GROUND ENGINEERING
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GROUND INVESTIGATION REPORT

CAPO DI MONTE

WINDMILL HILL

LONDON NW3

Report Reference No. C13361A

On behalf of:-

Michael Barclay Partnership LLP
105-109, The Strand
London
WC2R 0AA

February 2015

MICHAEL BARCLAY PARTNERSHIP LLP

REPORT ON A GROUND INVESTIGATION

AT

CAPO DI MONTE

WINDMILL HILL

LONDON NW3

Report Reference No. C13361A **February 2015**

INTRODUCTION

Michael Barclay Partnership LLP, the client, are involved with the redevelopment of a site known as Capo Di Monte, Windmill Hill, London NW3.

The proposed development includes an approximately 3.50m deep basement extension below the western half of Capo Di Monte, extending west below part of the rear garden. The basement extension floor level will be at 129mOD.

Ground Engineering Limited was instructed to carry out a ground investigation, under the direction of Michael Barclay Partnership LLP, in order to determine the nature and geotechnical properties of the underlying soils in relation to design of foundations and produce a factual report with additional interpretative comments to inform their basement impact assessment. In addition, groundwater monitoring was included within the scope of works.

LOCATION, TOPOGRAPHY AND GEOLOGY OF THE SITE

Location

Capo Di Monte, a much altered, late 18th Century Grade II listed dwelling, is situated on the western side of Windmill Hill and south-eastern side of Judges' Walk, at the southern edge of Hampstead Heath, within the London Borough of Camden, London NW3. The site is located some 70m east of Branch Hill and 190m west of Heath Street, and is centred at National Grid Reference TQ 26143 86164.

The approximately square site has a 23m long frontage onto the western side of Windmill Hill from which it extends east for about 20m. The site is bounded to the south and south-west Nos.1 to 4 Upper Terrace, and to the north by Judges' Walk. The site's eastern limit is formed by the Windmill Hill roadway.

At the time of the investigation, the site was occupied by the two-storey detached dwelling with part basement, and its small rear courtyard garden. A garage was attached to the southern end of the house, and had a short (3m) concrete-surfaced driveway linking it to the adjacent roadway, via a drop kerb. A number of trees were present adjacent the site, including a Lime tree within the Windmill Hill footpath, and a row of Oaks alongside Judges' Walk.

Topography

The site stands on the south-facing slopes of the Hampstead 'high ground'. The elevation of the adjacent roadway falls southward from about 133mOD to 131mOD, along the site frontage, whilst the ground floor level of the dwelling is at about 132.5mOD.

Geology

The 1934 geological map for this part of London (Sheet I.SE) at 6 inches to 1 mile scale (1:10,560) show the site to be directly underlain by the solid geology of the Bagshot Sand. The underlying solid geology of the Claygate Beds and London Clay are indicated directly

beneath the lower slopes some 240m and 500m to the south-west, respectively. Isolated patches of superficial Plateau Gravel are depicted covering the Bagshot Sand on this map, within the higher parts of Hampstead Heath, some 525m distant.

This map also depicts the rising of headwater streams 230m to the west, flowing and converging south-westwards to become Westbourne 'Brook'. The western headwater streams of the River Fleet rise 400m to 600m to the north-east, east and south-east, and flow east and south.

The 2006 geological map for the area at 1:50,000 scale, Sheet 256, also shows the site to be underlain by the renamed Bagshot Formation, and then in turn by the Claygate Member of the London Clay Formation and undifferentiated London Clay Formation strata. The Plateau Gravel patches have been ascribed on this map to the Stanmore Gravel, a pre-Anglian river terrace deposit.

Previous work within this part of London has found an often significant cover thickness of superficial 'hillwash' or Head Deposit mantling the solid geology strata. The geological memoir for the London district indicates a maximum thickness of 18m for the Bagshot Formation in cored boreholes on Hampstead Heath. A well record on the 1934 geological map, 270m south of the site and at a lower elevation, details the base of the 'sand' (Bagshot Sand) at 4.7m depth underlain by 34.6m of 'yellow sandy clay' (Claygate Member), and then at least 23.1m of 'blue clay' (London Clay).

Hydrogeology

The site is designated by the Environment Agency (EA) as being underlain by Secondary (A) Aquifers, the Bagshot Formation and Claygate Member, which overlie the Unproductive stratum of the London Clay. Based on the topography of the site area the direction of near surface groundwater and surface water flow would locally be from north to south/south-west.

Well records on the 1934 geological map indicate that the practically impervious Unproductive stratum of the London Clay is about 100m thick beneath this part of London and that the underlying Principal Aquifer of the White Chalk Subgroup lies about 160m below ground level, about -30mOD.

SITE WORK

A single window sample borehole was undertaken at a position determined by the client. The exploratory hole position is depicted on the site plan at the rear of this report. The site work was undertaken under the supervision of a Geoenvironmental Engineer from Ground Engineering Limited. The intrusive works were undertaken within a working area delineated by barriers.

The investigation was undertaken following the protocols detailed in British Standards (BS) 'Code of Practice for Site Investigations' (BS5930:1999) and 'Methods of test for soils for engineering purposes' (BS1377:1990).

Services information was provided prior to the start of the investigation and was referenced in relation to the exploratory hole position prior to boring and a scan was undertaken using a cable avoidance tool (CAT). The elevation of the exploratory hole position was interpolated from a site survey drawing provided by the client.

Window Sample Borehole

The window sample borehole (WS 1) was undertaken by a small tracked dynamic sampling rig on 13th August 2014, within the area of hardstanding immediately in front of the dwelling's garage.

The surface layer of concrete was broken out using a small hydraulic breaker and then a starter pit was dug to 1.20m below ground level using hand tools, in order to ensure the absence of buried services.

The dynamic/window sampling equipment consisted of 1.00m long drive-in samplers of specially constructed and strengthened 87mm to 57mm diameter steel sample tubes with a plastic core-liner. The samplers were driven into the ground by an automatic trip hammer weighing 63.50kg falling freely through 750mm. Upon extraction a continuous profile of the soil

was obtained in the plastic liners (U) inserted in the samplers. The borehole was completed at 6.45m depth.

Standard penetration tests were undertaken in the window sample borehole at regular intervals in order to give an indication of the in-situ relative density/shear strength of the material. The test was made by driving a 50mm diameter open shoe and split spoon sampler (S) into the soil at the base of the borehole by means of an automatic trip hammer weighing 63.50kg falling freely through 750mm. The penetration resistance was determined as the number of blows required to drive the tool the final 300mm of a total penetration of 450mm into the soil ahead of the borehole. The results have been tabulated to the rear of this report.

The window sample liners were split, sub-sampled and described on site by the supervising Geoenvironmental Engineer. In made ground and the underlying natural strata, representative disturbed samples were taken from the starter pits and liners, and placed in polycarbonate pots (D samples) or large sealed plastic bags (B samples). A water sample (W) was recovered from the borehole once sufficient water had accumulated for collection.

On completion of the window sample borehole, a 50mm diameter HDPE standpipe was installed to 6.00m depth. The annulus around the standpipe was backfilled with pea gravel and a bentonite seal placed around the top of the installations within 1.00m of ground level. A gas tap was installed in the top of the standpipe. A protective stopcock cover was concreted into the ground flush with the surface over the installation. The borehole beneath the installation was backfilled with clean arisings.

The window sample borehole record gives the descriptions and depths of the various strata encountered, details of all in-situ tests, the samples taken and the groundwater conditions observed during boring, on completion and subsequently within the standpipe.

Monitoring

The standpipe was monitored for methane, carbon dioxide and oxygen gas levels on 19th August and 21st October 2014. Ambient pressures and flow rates were recorded together

with the depth to groundwater. The water level in the standpipe was also checked, and together with the gas levels are presented following the exploratory hole record.

LABORATORY TESTING

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the exploratory hole record. The soil sample descriptions are in accordance with BS5930:1999. The testing was completed within a UKAS accredited laboratory.

The particle size distributions of selected samples of sand and gravel were obtained by sieve analysis. The particle size distribution passing the 63μm sieve was obtained for a single sample by pipette sedimentation. Results of these tests are given as particle size distribution curves at the end of this report. Where sieve analysis and sedimentation were carried out on the same sample the results are presented as a single combined distribution curve.

Selected samples of soil and water were analysed to determine the concentration of soluble sulphates. The pH values were also determined using an electrometric method.

GROUND CONDITIONS SUMMARY

The ground conditions encountered were broadly as expected from the geological records with made ground covering solid geology Bagshot Formation sand with atypical interbedded subordinate sand and gravel layers up to 1m thick. The borehole then entered typical Bagshot Formation silty fine sand at about 126mOD and this was found to at least 6.45m depth, 125.50mOD, where borehole WS 1 was completed.

The atypical and variable deposits of sand and gravel encountered to 6.00m depth may well represent 'hillwash' or Head Deposits derived from upslope strata, or in part belong to the superficial Stanmore Gravel. For simplicity, the sand and gravel strata are collectively denoted as belonging to the Bagshot Formation for the remainder of this report.

Groundwater

The window sample borehole WS 1 encountered water at 5.34m depth, which rose to 5.30m below ground level (126.65mOD).

The 6.00m deep standpipe in borehole WS 1 yielded water levels at 5.15m and 5.25m depth, 126.80mOD to 126.70mOD, during the two monitoring visits in August and October 2014.

Previous Adjacent Investigation – No.4 Upper Terrace

The client provided a copy of a ground investigation report, by others, which was undertaken within the adjacent site to the west, No.4 Upper Terrace. The 2013 investigation included three cable percussive boreholes, two 6m and one 20m deep, and groundwater monitoring. These boreholes were located within ground about 1m lower (131mOD) than Capo Di Monte, and penetrated a thin cover of made ground that was underlain by loose, medium dense and locally initially dense, medium to coarse sand with 1m to 2m thick layers of sand and gravel. At 126mOD and 125mOD, in two of the three holes, a thin (0.20m and 0.40m) layer of

firm grey clay was met. Below this clay layer and from a similar elevation in the third hole, a medium dense, locally dense, green grey or green brown, silty fine sand was entered. The two shallow holes were completed within this typical Bagshot Sand, which was proved to 9.10m depth (122mOD) in the deepest borehole.

The deepest borehole then met the sandy clay/silt of the Claygate Member of the London Clay Formation, which was found to at least 20m depth (111.10mOD), where this hole was completed.

The three boreholes were recorded as dry throughout boring and on completion. The hole records do not indicate whether or not it was necessary to add water to enable the drilling of the coarse grained soils encountered.

The shallowest water levels subsequently recorded in these boreholes were typically at 126.80mOD and 125.00mOD. Together with the results of this investigation these water levels indicate a hydraulic gradient towards the west and south-west, as expected.

COMMENTS ON THE GROUND CONDITIONS IN RELATION TO BASEMENT DESIGN AND CONSTRUCTION

The investigation found a cover of made ground associated with the construction of the dwelling and its short driveway. Foundations for the new basement will penetrate this made ground and be based within the underlying Bagshot Formation sand and gravel, which should have adequate bearing properties. Groundwater levels were generally recorded at 5.15m below ground level (126.80mOD) and at about the same elevation beneath the adjacent site to the west. The recorded groundwater level lies about 2.20m below the proposed basement excavation level of 129mOD, and so should not impact construction.

Foundation Depths

The borehole of this investigation encountered natural ground at 2.00m below ground level, although it was reportedly less than 1.00m thick in boreholes undertaken by others below the adjacent plot to the west.

The underlying sand and gravel of the Bagshot Formation would be considered non-shrinkable but the silty sand may be potentially frost susceptible and a minimum footing depth in this stratum would be 0.60m in order to avoid the potentially damaging effects of frost action.

Basement

The construction of the proposed basement will remove the surface layers of made ground and the top of the underlying Bagshot Formation. Foundations for the basement walls at or just below the basement floor level would be within the medium dense, locally loose, Bagshot Formation and could be designed using the results of the standard penetration tests, which indicate a bearing pressure of 120kN/m^2 for up to 1.20m wide foundations and up to 25mm of immediate settlement.

Similarly a bearing pressure of 80kN/m^2 could be applied on a basement raft foundation constructed on the Bagshot Formation strata. This pressure would not overstress the thin firm clay layers, between 126mOD and 125mOD, if present, or the Claygate Member strata below 122mOD. The results of the in-situ testing within these strata initially indicate a maximum safe bearing capacity of 80kN/m^2, with a factor of safety of 3.0 against general shear failure.

For the basement, theoretical base heave movement could take place at the centre of a 6m wide, 15m long excavation where up to 70kN/m^2 of overburden pressure has been removed. However, most of the heave would be expected to dissipate between inter-grain pore spaces within the 7m of sand and gravel remaining below the basement floor, and little, if any, heave is therefore likely to take place.

An adequately reinforced basement floor could be cast on the ground following proof rolling and careful inspection.

Excavations/Groundwater

The excavation of deep basement below existing ground floor level will require the construction of close support to its sides, the control of groundwater, and the need to avoid undermining adjacent structures.

The use of mass concrete walls, constructed in alternate panels around the perimeter of the basement could provide support to the excavation, although such a method of construction to the full depth required might prove difficult at this site.

An alternative would be to use sheet, contiguous or secant piled walls around the perimeter of the basement. Piling to a sufficient depth to mobilise adequate passive pressure below the basement level should be feasible on this site.

The excavation of a basement could then be undertaken within the piled walls, although it should be noted that contiguous pile lined excavations would not be water tight.

In order to construct the basement beneath this site it will be necessary to provide permanent support to the adjacent structures, some of which are likely to be based on relatively shallow strip foundations. This support can either be provided by underpinning these structures to the same depth as the proposed basement prior to basement construction or by constructing piled walls to the excavation that are adequately propped during construction by temporary support and permanently by the basement and ground floors, to prevent movement at the top of the retaining walls. Or a combination of the two.

Such lateral movement would otherwise be accompanied by settlement (vertical movement) of the ground behind the basement walls. As an example, Figure 2.12 of CIRIA C580 (2003) indicates very small scale (<10mm) settlement at a distance of 1.00m from a bored pile wall to a 4m deep basement excavation, and about 10mm when only 0.50m distant from this structure. The use of a high support stiffness system (such as high propped walls and top down construction) to the basement excavation would prevent deflection of the proposed basement walls, resultant changes to the state of soil stress, and result in negligible structural movement of neighbouring structures.

Although there is no specific method for assessing the magnitude of ground movement attributable to underpinning, it is accepted that underpinning carried out in a well-controlled manner by a competent contractor gives rise to movements that are typically small and any predicted damage should be no worse than category 1 (very slight) using the Burland BRE classification.

The advice of specialist groundworks contractors with experience of constructing such basements should be sought, particularly in respect of other potential methods of providing support to the sides of the basement excavation, such as grouting.

The basement excavation should be inspected on completion to ensure that the condition of the soil complies with that assumed in design. Should pockets of inferior material be present, they should be removed and replaced with well graded hardcore or lean mix concrete.

The excavated surface should be protected from deterioration and a blinding layer of concrete used where foundations are not completed without delay.

The WS 1 standpipe recorded the groundwater level beneath the site at 5.15m to 5.25m depth (about 126.80mOD), which concurs with water levels recorded on the adjacent plot to the west. This level will be at least 2.20m below the proposed basement excavation depth on this site, so large scale dewatering should not be necessary. Inflows of 'perched' water should be dealt with using screened sumps.

Potential flotation due to groundwater on this site should also not be a problem.

With potential 'perched' water present above the floor level of the proposed basement, it may be considered necessary to waterproof the basement in order to prevent the ingress of water, including downward percolating surface water, into the completed structure. A drained cavity system could also be incorporated within the basement design.

Slope Stability

The ground within which the plot is located slopes down to the south and south-west, and falls from 133mOD at the northern end of Windmill Hill opposite the site, to 121mOD some 140m to the south-west where Lower Terrace meets Branch Hill. This is an approximate slope angle of 5 degrees, and hence this slope is not marked on Figure 16 of the London Borough of Camden 'Guidance for subterranean development', which indicates slopes of greater than 7 degrees.

Slopes of 8 degrees or greater within the underlying Claygate Member in Hampstead are reported in this document to be potentially unstable if the land topography is adversely disturbed. On this site, on a terraced hillside bounded to the west and downslope to the south by existing dwellings (often with full or partial basements), gardens and retaining walls, with a relatively deep recorded groundwater level, it is considered unlikely that the proposed basement development will induce slope instability.

Other Issues

The basement development beneath this site would only be considered likely to affect the drainage system of the site itself. However, drainage and sewerage records for the surrounding buildings will need to be referenced, if available, or perhaps surveyed to confirm that the site does not share a communal drainage system that runs beneath the site.

The flow of surface water within the surrounding area, to the south-west, should not be changed by the proposed redevelopment of this small site.

As previously described, groundwater beneath this site stands within the Bagshot Formation at about 5.15m depth but 'perched' water may be encountered at shallower depths. The proposed 3.50m basement depth does not extend below the groundwater level and so there should be no displacement of groundwater by its exclusion from beneath the area of the basement after it has been constructed.

The north to south orientation of the proposed basement would be across the likely direction of near surface groundwater flow on this south-west facing slope, but as the proposed structure does not extend below the groundwater level, the drainage path should not be increased and would not be expected to impact the adjoining properties downslope to the south-west and south.

GROUND ENGINEERING LIMITED

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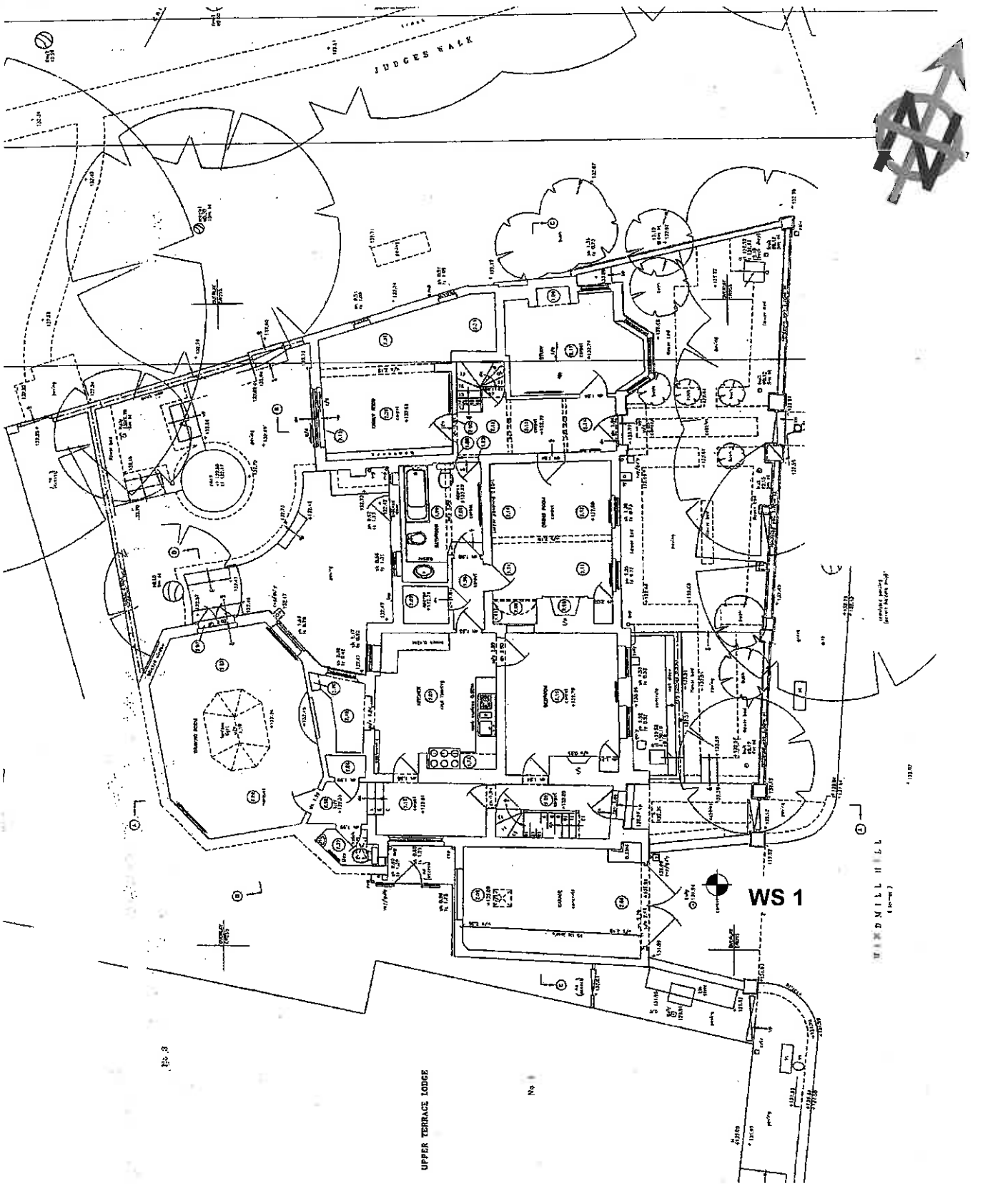
Exploratory Hole Location Plan

Not to Scale



Key

Borehole

Project: Capo Di Monte, Windmill Hill, London NW3 **Client:** Michael Barclay Partnership	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No.** **C13361**

GROUND ENGINEERING LIMITED

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Site: CAPO DI MONTE, WINDMILL HILL, LONDON NW3

WINDOW SAMPLE
WS1

Date: 13/08/14

Hole Size: 87mm dia to 1.20m
67mm dia to 4.00m
50mm dia to 6.45m

Ground Level: 131.95m. O.D.

Samples and in-situ Tests			(Date) Water	Inst.	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result						
					MADE GROUND - CONCRETE.		0.10	131.85
0.15	D1				MADE GROUND - Grey, brown and red brown, sandy GRAVEL. Gravel of concrete, brick, mortar and flint.		0.20	131.75
0.50	D2				MADE GROUND - Dark brown and dark grey, silty, gravelly SAND. Gravel of ash, flint, quartz and brick.			
1.00	D3							
1.20-2.00	U1						1.20	130.75
1.35-1.65	S	N25			MADE GROUND - Medium dense, brown and orange brown, clayey, gravelly, SAND. Gravel of flint and quartz, and occasional brick fragments.			
1.50	D4							
1.70-1.90	B1							
1.80	D5							
2.00-3.00	U2						2.00	129.95
2.10	D6				Medium dense, light brown, silty, gravelly, fine to coarse SAND with occasional thin bands of orange brown and red brown clayey sand. Gravel of sub-rounded to rounded flint and quartz.			
2.15-2.45	S	N21						
2.50-2.80	B2							
2.60	D7							
3.00-4.00	U3				...Sand fine to medium below 3.00m.			
3.10	D8							
3.15-3.45	S	N18						
3.60	D9							
3.70-3.90	B3							
4.00-5.00	U4							
4.10	D10							
4.15-4.45	S	N9					4.25	127.70
4.40	D11				Loose, light brown, silty, sandy GRAVEL. Gravel of coarse, rounded flint.		4.55	127.40
4.70	D12				Light, brown and orange brown, slightly clayey, silty, fine and medium SAND with rare, fine flint gravel.			
4.80-5.00	B4							
5.00-6.00	U5						5.00	126.95
5.10	D13		▼s		Loose, light grey and light brown, silty SAND AND GRAVEL. Gravel of rounded flint and quartz.			
5.15-5.45	S	N9	C					
5.30	W1							
5.40	D14							
5.70-5.90	B5							
							6.00	125.95
6.10	D15			BENEATH INSTALLATION	Loose, light brown, clayey, silty fine SAND.			
6.15-6.45	S	N6					6.45	125.50
					Borehole completed at 6.45m depth			

REMARKS
1. Excavating a pit from 0.00m to 1.20m
2. Gas monitoring standpipe installed to 6.00m depth

Project No 13361

Scale 1:50

Page 1/1

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed Sample
W - Water Sample
▽ Water Strike
▼ Depth to Water on completion
J - Jar Sample
M - Mackintosh Probe
V - Vane Shear Test Cohesion ( ) kPa
P( ) - Hand Penetrometer Cohesion ( ) kPa
▼s Standpipe Level

Groundwater Strikes

No	Depth m Struck	Rose to	Rate	Cased	Sealed
1	5.34	5.30			not

Groundwater Observations

Date	Depth m Hole	Casing	Water
13/08/14	6.45		5.34
19/08/14	6.00		5.15

Borehole Number	Depth (m)	Casing Depth (m)	Depth to Water (m)	Type of Test *	Seating Drive: Blows/Penetration (mm)	Test Drive: 300mm Blows for each successive 75 mm Penetration				N Value	Extrapolated Value
WS1	1.20 - 1.65			S	4/150	4	6	8	7	25	
	2.00 - 2.45			S	5/150	4	5	6	6	21	
	3.00 - 3.45			S	10/150	5	4	5	4	18	
	4.00 - 4.45			S	4/150	2	3	2	2	9	
	5.00 - 5.45			S	4/150	3	1	3	2	9	
	6.00 - 6.45			S	1/150	1	1	2	2	6	

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* C denotes test using a solid cone
S denotes test using a split barrel sampler

Results of Standard/Cone Penetration Tests

13361

CAPO DI MONTE, WINDMILL HILL, LONDON NW3

Table No 1

Groundwater/Gas Monitoring Record **GROUND ENGINEERING LIMITED**

Site: **Capo Di Monte, Windmill Hill, London NW3**

Report Ref: C13361

Date	Borehole	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Flow Rate (l/hr)	Atmosph. Pressure (mb)	Depth of Well (m)	Depth to Groundwater (m)
		Peak	Steady	Peak	Steady	Min.	Max.				
19/08/14	WS 1	<0.1	<0.1	1.8	1.8	17.7	17.7	<0.1	995	6.00	5.15
21/10/14	WS 1	<0.1	<0.1	0.6	0.6	19.4	19.4	<0.1	988	6.00	5.25

Equipment: GasLog GFM 430, 50m tape dipmeter.

LABORATORY TEST RESULTS

CONTRACT CAPO DI MONTE, WINDMILL HILL, LONDON NW3

Bore-hole	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates (SO_4)				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	
WS1	D3	1.00													82		7.2	
	B2	2.50													82		7.4	
	W1	5.30														49	6.7	

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

13361

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8180

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TEST CERTIFICATE

Determination of Particle Size Distribution

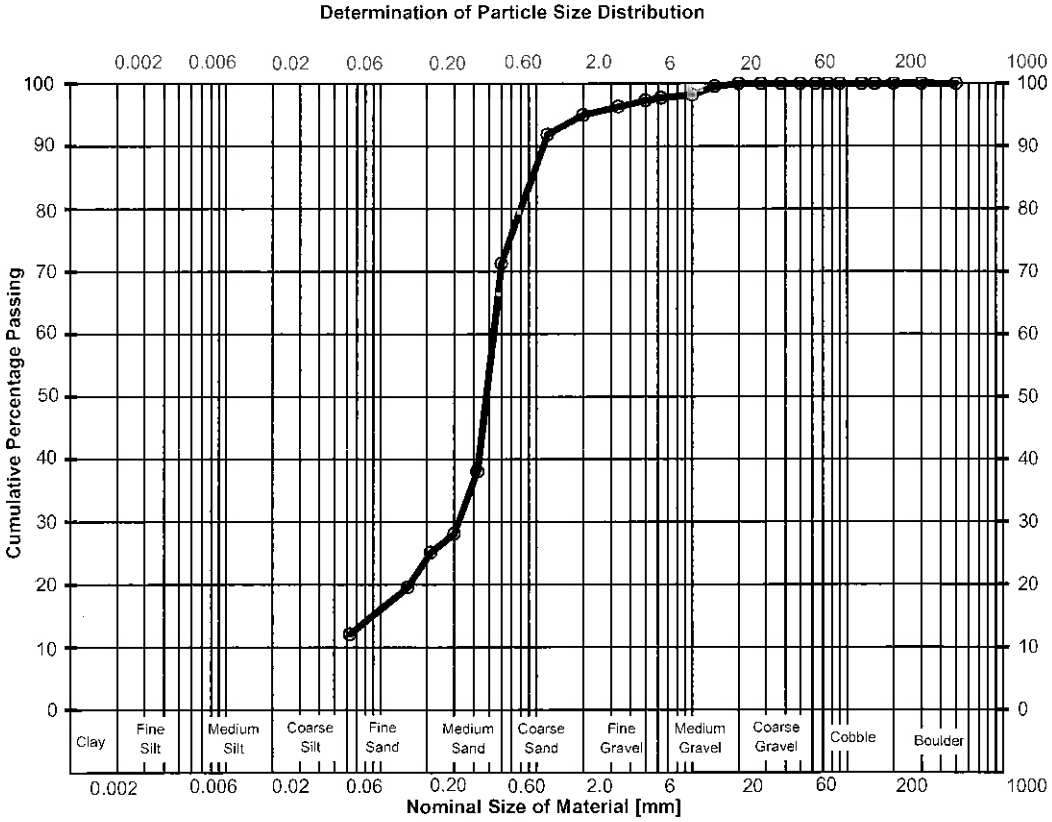
Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

Client:	Ground Engineering Ltd	Certificate Number:	PL4750-1/2/710-2
Client Address:	Newark Road	Client Reference:	C13361
	Peterborough	Lab Job Number:	PL4750-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	15.09.2014
Contact:	Steve Fleming	Date Tested:	24.09.2014
		Certificate of Sampling:	N/A
Site Name:	Capo Di Monte	Sampling Certificate No.:	N/A
Site Address:	Windmill Hill, London NW3	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL4750-1/2 **Pre-treatment for organic material:** N/A
Client Reference: B1

Sample Description: Brown orange brown slightly clayey silty SAND with firm friable very sandy clay lumps

Material Specification: Not Required **Depth Top:** 1.70m
Location: WS1 **Depth Base:** 1.90m
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	98
6.3	98
5.0	97
3.35	96
2.00	95
1.18	92
0.600	71
0.425	38
0.300	28
0.212	25
0.150	20
0.063	12
0.020	
0.006	
0.002	

Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 26.09.2014 Page 1 of 1
Form Number: GELab/C/709-2 Version 39

Registered in England & Wales
Registration Number: 6929574
Reg Office: Ground Engineering Ltd
Newark Rd, Peterbrough PE1 5UA

8180

GROUND ENGINEERING

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e: admin@groundengineering.co.uk

TEST CERTIFICATE

Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

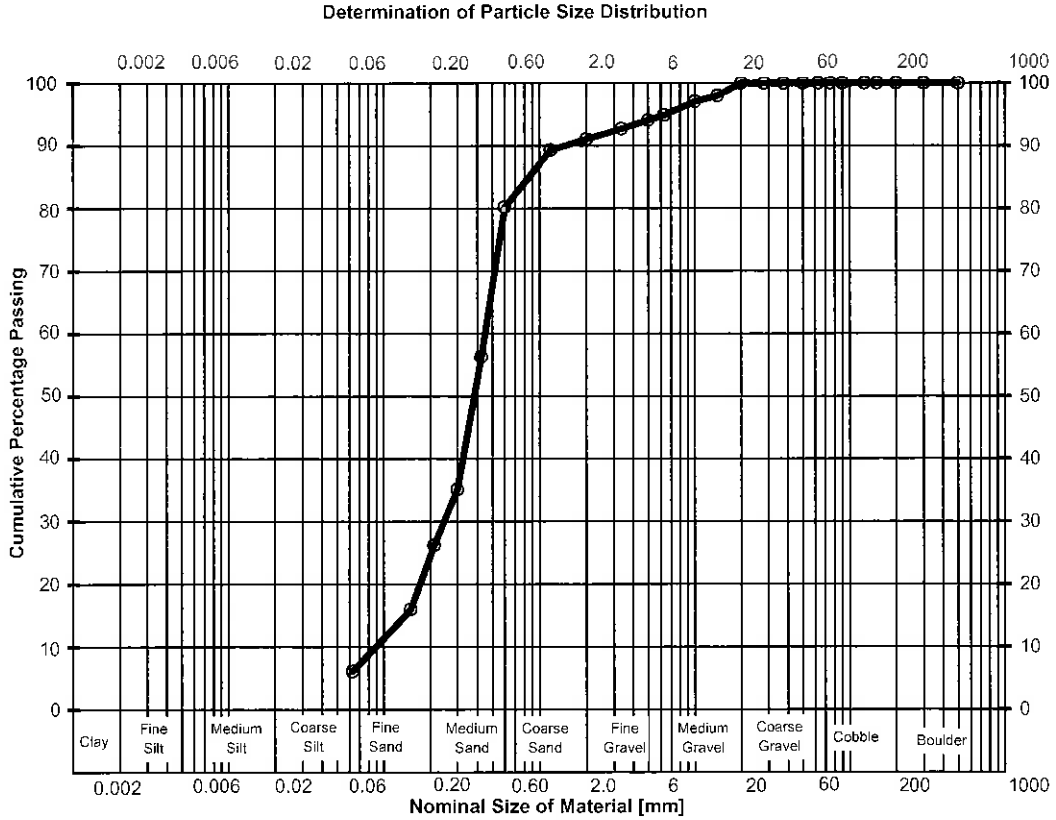
Client:	Ground Engineering Ltd	Certificate Number:	PL4750-1/3/710-2
Client Address:	Newark Road	Client Reference:	C13361
	Peterborough	Lab Job Number:	PL4750-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	15.09.2014
Contact:	Steve Fleming	Date Tested:	24.09.2014
		Certificate of Sampling:	N/A
Site Name:	Capo Di Monte	Sampling Certificate No.:	N/A
Site Address:	Windmill Hill, London NW3	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL4750-1/3 **Pre-treatment for organic material:** N/A
Client Reference: B2

Sample Description: Brown orange brown slightly silty slightly gravelly SAND

Material Specification: Not Required
Location: WS1
Source:

Depth Top: 2.50m
Depth Base: 2.80m
Supplier:



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	98
10	97
6.3	95
5.0	94
3.35	93
2.00	91
1.18	89
0.600	80
0.425	56
0.300	35
0.212	26
0.150	16
0.063	6
0.020	
0.006	
0.002	

Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Hartnup - Laboratory Manager Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 26.09.2014 Page 1 of 1
Form Number: GELab/C/709-2 Version 39

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Reg Office: Ground Engineering Ltd
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GROUND ENGINEERING

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

TEST CERTIFICATE

Determination of Particle Size Distribution

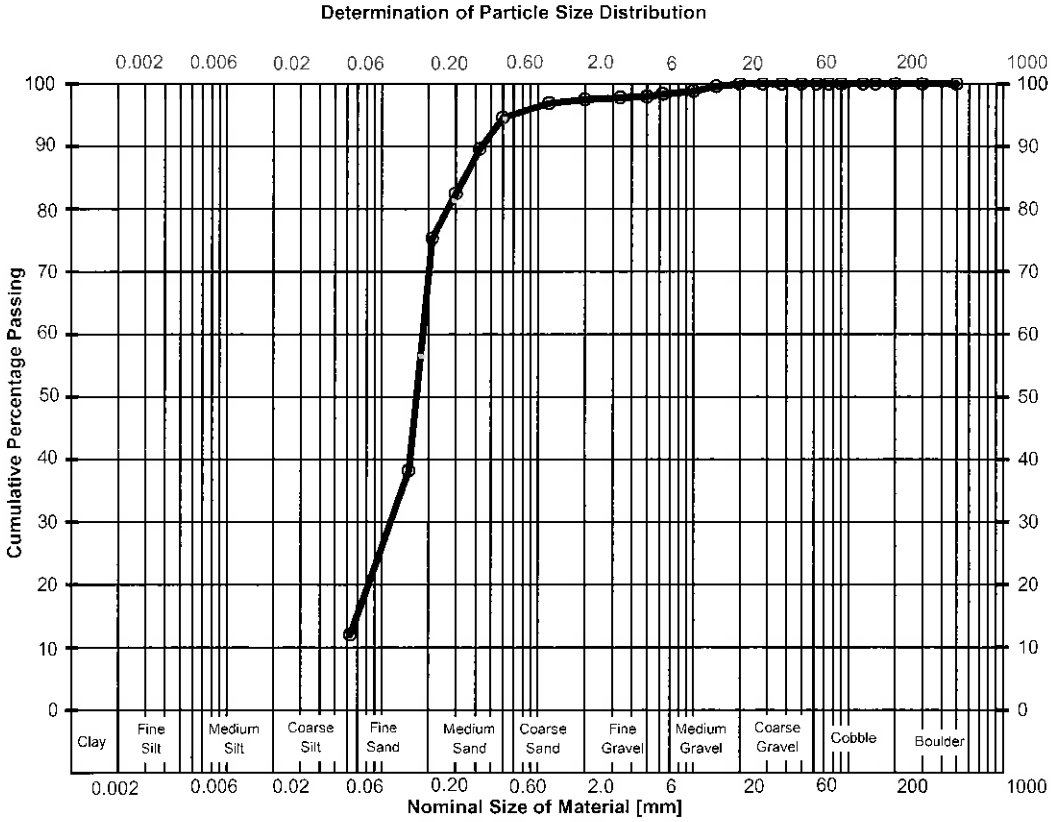
Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

Client:	Ground Engineering Ltd	Certificate Number:	PL4750-1/4/710-2
Client Address:	Newark Road	Client Reference:	C13361
	Peterborough	Lab Job Number:	PL4750-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	15.09.2014
Contact:	Steve Fleming	Date Tested:	24.09.2014
		Certificate of Sampling:	N/A
Site Name:	Capo Di Monte	Sampling Certificate No.:	N/A
Site Address:	Windmill Hill, London NW3	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL4750-1/4 **Pre-treatment for organic material:** N/A
Client Reference: B3

Sample Description: Brown orange brown slightly gravelly silty SAND with firm friable very sandy clay lumps

Material Specification: Not Required **Depth Top:** 3.70m
Location: WS1 **Depth Base:** 3.90m
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	99
6.3	98
5.0	98
3.35	98
2.00	97
1.18	97
0.600	95
0.425	90
0.300	82
0.212	75
0.150	38
0.063	12
0.020	
0.006	
0.002	

Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

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TEST CERTIFICATE

Determination of Particle Size Distribution

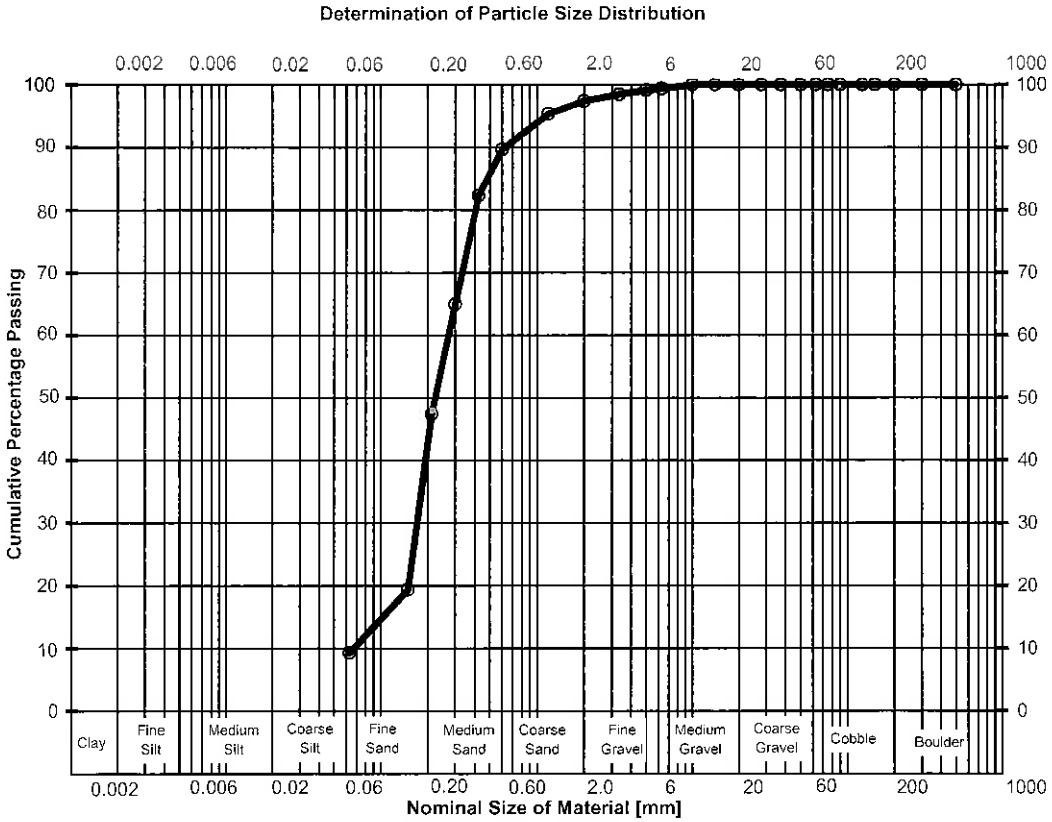
Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

Client:	Ground Engineering Ltd	Certificate Number:	PL4750-1/5/710-2
Client Address:	Newark Road	Client Reference:	C13361
	Peterborough	Lab Job Number:	PL4750-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	15.09.2014
Contact:	Steve Fleming	Date Tested:	24.09.2014
		Certificate of Sampling:	N/A
Site Name:	Capo Di Monte	Sampling Certificate No.:	N/A
Site Address:	Windmill Hill, London NW3	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL4750-1/5 **Pre-treatment for organic material:** N/A
Client Reference: B4

Sample Description: Brown orange brown slightly gravelly silty SAND with soft very sandy clay lumps

Material Specification: Not Required **Depth Top:** 4.80m
Location: WS1 **Depth Base:** 5.00m
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	99
5.0	99
3.35	98
2.00	97
1.18	95
0.600	90
0.425	82
0.300	65
0.212	47
0.150	19
0.063	9
0.020	
0.006	
0.002	

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Determination of Particle Size Distribution

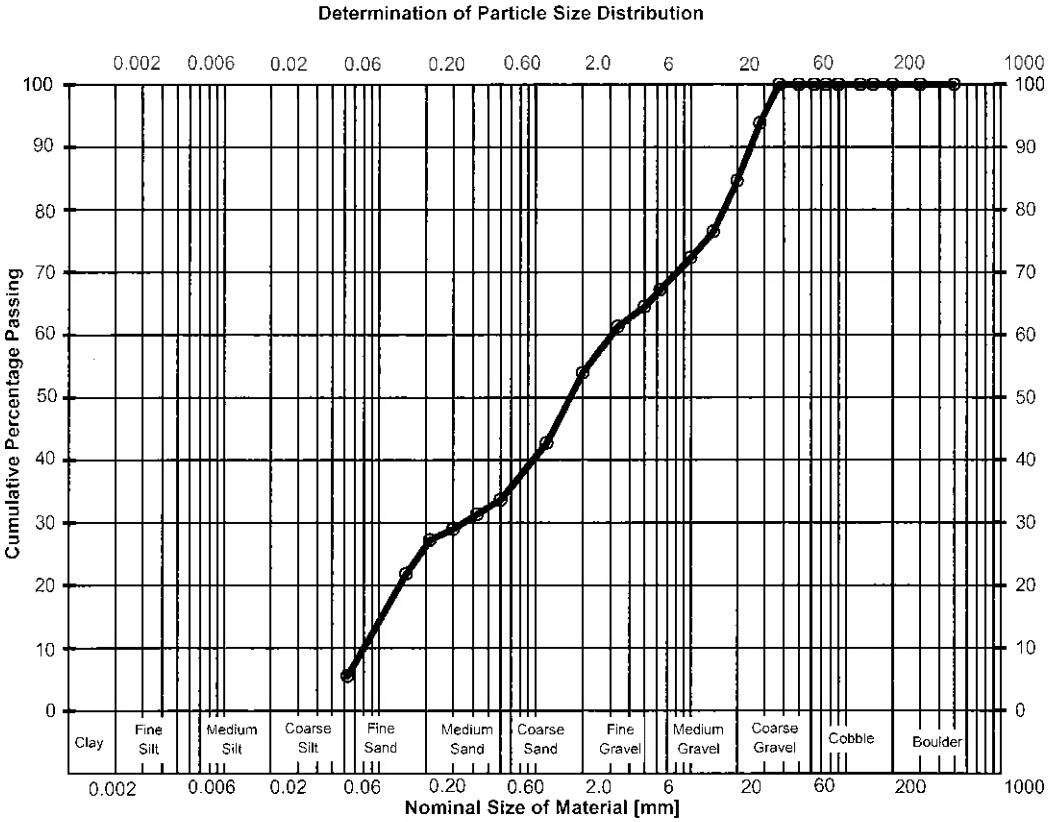
Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

Client:	Ground Engineering Ltd	Certificate Number:	PL4750-1/7/710-2
Client Address:	Newark Road	Client Reference:	C13361
	Peterborough	Lab Job Number:	PL4750-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	15.09.2014
Contact:	Steve Fleming	Date Tested:	24.09.2014
		Certificate of Sampling:	N/A
Site Name:	Capo Di Monte	Sampling Certificate No.:	N/A
Site Address:	Windmill Hill, London NW3	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL4750-1/7 **Pre-treatment for organic material:** N/A
Client Reference: B5

Sample Description: Light brown slightly clayey slightly silty SAND and GRAVEL

Material Specification: Not Required **Depth Top:** 5.70m
Location: WS1 **Depth Base:** 5.90m
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	94
20	85
14	77
10	72
6.3	67
5.0	65
3.35	61
2.00	54
1.18	43
0.600	34
0.425	31
0.300	29
0.212	27
0.150	22
0.063	6
0.020	
0.006	
0.002	

Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

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Determination of Particle Size Distribution

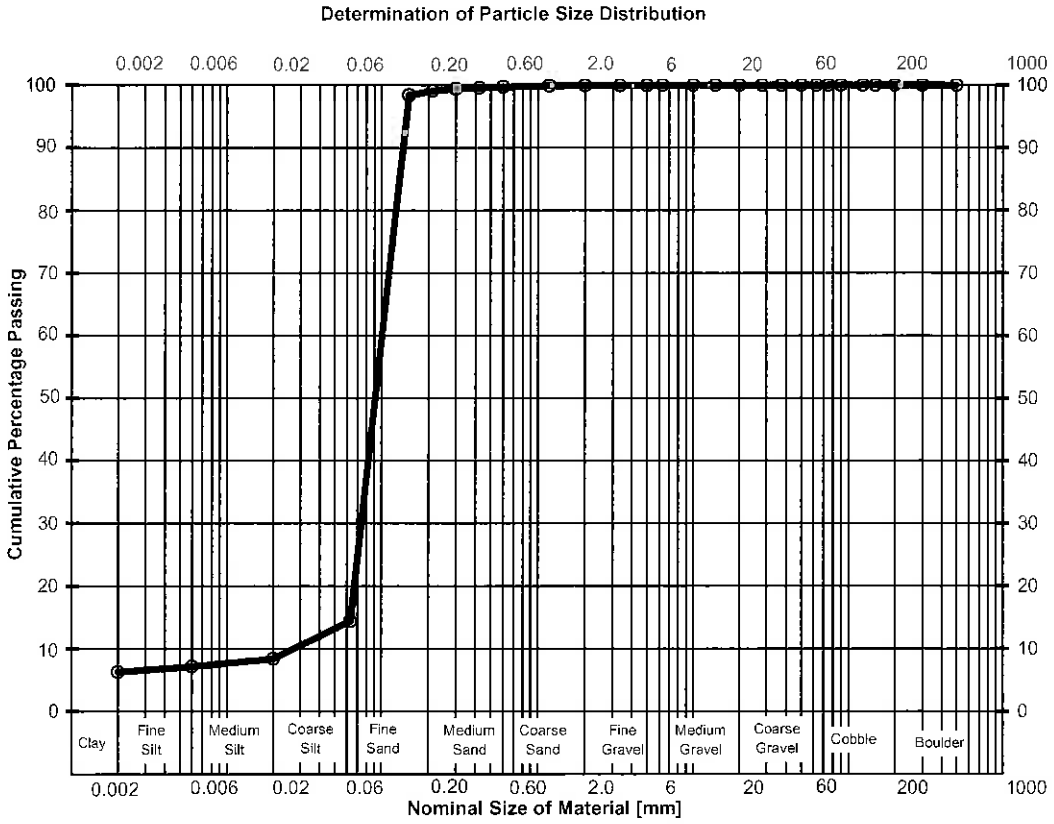
Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Sieved Grading and Sedimentation by Pipette

Client:	Ground Engineering Ltd	Certificate Number:	PL4750-1/8/710-2
Client Address:	Newark Road	Client Reference:	C13361
	Peterborough	Lab Job Number:	PL4750-1
	PE1 5UA	Date Sampled:	Unknown
		Date Received:	15.09.2014
Contact:	Steve Fleming	Date Tested:	24.09.2014
		Certificate of Sampling:	N/A
Site Name:	Capo Di Monte	Sampling Certificate No.:	N/A
Site Address:	Windmill Hill, London NW3	Sampled By:	Client

TEST RESULTS **Laboratory Reference:** PL4750-1/8 **Pre-treatment for organic material:** No
Client Reference: D15

Sample Description: Brown orange brown slightly clayey very silty SAND

Material Specification: Not Required **Depth:** 6.10m
Location: WS1
Source: **Supplier:**



Sieve Analysis

Sieve mm	%Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.600	100
0.425	100
0.300	99
0.212	99
0.150	98
0.063	14
0.020	**8**
0.006	**7**
0.002	**6**

Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

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for and on behalf of Ground Engineering Ltd

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