Logged By
1:50	MM

Figure No. 3648.BH52

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Site	Borehole Number
KIDDERPORE AVENUE - PHASE II	BH53

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		91.20	Barratt West London	3648
	Location	**Dates**	**Engineer**	**Sheet**
	See Site Plan	12/08/2011-16/08/2011	Gravity Consulting Engineers	1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				16/08/2011:NIL						
0.10-0.50	B1					(0.50)	MADE GROUND: Dark brown gravelly sand. Gravel consists of fine to coarse sub-angular flint brick concrete and Type 1			
					90.70	0.50				
0.60-1.10	B2						Soft becoming firm light orange brown mottled dark brown silty fine sandy CLAY becoming less sandy with depth. Silt is wispy and iron stained with depth			
1.20-1.65	U1			30 blows						
1.65	D1									
2.10-2.55	SPT N=8			1,2/1,2,2,3					▽1	
2.10-2.60	B3			seepages(1) at 2.20m.						
2.55	D2									
						(4.70)				
3.00-3.45	U2			35 blows						
3.45	D3									
4.00-4.45	U3			40 blows						
4.45	D4									
5.00-5.45	U4			40 blows						
					86.00	5.20				
5.45	D5						Firm dark grey mottled dark brown silty CLAY becoming less silty and stiffer with depth. Contains occasional shell fragments			
5.50-6.00	B4									
6.50-6.95	U5			40 blows						
				seepages(2) at 6.80m.					▽2	
6.95	D6									
8.00-8.45	U6			40 blows						
8.45	D7									
						(7.80)				
9.50-9.95	SPT N=22			3,3/4,5,6,7						

Remarks
Pit dry
Dig inspection pit to 1.20m
Chiselling from 0.00m to 1.20m for 1 hour. Breaking out from 0.00m to 1.20m for 1 hour.

Scale (approx)	Logged By
1:50	MM

Figure No.
3648.BH53

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Site	Borehole Number
KIDDERPORE AVENUE - PHASE II	BH53

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		91.20	Barratt West London	3648
	Location	**Dates**	**Engineer**	**Sheet**
	See Site Plan	12/08/2011-16/08/2011	Gravity Consulting Engineers	2/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							Firm dark grey mottled dark brown silty CLAY becoming less silty and stiffer with depth. Contains occasional shell fragments			
11.00-11.45	U7			50 blows						
11.45	D8					(7.80)				
13.00-13.50	B5				78.20	13.00	Stiff to very stiff dark greyish brown slightly silty CLAY with occasional shell fragments			
14.00-14.45	U8			50 blows						
14.45	D9									
15.50-15.95	SPT N=23			4,4/5,5,6,7						
17.00-17.45	U9			55 blows						
17.45	D10									
18.50-18.95	SPT N=34			4,5/7,8,9,10						
						(12.00)				

Remarks

Scale (approx)	Logged By
1:50	MM

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Site	Borehole Number
KIDDERPORE AVENUE - PHASE II	BH53

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		91.20	Barratt West London	3648
	Location	**Dates**	**Engineer**	**Sheet**
	See Site Plan	12/08/2011-16/08/2011	Gravity Consulting Engineers	3/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
20.00-20.45	U10			60 blows			Stiff to very stiff dark greyish brown slightly silty CLAY with occasional shell fragments			
20.45	D11									
21.50-21.95	SPT N=40			5,6/8,10,10,12						
						(12.00)				
23.00-23.45	U11			60 blows						
23.45	D12									
24.55-25.00	SPT N=42			5,7/8,10,12,12						
					66.20	25.00				
							Complete at 25.00m			

Remarks

Scale (approx)	Logged By
1:50	MM

Figure No. 3648.BH53

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Site	Number
KIDDERPORE AVENUE - PHASE II	HA56

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		88.35	Barratt West London	3648
	Location	**Dates** 23/09/2011	**Engineer** Gravity Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.06)	CONCRETE		
				87.29	1.06	Light greyish brown mottled orange silty CLAY. Silt is iron stained		
1.50	D1							
2.00	D2				(1.94)			
			Water strike(1) at 2.20m.					▽1
2.50	D3							
3.00	D4			85.35	3.00			
						Complete at 3.00m		

Remarks

Scale (approx)	Logged By
1:25	MM

Figure No. 3648.HA56

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Site	Number
KIDDERPORE AVENUE - PHASE II	HA57

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		88.35	Barratt West London	3648
	Location	**Dates** 24/09/2011	**Engineer** Gravity Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.24)	CONCRETE		
				87.11	1.24	Light brown and orange brown silty CLAY. Silt is wispy and iron stained		
1.50	D1							
2.00	D2				(1.76)			
2.50	D3							
3.00	D4			85.35	3.00	Complete at 3.00m		

Remarks

Scale (approx)	Logged By
1:25	MM

Figure No. 3648.HA57

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F 01932 851255
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Site	Number
KIDDERPORE AVENUE - PHASE II	HA58

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		88.35	Barratt West London	3648
	Location	**Dates** 24/09/2011	**Engineer** Gravity Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.00)	CONCRETE		
1.00	D1			87.35	1.00	Greyish brown mottled orange brown silty CLAY. Silt is wispy and iron stained		
1.50	D2							
2.00	D3				(2.00)			
2.50	D4							
3.00	D5			85.35	3.00	Complete at 3.00m		

Remarks

Scale (approx)	Logged By
1:25	MM

Figure No. 3648.HA58

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Site	Trial Pit Number
KIDDERPORE AVENUE - PHASE II	TPL

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Barratt West London	3648
	Location	**Dates**	**Engineer**	**Sheet**
		22/08/2012-22/08/2013	Gravity Consulting Engineers	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.05) 0.05	CONCRETE		
					(0.25) 0.30	MADE GROUND: Coarse sand and cement		
					(1.70) 2.00	Light brown mottled grey and orange brown slightly gravelly slightly sandy slightly silty CLAY becoming less sandy with depth. Gravel consists of fine to coarse sub-angular flint and red brick		
						Complete at 2.00m		

Plan

Remarks

Pit stable and dry
Backfilled with arisings

Scale (approx)	Logged By	Figure No.
1:25	MM	3648.TPL

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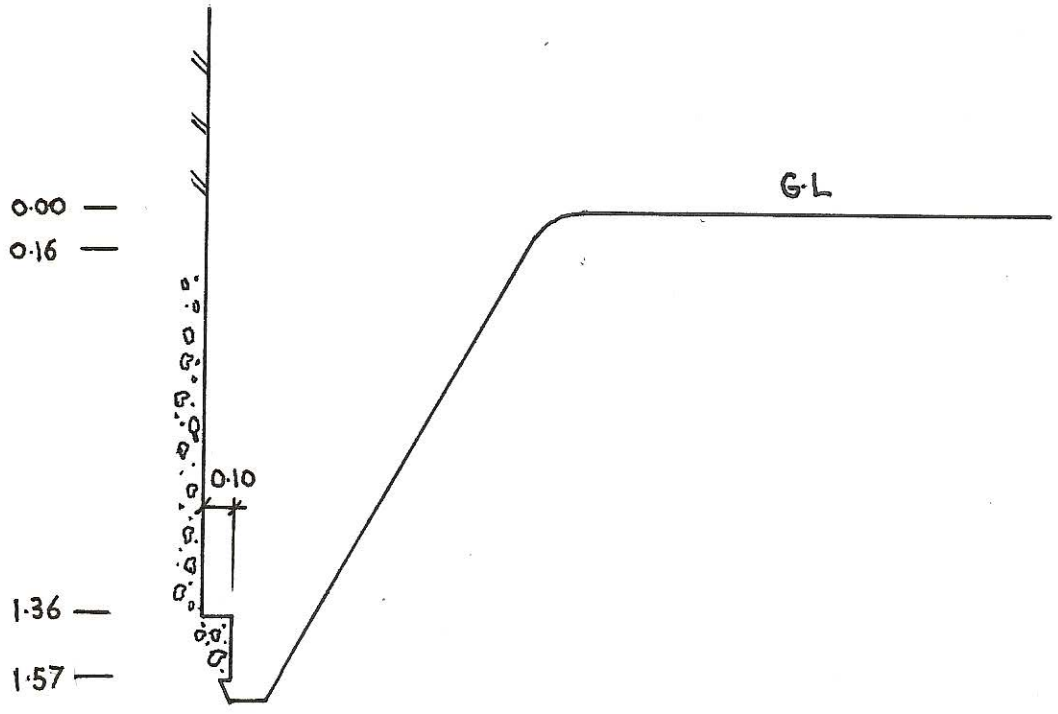
Site	Trial Pit Number
KIDDERPORE AVENUE - PHASE II	TPL

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Barratt West London	3648
	Location	Dates 22/08/2012-22/08/2013	Engineer	Sheet
			Gravity Consulting Engineers	2/2



Scale (approx)	Logged By	Figure No.
1:25	MM	3648.TPL

AP GEOTECHNICS
T 01932 848460
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Site	Trial Pit Number
KIDDERPORE AVENUE - PHASE II	TPM

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Barratt West London	3648
	Location	**Dates** 23/08/2011	**Engineer** Gravity Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
					0.30	Dark brown mottled orange slightly gravelly silty clay. Gravel consists of fine to medium angular flint, brick and rare ash		
0.50	D1							
					(1.18)			
1.00	D2							
			Water strike(1) at 1.25m.					▽1
1.40	D3							
					1.48	Complete at 1.48m		

Plan

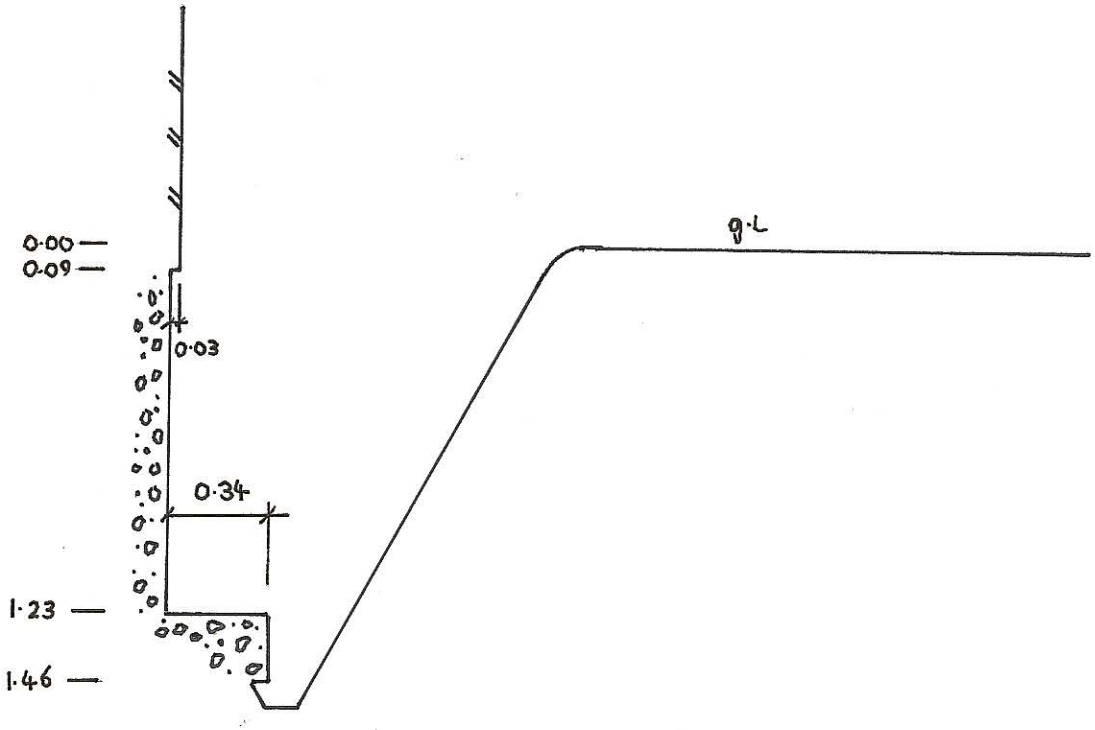
Remarks

Pit stabilised
Backfilled with arisings

Scale (approx)	Logged By	Figure No.
1:25	MM	3648.TPM

AP GEOTECHNICS	T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk	Site KIDDERPORE AVENUE - PHASE II	Trial Pit Number TPM

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Barratt West London	3648
	Location	**Dates** 23/08/2011	**Engineer** Gravity Consulting Engineers	**Sheet** 2/2



	Scale (approx)	Logged By	Figure No.
	1:25		3648.TPM

APPENDIX B

STANDPIPE RECORDS

STANDPIPE RECORDS

WATER LEVELS

Project: KIDDEPORE AVENUE - PHASE II
Client: Barratt West London
Agent: Gravity Consulting Engineers

Project No. 3648
Sheet No. 1/1

Location	BH51		BH52																	
Red. level	88.35		88.35																	
	Water level																			
Date	m bgl	m OD	m bgl	m OD																
23/08/2011	0.83	87.52	0.39	87.96																

Remarks

APPENDIX C

LABORATORY TEST RESULTS

SUMMARY OF GEOTECHNICAL TESTS

Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3643
Sheet No: 1/4

Location	Sample No	Depth m	Description	CLASSIFICATION							TRIAXIAL COMPRESSION - TOTAL STRESS							CHEMICAL		
				Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plast. Index %	Passing 425µm %	Mod. Plast. Index %	Class	Type	Moisture Content %	Bulk Density Mg/m³	Radial Stress kPa	Deviator Stress kPa	Cohesion cu, kPa assuming Øu = 0	Cohesion cu, kPa Øu, deg	Sulphate (SO4) Water g/l	Sulphate (SO4) Soil (Sol) g/l	pH
BH51	W19	3.80																0.11		7.15
	U2	4.50		28	41	21	20	100		CI	UU 102	28	1.95	90	128	64			0.68	7.32
	U4	5.50									UU 102	29	2.00	110	174	87				
	U6	6.50		29	38	18	20	100		CI	UU 102	23		130						
	U8	7.50									UU 102	23	2.05	150	236	118			0.65	7.41
	U11	10.00									UU 102	25	2.11	200	164	82				
	U14	13.00									UU 102	25	2.05	260	215	108				
	U17	16.00									UU 102	26	2.09	320	291	145				

Note: Soil Classification based upon unmodified Plasticity Index

SUMMARY OF GEOTECHNICAL TESTS

Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3643
Sheet No: 2/4

Location	Sample No	Depth m	Description	CLASSIFICATION							TRIAXIAL COMPRESSION - TOTAL STRESS							CHEMICAL		
				Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plast. Index %	Passing 425µm %	Mod. Plast. Index %	Class	Type	Moisture Content %	Bulk Density Mg/m³	Radial Stress kPa	Deviator Stress kPa	Cohesion cu, kPa assuming Øu = 0	Cohesion cu, kPa Øu, deg	Sulphate (SO4) Water g/l	Sulphate (SO4) Soil (Sol) g/l	pH
BH52	U2	4.50		27	52	26	26	100		CH	UU 102	27	2.04	90	115	58			0.31	7.27
	U4	5.50									UU 102	28	1.98	110	173	86				
	U6	6.50									UU 102	29	2.02	130	177	88				
	U9	7.50		25	46	23	23	100		CI	UU 102	25	2.08	150	132	66			0.36	7.54
	U12	9.00									UU 102	27	2.1	180	141	70				
	U14	10.50									UU 102	25	2.12	210	132	66			0.42	7.48
	U17	13.50									UU 102	22	2.09	270	200	100				

Note: Soil Classification based upon unmodified Plasticity Index

SUMMARY OF GEOTECHNICAL TESTS

Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3643
Sheet No: 3/4

Location	Sample No	Depth m	Description	CLASSIFICATION							TRIAXIAL COMPRESSION - TOTAL STRESS							CHEMICAL		
				Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plast. Index %	Passing 425µm %	Mod. Plast. Index %	Class	Type	Moisture Content %	Bulk Density Mg/m³	Radial Stress kPa	Deviator Stress kPa	Cohesion cu, kPa assuming Øu = 0	Cohesion cu, kPa Øu, deg	Sulphate (SO4) Water g/l	Sulphate (SO4) Soil (Sol) g/l	pH
BH53	U1	1.20									UU 102	30	1.91	24	68	34				
	U2	3.00		28	47	23	24	100		CI	UU 102	28	1.91	60	90	45			0.28	7.22
	U3	4.00									UU 102	30	1.86	80	136	68				
	U4	5.00									UU 102	28	1.88	100	145	72				
	U5	6.50									UU 102	30	1.99	130	98	49				
	U6	8.00									UU 102	23	1.98	160	142	71			0.31	7.28
	U7	11.00		24	44	19	25	100		CI	UU 102	24	2.03	220	110	55				
	U8	14.00									UU 102	27	1.99	280	292	146				

Note: Soil Classification based upon unmodified Plasticity Index

SUMMARY OF GEOTECHNICAL TESTS

Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3643
Sheet No: 4/4

Location	Sample No	Depth m	Description	CLASSIFICATION							TRIAXIAL COMPRESSION - TOTAL STRESS							CHEMICAL		
				Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plast. Index %	Passing 425µm %	Mod. Plast. Index %	Class	Type	Moisture Content %	Bulk Density Mg/m³	Radial Stress kPa	Deviator Stress kPa	Cohesion cu, kPa assuming Øu = 0	Cohesion cu, kPa Øu, deg	Sulphate (SO4) Water g/l	Sulphate (SO4) Soil (Sol) g/l	pH
BH53	U9	17.00		28	75	23	52	100		CV	UU 102	28	1.97	340	270	135				
	U10	20.00									UU 102	30	2.03	400	299	149			0.28	7.51
	U11	23.00									UU 102	25	2.00	460	306	153				

Note: Soil Classification based upon unmodified Plasticity Index

ONE - DIMENSIONAL CONSOLIDATION TEST

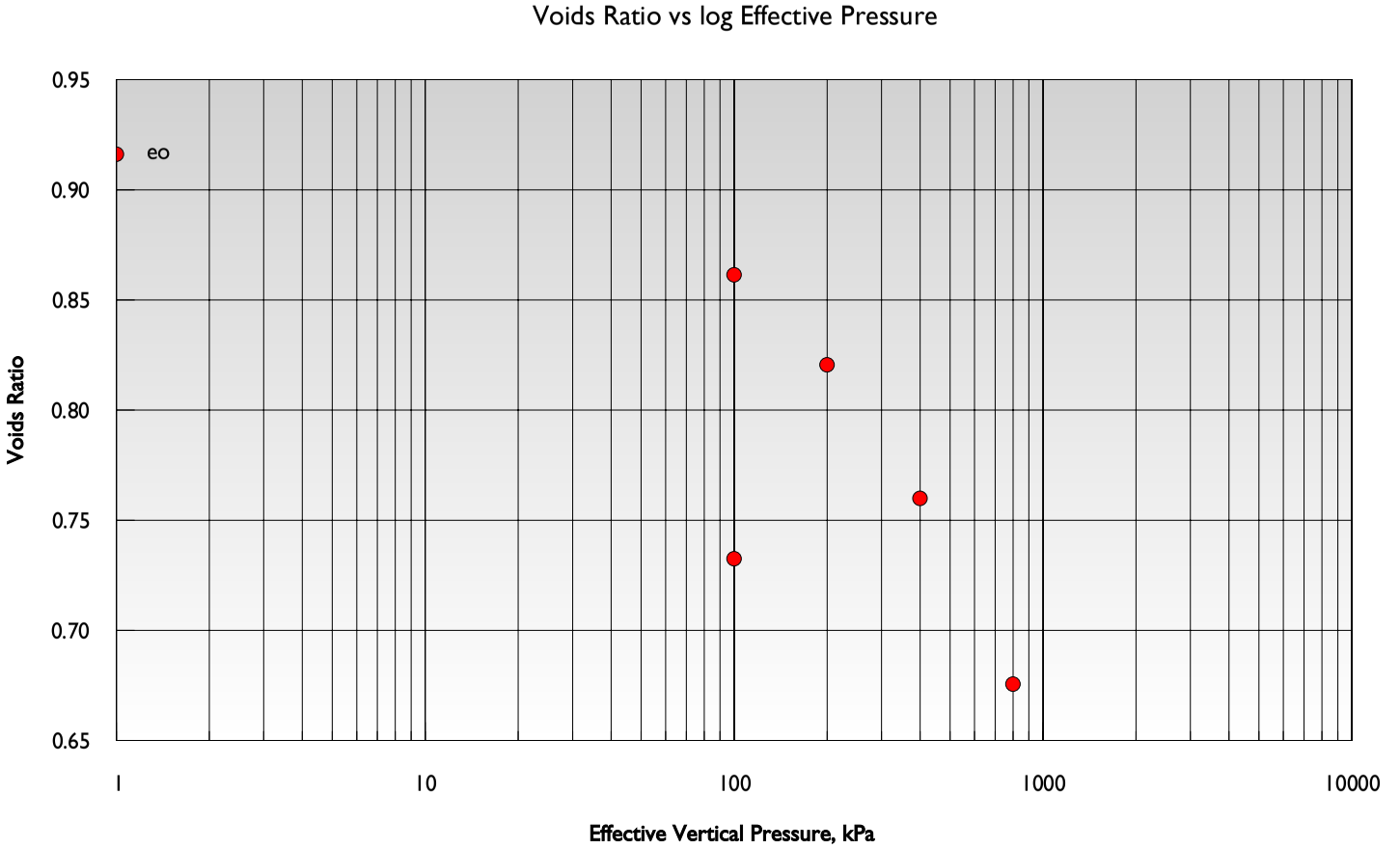
Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3648
Sheet No. 1/8

Borehole	Sample	Depth, m
BH51	U2	4.50
Description		
Stiff grey/brown silty sandy CLAY		

Specific Gravity	Moisture Cont. %	Dry Density Mg/m³
2.710 measured	start 34 finish 30	1.414

Pressure kPa	Coefficient of Consolidation m²/year	Coefficient of Compressibility m²/MN
0		
	0.772	0.286
100		
	1.422	0.219
200		
	1.399	0.166
400		
	1.288	0.120
800		
	1.172	0.048
100		



ONE - DIMENSIONAL CONSOLIDATION TEST

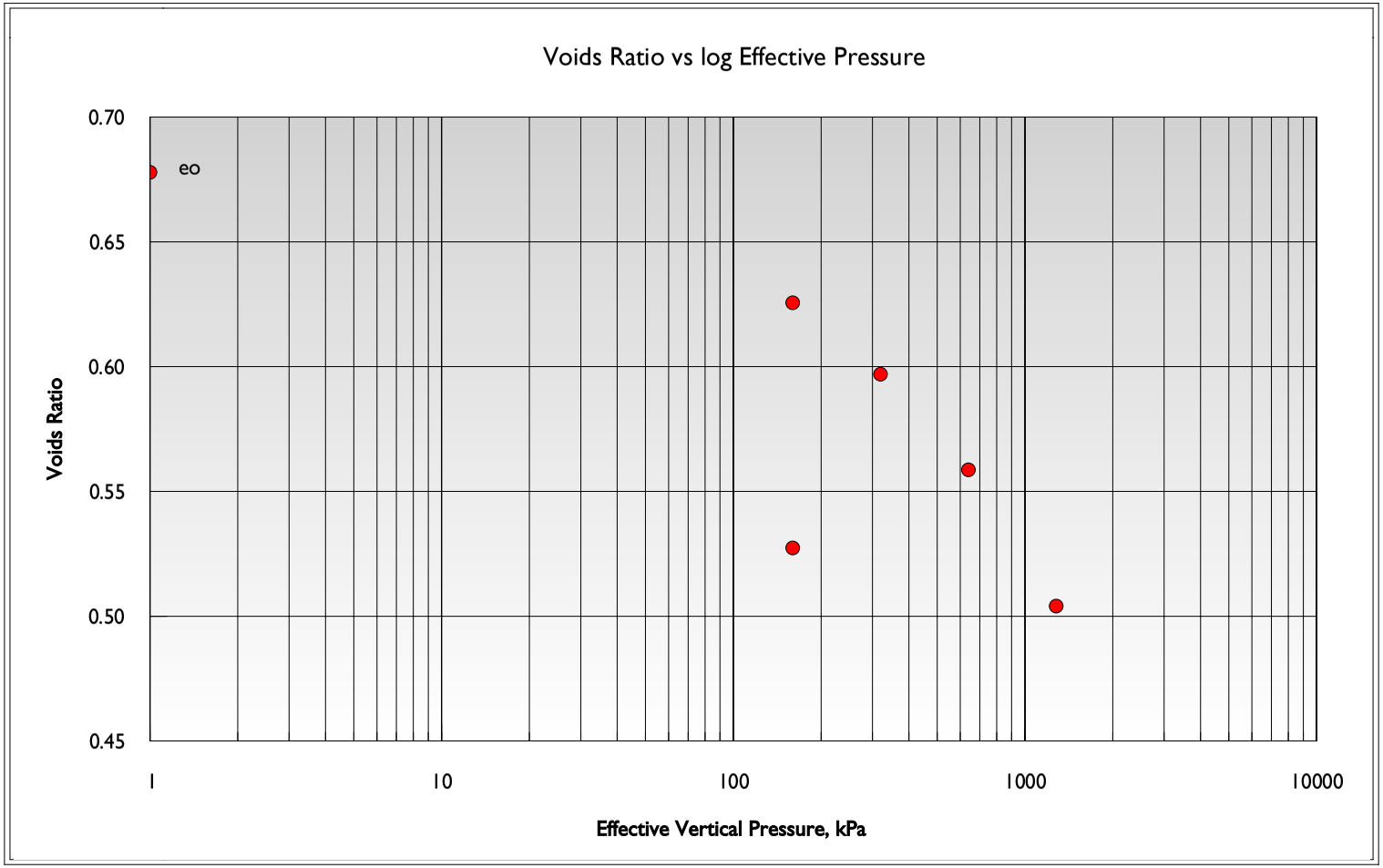
Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3648
Sheet No. 2/6

Borehole	Sample	Depth, m
BH51	U6	6.50
Description		
Very stiff grey very silty CLAY		

Specific Gravity	Moisture Cont. %	Dry Density Mg/m³
2.710 measured	start 23 finish 21	1.615

Pressure kPa	Coefficient of Consolidation m²/year	Coefficient of Compressibility m²/MN
0		
	0.373	0.195
160		
	0.477	0.110
320		
	0.293	0.075
640		
	0.701	0.055
1280		
	1.308	0.014
160		



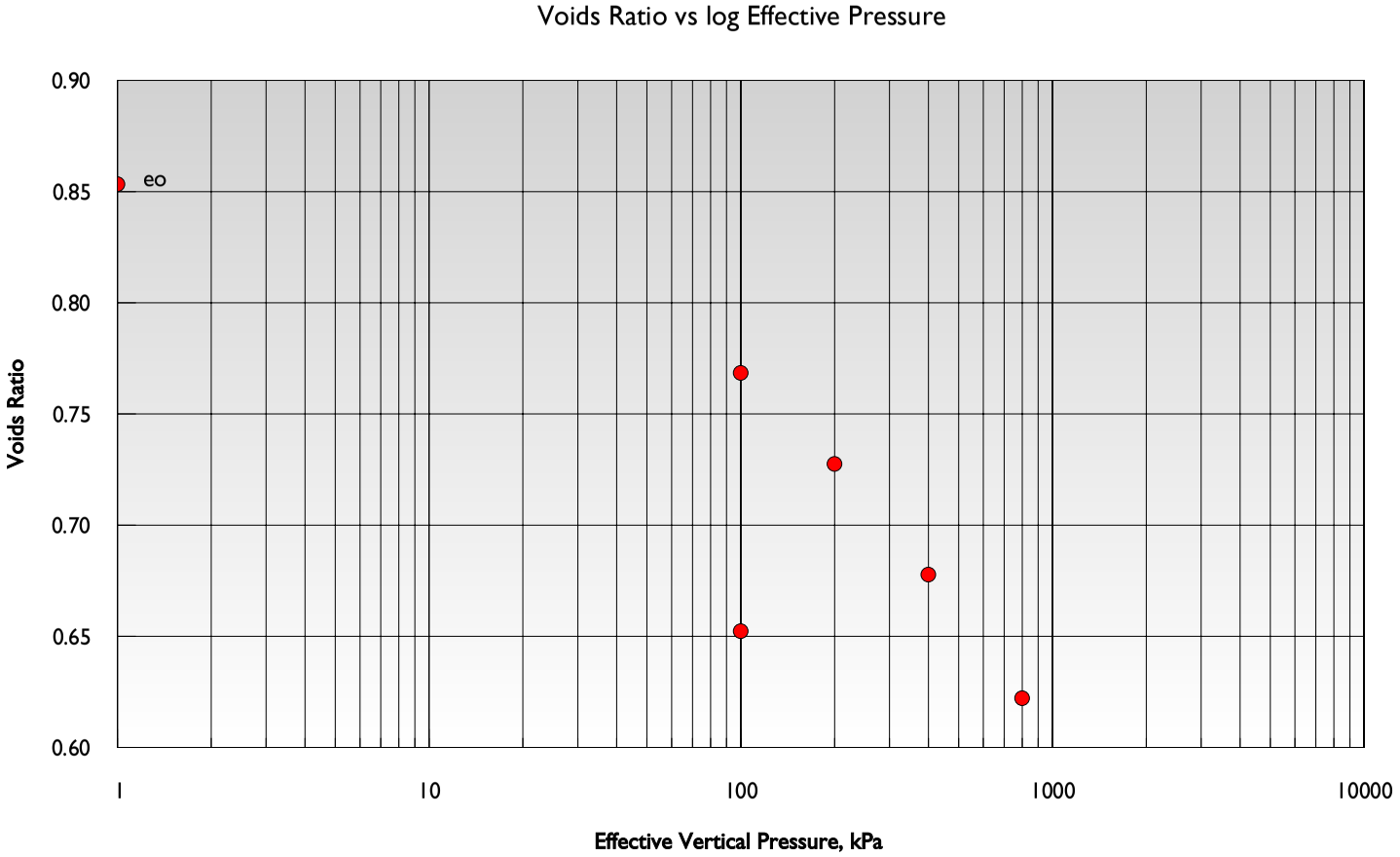
ONE - DIMENSIONAL CONSOLIDATION TEST

Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3648
Sheet No. 3/6

Borehole	Sample	Depth, m
BH52	U2	4.50
Description		
Firm brown silty sandy CLAY		
Specific Gravity	Moisture Cont. %	Dry Density Mg/m³
2.730 measured	start 28 finish 25	1.473

Pressure kPa	Coefficient of Consolidation m²/year	Coefficient of Compressibility m²/MN
0		
	0.924	0.458
100		
	1.847	0.232
200		
	2.026	0.144
400		
	3.167	0.083
800		
	36.997	0.027
100		

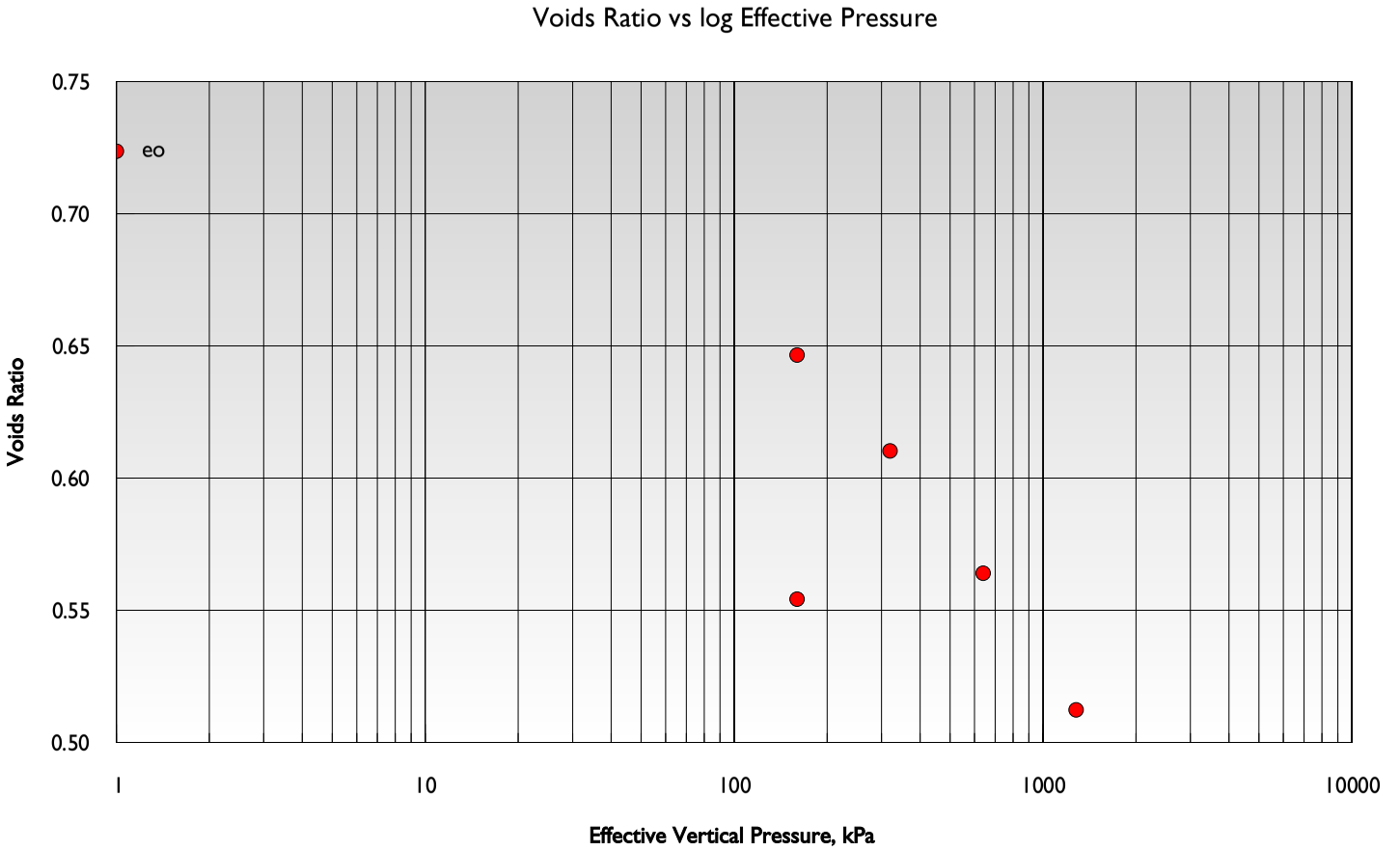


ONE - DIMENSIONAL CONSOLIDATION TEST

Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3648
Sheet No. 4/6

Borehole	Sample	Depth, m
BH52	U9	7.50
Description		
Firm to stiff dark grey silty sandy CLAY		
Specific Gravity	Moisture Cont. %	Dry Density Mg/m³
2.710 measured	start 25 finish 22	1.572
Pressure kPa	Coefficient of Consolidation m²/year	Coefficient of Compressibility m²/MN
0		
	0.699	0.280
160		
	0.730	0.138
320		
	0.638	0.090
640		
	0.616	0.052
1280		
	22.018	0.025
160		



ONE - DIMENSIONAL CONSOLIDATION TEST

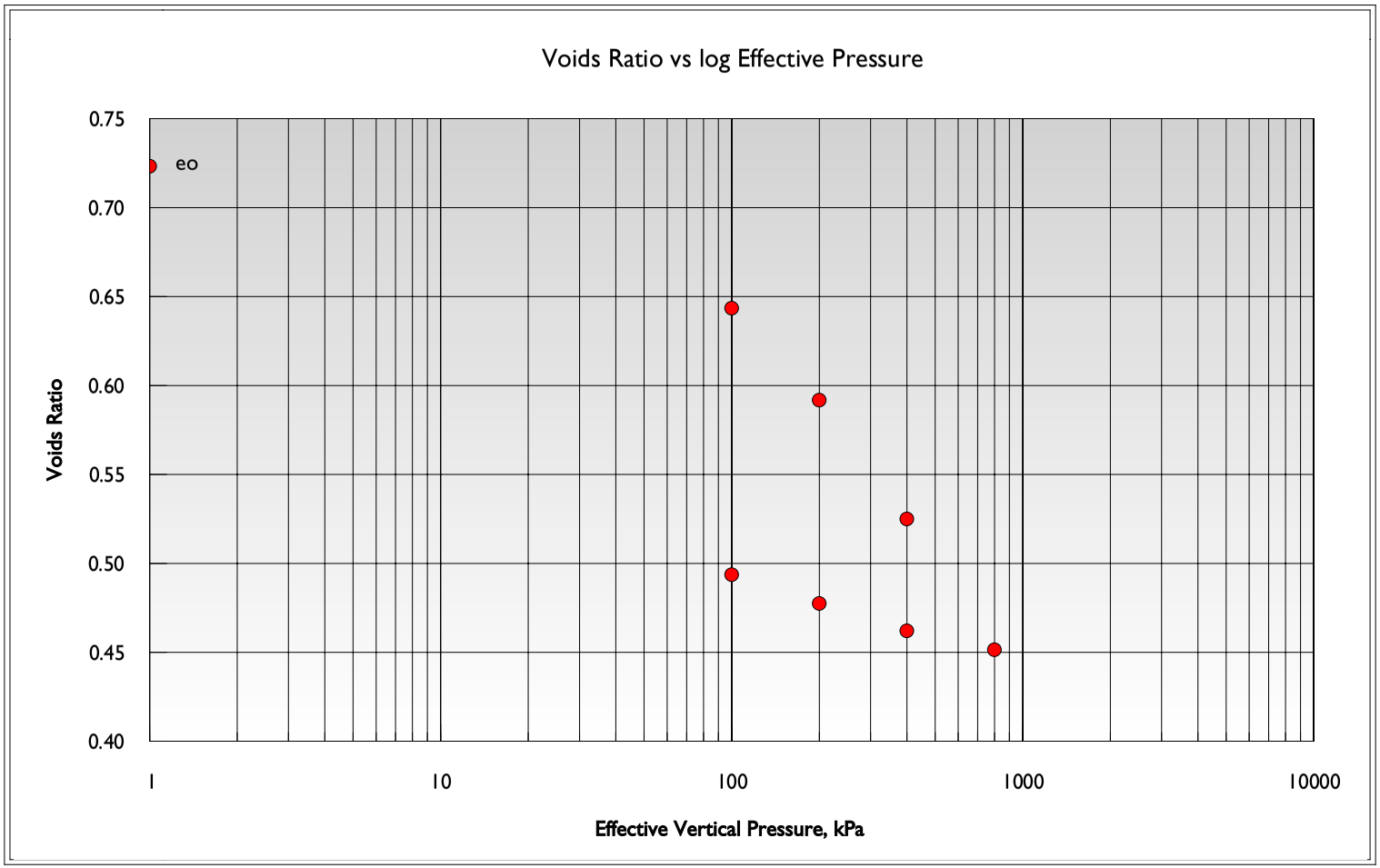
Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3648
Sheet No. 5/6

Borehole	Sample	Depth, m
BH53	U2	3.00
Description		
Firm mottled brown grey sandy silty CLAY		

Specific Gravity	Moisture Cont. %	Dry Density Mg/m³
2.710 measured	start 33 finish 28	1.573

Pressure kPa	Coefficient of Consolidation m²/year	Coefficient of Compressibility m²/MN
0		
	0.628	0.463
100		
	1.357	0.315
200		
	1.212	0.210
400		
	0.561	0.121
800		
	9.908	0.018
400		
	1.506	0.053
200		
	0.625	0.109
100		

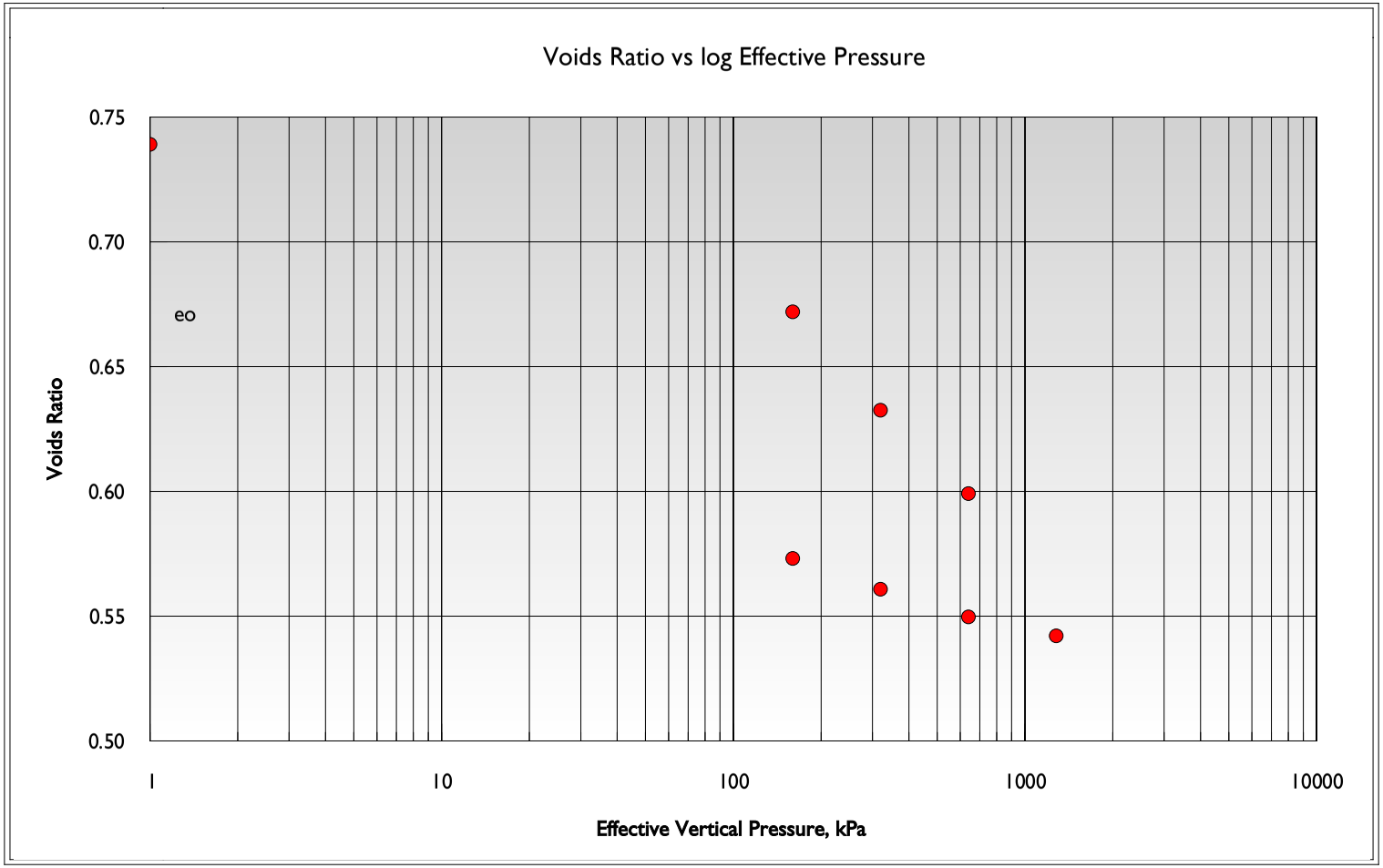


ONE - DIMENSIONAL CONSOLIDATION TEST

Project: KIDDERPORE AVENUE, PHASE III
Client: Barratt West London

Project No: 3648
Sheet No. 6/6

Borehole	Sample	Depth, m
BH53	U7	11.00
Description		
Firm to stiff dark grey silty sandy CLAY		
Specific Gravity	Moisture Cont. %	Dry Density Mg/m³
2.710 measured	start 24 finish 22	1.558
Pressure kPa	Coefficient of Consolidation m²/year	Coefficient of Compressibility m²/MN
0		
	2.185	0.241
160		
	1.288	0.147
320		
	0.706	0.064
640		
	3.401	0.056
1280		
	9.773	0.008
640		
	1.391	0.022
320		
	0.563	0.049
160		



APPENDIX D

FIGURES

Kidderpore Avenue Phase III - Block B

Borehole location Plan

Scale unknown

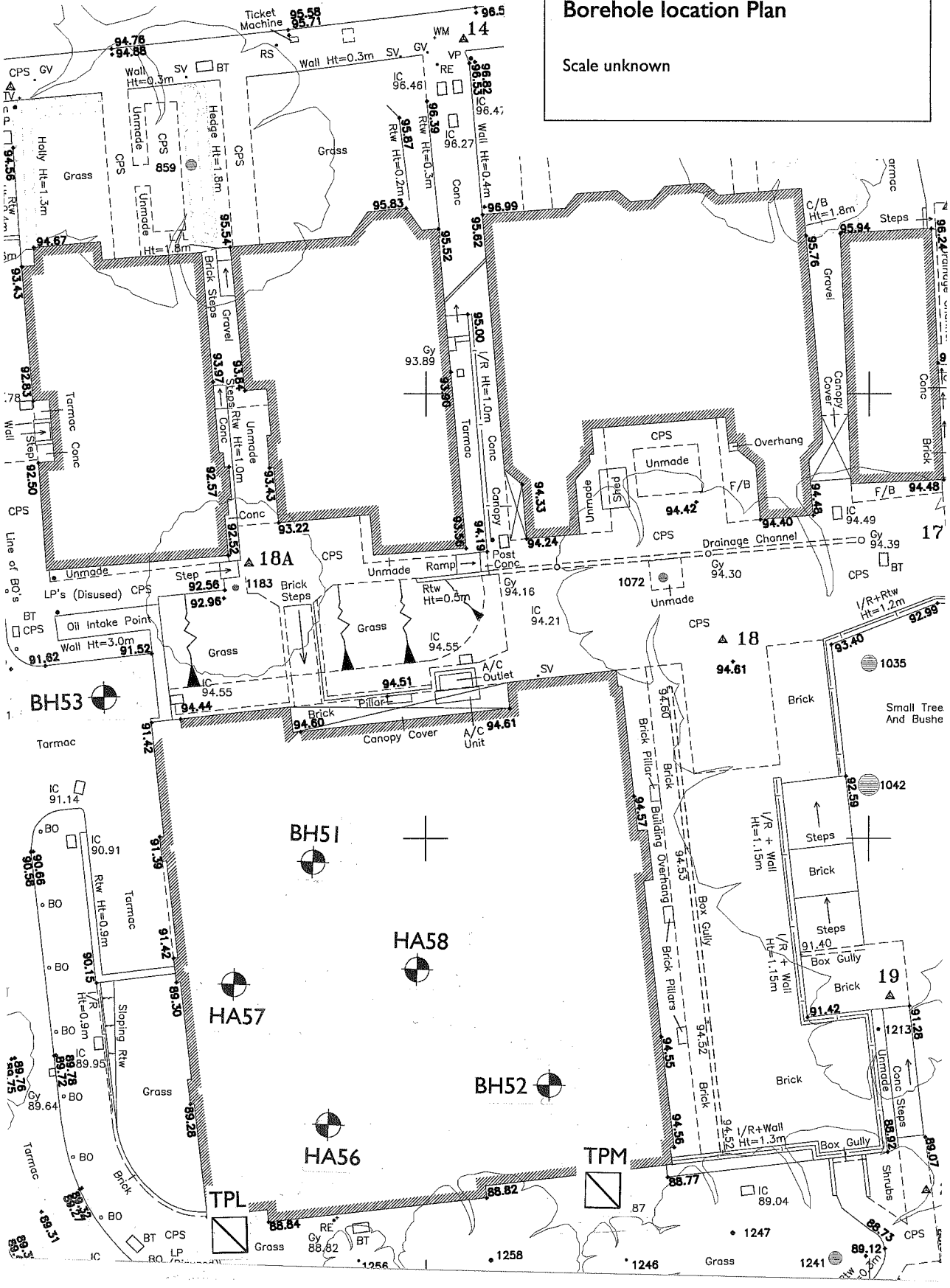


Figure 1

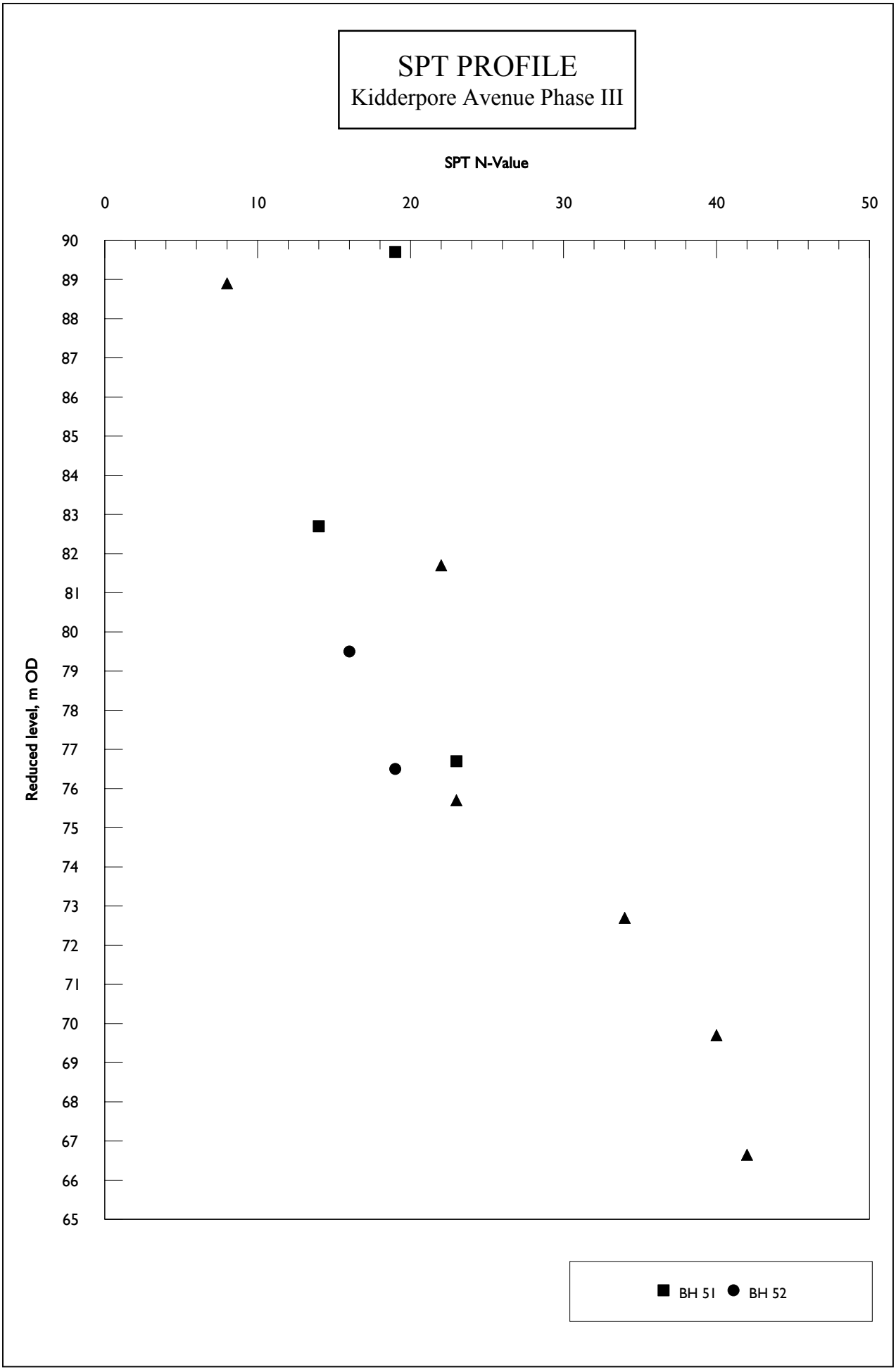


Figure 3

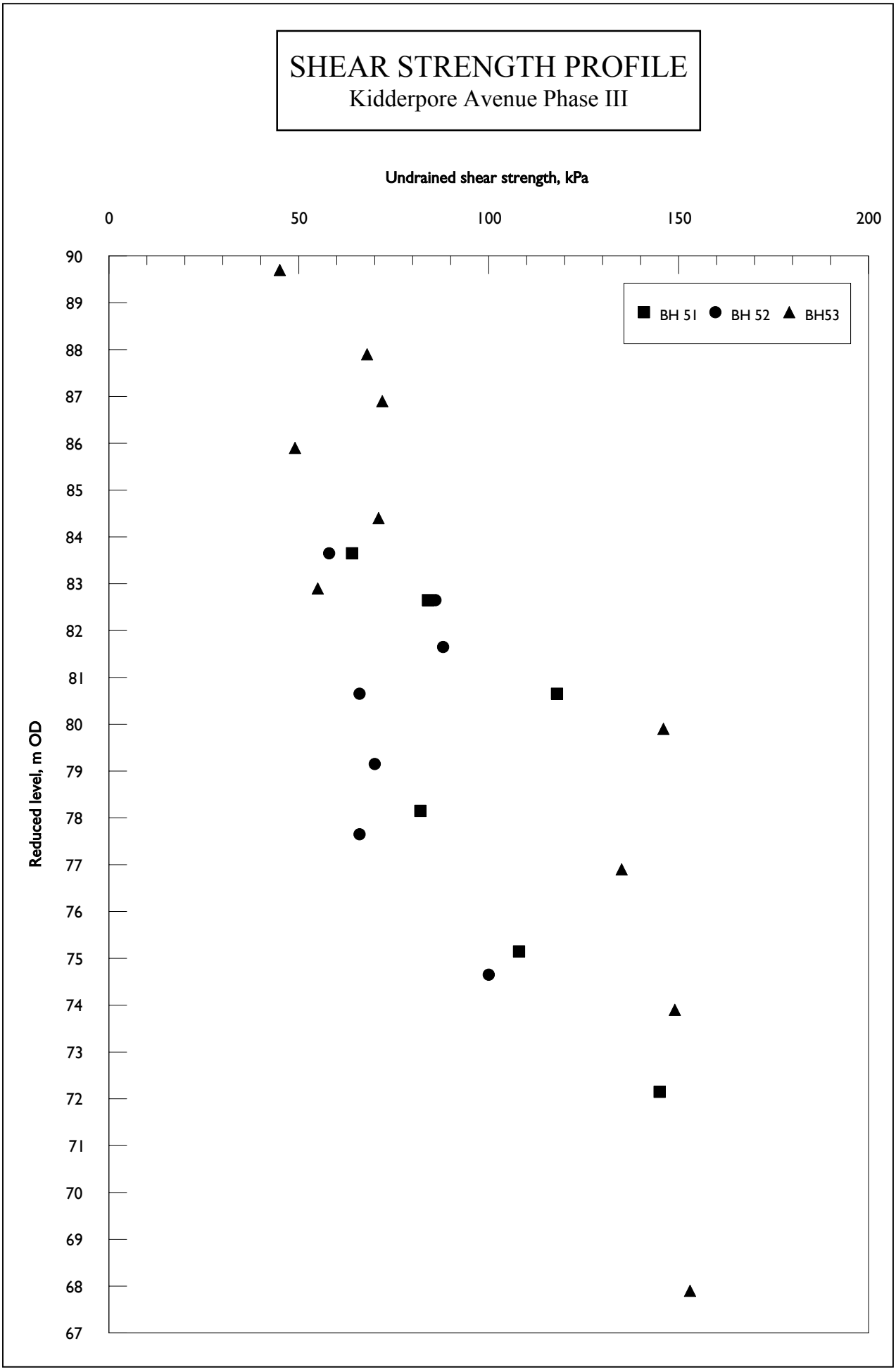


Figure 3