soils LIMITED

Basement Impact Assessment

at

163 Sumatra Road, London NW6 1PN

for

Drawing and Planning Limited

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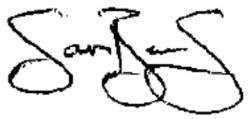

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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Commission

Soils Limited was commissioned by Drawing and Planning Limited to update a Basement Impact Assessment on land at 163 Sumatra Road, London NW6 1PN. The original assessment was undertaken in February 2013 and requires updating to comply with recent requirements set out by the London Borough of Camden, including review and sign-off by a chartered Geologist.

This document comprises the revised and reformatted Basement Impact Assessment and incorporates the results, discussion and conclusions to the investigation. The works undertaken to prepare this report comprised a scoping, screening and intrusive investigation followed by geotechnical laboratory testing.

Standards

The geotechnical laboratory testing was performed by K4 Soils Laboratories in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice was adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sample borehole implies the specific technique used to produce a trial hole.

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Section 1 Introduction

1.1 Objective of Investigation

This report comprises a Basement Impact Assessment which is in accordance with the *London Borough of Camden Development Policy DP27 – Basements and Lightwells* and the *LB Camden guidance document "Camden geological, hydrogeological and hydrological study – Guidance for subterranean development"* produced by Arup describe a risk-based impact assessment with regard to hydrology, hydrogeology and land stability. This has been used as relevant background technical guidance to the development of the Basement Impact Assessment (BIA).

The objective of this investigation was to establish the impact and risk of the proposed basement at 163 Sumatra Road, London NW6 1PN. The assessment would determine the impact on the surroundings structures with respect to groundwater and land stability and in particular to assess whether the development will affect the stability of neighbouring properties, local and regional hydrogeology and whether any identified impacts can be appropriately mitigated by the design of the development.

It is recognised that any Basement Impact Assessment is a live document and that further detailed assessments will be ongoing, if appropriate, as the design and construction progresses.

1.2 Location

The site address is 163 Sumatra Road, London, NW6 1PN approximately centred at OS Land Ranger Grid Reference TQ 252 848.

The site location plan is given in Figure 1 and aerial photography in Figure 2.

1.3 Proposed Development

The proposed redevelopment was to comprise the extension of an existing 2/3-storey terraced house to the rear, including a full basement, and conversion into four flats. The proposed redevelopment was to have light wells at the front and rear adjoining the new basement areas and a communal garden. Figures 3a and 3b present the proposed layout of the basement in plan and section, respectively.

In compiling this report reliance was placed on drawing numbers SMTRD-S701-703 and P700-705 dated June 2015, prepared and supplied by the Client. Any change or deviation from the scheme outlined in these drawings could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

The proposed development layout as provided by the client is included within Appendix C.

1.4 Limitations and Disclaimers

This Basement Impact Assessment relates to the site located at 163 Sumatra Road, London NW6 1PN and was prepared for the sole benefit of Drawing and Planning Limited (The "Client") to the brief described in Section 1.1 of this report.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contact of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently (within the last 20 years) removed trees and those planned as part of the site landscaping.

Ownership of land brings with it onerous legal liabilities in respect of harm to the

environment. “Contaminated Land” is defined in Section 57 of the Environment Act 1995 as:

“Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused”.

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

Section 2 Site Conditions

2.1 Site Details

The site comprised a terraced house with small front yard and rear garden. The site was bordered by further residential properties and gardens,and Sumatra Road to the north.

The rear garden was grass surfaced with bushes noted to the rear boundaries of the property. A mature Silver Birch tree was noted on the pavement to the front of the property.

The site sloped downwards to the south, with the wider topography sloping at a shallow gradient downward in a south / southwestdirection, with an average gradient of <2°.

Looking at available online historic maps the site was open land until the present property was built on it, circa 1890s. No discernible change to the property is noted up to the present day.

2.2 Published Geological Data

The 1:50,000 BGS map showed the site to be located on bedrock of the London Clay Formation with no overlying superficial geology recorded. The London Clay is underlain by the Lambeth Group, Thanet Sand Formation and the Chalk Group, in sequence.

A nearby borehole (BGS Reference: TQ28SE46), provided by the BGS website, records the London Clay Formation to a depth of approximately 74 m bgl, the Lambeth Group to approximately 88 m bgl and the Thanet Sand Formation to 96 m bgl, before reaching the Chalk Group.

2.2.1 London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay, and precautions against sulphate attack to concrete are sometimes required.

The lowest parts of the formation are sandy beds with black rounded gravel and occasional layers of sandstone.

In the north London area the upper part of the London Clay has been disturbed by periglacial processes and may contain pockets of sand and gravel.

2.3 Hydrology

The nearest surface water feature was the Leg of Mutton Pond and associated spring line on West Hampstead Heath recorded 1.82 km northeast of the site. The site was

recorded at an elevation of approximately 56 m AOD, and the Leg of Mutton Pond was at approximately 95 m AOD.

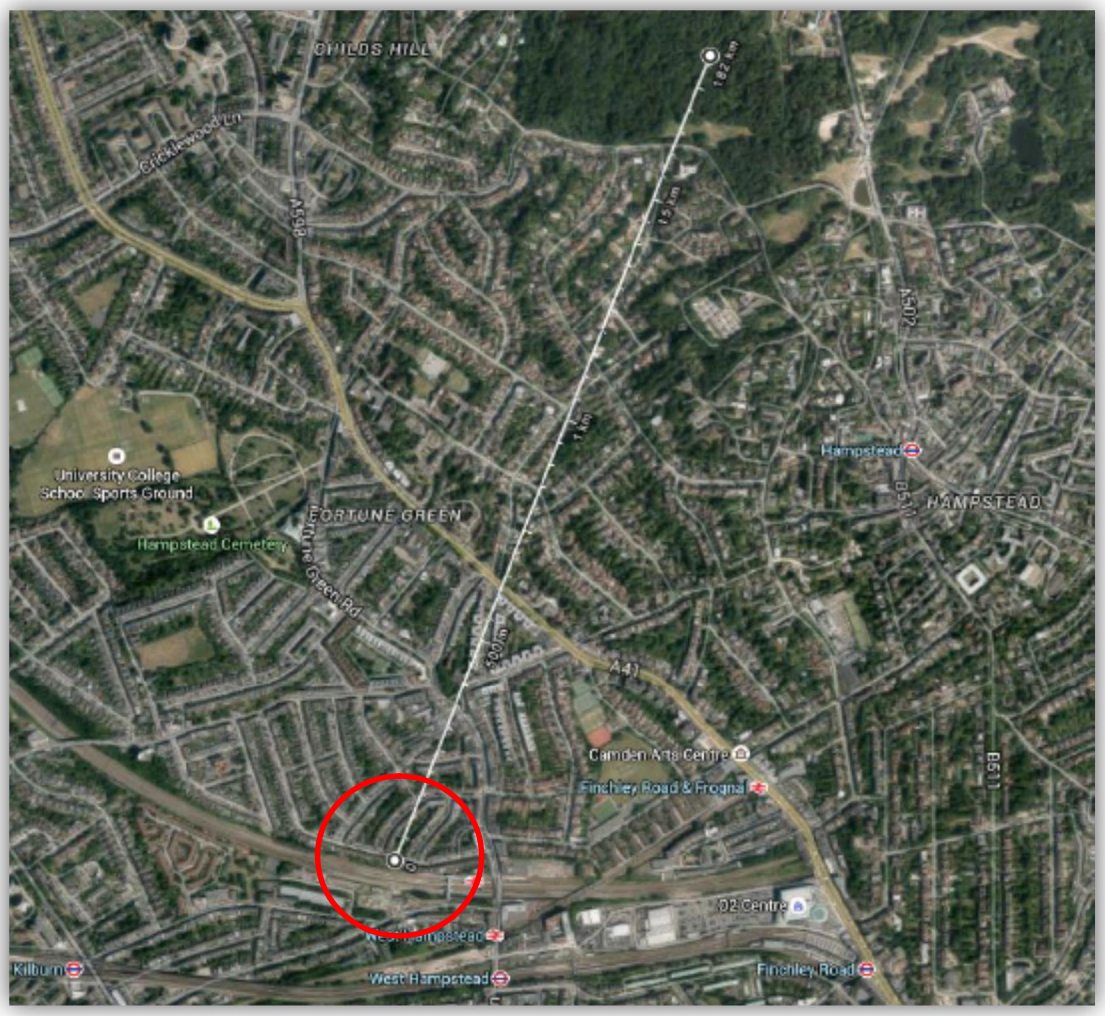


Figure 2.1. Surface Water Features (N to top, NTS)

2.4 Hydrogeology

Information presented by the Environment Agency classifies the London Clay bedrock as unproductive strata.

Any water infiltrating the London Clay Formation will generally tend to flow vertically downwards at a very slow rate. Due to the predominantly cohesive nature of the soils, the groundwater flow rate is anticipated to be very slow. Published permeability data for the London Clay Formation indicates the horizontal permeability to generally range between 10^{-10} m/s and 10^{-8} m/s, with an even lower vertical permeability.

2.5 Shallow Groundwater and Surface Runoff

The shallow groundwater flow direction would correspond to the natural relief of the surrounding ground. The area's topography was sloping gently in a south / south-

westerly direction (towards the River Thames).

The hydraulic gradient was shallow and flow rates would be very low and imperceptible as far as the development was concerned.

A seasonal variation in level within the shallow groundwater could be expected; however the geological map showed the site to be located directly on the soils of the London Clay Formation, within which shallow groundwater was anticipated to be perched. Published data for the permeability of the London Clay Formation indicates the horizontal permeability to generally range between 10^{-10} m/s and 10^{-8} m/s, or a maximum of horizontal groundwater flow of the order of 5 mm a year.

2.6 Deep Groundwater

The Chalk group, combined with the sands of the Thanet Sand Formation and the Lambeth Group, make up the water-bearing basal aquifer of the London Basin. The deep groundwater at the site is at approximately –25 m AOD within the Chalk as of January 2015, which is less than 1 m higher than in 2000 (Environment Agency, 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/429468/2015_London_GWL_Report_online.pdf). These geological formations lie below the London Clay.

‘The low permeability nature of the London Clay overlying these aquifer units prevents the water table reaching the surface and causes artesian pressure to build up underneath the London Clay. As groundwater pressure increases on the London Clay, it is increasingly saturated, albeit slowly. The London Clay is extensively fissured locally, and therefore rapid ingress of groundwater at higher elevations is possible on a small scale’ (EA, 2015, p. 5-6).

The site is at 50 m AOD, i.e. around 75 m higher than the water table, the level of which is maintained relatively constant below London by controlled abstractions. Therefore no interaction with the deep groundwater is likely to be possible and as such it does not need to be considered further as part of this assessment.

Section 3 Screening

3.1 Introduction

The Ove Arup 2008 Scoping Study prepared for the London Borough of Camden requires that any development proposal that includes a subterranean basement should be screened to determine whether or not a full BIA is required.

A number of screening tools are included in the Arup document (Ref: Camden geological, hydrogeological and hydrological study, Issue01/November 2010) and for the purposes of this report reference has been made to Appendices E and F of that report, which includes a series of questions within a screening flowchart for three categories; surface water flow, groundwater flow and land stability. Responses to the questions are tabulated below.

3.2 Surface Flow and Flooding Screening Assessment

The response to the Surface Flow and Flood Screening Assessment is given in Table 3.1.

Table 3.1 – Surface Flow and Flooding Screening

Question	Response
1. Is the site within the catchment of the pond chains on Hampstead Heath?	**No**– It was located 1.82 km to the south-west and down-gradient of the nearest part of the pond chains on Hampstead Heath.
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	**No** – Drainage will be taken to combined sewers in public highway.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	**Yes**– The proposed development will comprise extension of the existing house and basement into the rear garden, which is currently soft landscaping.
4. Will the proposed basement development result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?	**No** – The increase of impermeable area to the rear of the house could increase the peak flow to existing surface water drainage, however there will be negligible impact to adjacent properties or downstream watercourses.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**No** – All surface water will be taken to combined sewers in public highway not to a watercourse. Additionally, there were no Surface Water Features within a radius of 1.8 km, which could be affected by the development.

Question	Response
6. Is the site in an area known to be at risk from surface water flooding?	**Yes**– The site is not recorded on a floodplain according to the Environment Agency website. However, the document "Camden Planning Guidance – Basement and Lightwells, CPG4" *, shows that Sumatra Road was among a number of roads in Camden that were flooded in 1975 and 2002.

*Available at: http://www.camden.gov.uk/ccm/cms-service/stream/asset/;jsessionid=FEF1637103D7CD67C5B4CE7A61B96903?asset_id=3346904&

The above assessment has identified the following potential issues:

Q3. Proposed basement will increase the proportion of hard surfaced /paved areas;
Q6. Site is at risk from surface water flooding.

3.3 Subterranean (Groundwater) Screening Assessment

The response to the Subterranean (Groundwater) Screening Assessment is given in Table 3.2.

Table 3.2 – Subterranean (Groundwater) Screening

Question	Response
1a. Is the site located directly above an aquifer?	**No** –Geological maps show the site is located directly on bedrock of the London Clay Formation, an Unproductive Stratum.
1b. Will the proposed basement extend beneath the water table surface? **It must be mentioned that Appendix F2 of the Camden geological, hydrogeological and hydrological study by ARUP (Issue 01/November 2010) suggest that should the answer of Question 1a is "No", Question 1b could be omitted.**	**Unknown**– It is considered unlikely given the setting of the site but it may be that the proposed basement extends beneath the water table surface. It will need to be confirmed by a ground investigation.
2. Is the site within 100 m of a watercourse, well (used/ disused) or potential spring line?	**No** – The nearest Surface Water Feature a pond located ~1.82 km to the north-east, located at the south-western portion of Hampstead Heath.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	**Yes**– The proposed development will comprise extension of the existing house and basement into the rear garden, which is currently soft landscaping.
4. As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	**No** – The area is **not** underlain by an aquifer, thus any increase will not impact upon the groundwater flow or levels. Furthermore, drainage will be taken to combined sewers in public highway.

Question	Response
5. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than, the mean water level in any local pond or spring line?	**No**– The nearest Surface Water Feature pond located ~1.82 km to the north-east, located at the south-western portion of Hampstead Heath.

The assessment has identified the following potential issues:

Q1b. It is considered unlikely that the basement will extend beneath the water table surface but it will need to be confirmed by a ground investigation;
Q4. Proposed basement will increase the proportion of hard surfaced /paved areas.

3.4 Stability Screening Assessment

The response to the Stability Screening Assessment is given in Table 3.3.

Table 3.3 – Stability Screening

Question	Response
1. Does the existing site include slopes, natural or manmade, greater than 7°?	**No –** The site was noted to have a gentle fall from north to south of ~1.15 degrees. This was calculated from topographical data on plans provided by the Client.
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7°?	**No** – The proposed basement is not to alter existing site landscaping elevations.
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	**No –** The wider area was noted to be generally flat and level with a gentle slope to south and south-west that was calculated to be 1.23 degrees (4.3 m drop in elevation over a distance of 200 m in a north-east to south-west direction). No railway cuttings were in the close vicinity of the site.
4. Is the site within a wider hillside setting in which the general slope is greater than 7°?	**No –** The wider area was noted to be generally flat and level with a gentle slope to south and south-west that was calculated to be 1.23 degrees (4.3 m drop in elevation over a distance of 200 m in a north-east to south-west direction).
5. Is the London Clay the shallowest strata at the site?	**Yes** – The London Clay Formation is recorded as the shallowest strata, to be confirmed by the ground investigation.
6. Will any trees be felled as part of the proposed development and / or are any works proposed within any tree protection zones where trees are to be retained?	**No –** It is understood that no trees will be felled during the development.

Question	Response
7. Is there a history of seasonal shrink-swell subsidence in the local area and / or evidence of such effects at the site?	**Unknown –** Anticipated geology was London Clay Formation, which would potentially be subject to shrink-swell subsidence. There was no visual evidence of subsidence at the site or properties in the vicinity.
8. Is the site within 100 m of a watercourse or potential spring line?	**No** – The nearest Surface Water Feature a pond located ~1.82 km to the north-east, located at the south-western portion of Hampstead Heath.
9. Is the site within an area of previously worked ground?	**No** – The relevant geological map did not show any Made Ground or Worked Ground within or in close proximity to the site.
10. Is the site within an aquifer?	**No** - Geological maps show the site is located on bedrock of the London Clay Formation, an Unproductive Stratum.
11. Is the site within 5 m of a highway or pedestrian right of way?	**Yes**– the site is adjacent to Sumatra Road to the north and a pedestrian pathway (Black Path) to the south.
12. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	**Yes**–the proposed basement is under an existing terraced house with properties to both sides.
13. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	**No** – the site is located ~25 m to the north of a railway line. The nearest tunnel (Belsize Tunnels) was noted ~600 m to the east of the site.

The assessment has identified the following potential issues:

Q5 The London Clay Formation is recorded as the shallowest strata at the site;
Q7 The anticipated bedrock geology would suggest a susceptibility to shrink-swell subsidence;
Q11 The proposed basement is located within 5 m of a highway or pedestrian right of way; and
Q12 The proposed basement may increase the differential depth of foundations relative to neighbouring properties.

Section 4 Scoping

4.1 Introduction

The purpose of scoping is to assess in more detail the issues of concern identified in the screening process (i.e. where the answer is "yes" or "unknown" to any of the questions posed) to be investigated in the impact assessment. Potential hazards are assessed for each of the identified potential impact factors.

The scoping stage is furthermore to assist in defining the nature of the investigation required to assess the impact of the issues of concern identified in the screening process. The scope of the investigation must comply with the guidance issued by the London Borough of Camden and be a suitable basis on which to assess the potential impacts.

4.2 Potential Impacts

The following potential impacts were identified in Table 4.1.

Table 4.1 – Potential Impacts

Screening Flowchart Question	Potential Impacts	Discussion
Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Decrease recharge to the underlying ground. In areas underlain by aquifers this may impact upon groundwater flow/levels. In areas underlain by London Clay Formation this may mean changes in the degree of wetness and it could affect stability.	The geological map showed the site **not** to be underlain by an aquifer, however, this needs to be confirmed by ground investigation, comprising either **trial pitting or borehole drilling to sufficient depth**.
Is the site in an area known to be at risk from surface water flooding?	Property damage due to surface water either in the form of flash flooding due to surface run-off, rising groundwater, inadequate drain/sewer capacity or inadequate drain/sewer maintenance. Please note that as stated in "Camden Planning Guidance – Basement and Lightwells, CPG4", Sumatra Road was among a number of roads in Camden that were flooded in 1975 and 2002.	The site is not recorded on a floodplain. However, the document "Camden Planning Guidance – Basement and Lightwells, CPG4", shows that Sumatra Road was among a number of roads in Camden that were flooded in 1975 and 2002. Developer to undertake a **Flood Risk Assessment** in accordance with PPS25.
Will the proposed basement extend beneath the water table surface?	Alteration of existing groundwater flow regime, which in turn could potentially cause local increase or decrease of groundwater levels.	It may be that the proposed basement extends beneath the water table, though this will need to be confirmed by a ground investigation, as locally perched pockets of groundwater could be present. **Well installation and groundwater monitoring necessary**.

Screening Flowchart Question	Potential Impacts	Discussion
Is the London Clay the shallowest strata at the site?	Potential for shrink-swell subsidence in ground surrounding proposed basement.	Ground investigation to establish soil conditions by means of boreholes and laboratory analysis (Atterberg Limit Tests). Effects mitigated at design stage.
Is there a history of seasonal shrink-swell subsidence in the local area and / or evidence of such effects at the site?	Changes to vegetation on site could adversely affect foundations of adjoining structures.	Ground investigation to establish soil conditions by means of boreholes. Effects mitigated at design stage.
Is the site within 5 m of a highway or pedestrian right of way?	Excavation of a basement could result in structural damage to the roads/ footways or buried services.	Site investigation to establish soil conditions. Effects mitigated at design stage.
Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Basement construction can result in undermining of foundations of neighbouring properties and cause excessive ground movements resulting in structural instability.	Based on information supplied by the client, the properties adjoining the site do **not** include full basements. Therefore, they either have no basement, with foundations assumed to a depth of at least 1.0 m bgl or semi-basements (as the property on site). In both cases, given that the proposed basement levels are anticipated to be only at ~2.0 m bgl at its front (north) and ~1.0 m bgl at its rear (south) edge, **the differential depth increase was not significant.** Site investigation to establish soil conditions and details of existing foundations **by means of hand excavated trial pit(s).**

Section 5 Intrusive Investigation

5.1 Ground Conditions

The scoping intrusive investigation was carried out on the 1st November 2012 and comprised three windowless sampler boreholes (WS1 to WS3), were drilled on site, at locations given by the client, where access could be gained and no live services were identified to a depth of 5.0 metres below ground level (m bgl). Given the different in elevation between the front and rear gardens of the property, WS1-WS2 (front) were drilled at an elevation ~0.8 m higher than WS3 (rear). Standpipe piezometers were installed in the boreholes to a depth of 5.0 m to allow long term groundwater level monitoring following installation, as agreed with the client. Groundwater monitoring was undertaken on 4No. occasions, the results of which are presented in Section 5.4.

A dynamic probe (DP1) was driven adjacent to one of the boreholes (WS1), prior to its construction, using a 'Super Heavy' Dynamic Probe (DPSH-B) to a depth of 6.0 m bgl. One trial pit (TP1) was hand dug at a location given by the client, to a depth of 1.22 m, to expose and record the existing foundation details.

The trial hole locations are outlined in Figure 4.

Table 5.1 outlines the depths of each trial-hole.

Table 5.1 – Investigatory Depths of Trial-holes

Trial-hole (WS)	Final Depth (m bgl)
WS1	5.0
WS2	5.0
WS3	5.0
DP1	6.0
TP1	1.22

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the borehole logs and quoted in this report were measured from ground level directly adjacent to the boreholes.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots, or has been identified as part of the *in-situ* weathering profile, it has been described as Topsoil both on the logs and within this report. Where the soil has, in general, been found to have the same composition as the 'Topsoil' but also incorporated a minor constituent, e.g. less than an estimated 5%, of possibly non-naturally occurring material, or is of uncertain origin, the soil has been described as Topsoil/Made Ground both on the log and within this report. Where man has clearly either placed the soil, or the composition has been altered to a degree greater than an

estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the logs and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion, the succession of conditions encountered in the trial-holes, in descending order, are:

Made Ground (MG)
London Clay Formation (LC)

Table 5.2 summarises the ground conditions encountered.

Table 5.2 – Ground Conditions

Strata	Epoch	Depth Range (m bgl)		Typical Thickness (m)	Description
		Top	Bottom		
MG	Recent	GL	0.30-1.22	0.50	Dark brown sandy silt/silty clay with brick and concrete fragments, ash, gravel and roots.
LC	Ypresian	0.30-0.70	5.00[1] (inferred to 6.00)	Not proven	Orange brown to dark brown and grey mottled silty CLAY with occasional gravel horizons and very occasional selenite crystals and fine roots.

[1]**Maximum depth of investigation**

5.1.1 Made Ground

Made Ground was encountered from surface in WS3 or directly beneath a thin capping of concrete (0.04 m - 0.06 m) in WS1-WS2 and TP1 and comprised dark brown sandy silt/silty clay with brick and concrete fragments, ash, gravel and roots. Made Ground was proved to depths ranging between 0.30 m bgl in WS2 and 0.70 m bgl in WS3 and was found for the full depth of TP1 to 1.22 m bgl.

5.1.2 London Clay Formation

The soils of the London Clay Formation were found directly beneath the soils of the Made Ground in each of the trial holes, except TP1, and comprised orange brown to dark brown and grey mottled silty CLAY with occasional gravel horizons and very occasional selenite crystals and fine roots.

The geological records indicate a thickness of about 74 metres of the London Clay Formation in this area.

5.1.3 Roots

Roots were encountered in WS1 and WS2 to depths of 2.10 m and 1.50 m bgl, respectively, but were not encountered in WS3 or TP1.It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low, thus a direct observation such as

from within a trial pit is necessary to gain a better indication of the maximum root depth.
Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed, both within the site and its close environs.

5.1.4 Groundwater

Groundwater was not encountered during the borehole drilling or the excavation of the trial pit; however the speed of drilling may have masked any groundwater strikes.

Groundwater equilibrium conditions may only be conclusively established by means of a series of measurements made in piezometers installed in the ground after completion of site works.

Groundwater monitoring wells were installed in the boreholes to a depth of 5.0 m bgl.

Each well comprised a 38 mm diameter standpipe with a gravel filter surround. Slotted casing was used from 5.0-1.0 m bgl and plain casing with a bentonite seal, to prevent entry of surface water, from 1.0 m bgl to surface. A lockable 'top-hat' cover completed the installation.

Short-term and standing groundwater levels, where found, during the drilling of the boreholes and the groundwater monitoring are presented in Table 5.3.

Table 5.3 – Groundwater Records

Trial hole	Groundwater Depth (m bgl)	Comment
WS1	No groundwater encountered	Reading taken on 01.11.12
	Standing at 4.10	Reading taken from monitoring well on 13.11.12
	Standing at 3.09	Reading taken from monitoring well on 26.11.12
	Standing at 2.43	Reading taken from monitoring well on 19.12.12
	Standing at 2.23	Reading taken from monitoring well on 15.01.13
WS2	No groundwater encountered	Reading taken on 01.11.12
	Standing at 2.12	Reading taken from monitoring well on 13.11.12
	Standing at 1.97	Reading taken from monitoring well on 26.11.12
	Standing at 2.09	Reading taken from monitoring well on 19.12.12
	Standing at 2.06	Reading taken from monitoring well on 15.01.13
WS3	No groundwater encountered	Reading taken on 01.11.12
	No access to the rear of the property	Reading taken from monitoring well on 13.11.12
	Standing at 0.82	Reading taken from monitoring well on 26.11.12
	No access	Reading taken from monitoring well on 19.12.12
	No access	Reading taken from monitoring well on 15.01.13
TP1	No groundwater encountered	Reading taken on 01.11.12

Note: Given the different in elevation between the front and rear gardens of the property, WS1-WS2 (front) were drilled at an elevation ~0.8 m higher than WS3 (rear).

Changes in groundwater level do occur for a number of reasons including seasonal effects and variations in drainage. The site investigation and the groundwater monitoring were conducted between November 2012 and January 2013, when groundwater levels should typically be approaching their annual maximum (i.e. highest in March) elevation.

5.2 Atterberg Limit Tests

Atterberg limits tests were performed on five samples obtained from the cohesive soils of the London Clay Formation, a summary of the results has been presented in Table 5.4.

Table 5.4– Atterberg Limit Test Interpretation

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
LC	27 – 35	37 – 48	100	37 – 48	CH – CV	Medium to high	Medium to high

Note: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2
Soils Classification based on British Soil Classification System

(The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5)

The most common use of the term 'clay' is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.

The results from Atterberg Limit Tests confirmed that the cohesive soils of the London Clay Formation had **medium to high volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Section 6 Basement Impact Assessment

6.1 Mitigation of Adverse Effects

This section of the report addresses the potential impacts identified by the scoping study and the relevant findings of the ground investigation and mitigation measures, where required.

Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?

Potential Impacts: Decrease recharge to the underlying ground. In areas underlain by aquifers this may impact upon groundwater flow/levels. In areas underlain by the London Clay Formation this may mean changes in the degree of wetness and it could affect stability.

Ground Investigation Findings: Windowless sampler borehole drilling revealed that the site was underlain by a thin capping of Made Ground over the soils of the London Clay Formation to 5.0 m bgl, which were established to comprise predominantly very low permeability CLAY. Therefore the increased proportion of hard surfaced areas will not have an impact on groundwater flow/levels.

Mitigation: None required.

Is the site in an area known to be at risk from surface water flooding?

Potential Impacts: Property damage due to surface water either in the form of flash flooding due to surface run-off, rising groundwater, inadequate drain/sewer capacity or inadequate drain/sewer maintenance.

Ground Investigation Findings: The site is not recorded on a floodplain according to the Environment Agency website. However, the document “Camden Planning Guidance – Basement and Lightwells, CPG4”, shows that Sumatra Road was among a number of roads in Camden that were flooded in 1975 and 2002.

Mitigation: Developer to undertake a **Flood Risk Assessment** in accordance with PPS25.

Will the proposed basement extend beneath the water table surface?

Potential Impacts: Alteration of existing groundwater flow regime, which in turn could potentially cause local increase or decrease of groundwater levels.

Ground Investigation Findings: Windowless sampler borehole drilling revealed that the site was underlain by a thin capping of Made Ground over the soils of the London Clay

Formation to 5.0 m, which were established to comprise predominantly very low permeable CLAY. Therefore, as discussed in Section 3.3, **the relevant question could be omitted.**

Furthermore, **no** groundwater was encountered either during the borehole drilling or the hand excavation of the trial pit.

The proposed basement slab levels are anticipated to be at ~2.0 metres below existing ground level (bgl) at its front (north) and ~1.0 metre at its rear (south) edge. The ground level at WS3 is -1.393 m (as shown in Fig. 3b), and ground level at WS1 and WS2 is reported as being ~0.8 m higher, i.e. -0.59 m. As such, the highest groundwater level recorded during the long-term groundwater monitoring in WS3 was -2.195 m (c.f. basement floor at -3.747 m) and the highest water level recorded in WS2 was -2.56 m (c.f. same basement floor level, almost up to the front lightwell). These levels have been plotted on to Figure 3b to illustrate the potential impact on the basement construction.

In addition, it must be mentioned that the groundwater monitoring was undertaken between November 2012 and January 2013, when groundwater levels are approaching their annual maximum (i.e. highest elevation in March). Therefore it is likely that groundwater levels would increase to slightly higher levels than those recorded during this investigation, which would have a greater impact on basement construction.

Mitigation: Subject to the time of the year the basement excavation is to take place, dewatering is likely to be required to minimise the likelihood of constructing below the groundwater levels.

However, the magnitude of the change in water level ("damming effect") would be mitigated due to the following reasons:

a. The long axis of the footprint of the proposed basement is to be in alignment with the existing groundwater flow, therefore causing less deflection from its original path;
b. The absence of the "cumulative effect", which could have resulted by the existence of basements within the adjoining properties. As informed by the client, the adjoining properties do not include basements.

Is the London Clay the shallowest strata at the site?

Potential Impacts: London Clay Formation is the most prone to seasonal shrink-swell stratum from all the at-surface strata present in LB of Camden.

Ground Investigation Findings: Windowless sampler borehole drilling revealed that the site was underlain by a thin capping of Made Ground over the soils of the London Clay Formation to 5.0 m, which were established to comprise predominantly very low permeable CLAY.

The results of the Atterberg Limit testing indicated that the soils of the London Clay Formation fell into the BRE Digest 240 and the NHBC Standards Chapter 4.2 “medium to high volume change potential” classification.

Mitigation: The high volume change potential of the soils of the London Clay Formation must be taken into account in the design of the basement slab, in accordance with the relevant BRE Digest 240 and NHBC 4.2 Standards.

Is there a history of seasonal shrink-swell subsidence in the local area and / or evidence of such effects at the site?

Potential Impacts: Changes to vegetation on site could adversely affect foundations of adjoining structures

Ground Investigation Findings: Windowless sampler borehole drilling revealed that the site was underlain by a thin capping of Made Ground over the soils of the London Clay Formation to 5.0 m, which were established to comprise predominantly very low permeability CLAY. The hand excavation of a trial pit exposed the existing foundation that was **not** noted to have experienced any structural damage from heave or long-term swelling.

The results of the Atterberg Limit testing indicated that the soils of the London Clay Formation fell into the BRE Digest 240 and the NHBC Standards Chapter 4.2 “medium to high volume change potential” classification.

Mitigation: The high volume change potential of the soils of the London Clay Formation must be taken into account in the design of the basement slab, in accordance with the relevant BRE Digest 240 and NHBC 4.2 Standards.

Is the site within 5 m of a highway or pedestrian right of way?

Potential Impacts: Excavation of a basement could result in structural damage to the roads/ footways or buried services.

Ground Investigation Findings: Construction of proposed basement will take place at a distance less than 5.0 m (~3.0 m) from Sumatra Road.

Mitigation: Design of permanent and/or temporary works to ensure induced ground movements are within tolerable limits and temporary works to prevent damage during construction

Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

Potential Impacts: Basement construction can result in undermining of foundations of neighbouring properties and cause excessive ground movements resulting in structural instability.

Ground Investigation Findings: Based on information supplied by the client, the properties adjoining the site do not include full basements, which was further confirmed by the site investigation. Therefore, they either have no basement, with foundations assumed to a depth of at least 1.0 m bgl or semi-basements (as the property on site). The hand excavation of a trial pit exposed the existing foundation that was noted to extend to a depth of ~1.10 m bgl, which was assumed to be approximately the foundation depth of the adjoining properties.

Given that the proposed basement levels are anticipated to be only at ~2.0 m bgl at its front (north) and ~1.0 m bgl at its rear (south) edge, the differential depth increase was **not significant**.

Mitigation: Appropriate measures undertaken in design and construction phase**.** Close supervision will be made during the construction phase. Movement monitoring of neighbouring and nearby structures will be undertaken before construction starts and continued through the construction phase and for an appropriate period thereafter.

6.2 Effects of Basement Construction on Shallow Groundwater

The proposed redevelopment was to comprise the lateral extension of an existing basement of a 2/3-storey house, as well as the house itself. The proposed redevelopment was to have light wells at the front and rear adjoining the new basement areas.

The proposed basement slab levels are anticipated to be at ~2.0 metres below existing ground level (bgl) at its front (north) and ~1.0 metre at its rear (south) edge. The ground level at WS3 is -1.393 m (as shown in Fig. 3b), and ground level at WS1 and WS2 is reported as being ~0.8 m higher, i.e. -0.59 m. As such, the highest groundwater level recorded during the long-term groundwater monitoring in WS3 was -2.195 m (c.f. basement floor at -3.747 m) and the highest water level recorded in WS2 was -2.56 m (c.f. same basement floor level).

Given that the groundwater monitoring was undertaken between November 2012 and January 2013, when groundwater levels are approaching their annual maximum (i.e. highest elevation in March) there is potential for groundwater levels to increase slightly from those recorded.

The hydraulic gradient was shallow and flow rates would be very low and imperceptible as far as the development was concerned. Published data for the permeability of the London Clay Formation indicates the horizontal permeability to generally range between

10^{-10} m/s and 10^{-8} m/s, or a maximum of horizontal groundwater flow of the order 5mm a year.

The ARUP report raises the hazard of groundwater flow being impeded and creating a damming effect upslope. Subject to the time of the year the basement excavation is to take place, dewatering of limited scale maybe required to minimise the likelihood of constructing below the groundwater levels.

However, **the magnitude of the change in water level ("damming effect") would be mitigated** due to the following reasons:

a. The long axis of the footprint of the proposed basement is to be in alignment with the existing groundwater flow, therefore causing less deflection from its original path;

b. The absence of the "cumulative effect", which could have resulted by the existence of basements within the adjoining properties. As informed by the client, the adjoining properties do not include basements.

6.3 Surrounding Buildings

This section considers the potential effects of basement construction on nearby properties.

Detrimental effects would be manifested as cracking and more serious structural damage. Many old buildings in London do exhibit signs of historic movement and repair. In practice, it is often difficult to attribute cracks visible in a structure to specific site construction activities unless a detailed survey of the affected structure and its founding strata had been undertaken before the construction works.

Any observed changes in the state of the building can then be causally linked to the works with more confidence and less debate than if no pre-works condition survey had been undertaken. Surveys require the cooperation of the property owners, as entry by surveyors into the property will be necessary. This would normally be undertaken in collaboration with the neighbour's party wall surveyors.

Close supervision will be made during the construction phase. Movement monitoring of neighbouring and nearby structures will be undertaken before construction starts and continued through the construction phase and for an appropriate period thereafter.

The data from the site investigation has established soil and groundwater conditions. The client's engineer can prepare working drawings and construction method statements that will mitigate adverse effects of nearby properties.

6.4 Residual Impacts

On completion of the scheme there will be no residual effect on the environment or on nearby properties.

The proposed basement extension will not be a hindrance against the possibility of future basement construction to adjoining properties.

List of Figures

List of Appendices

Figure number	Title
1	Site Location Map

Project	Date
163 Sumatra Road, London NW6 1PN	July 2015

Client	Reference
Drawing and Planning Limited	13291

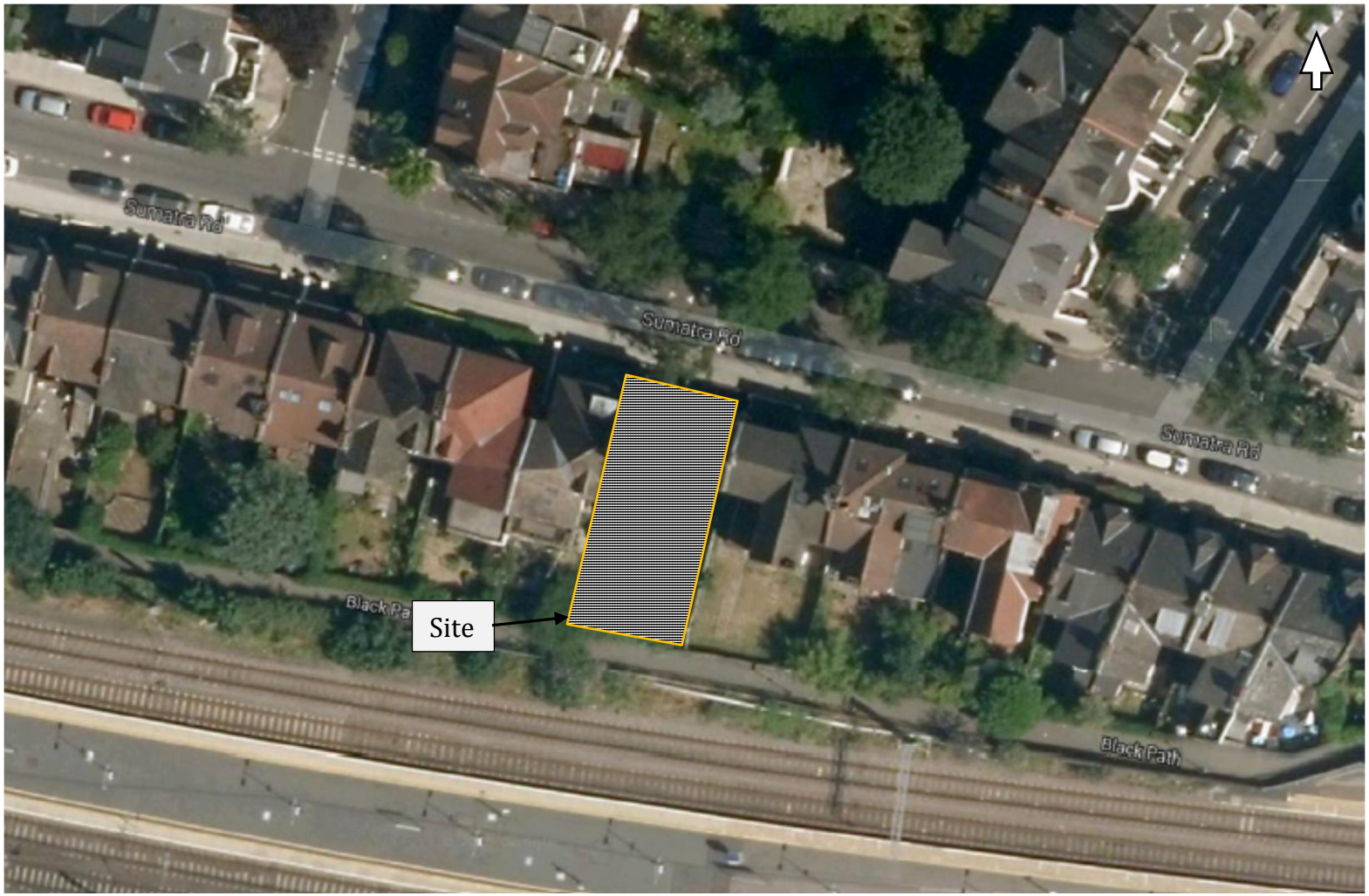


Figure number
2

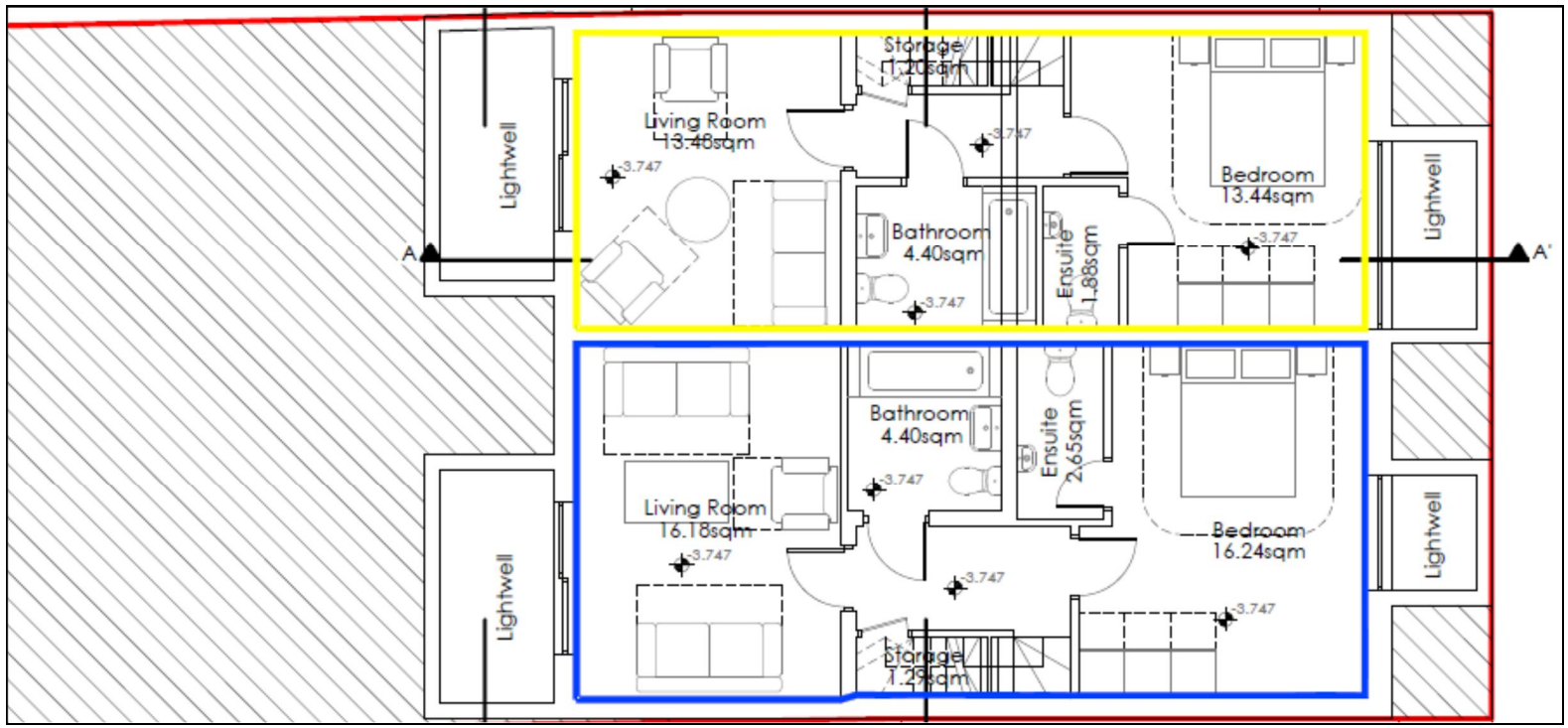
Project
163 Sumatra Road, London NW6 1PN

Client
Drawing and Planning Limited

Title
Aerial Photograph

Date
August 2015

Job Number
13291



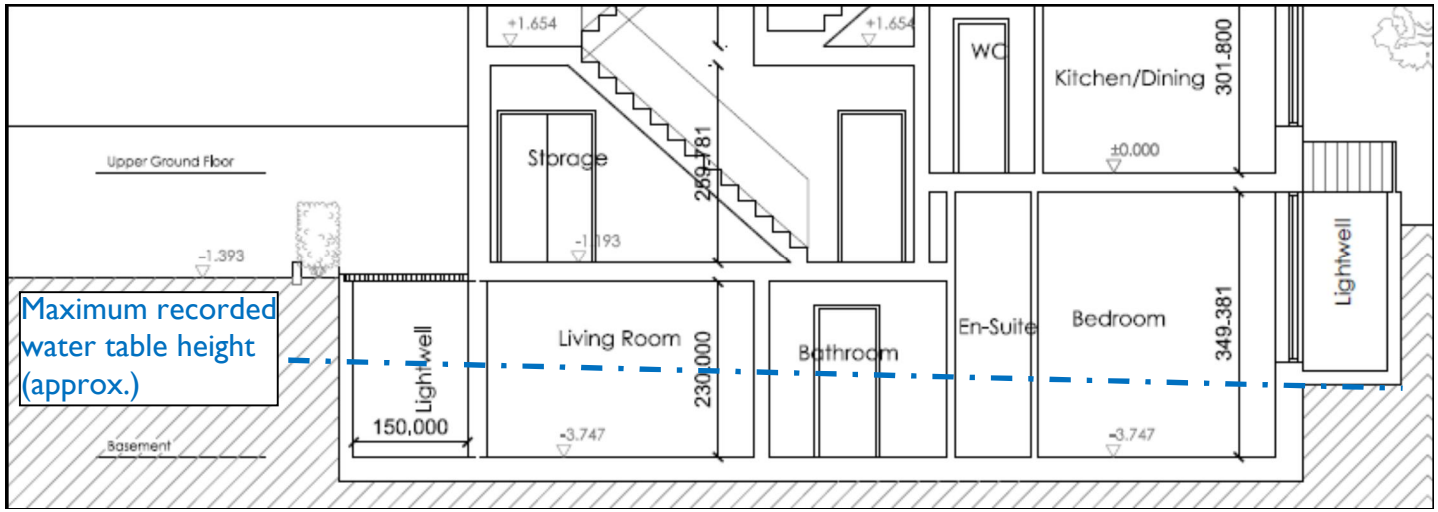


Figure number
3a & 3b

Project
163 Sumatra Road, London NW6 1PN

Client
Drawing and Planning Limited

Title
Proposed Basement Plan and Section

Date
August 2015

Job Number
13291

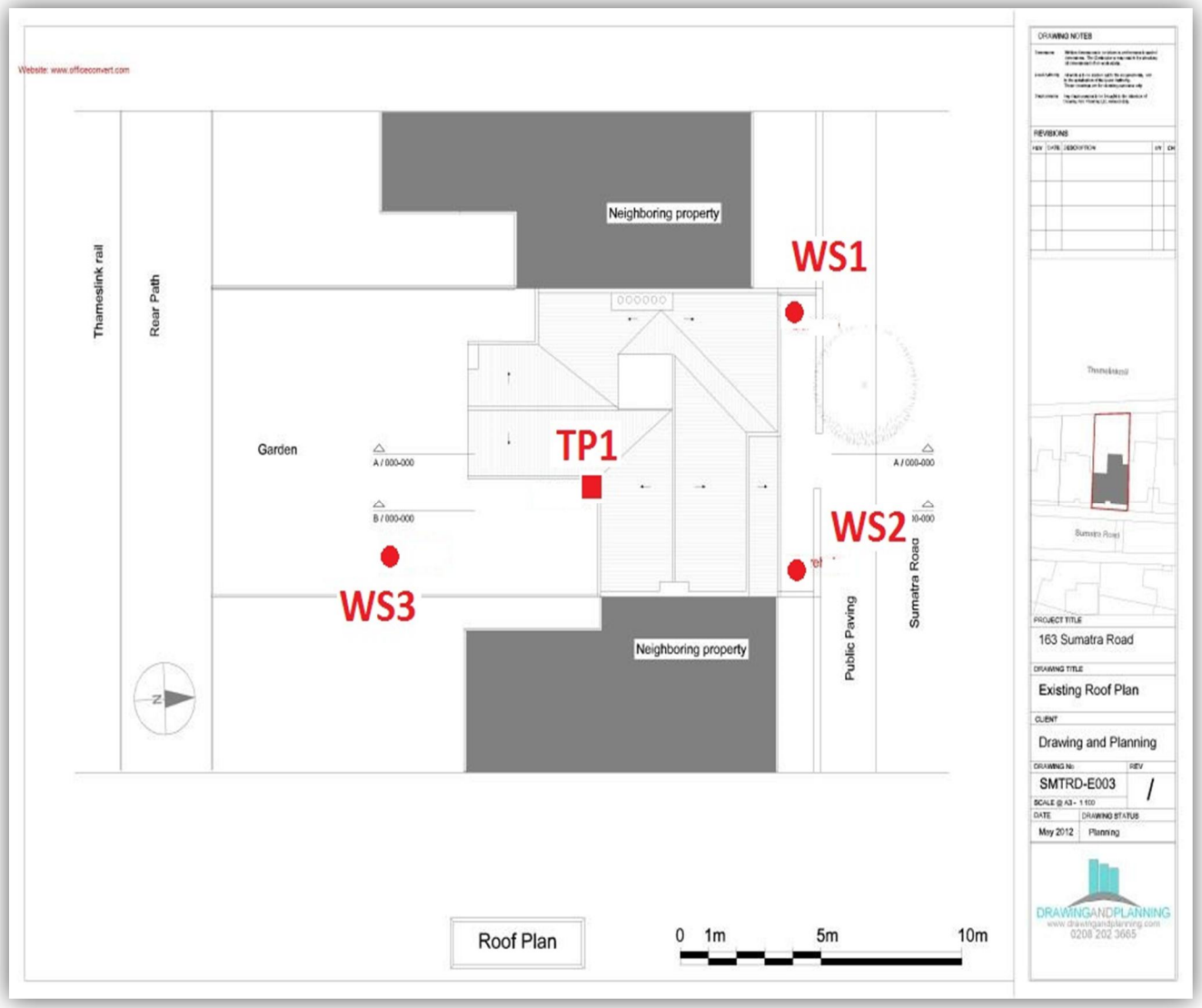


Figure number
4

Project
163 Sumatra Road, London NW6 1PN

Client
Drawing and Planning Limited

Title
Trial Hole Location Map

Date
August 2015

Job Number
13291

Appendix A Field Work

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557

WS: WS 1

Site:	163 Sumatra Road, London NW6 1PN	Start Date: 01/11/2012	Ground Level: -
Client:	Drawing and Planning Limited	End Date: 01/11/2012	Easting: -
Project No:	13291	Logged By: GJ	Northing: -
Site National Grid Reference:		Excavation Method:	
Site Level (mOD):	0.000	Plant: Premier Rig	
		Shoring/Support: None	
		Trial Pit Length: -	Trial Pit Width: -

Samples & Tests				Strata Details				
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth	Thick	Description
0.20 - 0.20	D					0.06	0.06	CONCRETE
							0.55	MADE GROUND Dark brown sandy silt with brick gravel and roots
0.70 - 0.70	D					0.60		
							0.50	MADE GROUND Orange brown and dark brown silty clay with brick, ash, gravel and roots
1.20 - 1.20	D		500.0			1.10		
								Orange brown stiff silty CLAY with roots occasional fine to medium sub-rounded gravel from 3.40-3.90m bgl
1.70 - 1.70	D		400.0					
2.20 - 2.20	D		250.0					
							2.80	
2.70 - 2.70	D		250.0					
3.20 - 3.20	D		250.0					
3.70 - 3.70	D		200.0					
						3.90		
4.20 - 4.50	D		325.0					Firm orange brown grey mottled silty CLAY
							1.10	
4.70 - 5.00	D		300.0					
						5.00		End of Borehole at 5.00 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptioins are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations:

Dry

Stability:

Stable

General Remarks:

Roots observed to 2.10m bgl. Well installed to 5.00m bgl

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557

WS: WS 2

Site:	163 Sumatra Road, London NW6 1PN	Start Date: 01/11/2012	Ground Level: -
Client:	Drawing and Planning Limited	End Date: 01/11/2012	Easting: -
Project No:	13291	Logged By: GJ	Northing: -
Site National Grid Reference:		Excavation Method:	
Site Level (mOD):	0.000	Plant: Premier Rig	
		Shoring/Support: None	
		Trial Pit Length: -	Trial Pit Width: -

Samples & Tests

Depth	Type	Result	Hand Pen.
0.20 - 0.20	D		
0.70 - 0.70	D		
1.00 - 1.00	D		150.0
1.50 - 1.50	D		125.0
2.00 - 2.00	D		175.0
2.50 - 2.50	D		175.0
3.00 - 3.00	D		200.0
3.50 - 3.50	D		225.0
3.70 - 3.70	D		
4.20 - 4.50	D		
4.70 - 5.00	D		

Strata Details

Elev.	Legend	Depth	Thick	Description
		0.04	0.04	CONCRETE
		0.95	0.91	MADE GROUND Dark brown and brown sandy silty / silty clay with brick, concrete, ash and roots
		3.90	2.95	Orange brown and brown grey mottled silty CLAY with occasional dark brown flecks, roots and gravel from 3.60m bgl
		5.00	1.10	Orange brown and grey mottled silty CLAY
				End of Borehole at 5.00 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptioins are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations:

Dry

Stability:

Stable

General Remarks:

Roots observed to 1.50m bgl

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557

WS: WS 3

Site:	163 Sumatra Road, London NW6 1PN	Start Date: 01/11/2012	Ground Level: -
Client:	Drawing and Planning Limited	End Date: 01/11/2012	Easting: -
Project No:	13291	Logged By: GJ	Northing: -
Site National Grid Reference:		Excavation Method:	
Site Level (mOD):	0.000	Plant: Premier Rig	
		Shoring/Support: None	
		Trial Pit Length: -	Trial Pit Width: -

Samples & Tests

Strata Details

Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth	Thick	Description
0.20 - 0.20	D					0.60	0.60	MADE GROUND Dark brown sandy silt with brick, ash and gravel
0.70 - 0.70	D					1.10	0.50	Orange brown sandy silty CLAY
1.20 - 1.20	D		150.0					Orange brown and grey mottled occasional dark brown fleck silty CLAY
1.70 - 1.70	D		200.0					
2.20 - 2.20	D		250.0			2.70	1.60	
2.70 - 2.70	D		250.0					Firm orange brown and grey mottled silty CLAY with occasional selenite from 4.20m bgl
3.20 - 3.20	D		275.0					
3.70 - 3.70	D		300.0					
4.20 - 4.50	D		350.0			5.00	2.30	
4.70 - 5.00	D		300.0					End of Borehole at 5.00 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptioins are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

Groundwater Observations:

Dry

Stability:

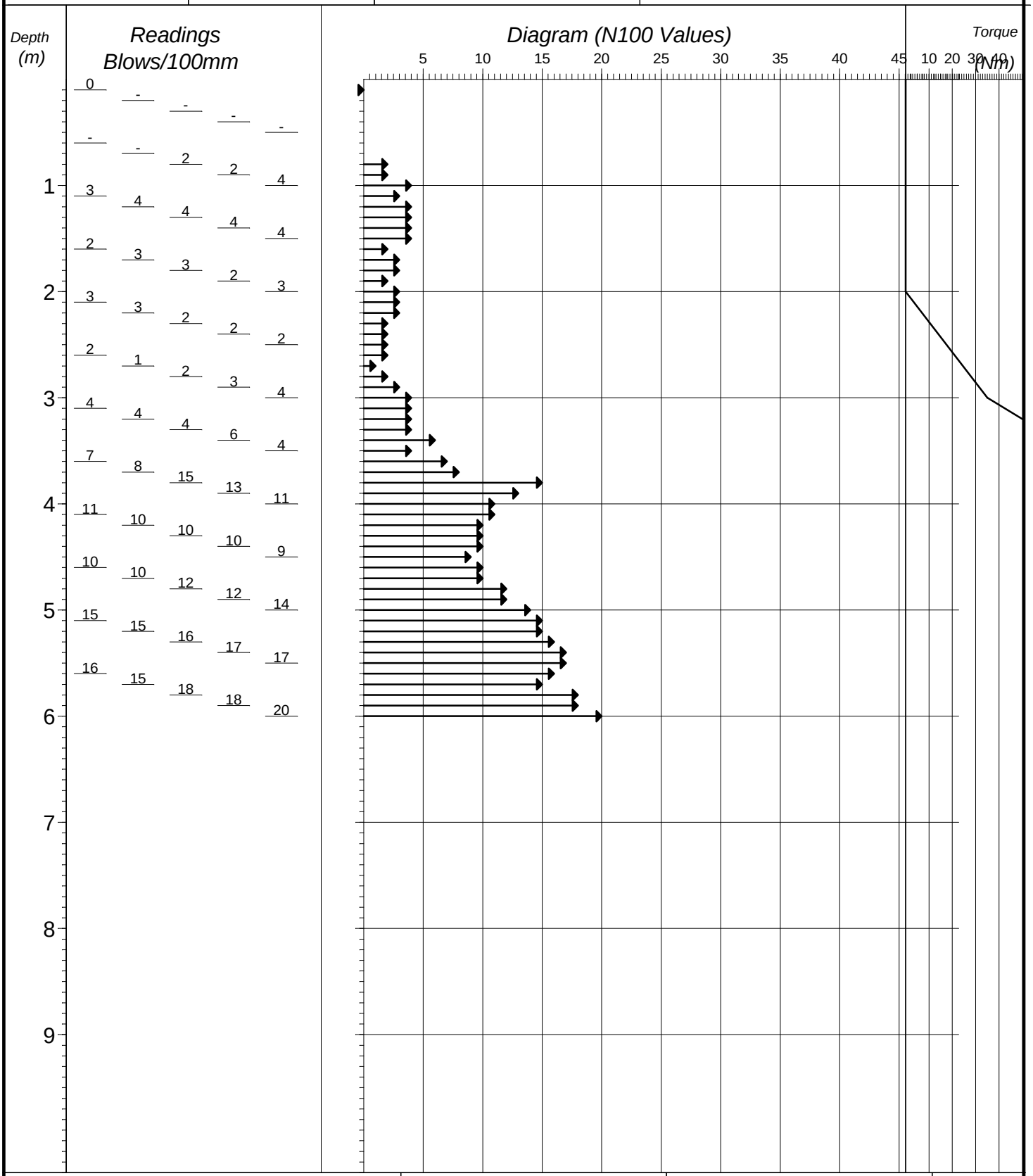
Stable

General Remarks:

No roots observed. Well installed to 5.00m bgl

DYNAMIC PROBING

Probe No **DP 1**	
Client **Drawing and Planning Limited**	Sheet 1 of 1
Site **Sumatra Road**	Location No **13291**
E -	N -	Level -	Date **01/11/2012**



Fall Height	**750**	Cone Diameter	**50**
Hammer Wt	**63.50**	Final Depth	**5.900**
Probe Type	**DPSH**	Log Scale	1:50

Logger **Soils**

Soils Limited
Newton House
Cross Road
Tadworth KT20 5SR
Tel: 01737 814221 Fax: 01737 812557

Trial Pit: TP 1

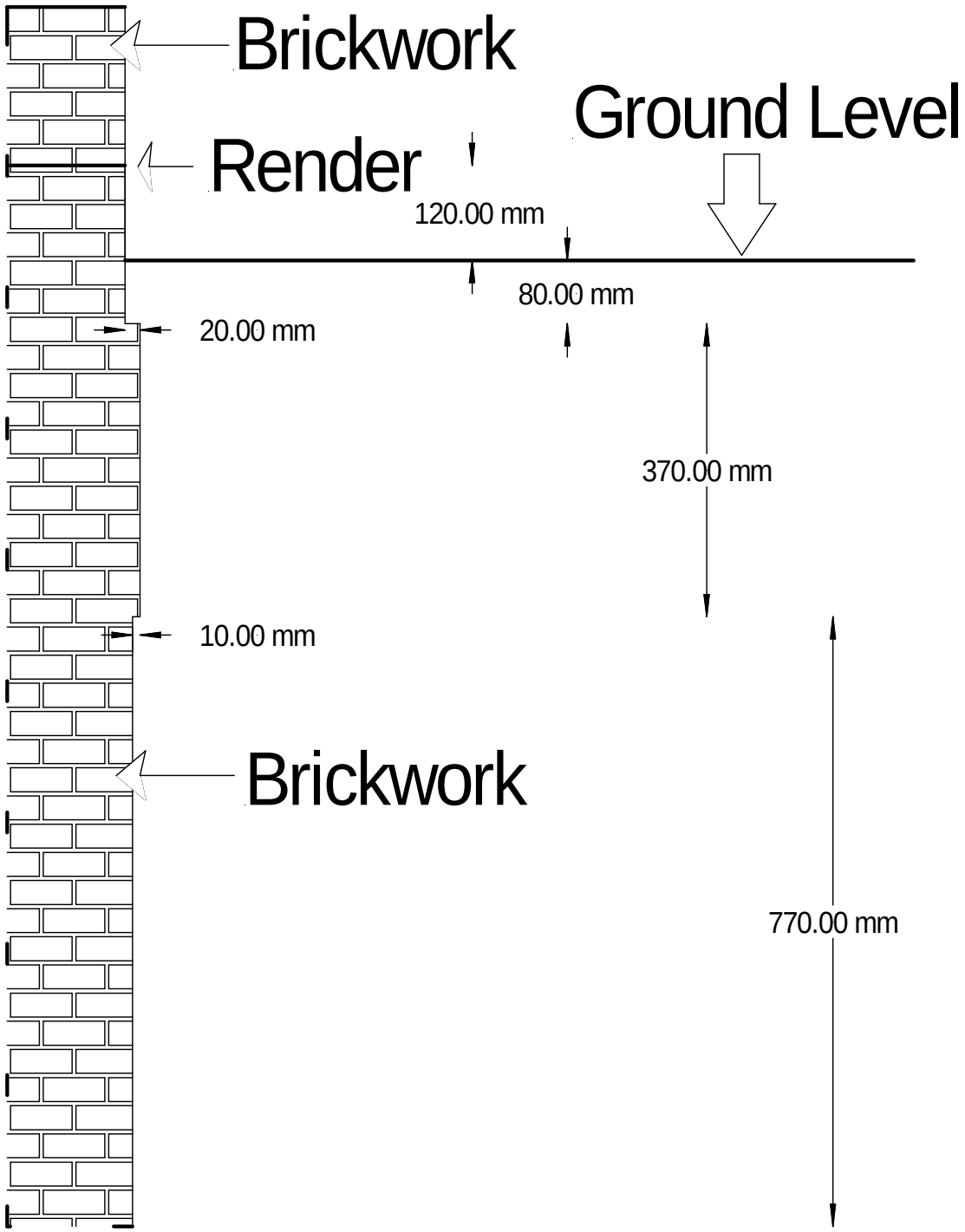
Site:	163 Sumatra Road, London NW6 1PN	Start Date: 01/11/2012	Ground Level: -
Client:	Drawing and Planning Limited	End Date: 01/11/2012	Easting: -
Project No:	13291	Logged By: GJ	Northing: -
Site National Grid Reference:		Excavation Method:	
Site Level (mOD):	0.000	Plant:	
		Shoring/Support: None	
		Trial Pit Length: -	Trial Pit Width: -

Samples & Tests				Strata Details			
Depth	Type	Result	Hand Pen.	Elev.	Legend	Depth (Thick)	Description
						0.06 (0.06)	CONCRETE
						0.18 (0.12)	MADE GROUND Brick rubble
						1.04	MADE GROUND Brown to dark brown sandy silty clay with brick, gravel, ash and old drain fragments
1.00 -	D						
						1.22	End of Trial Pit at 1.22 m

General Notes:

1. All linear dimensions are in metres unless otherwise stated
2. All relative density/shear strength descriptioins are based only on field observations and available in-situ test data.
3. Trial pit logged from the ground surface below 1.2 m depth.

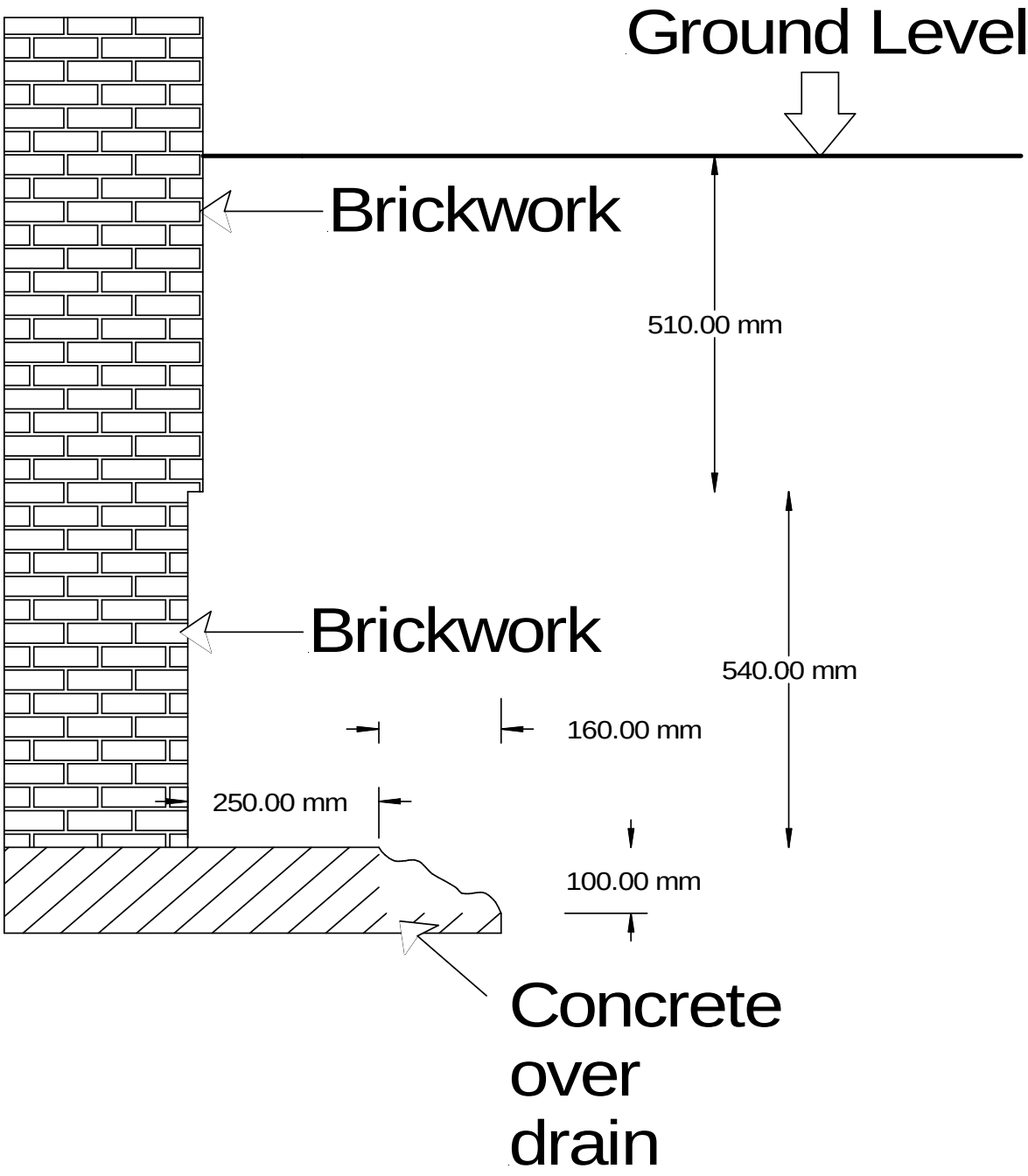
Groundwater Observations:	Stability:	General Remarks:
Dry	Stable	No roots observed



Project: **163 Sumatra Road, London, NW6 1PN**	**Fig No. 3**
Client **Drawing and Planning Limited**	Date: **December 2012**
Foundation Exposure Section TP1A	Ref: **J13291**

soils LIMITED

Geotechnical & Environmental Consultants



Project: **163 Sumatra Road, London, NW6 1PN**	**Fig No. 4**
Client **Drawing and Planning Limited**	Date: **December 2012**
Foundation Exposure Section TP1B	Ref: **J13291**

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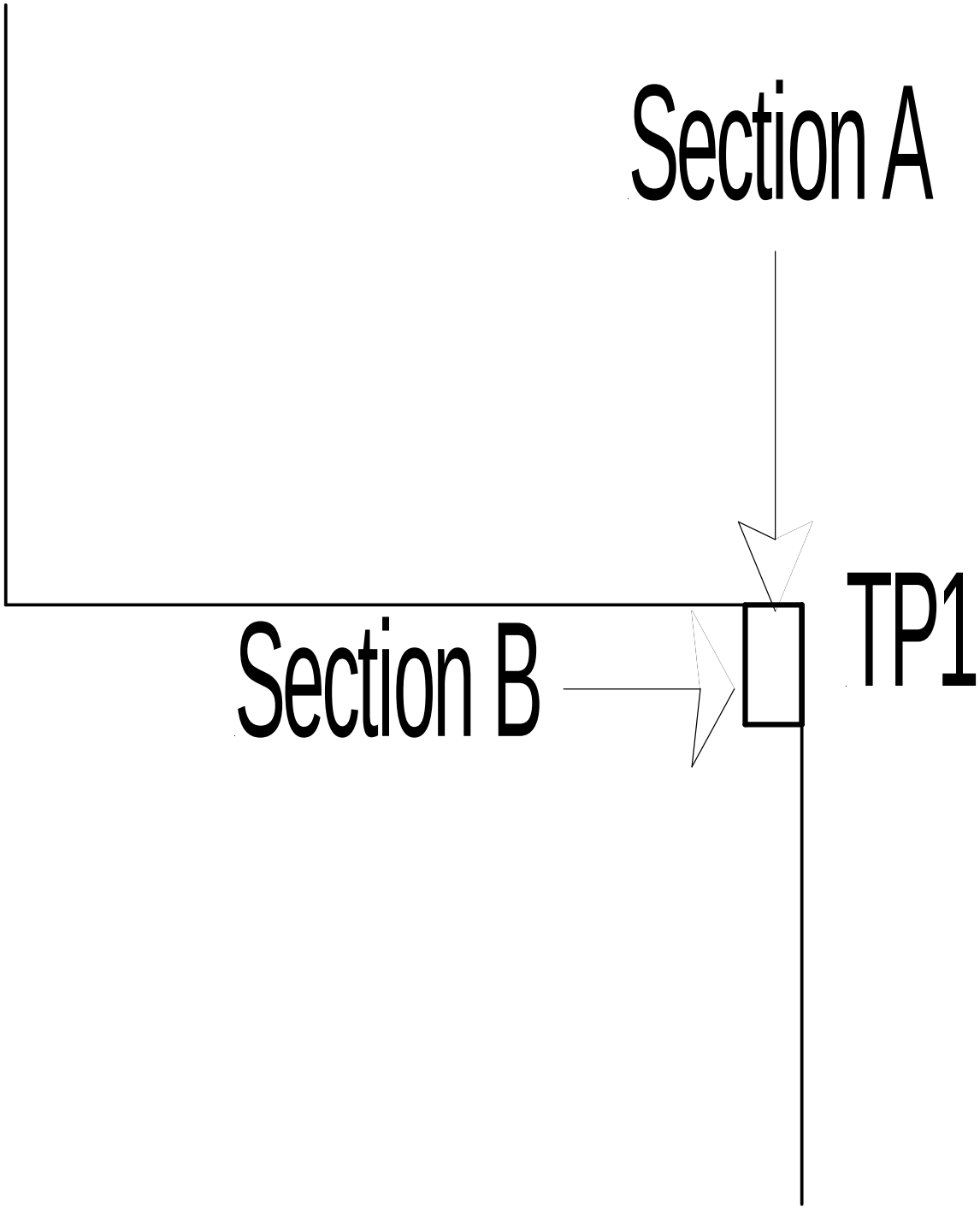


Project: **163 Sumatra Road, London, NW6 1PN**	**Fig No. 5**
Client **Drawing and Planning Limited**	Date: **December 2012**
Foundation Exposure Plan TP1	Ref: **J13291**

soils LIMITED

Geotechnical & Environmental Consultants

Appendix B Geotechnical Laboratory Results

Project Name:	Sumatra Road			**Samples Received:**	08/11/2012
				Project Started:	09/11/2012
Client:	Soils Ltd			**Testing Started:**	27/11/2012
Project No:	J13291	**Our job/report no:**	13642	**Date Reported:**	28/11/2012

K4 SOILS

Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
WS1	D	2.20	Dark brown and occasional grey CLAY	27	65	24	41	100	CH
WS2	D	2.50	Dark brown and occasional grey CLAY	35	77	29	48	100	CV
WS3	D	1.70	Dark brown CLAY	27	60	23	37	100	CH
WS3	D	2.20	Dark brown CLAY	27	66	27	39	100	CH
WS3	D	2.70	Dark brown and occasional brown and grey CLAY	31	72	27	45	100	CV

UKAS TESTING 2519

Summary of Test Results

BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method.

BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index.

BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.

Checked and Approved

Initials: K.P

Date: 28/11/2012

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Nikos Sidiropoulos
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 851105
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 12-11705

Site Reference:	Sumatra Road
Project / Job Ref:	J13291
Order No:	None Supplied
Sample Receipt Date:	09/11/2012
Sample Scheduled Date:	09/11/2012
Report Issue Number:	1
Reporting Date:	15/11/2012

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 851105

4480

Soil Analysis Certificate						
QTS Environmental Report No: 12-11705	**Date Sampled**	01/11/12	01/11/12			
Soils Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: Sumatra Road	**TP / BH No**	WS1	WS3			
Project / Job Ref: J13291	**Additional Refs**	None Supplied	None Supplied			
Order No: None Supplied	**Depth (m)**	2.70	3.20			
Reporting Date: 15/11/2012	**QTSE Sample No**	55349	55350			

Determinand	Unit	MDL	Accreditation					
pH	pH Units	N / a	MCERTS	8.1	8.2			
Total Sulphate as SO_4	mg/kg	< 200	NONE	403	508			
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	NONE	0.09	0.13			
Total Sulphur	mg/kg	< 200	NONE	< 200	< 200			
Ammonium as NH_4	mg/kg	< 0.5	NONE	1.1	1.3			
W/S Chloride (2:1)	mg/kg	< 10	NONE	13	11			
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 4	NONE	< 4	< 4			
W/S Magnesium	mg/kg	< 10	NONE	57	77			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C
Analysis carried out on the dried sample is corrected for the stone content
Stone content is classified as material greater than 10mm in diameter
Subcontracted analysis $^{(S)}$

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 851105

4480

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 12-11705	
Soils Ltd	
Site Reference: Sumatra Road	
Project / Job Ref: J13291	
Order No: None Supplied	
Reporting Date: 15/11/2012	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
55349	WS1	None Supplied	2.70	19.8	Brown clay
55350	WS3	None Supplied	3.20	16.6	Brown clay

Insufficient sample I/S
Unsuitable Sample U/S

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 851105

4480

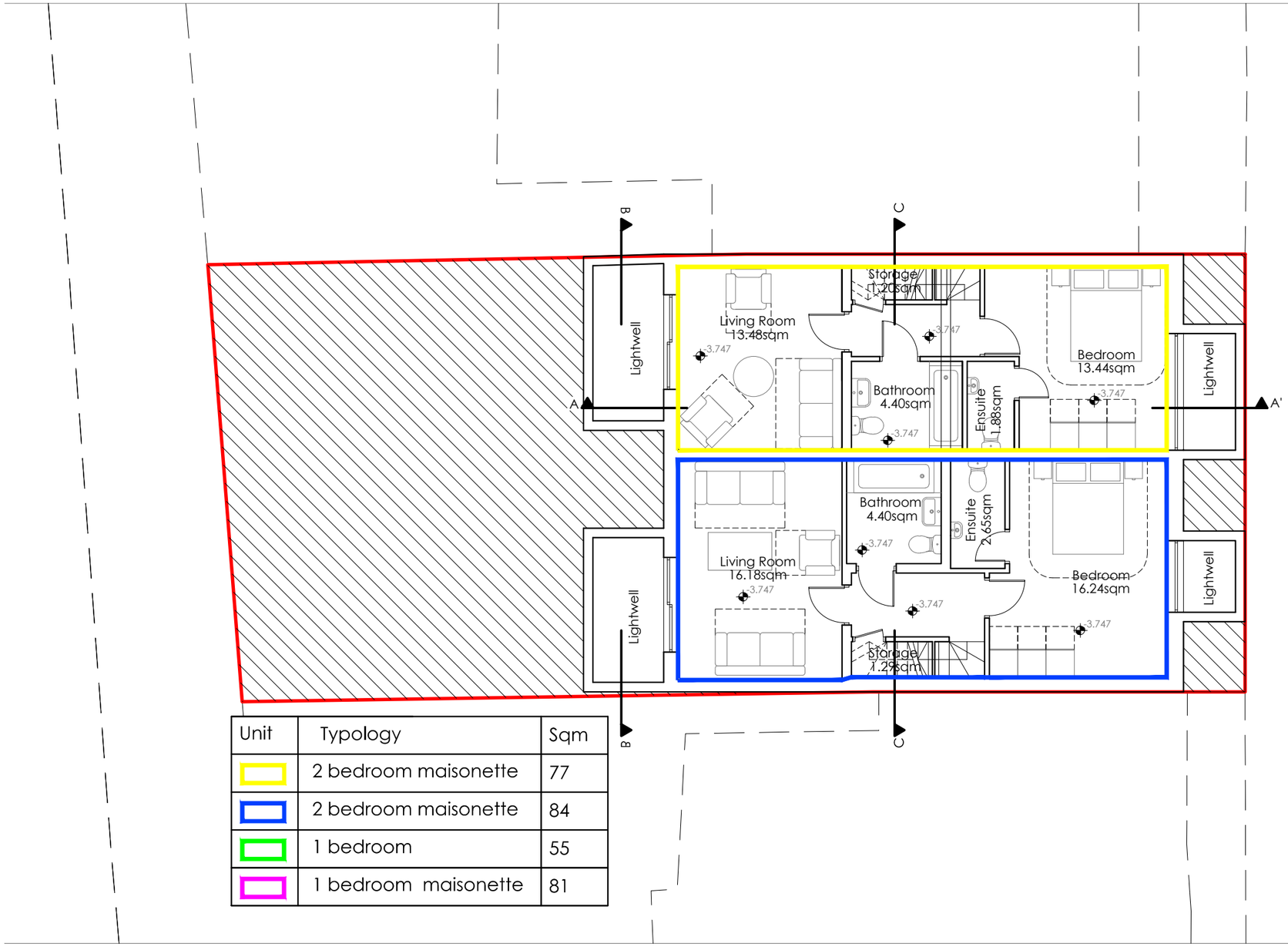
Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 12-11705
Soils Ltd
Site Reference: Sumatra Road
Project / Job Ref: J13291
Order No: None Supplied
Reporting Date: 15/11/2012

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	AR	Asbestos Screening	Visual screening of samples for fibrous material	E024
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E021
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by turbidimeter	E020
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E023
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	D	Loss on Ignition @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	D	Phosphorus	Determination of phosphorus by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	AR	Sulphide	Determination of sulphide by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia, potassium iodide/iodate followed by ICP-OES	E002
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E009
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E009
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E010
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E009
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001
Soil	AR	EPH TEXAS	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	TPH CWG	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	EPH (with florisil cleanup)	Determination of acetone/hexane extractable hydrocarbons with florisil cleanup step by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001

Key

D Dried
AR As Received

Appendix C Information Provided by the Client



Unit	Typology	Sqm
	2 bedroom maisonette	77
	2 bedroom maisonette	84
	1 bedroom	55
	1 bedroom maisonette	81

N

Basement Plan

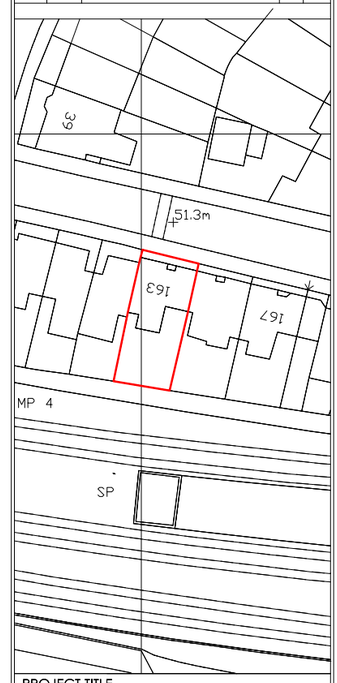
0 1m 5m 10m

DRAWING NOTES

Dimensions	Written dimensions to be taken in preferences to scaled dimensions. The Contractor is responsible for checking all dimensions before work starts.
Local Authority	All work is to be carried out to the requirements, and to the satisfaction of the Local Authority. These drawings are for planning purposes only
Discrepancies	Any discrepancies to be brought to the attention of Drawing And Planning Ltd. immediately.

REVISIONS

REV	DATE	DESCRIPTION	BY	CH
A	06/15	Reduction from 5 flats to 4 and internal alterations	CB FB	BL



PROJECT TITLE

163 Sumatra Road

DRAWING TITLE

Proposed Basement

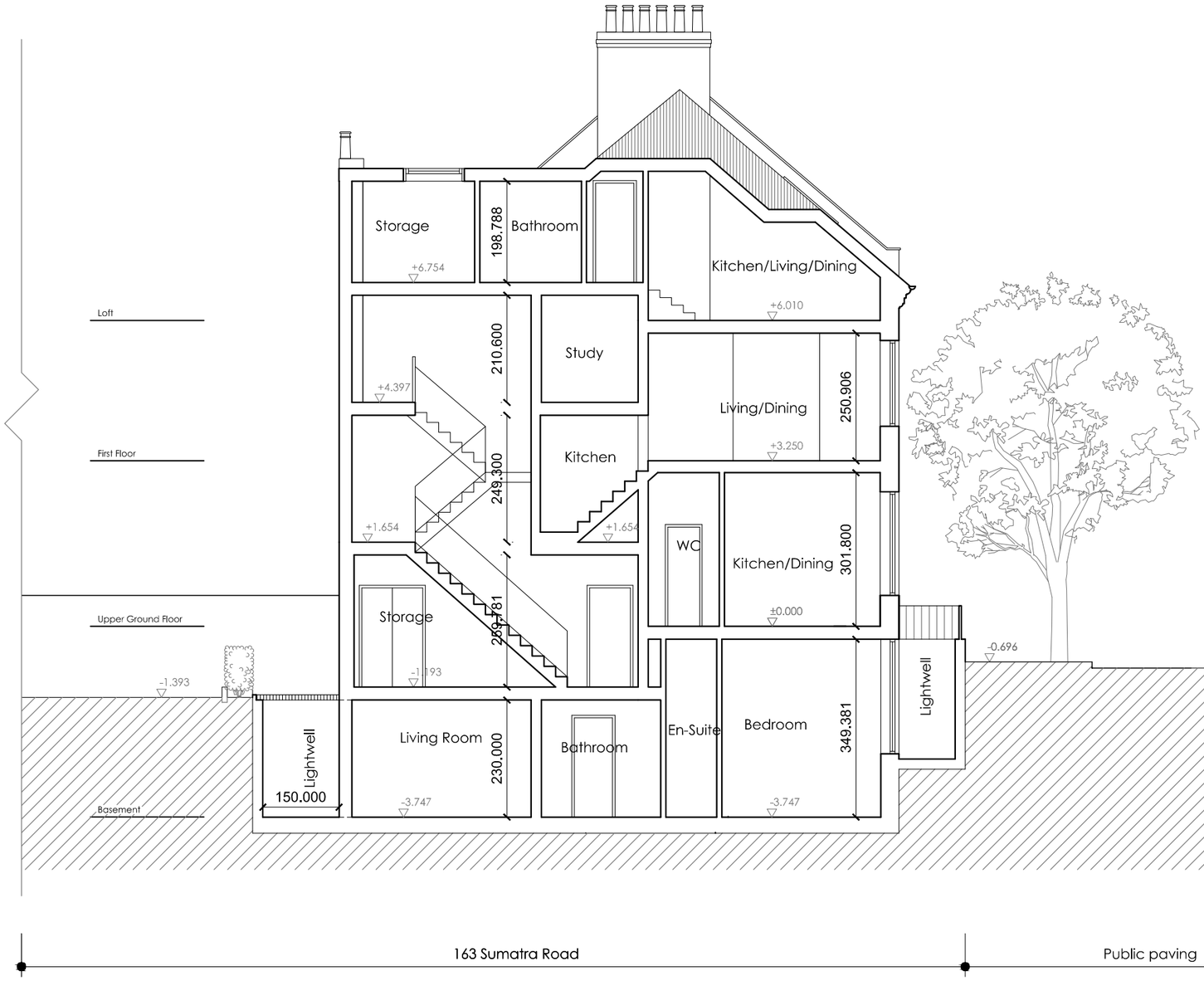
CLIENT

Jeremy Stein

DRAWING No	REV
SMTRD-P700	A
SCALE @ A3 - 1:100	

DATE	DRAWING STATUS
Jun 2015	Planning

DRAWINGANDPLANNING
www.drawingandplanning.com
0208 202 3665



Section AA

0 1m 5m 10m

DRAWING NOTES

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Local Authority	All work is to be carried out to the requirements, and to the satisfaction of the Local Authority. These drawings are for planning purposes only
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REVISIONS

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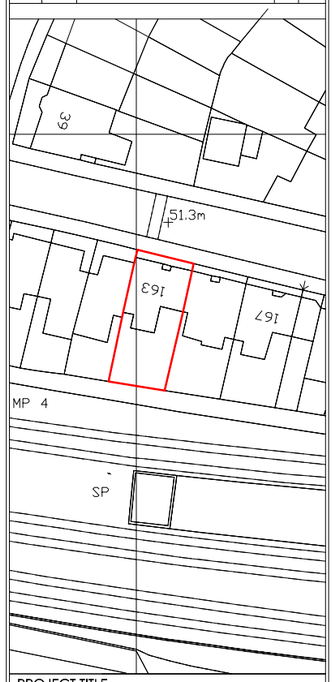

PROJECT TITLE

163 Sumatra Road

DRAWING TITLE

Proposed Section AA

CLIENT

Jeremy Stein

DRAWING No	REV
SMTRD-S701	A
SCALE @ A3 - 1:100	

DATE	DRAWING STATUS
Jun 2015	Planning

DRAWINGANDPLANNING
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