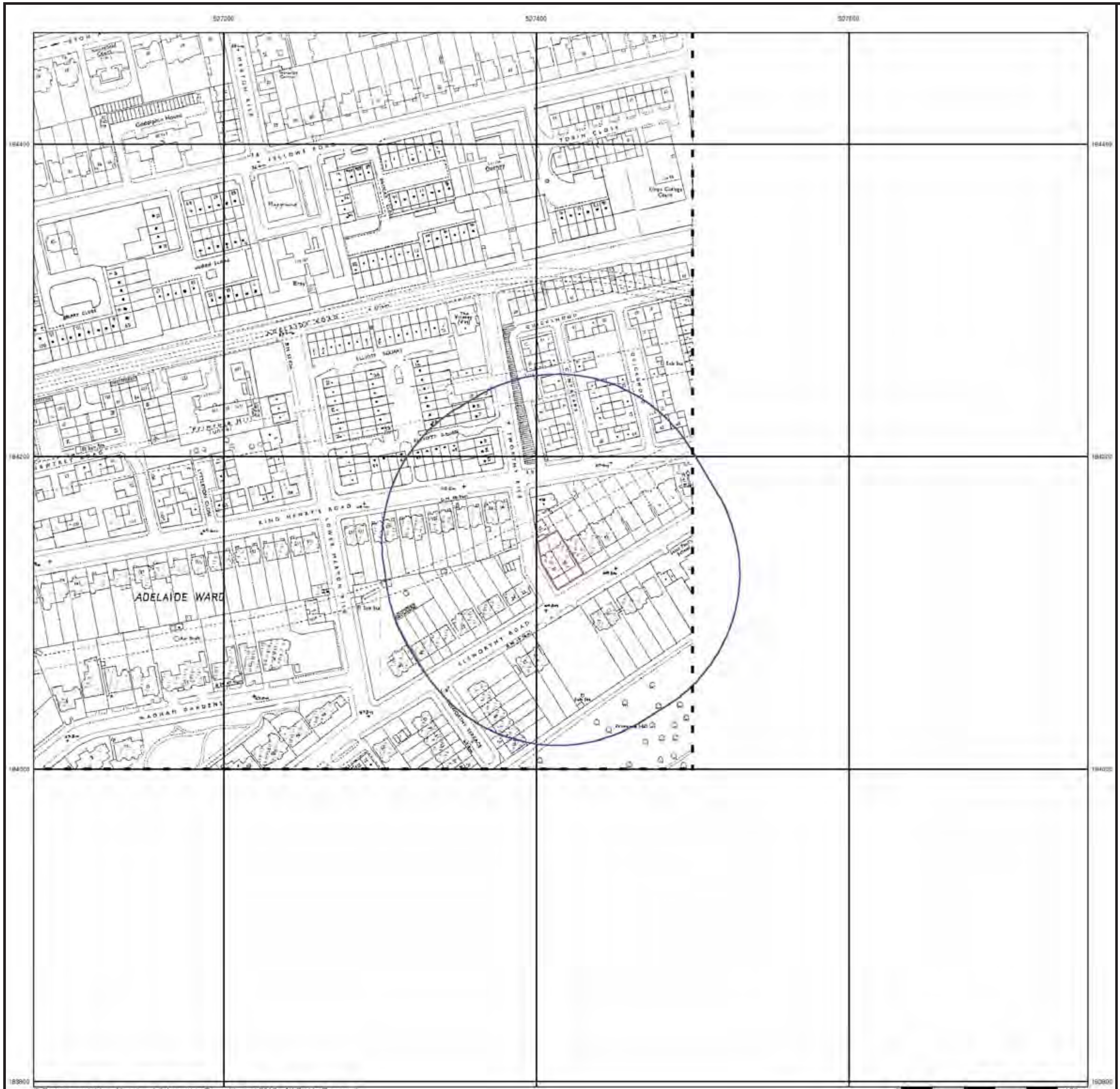

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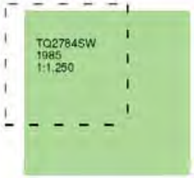
Additional SIMs

Published 1985

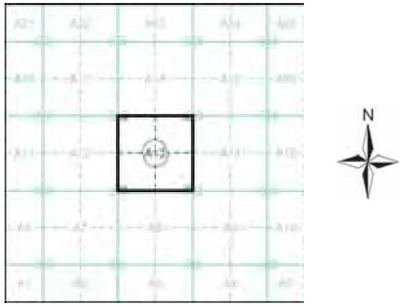
Source map scale - 1:1,250

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	56206260_1_1
Customer Ref:	14/22154
National Grid Reference:	527410, 184130
Slice:	A
Site Area (Ha):	0.07
Search Buffer (m):	100

Site Details

18-20 Elsworthy Road, LONDON, NW3 3DJ

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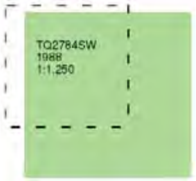
Ordnance Survey Plan

Published 1988

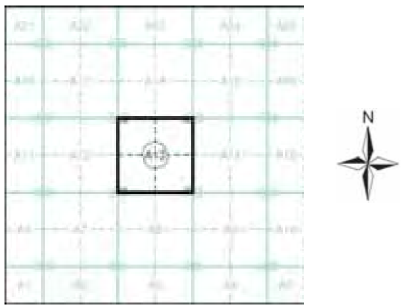
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)


TQ2784SW
1988
1:1,250

Historical Map - Segment A13



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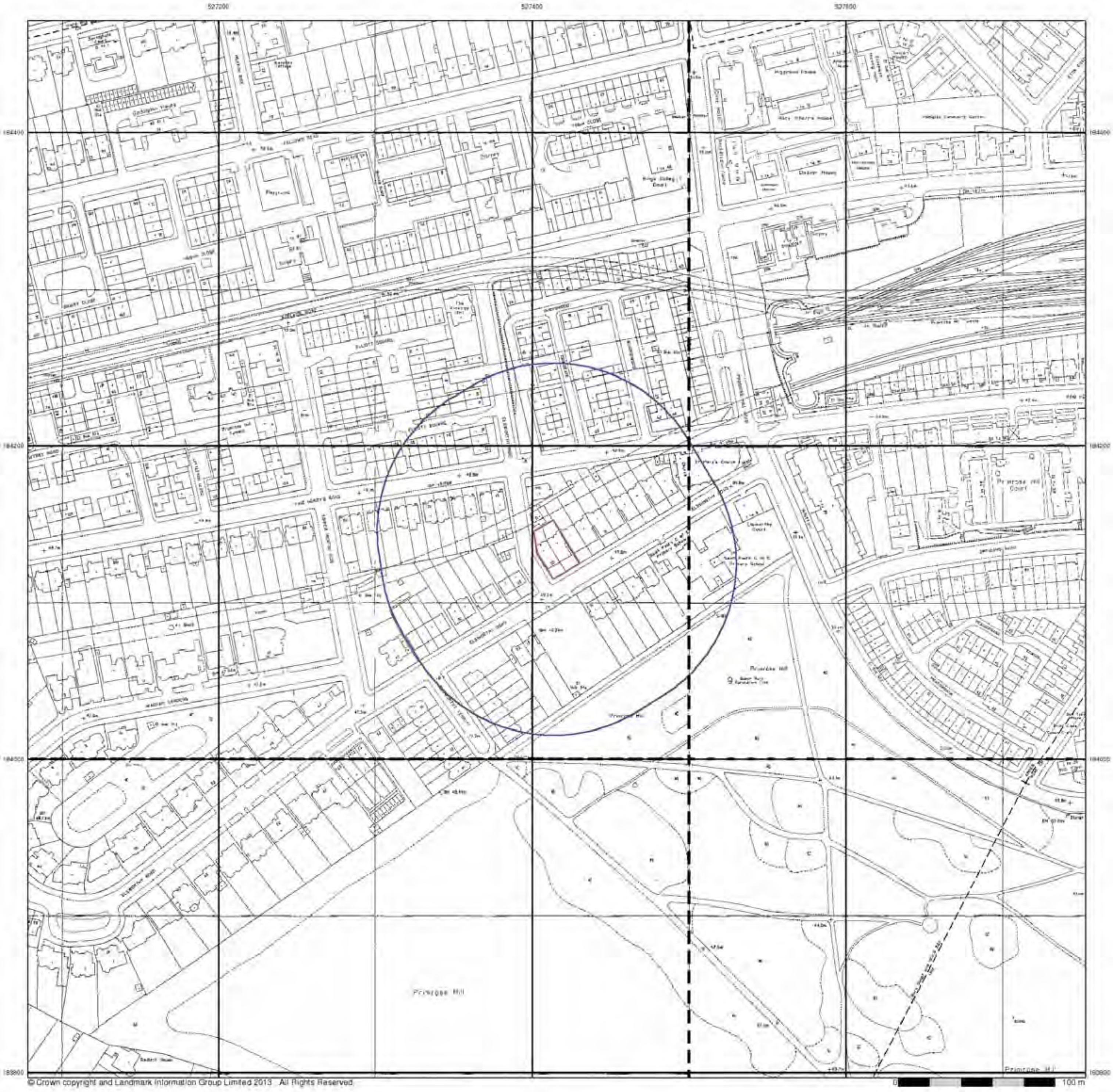

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Large-Scale National Grid Data

Published 1991

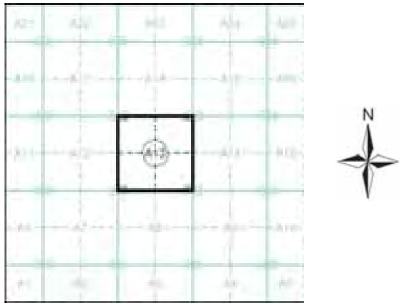
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

TQ2784SW 1991 1:1,250	TQ2784SE 1991 1:1,250
TQ2783NW 1991 1:1,250	TQ2783NE 1991 1:1,250

Historical Map - Segment A13



Order Details

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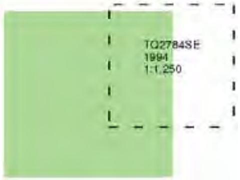
Map Name(s) and Date(s)



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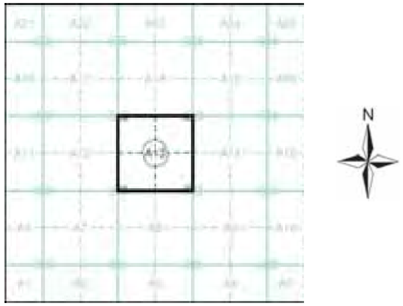

Order Details

Order Number:	56206260_1_1
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A Landmark Information Group Service v47.0 13-May-2014

Site Analytical Services Ltd.

Site Investigations, Analytical & Environmental Chemists, Laboratory Testing Services

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Your Ref: Our Ref: **11/17857**
May 2011

18-20 ELSWORTHY ROAD AND 15 ELSWORTHY RISE

LONDON, NW3 3DJ

REPORT ON A GROUND INVESTIGATION

Prepared for

Lamb Property Limited

Reg Office: Units 14 + 15, River Road Business Park,
33 River Road, Barking, Essex IG11 0EA
Business Reg. No. 2255616

Ref: 11/17857
May 2011

Report on a Ground Investigation

At

18 and 20 Elsworthy Road and 15 Elsworthy Rise,

Primrose Hill, London, NW3 3DJ

For

Lamb Property Limited

1.0 INTRODUCTION

At the request of Lamb Property Limited, acting in liaison with Price and Myers, Consulting Engineers, a ground investigation was carried out in connection with a proposed new residential development with an additional mansarded upper storey, basement and sub-basement at the above site.

The information was required for the design and construction of foundations and infrastructure for the proposed development. A study to assess whether any remediation was required for the protection of the end-user from the presence of potential contamination within the soils encountered was outside the scope of the present report.

Anticipated foundation loads for the proposed new development are expected to be moderate and of the order of 150-200kN/m^2.

The recommendations and comments given in this report are based on the ground conditions encountered in the exploratory holes made during the investigation and the results of the tests made in the field and the laboratory. It must be noted that there may be special conditions prevailing at the site remote from the exploratory hole locations which have not been disclosed by the investigation and which have not been taken into account in the report. No liability can be accepted for any such conditions.

2.0 THE SITE AND LOCAL GEOLOGY

(National Grid Reference: TQ 274 841)

2.1 General

The site of the proposed development is located at 18 and 20 Elsworthy Road and 15 Elsworthy Rise in the Primrose Hill area of London, NW3 3DJ. The site comprises of two semi-detached three-storey flat roof houses in use as residential flats with small front gardens and an enclosed small rear garden together with a two-storey house forming 15 Elsworthy Rise to the north and rear. The site is located on corner of Elsworthy Road and Elsworthy Rise and is bounded by these roads to the south and west and by further residential properties to the north and east. Further details of the layout are shown on the sketch site plan (Figure 1).

The site is essentially flat although the surrounding ground rises gently to the north towards Hampstead Heath and there are a number of trees present in and around the rear garden.

2.2 Geology

The 1:50000 Geological Survey of Great Britain (England and Wales) covering the area indicates the site to be underlain directly by the London Clay Formation, although a surface cover of made ground is to be expected in this long established urban area.

3.0 SCOPE OF WORK

3.1 General

The scope of the investigation was generally agreed with the Client and the Consulting Engineer and comprised:

- The drilling of three continuous flight auger boreholes, one to a depth of 10.00m below ground level and two to a depth of 5.00m below ground level.
- The placement of a gas and groundwater monitoring standpipe to a depth of 8.00m below ground level in the deeper borehole (Borehole 1).
- Sampling and in-situ testing as appropriate to the ground conditions encountered in the boreholes.
- Laboratory testing to determine the chemical properties of the soils encountered in the boreholes.
- Brief interpretative reporting on foundation options and infrastructure for the proposed development.

- A study into the possibility of the presence of toxic substances in the soil, together with any remediation required was outside the scope of the present investigation.

3.2 Ground Conditions

The locations of the boreholes are shown on the sketch site plan (Figure 1).

The boreholes revealed ground conditions that were generally consistent with the geological records and known history of the area and comprised made ground between 1.10m and 1.20m in thickness resting on deposits typical of the London Clay Formation.

For detailed information on the ground conditions encountered in the boreholes, reference should be made to the exploratory hole records presented in Appendix A.

The made ground extended down to a depth of 1.20m below ground level in Boreholes 1 and 3 and to a depth of 1.10m below ground level in Borehole 2. It consisted of a surface layer of stone slabs set on sand cement followed by a mixture of loose and medium dense silty sand, fine to medium gravel, ashes, clinker and brick rubble.

The underlying natural soil initially consisted of firm mottled silty clay with pockets and partings of silty fine sand that extended down to respective depths of 1.60m, 1.60m and 1.70m below ground level in Boreholes 1, 2 and 3. The underlying materials consisted of a sequence of stiff becoming very stiff mottled silty clay with occasional partings of silty fine sand and scattered small gypsum crystals representing weathered London Clay. These materials extended down to the full depths of investigation of up to 10.00m below ground level in each of the boreholes.

3.3 Groundwater

Groundwater was not encountered during boring in Boreholes 1, 2 and 3 during drilling operations and the material remained essentially dry throughout.

It must be noted that the speed of excavation is such that there may well be insufficient time for light seepages of groundwater to enter the boreholes and hence be detected particularly in cohesive soils.

Groundwater was subsequently found to have stabilised at a depth 2.03m below ground level in the monitoring standpipe installed in Borehole 1 after a period of approximately three weeks.

Isolated pockets of groundwater could possibly be present perched within any less permeable material found at shallower depth on other parts of the site especially within the made ground.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (April and May 2011) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

4.0 IN-SITU AND LABORATORY TESTS

4.1 In-Situ Shear Vane and Mackintosh Probe Tests

In made ground and essentially cohesive soils with a granular content, Mackintosh Probe tests were made in order to assess the undrained shear strength or relative density of the materials. The results indicate that the made ground is in a generally loose state of compaction and the underlying natural soils are of a firm consistency based on the methods outlined by Stroud and Butler and the generally accepted correlation as follows:

Mackintosh N75 X 0.38 = SPT 'N' Value

or

Mackintosh N300 X 0.1 = SPT 'N' Value

In essentially cohesive soils, in-situ shear vane tests were made at regular depth increments in order to assess the undrained shear strength of the materials. The results indicate that these soils are of a firm becoming stiff and then very stiff consistency with increasing depth below ground level.

The results of the in-situ tests are shown on the appropriate borehole records contained in Appendix A.

4.2 Classification Tests

Atterberg Limit tests were conducted on nine selected samples of cohesive soil taken from the near surface natural soils present in Boreholes 1, 2 and 3. The results showed the samples tested to fall into Classes CI/CH, CH and CV according to the British Soil Classification System.

These are fine grained sometimes sandy silty clay soils of intermediate to high, high and very high plasticity and as such generally have moderate bearing and settlement characteristics, have a low permeability and a generally high susceptibility to shrinkage and swelling movements with changes in moisture content, as defined by the NHBC Chapter 4.2. The results indicated Plasticity Index values of between 30% and 49%, seven of the samples being at or above the 40% boundary between soils assessed as being of medium swelling and shrinkage potential and those assessed as being of high swelling and shrinkage potential with the other two shallower samples falling below this boundary.

The test results are given on Table 1 contained in Appendix B.

4.3 Sulphate and pH Analyses

The results of the sulphate and pH analyses made on three soil samples selected to give a range of depth are presented on Table 2 contained in Appendix B and show the soil samples tested to have water soluble sulphate contents of up to 3.05g/litre associated with near neutral pH values.

4.4 Gas and Groundwater Monitoring Results

The standpipe installed in Borehole 1 was monitored for gas and groundwater levels on 20th April and 4th May 2011 and the results are presented on Tables 3 and 3a, contained in Appendix B.

The groundwater level measurements indicate that the groundwater level has stabilised after a period of about three weeks at a depth of 2.03m below ground level in the monitoring standpipe installed in Borehole 1.

4.4.1 Methane

Methane is a flammable asphyxiating gas, the flammable range being 5 to 15% by volume in air. If such a methane-air mixture is confined in some way and ignited it will explode. The 5% by volume concentration is termed the lower explosive limit (LEL). Methane is a buoyant gas having a density about two-thirds that of air. Carbon Dioxide is a non-flammable toxic gas, which is about 1.5 times as heavy as air.

Various guidelines have been published to help determine mitigation measures for landfill gas. 'Landfill Gas' includes gas which may be generated in natural soils such as organic alluvium peat. Methane presents an explosion and asphyxiant hazard and Carbon Dioxide an asphyxiant hazard.

Building Research Establishment Report BR212 'Construction of New Buildings on Gas-Contaminated Land', states that if Methane concentrations in the ground are unlikely to exceed 1% by volume and a house or small building is constructed in accordance with its recommendations, then no further protection is required. The recommendations include installing granular under slab venting and sealing floor slabs.

CIRIA Report C665 (2007) "Assessing risks posed by hazardous ground gases to buildings" provides guidance on the monitoring and control of landfill gas. The report suggests a classification system which is summarised in Table 8.5 in the document and employs a method which uses both gas concentrations and borehole flow rates to define a characteristic situation for a site based on the Gas Screening Value (also named the limiting borehole gas volume flow) for methane and carbon dioxide.

4.4.2 Carbon Dioxide

Building Research Establishment Report BR212 'Construction of New Buildings on Gas-Contaminated Land', 1991 states that if carbon dioxide concentrations are above 1.5% by volume then protection should be considered to prevent gas ingress. If concentrations exceed 5% by volume, such protective measures are required. This has been superseded by CIRIA Report C665 (2007), states that if carbon dioxide concentrations are above 5% by volume then protection should be considered to prevent gas ingress.

4.4.3 Oxygen

CIRIA Report 149 summarises the physiological effects of an oxygen deficient atmosphere. Between 19-21% Oxygen (Vol.) is described as the normal range of concentration in the atmospheric air, whilst <6% causes convulsions, gasping respiration and death.

4.4.4 Carbon Monoxide

The occupational exposure standards for carbon monoxide are 30 ppm for long term exposure (8 hours calculated from the HSE Guidance Note EH40, 1991) and 200 ppm for short term exposure (15 minutes calculated from the HSE Guidance Note EH40, 1991) (CIRIA Report C665).

4.4.5 Hydrogen Sulphide

Hydrogen sulphide is toxic at low concentrations. The occupational exposure standard for hydrogen sulphide is 10 ppm for 8-hour time weighted average reference period and 15 ppm for short-term exposure (10 minutes reference period) (HSE Guidance Note EH40, 1991).

4.4.6 Results

The Gas Screening Value is calculated as follows:

The Gas Screening Value (litres of gas per hour) = maximum borehole flow rate (l/h) x maximum gas concentration (%)

On-site monitoring has shown emissions of methane in air of 0.0% and carbon dioxide in air of up to 1.5% recorded during the monitoring visits. The maximum borehole flow rate was 0.0 l/h.

As such the Gas Screening Value for methane at site is 0.0 l/h and the Gas Screening Value for carbon dioxide at site is also 0.0 l/h. As such the worst case value for the site would be less than 0.01 litres of gas per hour.

Carbon monoxide and Hydrogen Sulphide were not detected above the detection limits of the gas monitoring instrument in either of the boreholes monitored during the monitoring programme.

The minimum level of oxygen recorded during the monitoring period was 20.1%. This falls into the physiological effects bracket of '*normal range of concentration in the atmospheric air*'. Such levels do not pose potential risk to human health.

These results equate to a Characteristic Situation 1, which requires no special precautions at site.

Employing the NHBC 'traffic light' characterisation system, the site would be classified as Green in accordance with CIRIA Report C665. Table 8.7 using the Gas Screening Value for methane and carbon dioxide and as such gas prevention measures would not be considered necessary for the site.

For further information on design and construction details, discussions should be sought with a specialist contractor. Guidance may also be obtained from the BRE Report BR212 'Construction of New Buildings on Gas-Contaminated Land' and CIRIA Report C665 (2007). It may also be prudent to contact the local Environmental Health Officer in order to comply with the Local Authority requirements.

5.0 FOUNDATION DESIGN

5.1 General

It is proposed to construct a new residential development at the site with an additional mansarded upper storey, basement and sub-basement supported on reinforced concrete beams supported on either conventional spread foundations or piled foundations. Exact details of the structure, layout and loadings were not available at the time of preparation of this report although anticipated foundation loads are expected to be moderate and of the order of 150-200kN/m^2.

5.2 Conventional Spread Foundations

A result of the inherent variability of uncontrolled fill, (Made Ground) is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should therefore, be taken through any made ground and either into, or onto a suitable underlying natural strata of adequate bearing characteristics.

Based on the ground and groundwater conditions encountered in the borehole, it should be possible to support the proposed development on conventional spread or basement raft foundations taken down below the made ground and any soft or loose superficial soils and placed in the natural firm becoming stiff clay deposits which were encountered at a depth of about 1.20m below ground level. Such foundations should be placed at a minimum depth of 1.10m below final ground level in order to avoid the zone affected by seasonal moisture content changes.

Such foundations placed within natural soils may be designed to an allowable net bearing pressure of approximately 125kN/m^2 at 1.50m depth increasing linearly to about 250kN/m^2 at depths in excess of 3.50m below ground level. These values allow for a factor of safety of about three against general shear failure and should be sufficiently low to ensure that overstressing of the underlying soils does not occur.

Total and differential settlement is expected to be within tolerable limits and should not exceed approximately 10-15mm under the loadings given above.

The actual allowable bearing pressure applicable will depend on the form of foundation, its geometry and depth in accordance with classical analytical methods, details of which can be obtained from "Foundation Design and Construction", Seventh Edition, 2001 by M J Tomlinson (see references) or similar texts.

Any soft or loose pockets encountered within otherwise competent formations should be removed and replaced with well compacted granular fill.

In addition, foundations will need to be taken deeper where they are within the zones of influence of both existing trees and any proposed tree planting. The depth of foundation required to avoid the zone likely to be affected by the root systems of trees is shown in the recommendations given in NHBC Standards, Chapter 4.2, April 2003, "Building near Trees" and it is considered that this document is relevant in this situation.

5.3 Piled Foundations

In the event that the use of conventional spread foundations proves either impracticable or uneconomical due to the size and depth of foundation, then a piled foundation will be required. In these ground conditions, it is considered that some form of bored and in-situ cast concrete piled foundation with reinforced concrete ground beams would prove satisfactory.

The construction of a piled foundation is a specialist activity and the advice of a reputable contractor, familiar with the type of soil and groundwater conditions encountered at this site, should be sought prior to finalising the foundation design. The actual pile working load will depend on the particular type of pile chosen and method of installation adopted.

To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter. Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

Driven piles could also be used and would develop much higher working loads approximately 2.5 to 3 times higher than bored piles of a similar diameter at the same depth.

5.4 Excavations

Shallow excavations for foundations and services are likely to require nominal side support in the short term and groundwater is unlikely to be encountered in significant quantities once any accumulated surface water has been removed. Deeper and longer excavations below approximately 1.2m below existing ground level will require close side support and some seepages of groundwater could be encountered.

No particular difficulties are envisaged in removing any water by conventional internal pumping methods from open sumps.

Normal safety precautions should be taken if excavations are to be entered.

5.5 Ground Floor Slabs

A ground bearing basement slab may be adopted provided that the exposed formation is adequately compacted and protected from the elements.

5.6 Basement Retaining Walls

The results of the investigation indicated that made ground occurs to a depth of about 1.20m below existing ground level and is underlain by a sequence of firm becoming stiff and then very stiff silty clay down to at least 10m depth. The general groundwater level beneath the site lies at a depth of about 2m below existing ground level.

Retaining walls should generally be designed as self-supporting cantilevered retaining walls. The excavations for a basement must not affect the integrity of adjacent structures and therefore will need to be supported. Two forms of support could be considered, these being temporary works i.e. sheet piling which could be removed after the earth retaining walls have been constructed or as permanent works incorporated into the final design.

To facilitate support of the excavation, consideration could be given to a contiguous, secant or a sheet piled wall. Generally, cantilevered piled walls have an open face to embedded ratio of about one to two, i.e. a supported face three metres in height would require a penetration into the ground of about six metres below the base of the excavation. Should the piled retaining wall be purely an unsupported cantilever, then it is likely that quite deep section sheet piles or large diameter bored piles would be required.

The section of the sheet or the diameter of the piles could be reduced by installing a braced waling to the wall. Piles placed as part of the permanent works would be propped by the roof to the basement and would not be acting purely as a cantilevered support in the long term.

To reduce the likelihood of loss of ground if a sheet piled wall was adopted when removing the sheets, it is considered that the sheet piles should be incorporated into the final wall design. Assuming that the earth retaining wall will be propped, i.e. have its base slab and first floor slab cast in place soon after excavation, it is unlikely that full if any earth pressures will act on the wall while it is not propped. The greatest force acting on the wall, in the short term, is likely to be from the hydrostatic head should water percolate and be retained to the rear of the earth retaining structure.

Given the unknown depth of the proposed new floor slab (and therefore unknown founding material); the design parameters for each element of soil recorded in the relevant exploratory holes are provided in Table A below. The depth of pile penetration can be calculated once structural details of the proposed basement are known.

Founding Material	Depth to top of stratum³ (m)	Description	Angle of Shearing Resistance (degrees) (Φ)¹	Coefficient active pressure (Ka)	Coefficient passive resistance (Kp)	Presumed Safe Bearing Capacity qS (kN/m2)²
Made Ground	GL	Loose silty sand with flint gravel, ashes, brick, etc.	30	0.3	3.0	N/A
London Clay	1.20	Firm becoming stiff silty CLAY	22	0.46	2.2	125-250
London Clay	5.00	Stiff becoming very stiff silty CLAY	20	0.49	2.0	250-300

Table A. Summary of design parameters for proposed basement foundation

Notes:

1. Calculated using guidance from BS8002
2. As the depth and structural details of the proposed basement are unknown these values should be used as guidance only
3. Depths are provided mainly in accordance with stratigraphy from Borehole 1 augmented by shallower Boreholes 2 and 3.

Any groundwater level observed during site works will affect the stability of the basement wall and slab, since the allowable bearing pressure is reduced when the groundwater level is near the foundation level.

The varying loads placed onto the soil may cause issues surrounding yielding and basal instability of the structure.

It is further considered that should a basement raft foundation be adopted, then there is a potential for some total and differential settlement and consequently the foundation should be designed to a maximum loading of 100kN/m^2, be constructed on a 300mm thick proof rolled layer of gap graded granular fill and be of a sufficient stiffness to be capable of allowing for a minimum of two linear metres loss of support. Any service entry and exit points should be designed to accommodate settlement by the use of sealed flexible joints.

It is considered that such a foundation would generate total settlements of the order of 10 to 15mm of which approximately 80% (10mm) would be due to immediate elastic settlement during the construction period and remainder over a ten year period.

5.7 Chemical Attack on Buried Concrete

The results of the chemical analyses show the natural soil samples tested to have water soluble sulphate contents of up to 3.05g/litre associated with near neutral pH values.

In these conditions, it is considered that deterioration of buried concrete due to sulphate attack is likely to occur unless precautions are taken. The final design of buried concrete according to Tables C1 and C2 of BRE Special Digest 1:2005 should be in accordance with Class DS-4 conditions.

In addition, segregations of gypsum were noted within the London Clay and also are well known to occur within London Clay. Consequently, it is considered that any buried concrete at depth may be attacked by such sulphates in solution and that it would be prudent to design any such concrete in accordance with full Class DS-4 conditions.

p.p. SITE ANALYTICAL SERVICES LIMITED

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A P Smith BSc (Hons), FGS
Engineering Geologist

REFERENCES

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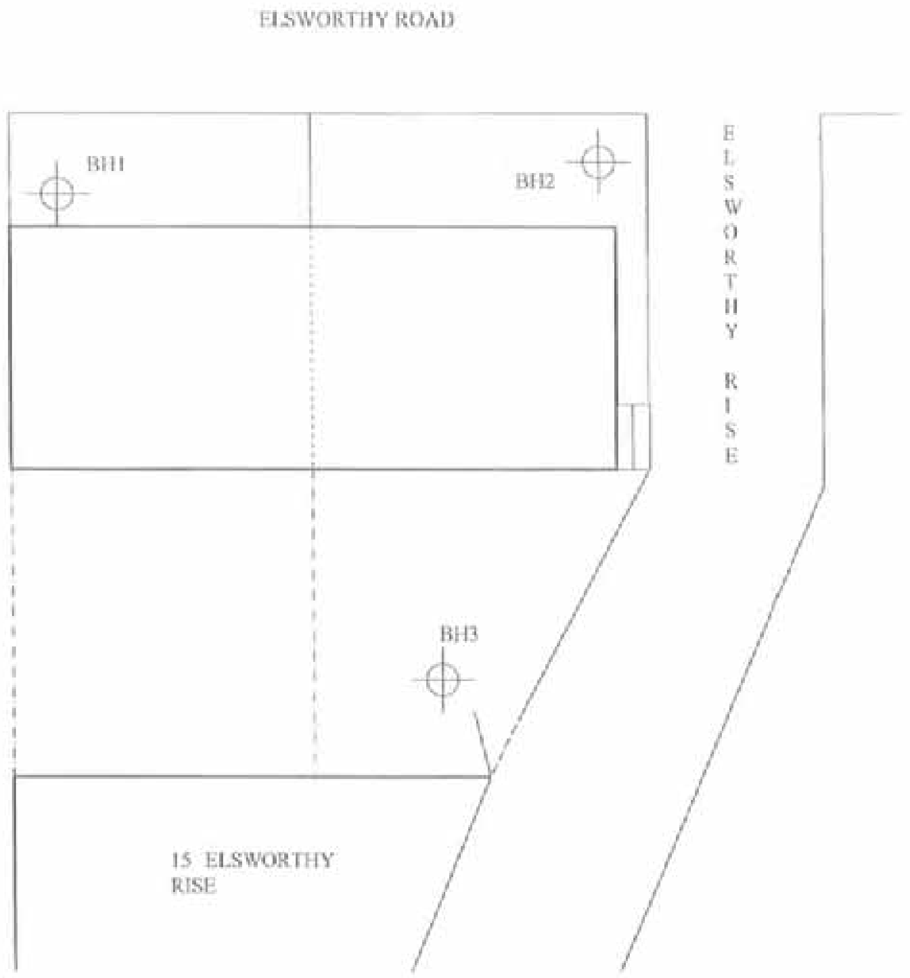
Site Analytical Services Ltd.		REF: 11/17857
LOCATION: 18-20 Elsworthy Road, London, NW3 3DJ		FIG: 1
TITLE: Sketch Site Plan	DATE: April 2011	SCALE: NTS



APPENDIX 'A'

Borehole / Trial Pit Logs

Site Analytical Services Ltd.

Site
18-20 ELSWORTHY ROAD AND 15 ELSWORTHY RISE, PRIMROSE HILL, LONDON, NW3 3DJ

Borehole Number
BH1

Boring Method
CONTINUOUS FLIGHT AUGER

Casing Diameter
100mm cased to 0.00m

Ground Level (mOD)

Client
LAMB PROPERTY LIMITED

Job Number
11/7457

Location
TQ 274 841

Dates
14/04/2011

Engineer
PRICE AND MYERS

Sheet
1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records
0.25	D1			
0.50	D2			
0.75	D3			
1.00	D4			
1.00-1.50	M1 44/020			
1.50	D5			
1.50	V1 81			
2.00	D6			
2.00	V2 80			
2.50	D7			
2.50	V3 113			
3.00	D8			
3.00	V4 119			
3.50	V5 132			
3.50	D9			
4.00	D10			
4.00	V6 148			
4.50	D11			
4.50	V7 140+			
5.00	D12			
5.00	V8 140+			
6.00	V9 140+			
6.00	D13			
7.00	D14			
7.00	V10 140+			
8.00	D15			
8.00	V11 140+			
9.00	D16			
9.00	V12 140+			
10.00	V13 140+			14/04/2011 DRY
10.00	D17			

Level (mOD)	Depth (m) (Thickness)	Description
	(0.14) 0.14	MADE GROUND - crazy paving slabs set on sand cement
	(0.56) 0.70	MADE GROUND - medium dense grey brown silty sand, fine to medium gravel, ashes and brick rubble
	(0.50) 1.20	MADE GROUND - loose black ashes, clinker and silty sand
	(0.40) 1.60	Firm mottled brown, orange brown and blue grey silty CLAY with pockets and partings of orange brown silty fine sand
	(8.40) 10.00	Stiff becoming very stiff brown and mottled orange brown and veined blue grey silty CLAY with occasional partings of orange brown silty fine sand and scattered small gypsum crystals

Remarks
Groundwater was not encountered during boring
D = Disturbed Sample
M = Mackintosh Probe - Blows/Penetration (mm)
V = Vane Test - Result in kPa

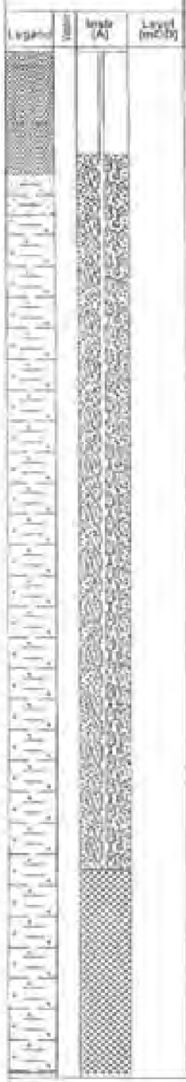
Scale (approx)
1:50

Logged By
JP

Figure No.
11/7457.BH1

Site Analytical Services Ltd.

Installation Type MONITORING STANDPIPE	Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 100 mm	Site 18-20 ELSWORTHY ROAD AND 15 ELSWORTHY RISE, PRIMROSE HILL, LONDON, NW3 3DJ	Borehole Number BH1
		Client LAMB PROPERTY LIMITED	Job Number 1117857
	Location TQ 274 841 Ground Level (mOD)	Engineer PRICE AND MYERS	Sheet 1/1



Legend	Water	Instr [A]	Level (mOD)	Depth (m)	Description
					Bentonite Seal
				1.00	Slotted Standpipe
				8.00	General Backfill
				10.00	

Groundwater Strikes During Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	10 min	15 min	20 min	Depth Sealed (m)

Groundwater Observations During Drilling

Date	Start of Shift Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	End of Shift Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
14/04/11				DRY			10.00		DRY	

Instrument Groundwater Observations

Inst. [A] Type : SINGLE STANDPIPE

Date	Instrument [A] Time	Depth (m)	Level (mOD)	Remarks
20/05/11		0.93		Gas readings taken
06/05/11		2.23		Gas readings taken

Remarks
Lockable cover set in concrete.
Gas valve fitted

Site Analytical Services Ltd.

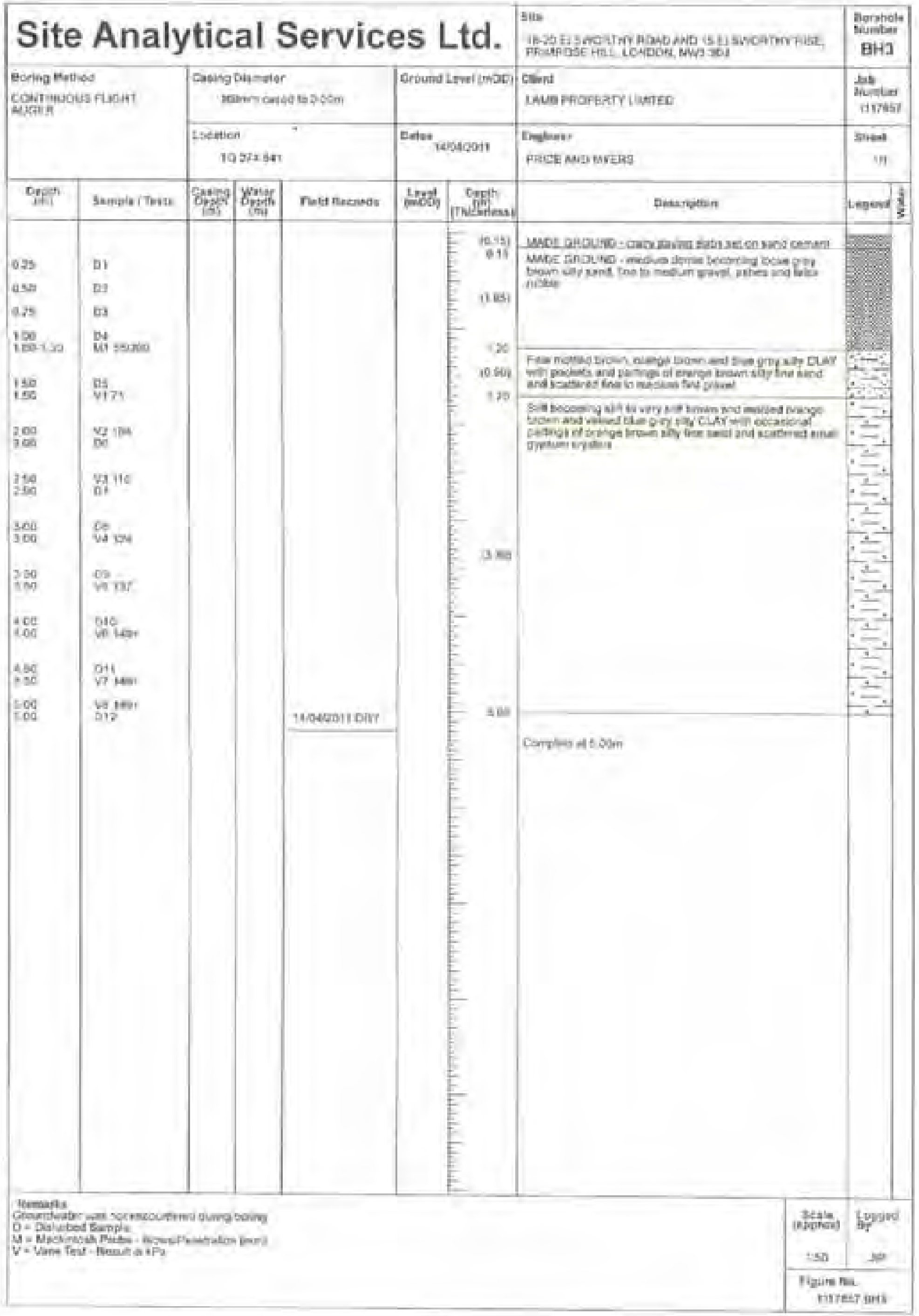
			Site 18-20 ELSWORTHY ROAD AND 15 ELSWORTHY RISE, PRIMROSE HILL, LONDON, NW3 3DJ	Borehole Number BH2
Boring Method CONTINUOUS FLIGHT AUGER	Casing Diameter 100mm cased to 5.00m	Ground Level (mOD)	Client LAMB PROPERTY LIMITED	Job Number 1117857
	Location TQ 274 841	Dates 14/04/2011	Engineer PRICE AND MYERS	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
						(0.15) 0.15	MADE GROUND - (crazy paving slabs set on sand cement)
0.25	D1						MADE GROUND - loose to medium dense grey brown silty sand, fine to medium gravel, ashes and brick rubble
0.50	D2					(0.95)	
0.75	D3						
1.00 1.00-1.30	D4 M1 65/300					1.10 (0.50)	Firm mottled brown, orange brown and blue grey silty CLAY with pockets and partings of orange brown silty fine sand
1.50 1.50	D5 V1 75					1.60	Stiff becoming stiff to very stiff brown and mottled orange brown and veined blue grey silty CLAY with occasional partings of orange brown silty fine sand and scattered small gypsum crystals
2.00 2.00	D6 V2 104						
2.50 2.50	V3 114 D7						
3.00 3.00	V4 122 D8					(3.40)	
3.50 3.50	D9 V5 130						
4.00 4.00	D10 V6 140+						
4.50 4.50	D11 V7 140+						
5.00 5.00	D12 V8 140+			14/04/2011 DRY		5.00	Complete at 5.00m

Remarks
V = Vane Test - Result in kPa
M = Mackintosh Probe - Blows/Penetration (mm)
D = Disturbed Sample
Groundwater was not encountered during boring

Scale (approx)	Logged By
1:50	JBP

Figure No.
1117857.BH2



Site Analytical Services Ltd.

Site: 18-20 ELSWORTHY ROAD AND 15 ELSWORTHY RISE, PRIMROSE HILL, LONDON, NW3 3DJ

Borehole Number: BH3

Boring Method: CONTINUOUS FLIGHT AUGER

Casing Diameter: 300mm cased to 0.00m

Ground Level (mOD):

Client: LAMB PROPERTY LIMITED

Job Number: 117657

Location: TQ 274 841

Dates: 14/04/2011

Engineer: PRICE AND MYERS

Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.15) 0.15	MADE GROUND - crazy paving slabs set on sand cement		
0.25	D1						MADE GROUND - medium dense becoming loose grey brown silty sand, fine to medium gravel, ashes and brick rubble		
0.50	D2								
0.75	D3					(1.05)			
1.00 1.00-1.30	D4 M1 55/300					1.20			
1.50 1.50	D5 V1 71					(0.50) 1.70	Firm mottled brown, orange brown and blue grey silty CLAY with pockets and partings of orange brown silty fine sand and scattered fine to medium flint gravel		
2.00 2.00	V2 104 D6						Stiff becoming stiff to very stiff brown and mottled orange brown and veined blue grey silty CLAY with occasional partings of orange brown silty fine sand and scattered small gypsum crystals		
2.50 2.50	V3 110 D7								
3.00 3.00	D8 V4 124								
3.50 3.50	D9 V5 137					(3.30)			
4.00 4.00	D10 V6 140+								
4.50 4.50	D11 V7 140+								
5.00 5.00	V8 140+ D12			14/04/2011 DRY		5.00			
							Complete at 5.00m		

Remarks
Groundwater was not encountered during boring
D = Disturbed Sample
M = Mackintosh Probe - Blows/Penetration (mm)
V = Vane Test - Result in kPa

Scale (Approx): 1:50

Logged By: JP

Figure No.: 117657 BH3

APPENDIX 'B'

Laboratory Test and Gas Monitoring Data

Site Analytical Services Ltd.

Ref: 11/17857

PLASTICITY INDEX & MOISTURE CONTENT DETERMINATIONS

LOCATION 18-20 Elsworthy Road And 15 Elsworthy Rise, London, NW3 3DJ

BH/TP No.	Depth m	Natural Moisture %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 425 µm %	Class
BH1	1.50	27	50	20	30	98	CI/CH
	2.50	28	67	27	40	100	CH
	3.50	28	67	26	41	100	CH
BH2	2.00	28	69	26	43	98	CH
	3.00	28	72	27	45	99	CV
	4.00	28	75	26	49	98	CV
BH3	1.50	29	57	24	33	89	CH
	2.50	29	71	25	46	98	CV
	3.50	29	71	26	45	100	CV

Table 1

Site Analytical Services Ltd.

Ref: 11/17857

SULPHATE & pH DETERMINATIONS

LOCATION 18-20 Elsworthy Road And 15 Elsworthy Rise, London, NW3 3DJ

BH/TP No.	DEPTH BELOW GL m	SOIL SULPHATES AS SO_4 TOTAL %	SOIL SULPHATES AS SO_4 WATER SOL g/l	WATER SULPHATES AS SO_4 g/l	pH	CLASS	SOIL - 2mm %
BH1	6.00		3.05		7.5	DS-4	100
BH2	1.50		0.46		7.6	DS-1	100
BH3	3.00		2.93		7.7	DS-3	100

Classification – Tables C1 and C2 : BRE Special Digest 1 : 2005

Table 2

Ref: 11/17857

GAS MONITORING

LOCATION 18-20 Elsworthy Road And 15 Elsworthy Rise, London, NW3 3DJ

MONITORING DATE 20th April 2011

BOREHOLE REF:		BH1
Methane	(%)	0.0
Carbon Dioxide	(%)	1.2
Oxygen	(%)	20.2
Hydrogen Sulphide	(p.p.m.)	0
Carbon Monoxide	(p.p.m.)	0
Atmospheric Pressure	(mb)	1012
Water Level	(m.bgl)	0.83
Oxygen in Air	(%)	21.0
Flow	(l/hour)	0.0

N.B. Methane Lower Explosive Limit - 5% Gas in Air

Table 3

Ref: 11/17857

GAS MONITORING

LOCATION 18-20 Elsworthy Road And 15 Elsworthy Rise, London, NW3 3DJ

MONITORING DATE 4th May 2011

BOREHOLE REF:		BH1
Methane	(%)	0.0
Carbon Dioxide	(%)	1.5
Oxygen	(%)	20.1
Hydrogen Sulphide	(p.p.m.)	0
Carbon Monoxide	(p.p.m.)	0
Atmospheric Pressure	(mb)	1019
Water Level	(m.bgl)	2.03
Oxygen in Air	(%)	20.9
Flow	(l/hour)	0.0

N.B. Methane Lower Explosive Limit - 5% Gas in Air

Table 3a

Norwest Holst Soil Engineering Ltd.

Borehole No. **3**

BOREHOLE LOG

Contract No. F8715
Location Elsworthy Road (17 & 19)
Client Norwest Holst Project Services Ltd
Method of Boring Cable Percussion
Diameter of Borehole 150mm

Sheet 1 of 2
Chainage
Ground Level m.A.O.D.
Date 13/2/90

Description of Strata	Legend	Depth Below G.L. (m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
MADE GROUND: Brick rubble with brown clay		0.80		150mm to 1.00m			13/2
Soft to firm brown mottled green grey fissured CLAY with some to numerous selenite crystals					1.00 (45) 2.00 (45) 3.00 (45)		
Firm brown fissured silty CLAY with orange brown staining and occasional selenite crystals		4.00			4.00 (45) 5.00 (50) 6.50 (55) 8.00 (55)		
Firm to stiff brown grey laminated fissured CLAY		9.50			9.50 (60)		

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic	C.P.T.	x	Vane
0	Jar	△	Water
●	Bulk	▥	Piezometer

Remarks (Observations of Ground Water etc.) () - U100 blows
Groundwater not encountered

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

Borehole No. 3

BOREHOLE LOG

Contract No. F8715
Location Elsworthy Road (17 & 19)
Client Norwest Holst Project Services Ltd
Method of Boring Cable Percussion
Diameter of Borehole 150mm

Sheet 2 of 2
Chainage
Ground Level m.A.O.D.
Date 13/2/90

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm to stiff brown grey laminated fissured CLAY							
					▮ ○ 11.00 (60)		
					▮ ○ 12.50 (65)		
					▮ ○ 14.00 (60)		
Borehole complete at 15.00m		15.00			○		13/2

Type of Sample

Is S.P.T. ▮ Undisturbed
Ic C.P.T. X Vane
O Jar △ Water
● Bulk ▮ Piezometer

Remarks (Observations of Ground Water etc.) () - U100 blows

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. 4

Contract No. F8715
Location Elsworthy Road (17 & 19)
Client Norwest Holst Project Services Ltd
Method of Boring Cable Percussion
Diameter of Borehole 150mm

Sheet 1 of 2
Chainage
Ground Level m.A.O.D.
Date 14/2/90

Description of Strata	Legend	Depth Below G.L. (m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.40					14/2
Soft to firm, brown mottled grey and locally orange brown CLAY with occasional selenite crystals ...0.40-0.50m with black roots and rootlets.		4.00		150mm to 1.00	1.00 (45) 2.00 (40) 3.00 (50)		
Firm brown fissured silty CLAY with orange brown staining and occasional selenite crystals.		9.00			4.00 (50) 5.00 (50) 6.50 (50) 8.00 (55)		
Firm to stiff brown grey laminated fissured CLAY.					9.50 (60)		

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic	C.P.T.	x	Vane
o	Jar	△	Water
●	Bulk	▮	Piezometer

Remarks (Observations of Ground Water etc.) () U100 blows

Groundwater not encountered

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. **4**

Contract No. F8715
Location Elsworthy Road (17#19)
Client Norwest Holst Project Services Ltd.
Method of Boring Cable Percussion
Diameter of Borehole 150mm

Sheet 2 of 2
Chainage
Ground Level m.A.O.D.
Date 14/2/90

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm to stiff brown grey laminated fissured CLAY.							
					11.00 (60)		
					12.50 (60)		
					14.00 (65)		
					15.50 (65)		
					17.00 (65)		
					18.50 (65)		
Borehole complete at 20.00m		20.00					14/2

Type of Sample

Is	S.P.T.	▮	Undisturbed
Ic	C.P.T.	x	Vane
0	Jar	△	Water
●	Bulk	▮	Piezometer

Remarks (Observations of Ground Water etc.)

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. 5

Contract No. F8715

Location Elsworthy Road I.T. (17&19)

Client Norwest Holst Project Services Ltd

Method of Boring Cable Percussion

Diameter of Borehole 150mm

Sheet 1 of 2

Chainage

Ground Level m.A.O.D.

Date 18/1/90

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL	▩	0.10					18/1
MADE GROUND: Brick rubble with angular gravel.	▩	0.60					
MADE GROUND: Soft light brown CLAY with some yellow sand and brick fragments.	▩	3.20			1.00 (45) 2.00 (40) 3.00 (40) (NR)		
MADE GROUND: Fine brick angular rubble.	▤	3.30					
Firm brown mottled grey fissured CLAY. ...with some orange brown mottling	▤	4.50		150mm to 4.00	3.50 (45) 4.50 (45)		
Firm brown fissured silty CLAY with some orange brown staining.	▤	8.70			6.00 (50) 7.50 (55)		
Firm to stiff brown grey laminated fissured CLAY.	▤				9.00 (55)		

Type of Sample

Is	S.P.T.	▮	Undisturbed
Ic	C.P.T.	x	Vane
0	Jar	△	Water
●	Bulk	▮	Piezometer

Remarks (Observations of Ground Water etc.)

() U100 blows
NR No Recovery

Water struck at 3.40m, level rose after 20 mins to 3.30m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

Borehole No.
5

BOREHOLE LOG

Contract No. F8715
Location Elsworthy Road (17 & 19)
Client Norwest Holst Project Services Ltd
Method of Boring Cable Percussion
Diameter of Borehole 150mm

Sheet 2 of 2
Chainage
Ground Level m.A.O.D.
Date 18/1/90

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm to stiff brown grey laminated fissured CLAY.					■ ○ 10.50 (65)		
					■ ○ 12.00 (60)		
					■ ○ 13.50 (60)		
					■ ○ 15.00 (65)		
					■ ○ 16.50 (60)		
					■ ○ 18.00 (60)		
					■ ○ 19.50 (60)		
Borehole complete at 20.00m		20.00					18/1

Type of Sample	
Is S.P.T.	■ Undisturbed
Ic C.P.T.	x Vane
o Jar	△ Water
● Bulk	▮ Piezometer

Remarks (Observations of Ground Water etc.)

Water levels are subject to seasonal or tidal variations and should not be taken as constant

TERRESEARCH LIMITED

2745
8-34

BOREHOLE NO. 2

Contract Name Adelaide Road,
Report No. S. 476/12
Client W. E. J. Budgen & Partners
Site Address Adelaide Road,
West Hampstead
N.W. 3
Address 54, Queen Anne Street
London, W.1.
For Hampstead Borough Council

Standing Water Level
Diameter 8"
Water Struck None
Method of Boring Shell/Auger
Ground Level
Start 25.10.62 Finish 27.10.62

Remarks: Blue clay at 40 feet is breaking up, with the break at an angle as if moving with the slope of the ground

Description of Strata	Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
Made ground	2'0"	2'0"	J2001 1'6"	
Concrete	0'5"	2'5"	J2002 3'0"	
Soft light brown clay	5'7"	8'0"	J2004 7'6"	U2003 5'0"
Light brown clay, mottled blue	8'0"	16'0"	J2006 12'6"	U2005 10'0" U2007 15'0"
Stiff Brown clay	18'0"	34'0"	J2008 17'6" J2010 22'6" J2012 27'6" J2014 32'6"	U2009 20'0" U2011 25'0" U2013 30'0"
London Blue clay	46'0"	80'0"	J2016 37'6" J2018 42'6" J2020 47'6" J2022 52'6" J2024 57'6" J2026 62'6" J2028 67'6" J2030 72'6" J2032 77'6"	U2015 35'0" U2017 40'0" U2019 45'0" U2021 50'0" U2023 55'0" U2025 60'0" U2027 65'0" U2029 70'0" U2031 75'0" U2033 78'6"
TOTALS	80'0"	80'0"		

Notes: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations".
2. J indicates Jar Samples.
B " Bulk Samples.
W " Water Samples.
U " Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.
N " Number of blows per ft. penetration with Standard Penetration Tests.

TERRESEARCH LIMITED

BOREHOLE NO. 3

2742
8434

Contract Name Adelaide Road
Report No S. 476/12

Client W. E. J. Budgen & Partners,
Site Address Adelaide Road,
Hampstead.

Address 54, Queen Anne Street,
London, W. 1.

For Hampstead Borough Council

Standing Water Level
Diameter 8"
Water Struck None
Method of Boring Shell/Auger
Ground Level
Start 30.10.62 Finish 31.10.62
Remarks

Description of Strata	Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
Made ground	4'6"	4'6"	J2058 2'6"	
Soft light brown clay	4'6"	9'0"	J2060 '6"	U2059 5'0"
Light brown clay with blue mottle	7'0"	16'0"	J2061 10'0" J2062 12'6"	U2063 15'0"
Brown clay	17'0"	33'0"	J2064 17'6" J2065 20'0" J2066 22'6" J2068 27'6" J2069 30'0" J2070 32'6"	U2067 25'0"
London blue clay	47'0"	80'0"	J2072 37'6" J2073 40'0" J2074 42'6" J2076 50'0" J2077 52'6" J2079 57'6" J2080 60'0" J2081 62'6" J2083 67'6" J2084 70'0" J2086 75'6"	U2071 35'0" U2075 47'0" U2078 55'0" U2082 65'0" U2085 73'0" U2087 79'0"
TOTALS	80'0"	80'0"		

Notes: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations"
2. J indicates Jar Samples.
B " Bulk Samples.
W " Water Samples.
U " Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.
N " Number of blows per ft. penetration with Standard Penetration Tests.

APPENDIX C :

SITE INVESTIGATION INTERPRETIVE REPORT

soiltechnics
environmental and geotechnical consultants

Proposed basement extension
18-20 Elsworthy Road
London
NW3

Supplement to a Basement Impact Assessment Report

Cedar Barn, White Lodge, Walgrave, Northamptonshire NN6 9PY

t: 01604 781877 **e**: mail@soiltechnics.net
f: 01604 781007 **w**: www.soiltechnics.net

Proposed basement extension at
18-20 Elsworthy Road
London
NW3 3QY

SUPPLEMENT TO A
BASEMENT IMPACT ASSESSMENT REPORT

Soiltechnics Ltd. Cedar Barn, White Lodge, Walgrave, Northampton. NN6 9PY.
Tel: (01604) 781877 **Fax: (01604) 781007** **E-mail: mail@soiltechnics.net**

Report originators

Prepared by

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Director, Soiltechnics Limited

ACM
Registered to:
ISO 9001
ISO 14001
OHSAS 18001
UKAS MANAGEMENT SYSTEMS
248

Aerial photograph of property

Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Introduction and brief		
2	Description of the property and project proposals		
3	Desk study information		
4	Flood risk		
5	Basement construction		

List of appendices

Appendix	Content
A	Copy of drawings illustrating proposals

1 Introduction and brief

1.1 Objectives

This report presents information to supplement a basement impact assessment prepared by QED Structures, for a proposed development at 18-20 Elsworthy Road, London NW3 3QY.

The principal objective of the assessment is to present evidence to support a planning application for the project as required by Camden Planning Guidance (CPG4) '*Basements and lightwells'*.

Our brief is to report on the following

- Geography, geology and hydrology of the area
- Flood risk (sewer flooding investigations by others)
- Likely ground movements associated with the basement construction.

1.2 Client instructions and confidentiality

This report has been produced following instructions received from Bonsoir of London Ltd.

This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

1.3 Author qualifications

This report has been prepared by a chartered Civil Engineer, (C.Eng., M.I.C.E) who is also a Fellow of the Geological Society (FGS). The Author is a practising Civil Engineer with specialist experience (exceeding 30 years) in geotechnical engineering including basement construction, flood risk and drainage.

1.4 Published Guidance

We have followed Camden Planning Guidance (CPG4) '*Basements and lightwells'*, and Camden geological, hydrogeological and hydrological study report '*Guidance for subterranean development,*' produced by Arup on behalf of the London Borough of Camden. We have also referred to the '*Strategic Flood Risk Assessment Report for North London*' dated August 2008 prepared by Mouchel, as well as other readily available information on websites.

1.5 Status of this Report

This report is final but may be subject to change following consultation with interested parties, any of which are listed in the table below.

1.6 Report Distribution

This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, although this list may not be exhaustive:

Party	Reason
Client	For information / reference
Developer / Contractor / project manager	To ensure strategic information on drainage design are implemented, programmed and costed
Planning department	To support a planning application,
Environment Agency	As statutory consultees to the local planning authority
Independent inspectors such as Building Control	For compliance with building regulations,
Project design team	To progress the design by taking into consideration strategic information contained in this report
CDM Coordinator	To advise in construction risk identification and management under the Construction (design and management) regulations

2 Description of the property and project proposals

2.1 Description of the property

The site is currently occupied by a pair of (semi-detached) three storey houses, with front gardens to the south facing Elsworthy Road and to the rear. There are similar houses to the east about 2m distant (not measured by us). Elsworthy Rise follows the western property boundary. Ground levels in the area are reasonably uniform. There is a railway tunnel close to the northern boundary of the rear of the property.

2.2 Project proposals

Development proposals are to refurbish the existing property and construction of a single storey deep basement extending approximately 3.4m below existing ground floor levels with the basement extending outside the existing building footprint.

Copies of our Client's Architects drawings showing project proposals are presented in Appendix A.

3 Desk study information

3.1 Site history

Review of Ordnance Survey and London town maps dating back to 1850 indicate the site remained undeveloped until the late 1800s and first recorded on the 1895map. There is a railway tunnel (Primrose Hill Tunnel) following an east – west route in the northern extremity of the rear gardens

3.2 Geology and geohydrology of the area

3.2.1 Geology

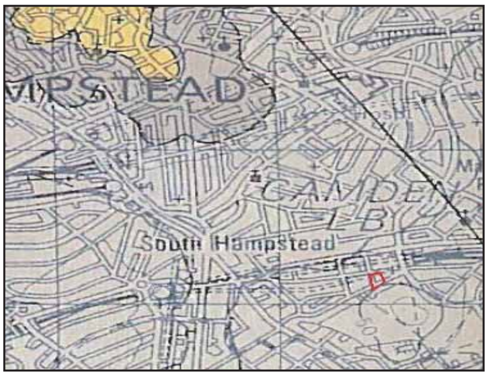
Inspection of the geological map of the area published by the British Geological Survey (BGS) indicates the following sequence of strata. The thickness of the strata has been obtained from a combination borehole record data formed within 500m of the property available on the BGS website, and geological sections shown on the BGS map.

Strata	Bedrock or drift	Approximate thickness	Typical soil type	Likely permeability	Likely aquifer designation
London Clay	Bedrock	50m	Clays	Impermeable	Unproductive strata
Lambeth Group	Bedrock	12m	Sandy clay	Effectively impermeable	Unproductive strata
Thanet sands	Bedrock	12m	Fine sands	Marginally permeable	Unproductive strata
Chalk	Bedrock	200m	Chalk	Permeable	Principal aquifer

Table 1

The soil types and assessments of permeability are based on geological memoirs, in combination with our experience of investigations in these soil types.

An extract copy of the geological map is presented below, with brown shading representing the outcrop of the London Clay Formation. The property is located within the red box.



3.2.2 Ground Investigations

A series of three boreholes have been excavated around the property by Site Analytical Services (SAS) which encountered some 1.2m of made ground, probably associated with general construction activities in the area overlying clays forming the upper horizons of the London Clay Formation. Each borehole extended to some 5m. None of the boreholes encountered groundwater. The SAS report is separately presented.

3.2.3 Geohydrology

Strata overlying the Chalk are considered unproductive strata, which are defined as deposits exhibiting low permeability with negligible significance for water supply or river base flow. An unproductive strata is generally regarded as not containing groundwater in exploitable quantities.

Chalk is a principal aquifer. Principal aquifers are defined as deposits exhibiting high permeability capable of high levels of groundwater storage. Such deposits are able to support water supply and river base flows on a strategic scale.

3.2.4 Source protection zone

The property is located within a zone protecting a potable water supply abstracting from a principle aquifer (i.e. a source protection zone). An extract of the plan recording source protection zones is presented below, which shows the property is zone 2. Groundwater will be extracted from the Chalk Aquifer some 250 to 500m distant from the property. The property is located within the black square. As water will be extracted from the chalk at depths in excess of 200m, the basement proposals will have no effect.

3.2.5 Quarrying/mining

With reference to the coal mining and brine subsidence claims gazetteer for England and Wales, available on the Coal Authority web site, the area has not been subject to exploitation of coal or brine. Inspection of old Ordnance Survey maps dating back to the first editions (late 1800s) does not record any quarrying activities within 250m of the property.

4 Flood risk

4.1 Fluvial/tidal flooding

The Environment Agency website indicates the site is not located within a fluvial or tidal flood plain. An extract copy of the flood risk map is presented below which shows no blue shading representative of flooding. The property is located within the red box.

4.2 Flooding from Reservoirs, Canals and other Artificial Sources

The Environment Agency website indicates the site is not located within an area considered at risk of flooding from breach of reservoir containment systems. An extract copy of the flood risk map is presented below which shows no blue shading representative of flooding as a result of failure of containment systems. The property is located within the red box.

The property is located about 750m to the north-west of Regents canal on higher topographical levels, thus any breach or flooding associated with the canal will not cause flooding of the property.

There are likely to be below ground water supply pipes operated by Thames water in public highways around the property. These are generally relatively small diameter pipes. It is considered that the property is unlikely to be at enhanced risk of flooding due to ruptures in the potable water supply system in the area

4.3 Flooding from sewers.

The Environment Agency web site records areas which are considered to be at risk of surface water flooding. An extract copy of the map is shown below, with blue shading recording areas at risk. The property is located within the red box and outside areas of recorded surface water flooding.

We have viewed the Camden Flooding map presented in the '*Strategic Flood Risk Assessment Report for North London*'. This identifies flooding which has occurred in the past. The map below provides a summary of flooded roads between 1975 and 2002 and although there is no reported stormwater located on the site, some flooding has been reported in the local area. The property is shown edged in black.

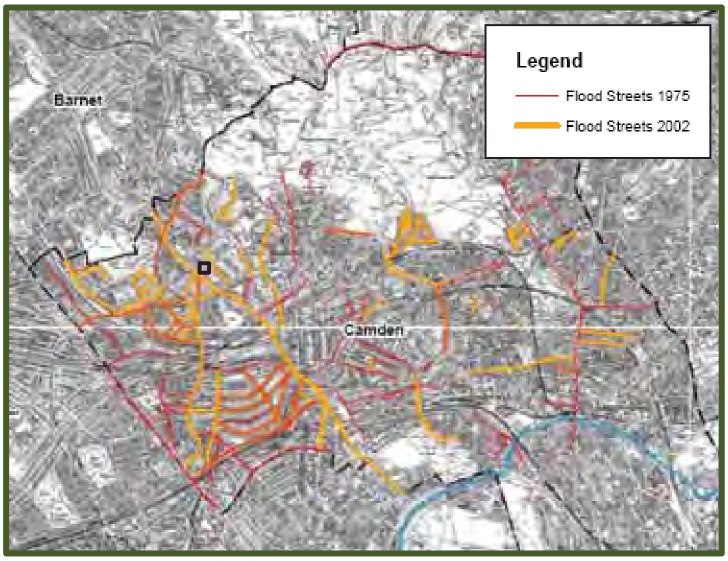


Figure 11 of the *"Camden Geological, Hydrogeological and Hydrological Study"*, shows the location of former watercourses which originally drained north London. Many of these watercourses have been culverted but in times of extreme rainfall some of these culverts become overwhelmed and overland flows can occur resulting in some flooding. The property is remotely located from these watercourses and indeed some 300m distant from a tributary of the Tyburn.

An extract of figure 11 from the Camden Geological, Hydrogeological and Hydrological Study (referenced in Section 1.4) is presented below. The blue lines show the locations of branches of the former River Westbourne, Fleet and Tyburn. The property is located within the black box.

4.4 Flooding from Groundwater

The site is underlain with a substantial thickness (50m) of relatively impermeable London Clay Formation. On this basis groundwater is not likely to be available at the site and thus is unlikely to present a risk of causing groundwater flooding.

4.5 Conclusion

Based on the above evidence the property is located remote from areas at risk of fluvial and tidal flooding and would classified as located in flood zone 1 in accordance with table 1 of '*Technical guidance to the National Planning Policy Framework*'. As a residential property the development would be classified as more vulnerable in accordance with table 2, then referring to table 3 of the above publication the development would be considered 'appropriate'. An extract copy of table 3 is presented below

Flood risk Vulnerability classification	**Essential Infrastructure**	**Water compatibility**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	X	Exception Test required	✓
Zone 3b	Exception Test required	✓	X	x	X

Again based on the above evidence, the property is considered unlikely to be at enhanced risk of being flooded by exceedences in capacity of stormwater drainage, or flooding form other artificial sources.

5 Basement construction

5.1 Outline Proposals.

The principle means of forming the basement will be the installation of a perimeter contiguous embedded piled retaining wall. This will be installed prior to excavation of the basement and will provide a retaining structure both in the temporary and permanent condition. Details of the construction sequence will be provided by our client's structural Engineer. The excavation will extend to depths of about 3.4m before commencement of permanent basement construction works. The perimeter piled wall will be propped during excavation works to minimise inward yielding of the piles.

5.2 Hydrological impacts

Based on both geological records and indeed completed borehole investigations described above the basement excavation will be formed in London Clays. The London Clay is not capable of transmitting groundwater but because it is predominantly clay, it does hold water. As such there is not generally a water table present within it. Monitoring boreholes drilled within the London Clay do slowly fill with groundwater over time; however there is little or no hydraulic continuity between boreholes due to the very low permeability of the clay and ability of the clay matrix to hold or adsorb water. On this basis the basement construction will have no adverse impact on the local hydrology.

5.3 Settlement around and inward yielding of basement excavations

It is recognised that some inward yielding of supported sides of strutted excavations and accompanying settlement of the retained ground surface adjacent to the excavation will occur even though structurally very stiff props / strutting will be employed. The amount of yielding for any given depth of excavation is a function of the characteristics of the supported soils and not the stiffness of the supports. Based on observations of excavations in over consolidated clay soils (which will be the case at this site) the average maximum yield / excavation depth (%) will be about 0.16, with a range of 0.06 to 0.3. Assuming a maximum excavation depth of 3.4m, then the likely inward yield will be in the order of 3.4 x 0.16/100 x1000 = 5mm.

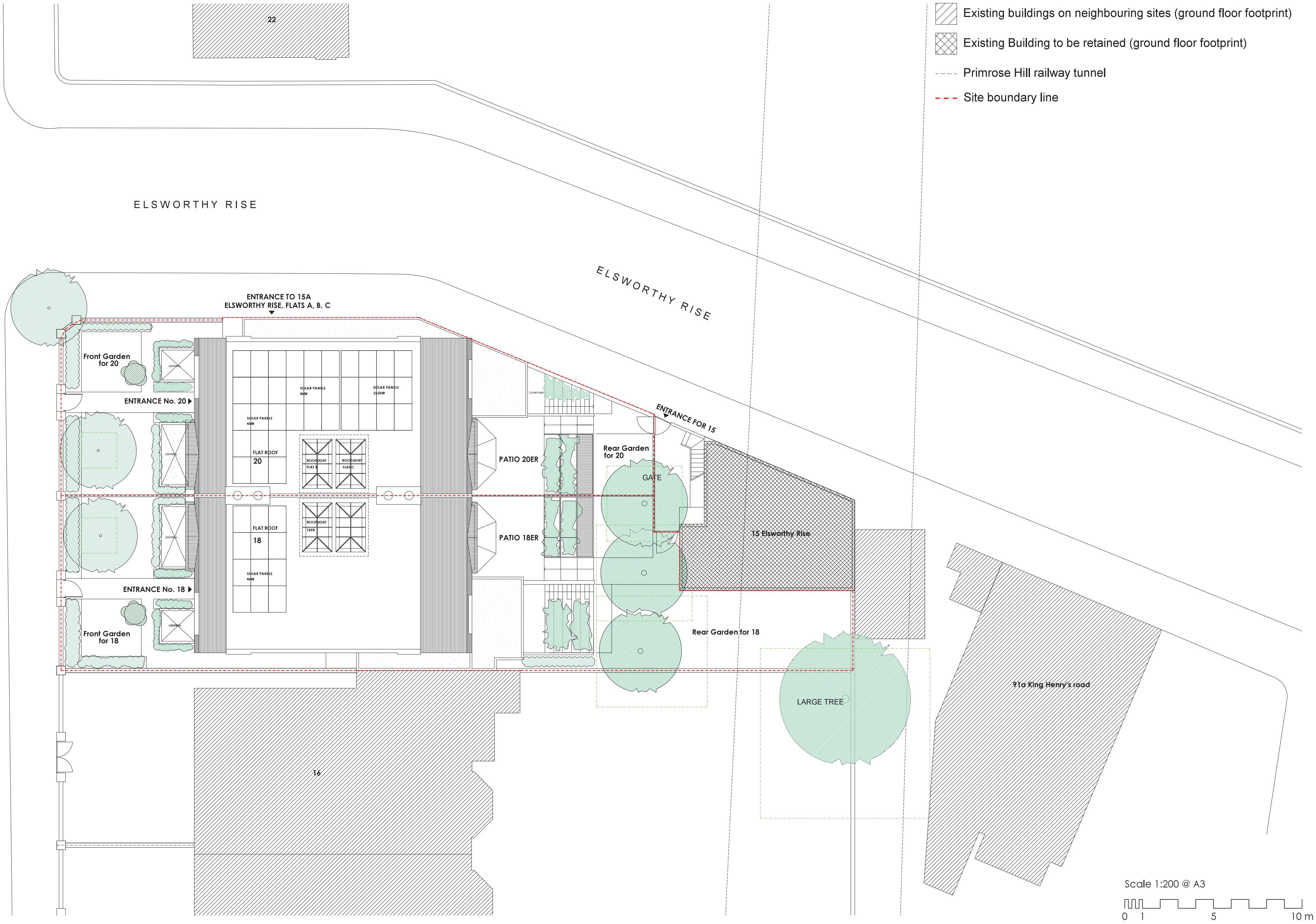
Coincidental with the inward yield of embedded perimeter piles, some settlement of the retained soils around the excavation will occur. Again, based on published observations, the ratio of surface settlement to excavation depth in over consolidated clays is about 0.3% (range 0.1 to 0.6). Adopting the average of 0.3, and a maximum 3.4m deep excavation, then surface settlement in the order of 3.4 x 0.3/100 x 1000 = 10mm will occur. Importantly, whilst some surface settlement will occur around the excavation, this settlement profile will extend for a distance of about 4 times the depth of excavation ie about 13.6m in a reasonably linear fashion. For a settlement of 10mm immediately adjacent to the excavation, diminishing over 13.6m this amounts to an angle of distortion of about 1 in 1300. Such an angle of distortion would not cause damage to any nearby buildings or indeed below ground services. Published values indicate angles of distortions exceeding 1 in 500 could cause crack damage in buildings and with structural damage around 1 in 150.

5.4 Effect of the basement on the nearby railway tunnel.

We are aware that the structural Engineer for the project has contacted Network Rail to determine their requirements and processes to gain consent for construction of the basement. Based on the Architects drawings the edge of the tunnel is located about 7.5m distance from the outside perimeter of the proposed basement wall. A survey of the tunnel is required to confirm this. In addition, the depth of the tunnel is not known at this stage and again a survey is required to determine this. Based on the estimate of 5mm of lateral pile movement (inward yielding) immediately adjacent to the excavation (see section 5.3) and assuming a worst case of the tunnel being located at the same level of the basement (unlikely scenario) then lateral movement of the tunnel will be negligible and any damage of the tunnel lining / alignment very unlikely. As we understand the tunnel was bored, and thus likely to be at a depth below the basement floor level, the influence of the basement on the tunnel will be much reduced. Clearly position and pre-construction (condition) surveys to the tunnel require completion and consent to the basement construction works by Network Rail is required prior to commencement of any works on site.

Appendix A

Copy of Structural Engineer’s drawings illustrating proposed basement works



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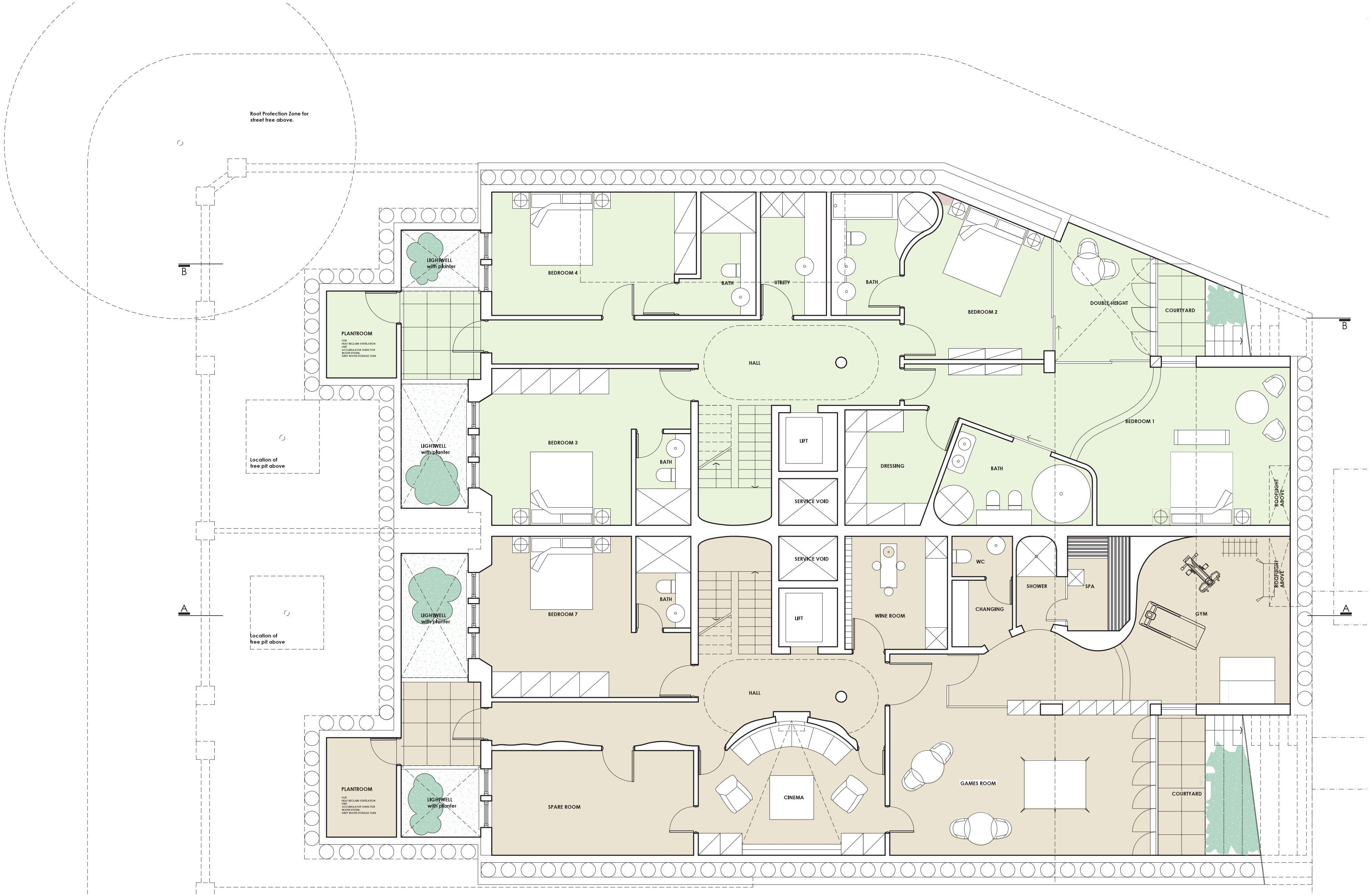
Proposed Redevelopment
SITE PLAN - AS PROPOSED
July 2013

18-20ERF
PR01



GROSS INTERNAL FLOOR AREA OF 18 = 194.27 M²
GROSS INTERNAL FLOOR AREA OF 20 = 186.48 M²
TOTAL GROSS INTERNAL FLOOR AREA = 380.75 M²

Scale 1:100 @ A3

0 1 5 10 m

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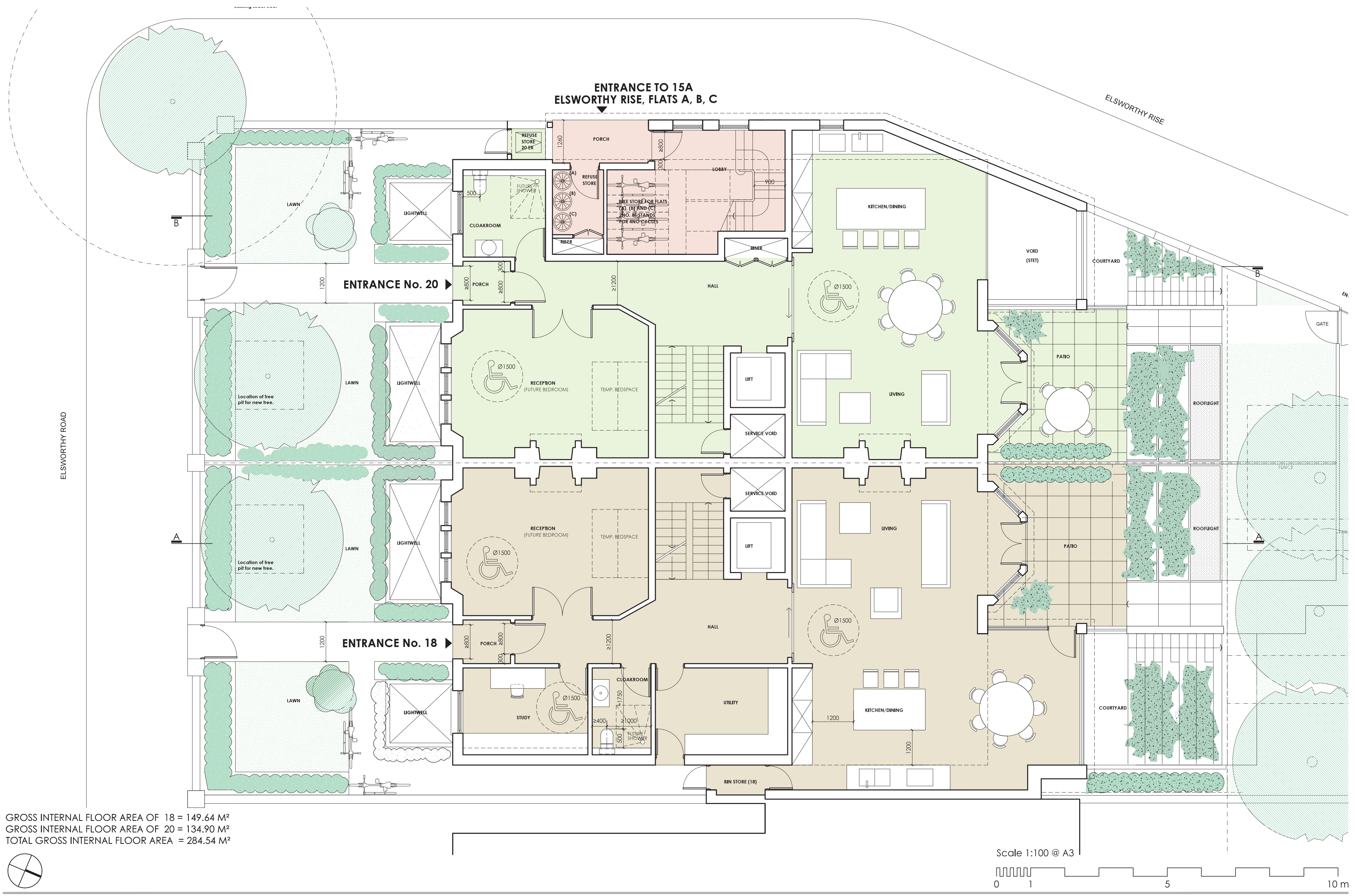
Proposed Redevelopment
BASEMENT FLOOR PLAN - AS PROPOSED
July 2013

18-20ERF
PR02



GROSS INTERNAL FLOOR AREA OF 18 = 149.64 M²
GROSS INTERNAL FLOOR AREA OF 20 = 134.90 M²
TOTAL GROSS INTERNAL FLOOR AREA = 284.54 M²

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18-20 Elsworthy Rd. London NW3
Proposed Redevelopment
GROUND FLOOR PLAN - AS PROPOSED
July 2013

18-20ERF
PR03

GROSS INTERNAL FLOOR AREA OF FLAT A =118.07 M²

GROSS INTERNAL FLOOR AREA OF 18 = 127.64 M²
GROSS INTERNAL FLOOR AREA OF 20 = 128.11 M²
TOTAL GROSS INTERNAL FLOOR AREA = 255.75 M²

Scale 1:100 @ A3
0 1 5 10 m

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18-20 Elsworthy Rd. London NW3
Proposed Redevelopment
FIRST FLOOR PLAN - AS PROPOSED
July 2013

18-20ERF
PR04

GROSS INTERNAL FLOOR AREA FOR FLAT B = 60.47 M²
GROSS INTERNAL FLOOR AREA FOR FLAT C = 55.29 M²

GROSS INTERNAL FLOOR AREA OF 18 = 128.10 M²
GROSS INTERNAL FLOOR AREA OF 20 = 128.55 M²
TOTAL GROSS INTERNAL FLOOR AREA = 256.65 M²

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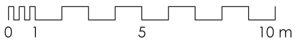
18-20 Elsworthy Rd. London NW3
Proposed Redevelopment
SECOND FLOOR PLAN - AS PROPOSED
July 2013

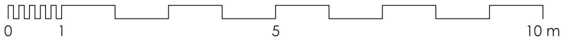
18-20ERF
PR05

South Elevation with Adjoining Buildings (Elsworthy Road)

Scale 1:200 @ A3



Street Elevation (Elsworthy Road)
Scale 1:100 @ A3



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18-20 Elsworthy Rd. London NW3

Proposed Redevelopment
FRONT(SOUTH) ELEVATION - AS PROPOSED
19/04/13

18-20ERF
PR06 A