Desk Study and Ground Investigation Report

63 Frognal
Hampstead
London
NW3

Client Azmil Khalid and Fuziah Hussein

Engineer Conisbee

J12288

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Geotechnical & Environmental Associates

Document Control

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Report prepared by	Hannah Dashfield BEng FGS		
With input from	pp Martin Cooper BEng CEng MICE FGS	John Evans MSc FGS CGeol	
Report checked and approved for issue by	pp Steve Branch BSc MSc CGeol FGS FRGS MIEnvSc		

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This report has been issued by the GEA office indicated below. Any enquiries regarding the report should be directed to the office indicated or to Steve Branch in our Herts office.

✓	Hertfordshire	tel 01727 824666	mail@gea-ltd.co.uk
☐	Nottinghamshire	tel 01509 674888	midlands@gea-ltd.co.uk

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EXECUTIVE SUMMARY

This executive summary contains an overview of the key findings and conclusions. No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information that puts into context the findings that are summarised in the executive summary.

BRIEF

This report describes the findings of a site investigation carried out by Geotechnical and Environmental Associates Limited (GEA), on the instructions of Conisbee, on behalf of Azmil Khalid and Fuziah Hussein, with respect to the construction of a single level basement beneath the entire footprint of the existing house and rear garden, extending to a depth of approximately 4.5 m below existing ground floor level. The purpose of the investigation has been to research the history of the site with respect to possible contaminative uses, to determine the ground conditions and hydrogeology, to investigate the existing foundations, to assess the extent of any contamination and to provide information to assist with the design of suitable foundations and retaining walls. The report also includes information required to comply with the London Borough of Camden (LBC) Planning Guidance CPG4, relating to the requirement for a Basement Impact Assessment (BIA).

DESK STUDY FINDINGS

The historical map searches have indicated that Frognal was laid out by 1850, the date of the earliest map studied. On the next map studied, dated 1871, the site is shown and appears to be undeveloped and comprised open fields with a few trees. The site was first developed at some time between 1934 and 1954 with what appears to be the existing house and garage, and during this period the houses to the north and south of the site were constructed.

GROUND CONDITIONS

The investigation has confirmed the expected ground conditions in that, below a moderate thickness of made ground, extending to depths of between 0.15 m and 1.50 m, the Claygate Member was encountered overlying the London Clay, which was proved to the full depth investigated. The Claygate Member initially comprised soft becoming firm brown mottled grey silty sandy clay with rare carbonaceous material, which extended to depths of between 3.50 m (92.90 m OD) and 4.50 m (92.95 m OD). Below this depth, firm brownish grey silty sandy clay with occasional partings of orange-brown silt and fine sand was encountered, which extended to depths of between 4.00 m (92.40 m OD) and 5.00 m (92.72 m OD), and was in turn underlain by stiff dark grey silty sandy clay, which became less sandy with depth and extended to depths of between 8.00 m (89.68 m OD) and 9.00 m (87.40 m OD). The London Clay comprised stiff becoming very stiff dark grey fissured silty clay, with rare partings of grey silt and fine sand, and was proved to the maximum depth investigated of 20.00 m. Shallow groundwater was encountered during the investigation from within the silt and sand partings of the Claygate Member at depths of between 0.25 m and 1.70 m and was found as perched water around the existing foundations at depths of 1.20 m and 1.50 m.

The trial pits have indicated that the footings of the existing house comprise brick corbels over concrete founded at depths of between 0.81 m and 1.54 m, bearing on firm brown mottled grey silty sandy clay. Probing with a 'Hilti' drill found the concrete toe of the retaining wall to be 500 mm thick.

Contamination testing has revealed elevated concentrations of lead, total PAH including benzo(a)pyrene in a single sample of made ground tested.

RECOMMENDATIONS

Formation level of the basement will be within the Claygate Member. On the basis of the investigation, some form of groundwater control will be required for basement excavation. It is understood that the preferred method is to use sheet piles as a permanent retaining wall, which is a suitable option although silent and vibration free installation methods may need to be adopted. Excavations for the proposed basement structure will require temporary support to maintain stability of the excavation and surrounding structures at all times. The existing foundations will need to be underpinned prior to construction of the proposed new basement or will need to be supported by new retaining walls. The made ground will be removed by the basement construction and there will therefore be no risk to end users unless any of the excavated material is to be re-used in a reinstated garden above the basement. If this is proposed there is likely to be a requirement for testing of the retained soil. The BIA has not indicated any concerns with regard to the effects of the proposed basement on the site and surrounding area.

Part 1: INVESTIGATION REPORT

This section of the report details the objectives of the investigation, the work that has been carried out to meet these objectives and the results of the investigation. Interpretation of the findings is presented in Part 2.

1.0 INTRODUCTION

Geotechnical and Environmental Associates (GEA) has been commissioned by Conisbee, on behalf of Azmil Khalid and Fuziah Hussein to carry out a desk study and ground investigation at 63 Frognal, Hampstead, London, NW3 6XD. This report also includes a Basement Impact Assessment (BIA), which has been carried out in support of a planning application.

1.1 Proposed Development

It is proposed to construct a single level basement beneath the footprint of the entire house and into the rear garden. The basement will extend to a depth of approximately 4.5 m below existing ground floor level.

This report is specific to the proposed development and the advice herein should be reviewed if the proposals are amended.

1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows:

- to check the history of the site and surrounding areas with respect to previous contaminative uses;
- to determine the ground conditions and their engineering properties;
- to investigate the configuration of existing foundations and retaining walls;
- to assess the possible impact of the proposed development on the local hydrogeology;
- to provide advice with respect to the design of suitable foundations and retaining walls;
- to provide an indication of the degree of soil contamination present; and
- to assess the risk that any such contamination may pose to the proposed development, its users or the wider environment.

1.3 Scope of Work

In order to meet the above objectives, a desk study was carried out, followed by a ground investigation. The desk study comprised:

- a review of readily available geological and hydrogeological maps;
- a review of historical Ordnance Survey (OS) maps and environmental searches sourced from the Envirocheck database; and
- a walkover survey of the site carried out in conjunction with the fieldwork.

In light of the desk study, an intrusive ground investigation was carried out which comprised, in summary, the following activities:

- three cable percussion boreholes, advanced to depths of 10.0 m, 15.0 m and 20.0 m, by means of a dismantlable cable percussion drilling rig;
- standard penetration tests (SPTs), carried out at regular intervals in the boreholes, to provide quantitative data on the strength of the soils;
- four drive-in window sampler boreholes advanced to a maximum depth of 5.50 m;
- the installation of three groundwater monitoring standpipes and six subsequent monitoring visits over a period of roughly five weeks;
- rising head tests carried out in two of the standpipes to provide preliminary information on the groundwater inflows that may be encountered during basement excavation;
- seven trial pits excavated by hand to depths of between 0.20 m and 1.65 m to investigate the existing foundations;
- laboratory testing of selected soil samples for geotechnical purposes and for the presence of contamination; and
- provision of a report presenting and interpreting the above data, together with our advice and recommendations with respect to the proposed development.

The report includes a contaminated land assessment which has been undertaken in accordance with the methodology presented in Contaminated Land Report (CLR) 11[1] and involves identifying, making decisions on, and taking appropriate action to deal with, land contamination in a way that is consistent with government policies and legislation within the United Kingdom. The risk assessment is thus divided into three stages comprising Preliminary Risk Assessment, Generic Quantitative Risk Assessment, and Site-Specific Risk Assessment.

1.3.1 Basement Impact Assessment (BIA)

The work carried out also includes a Hydrogeological Assessment and Land Stability Assessment (also referred to as Slope Stability Assessment), all of which form part of the BIA procedure specified in the London Borough of Camden (LBC) Planning Guidance CPG4[2] and their Guidance for Subterranean Development[3] prepared by Arup. The aim of the work is to provide information on land stability and in particular to assess whether the development will affect the stability of neighbouring properties and whether any identified impacts can be appropriately mitigated by the design of the development.

1.4 Qualifications

The land stability element of the Basement Impact Assessment (BIA) has been carried out by Martin Cooper, a BEng in Civil Engineering, a chartered engineer (CEng), member of the Institution of Civil Engineers (MICE), and Fellow of the Geological Society (FGS) who has

1 *Model Procedures for the Management of Land Contamination* issued jointly by the Environment Agency and the Department for Environment, Food and Rural Affairs (DEFRA) Sept 2004
2 London Borough of Camden Planning Guidance CPG4 *Basements and lightwells*
3 Ove Arup & Partners (2010) *Camden geological, hydrogeological and hydrological study. Guidance for Subterranean Development.* For London Borough of Camden November 2010

over 20 years specialist experience in ground engineering. The subterranean (groundwater) flow assessment has been carried out by John Evans, MSc in Hydrogeology, Chartered Geologist (CGeol) and Fellow of the Geological Society of London (FGS). The assessments have been made in conjunction with Steve Branch, a BSc in Engineering Geology and Geotechnics, MSc in Geotechnical Engineering, a chartered geologist (CGeol) and Fellow of the Geological Society (FGS) with 25 years' experience in geotechnical engineering and engineering geology. All assessors meet the Geotechnical Adviser criteria of the Site Investigation Steering Group and satisfy the qualification requirements of the Council guidance.

The surface water and flooding element of the BIA is provided for guidance only and should be confirmed by a suitably qualified engineer experienced in carrying out surface water assessments.

1.5 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or groundwater samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

2.0 THE SITE

2.1 Site Description

The site is located in the London Borough of Camden, in a residential area, approximately 250 m to the southwest of Hampstead London Underground Station. It is roughly rectangular in shape, measuring 25 m by 30 m and fronts onto Frognal to the east. The site is bordered to the north and south by two-storey detached houses and to the west by the rear gardens of properties that front onto Chesterford Gardens. The site may be additionally located by National Grid Reference 526050, 185600 and is shown on the map below.

The site is currently occupied by a two-storey detached L-shaped brick house with a single storey detached garage with drive to the south of the house. The front garden is essentially laid to lawn and the rear garden comprises a patio area with steps leading up to a central lawn with shrub borders. A 5 m high ornamental tree is present in the rear garden to the northwest of the house.

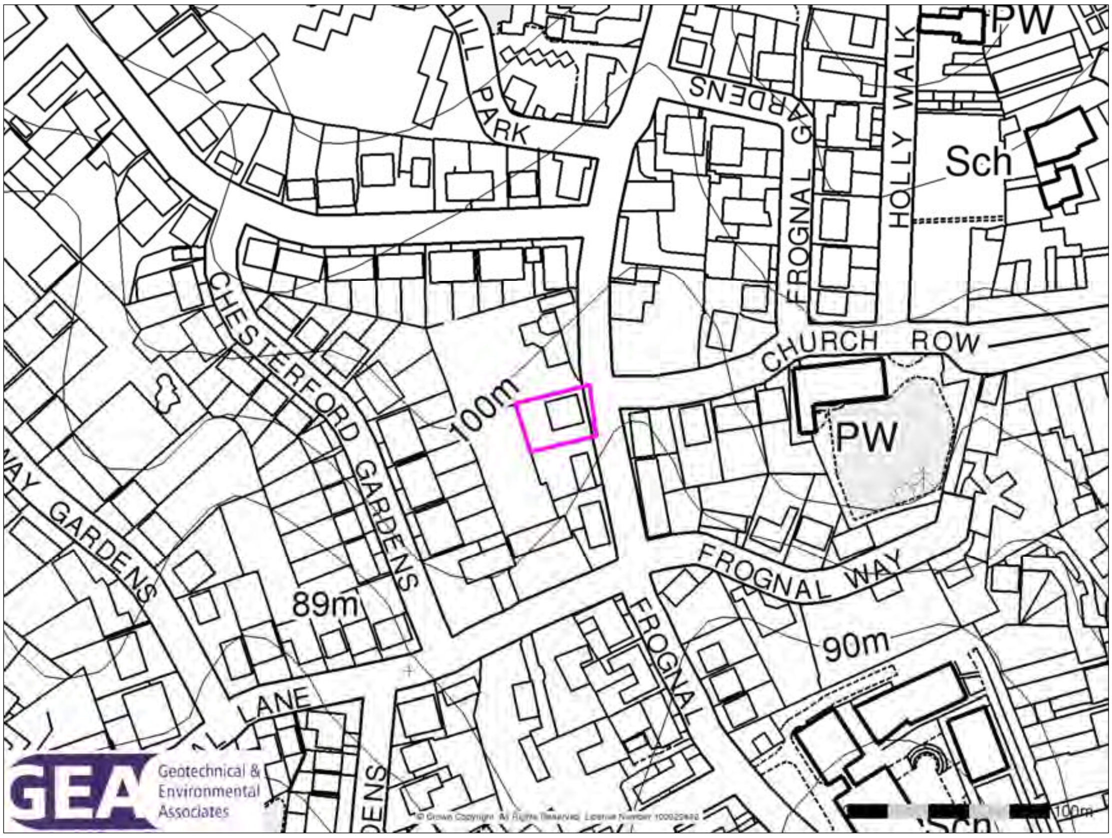
A number of photographs of the site are provided below.

Eastern elevation

Western elevation

Rear garden, looking northwest

The local topography slopes down towards the south, such that the property to the north is located on higher ground and the property to the south is located at a lower elevation. The site itself is on a number of different levels to accommodate the natural slope of the ground but is essentially on a level plot at an elevation of approximately 97 m OD.



Numerous trees are present outside the site along the northern, southern and western perimeters. Two lime trees, 5.0 m and 20.0 m in height, are present on the pavement along Frognal.

2.2 Site History

The history of the site and surrounding area has been researched by reference to historical Ordnance Survey (OS) maps sourced from the Envirocheck database.

The historical map searches have indicated that Frognal was laid out by 1850, the date of the earliest map studied. On the next map studied, dated 1871, the site is shown and appears to be undeveloped and comprised open fields with a few trees. Tributaries of the River Westbourne are shown on this map issuing from ponds, located roughly 150 m to the southwest and approximately 120 m to the southeast of the site. Both ponds are located near the Claygate Member / London Clay boundary and flowed in a southerly direction. The streams are not shown on maps after 1879 so presumably had been culverted or diverted into sewers.

On the 1895 map, the site is shows as undeveloped but a building had been constructed on the neighbouring sites along the southern and western boundaries at some time between 1879 and 1895. The building along the southern boundary was removed at some time between 1915 and 1934. The ponds to the southeast and southwest are not shown on the map dated 1934 and have been presumably infilled and subsequently built on.

On the 1934 map, features that could be interpreted as a pond fed by a steam are shown on the neighbouring site to the north. The site was first developed at some time between 1934 and 1954 with what appears to be the existing house and garage and during this period the houses to the north and south of the site were constructed. It appears that the house to the north of the site was constructed over the pond like feature. The building along the western boundary of the site was demolished at some time between 1970 and 1974. The site has remained essentially unchanged to the present day.

2.3 Other Information

A search of public registers and databases has been made via the Envirocheck database and relevant extracts from the search are appended. Full results of the search can be provided if required.

The desk study research has indicated that there are no registered landfills, historic landfills, registered waste transfer sites or waste management facilities within 500 m of the site and there have been no pollution incidents to controlled waters within 1 km of the site.

The search has indicated that the site is located in an area where less than 1% of homes are affected by radon emissions; which is the lowest classification given by the Health Protection Agency (HPA) and therefore no radon protective measures will be necessary.

The site is not located within a nitrate vulnerable zone or any other sensitive land use.

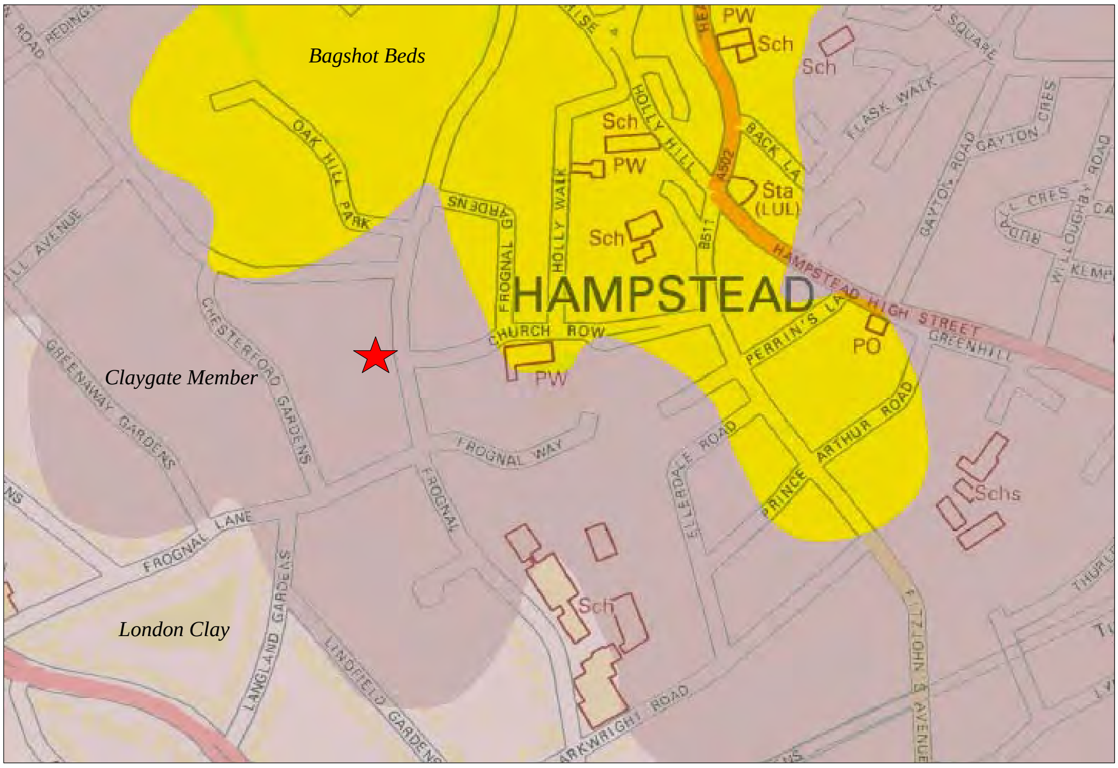
2.4 Geology

The British Geological Survey (BGS) map of the area (Sheet 256) indicates the site to be underlain by the Claygate Member overlying the London Clay.

The boundary between the Bagshot Formation and the underlying Claygate Member is located 100 m to the north of the site and the boundary between the Claygate Member and London Clay is located 300 m to the southwest of the site.

The geology in this area is generally horizontally bedded such that the boundary between the geological formations roughly follows the ground surface contour lines.

Our archives of nearby investigations indicate that the Bagshot Beds extends to a depth of approximately 106 m OD and the Claygate Member extends to a depth of roughly 90 m OD in this area.



2.5 Hydrology and Hydrogeology

The Claygate Member is classified by the Environment Agency as a Secondary 'A' Aquifer, defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers, however, this classification is based on the presence of saturated sand bed horizons within the Claygate Member. The London Clay is classified as 'Unproductive Strata', as defined by the Environment Agency as rock or drift deposits with low permeability that have negligible significance for water supply or river base flow.

There are no Environment Agency designated Source Protection Zones (SPZs) on the site. The nearest surface water feature is located 912 m northeast of the site and appears to be a pond.

The site lies outside the catchment of the Hampstead Heath chain of ponds.

Groundwater is likely to be present within the Claygate Member, and other investigations carried out around the area of Hampstead Heath indicate that spring lines, reflecting the presence of perched groundwater, are present at the interface of the Bagshot Beds and the Claygate Member, and at a lower level at the boundary between the Claygate Member and the underlying essentially impermeable London Clay. These springs have been the source of a number of London's "lost" rivers, notably the Fleet, Westbourne and Tyburn, which all rose on Hampstead Heath, to the south and southwest of the current site, at the base of the Bagshot Beds.

Historically two tributaries of the Westbourne River[4] issued from ponds located roughly 120 m southeast of the site and 150 m to the southwest of the site, both flowing in a roughly southerly

4 Nicholas Barton (2000) *London's Lost Rivers.* Historical Publications Ltd

direction. Today the Westbourne is entirely covered and culverted and forms part of the surface water sewerage system, running beneath South Hampstead to where it discharges into the Thames to the west of Chelsea Bridge.

Given the location of the headwaters of the Westbourne, it is likely that it was formed by springs issuing from within the interface of the Claygate Member and the underlying less permeable London Clay.

Groundwater within the silty sandy clays of the Claygate Member is considered to be dominated by fissure flow. The absence of any significant sand bed horizons reduces the water bearing potential of the Claygate Member to that similar to the underlying London Clay. Due to the very low permeability of the London Clay, any groundwater flow will be at very low rates. Published data for the permeability of the London Clay indicates the horizontal permeability to generally range between 1 x 10-10 m/s and 1 x 10-8 m/s, with an even lower vertical permeability. However, the Claygate Member is sandier in composition and permeability could be expected to be higher.

The direction of groundwater flow within the Claygate Member beneath the site is likely to be controlled by the local topography and therefore in a south and southwesterly direction.

The site is not at risk of flooding from rivers or sea, as defined by the Environment Agency; Frognal has not been identified as a street at risk of surface water flooding, specified in the London Borough of Camden (LBC) Planning Guidance CPG4 and therefore a flood risk assessment will not be required.

2.6 Preliminary Risk Assessment

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. The determination of contaminated sites is based on a “suitable for use” approach which involves managing the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of a source-pathway-receptor approach.

2.6.1 Source

The desk study research has indicated that the site has only been occupied by the existing residential property for its entire known developed history. The site and immediate surrounding areas are not considered to have had a contaminative history.

There are no historical or existing landfill sites within 500 m of the site and therefore there is not a risk to the site from landfill gas.

2.6.2 Receptor

The site will continue to have a residential end use following the excavation of the basement and no new receptors will result. However, the residential end use is considered a high sensitivity end-use. Buried services are likely to come into contact with any contaminants present within the soils through which they pass and site workers are likely to come into direct contact with any contaminants present in the soil and through inhalation of vapours during basement excavation and construction. Being underlain by a Secondary ‘A’ Aquifer, groundwater may be considered to be a moderately sensitive target.

2.6.3 Pathway

The majority of the shallow soils will be removed by the excavation of a basement and no new pathways will be introduced for end users to come into contact with the soil. End users could conceivably come into contact with soils within private garden areas although this pathway is already in existence. There will be a limited potential for contaminants to move onto or off the site, except horizontally within any made ground or topsoil layer or upon the interface with the underlying Claygate Member, in association with perched groundwater movements, this pathway is also already in existence. A pathway for ground workers to come into contact with any contamination will exist during construction work and services will come into contact with any contamination within the soils in which they are laid.

2.6.4 Preliminary Risk Appraisal

On the basis of the above it is considered that there is a VERY LOW risk of there being a significant contaminant linkage at this site which would result in a requirement for major remediation work. Furthermore as there is no evidence of filled ground within the vicinity of the site and no landfill sites, there is not considered to be a significant potential for hazardous soil gas to be present on or migrating towards the site: there should thus be no need to consider landfill gas exclusion systems.

3.0 SCREENING

The LBC guidance suggests that any development proposal that includes a subterranean basement should be screened to determine whether or not a full BIA is required.

3.1 Screening Assessment

A number of screening tools are included in the Arup document and for the purposes of this report reference has been made to Appendix E which includes a series of questions within a screening flowchart for three categories; groundwater flow; land stability; and surface water flow. Responses to the questions are tabulated below.

3.1.1 Subterranean (groundwater) Screening Assessment

Question	Response for 63 Frognal
1a. Is the site located directly above an aquifer?	*Yes. The Site is underlain by the Claygate Member of the London Clay Formation which is designated as Secondary Aquifer by the Environment Agency, capable of supplying local water supplies and supporting small watercourses.*
1b. Will the proposed basement extend beneath the water table surface?	*Yes. Monitored groundwater levels within the Claygate Member are between 0.25m and 1.70m bgl. The proposed basement formation level would extend to a depth of approximately 4.5m below existing ground level.*
2. Is the site within 100 m of a watercourse, well (used/ disused) or potential spring line?	*No. Historic maps indicate two headwater tributaries of the River Westbourne flowed c.150m to the southwest and c.120m to the southeast of the Site. These are not present at surface and are likely to have been culverted to form part of the local surface water sewer.*
3. Is the site within the catchment of the pond chains on Hampstead Heath?	*No. The Site is outside the catchment of Hampstead Heath ponds.*
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	*No. The proposed basement would extend beneath the footprint of the existing building and would not extend significantly into the garden area. Site drainage will be directed to public sewer as ground conditions would not be suitable for a soakaway or similar SUDS based system.*

Question	Response for 63 Frognal
5. 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 very lowly permeable nature of the Claygate Member strata is unsuitable for receiving discharge to ground.*
6. 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. There are no local ponds or spring lines present within 100m of the Site.*

The screening exercise has identified the following potential issues which should be assessed:

Q1a The Site is located on a Secondary 'A' Aquifer.
Q1b The basement is likely to extend below the groundwater level.

3.1.2 Stability Screening Assessment

Question	Response for 63 Frognal
1. Does the existing site include slopes, natural or manmade, greater than 7°?	*No*
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7°?	*No*
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	*No*
4. Is the site within a wider hillside setting in which the general slope is greater than 7°?	*No*
5. Is the London Clay the shallowest strata at the site?	*No*
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*
7. Is there a history of seasonal shrink-swell subsidence in the local area and / or evidence of such effects at the site?	*Not known. The Claygate Member has some potential for shrink-swell.*
8. Is the site within 100 m of a watercourse or potential spring line?	*No*
9. Is the site within an area of previously worked ground?	*No*
10. Is the site within an aquifer?	*Yes. The Site is underlain by the Claygate Member of the London Clay Formation which is designated a Secondary Aquifer by the Environment Agency, capable of supporting baseflow to watercourses.*
11. Is the site within 50 m of Hampstead Heath ponds?	*No*
12. Is the site within 5 m of a highway or pedestrian right of way?	*Yes. The site fronts onto a public road.*
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	*Yes? The development will increase foundation depths to in excess of 4.5 m deep but the depths of foundations of adjacent properties are not known.*
14. Is the site over (or within the exclusion zone of) any tunnels, eg railway lines?	*No*

The above assessment has identified the following potential issues that need to be assessed:
Q7 The site is possibly in an area of seasonal shrink-swell.
Q10 The site is underlain by a Secondary 'A' Aquifer.
Q12 The site is within 5 m of a public highway on one side.

Q13 The development will increase the foundation depths relative to the neighbouring properties to a relatively significant extent.

3.1.3 Surface Flow and Flooding Screening Assessment

This element of the BIA is provided for guidance only and should be confirmed by a suitably qualified engineer experienced in carrying out surface water assessments.

Question	Response for 63 Frognal
1. Is the site within the catchment of the pond chains on Hampstead Heath?	*No*
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*
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	*No*
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*
5. Will the proposed basement result in changes to the quantity of surface water being received by adjacent properties or downstream watercourses?	*No*
6. Is the site in an area known to be at risk from surface water flooding such as South Hampstead, West Hampstead, Gospel Oak and Kings Cross, or is it at risk of flooding because the proposed basement is below the static water level of a nearby surface water feature?	*No*

The above assessment has not identified any potential issues that need to be assessed.

4.0 SCOPING AND SITE INVESTIGATION

The purpose of scoping is to assess in more detail the factors to be investigated in the impact assessment. Potential consequences are assessed for each of the identified potential impact factors.

4.1 Potential Impacts

The following potential impacts have been identified.

Potential Impact	Possible Consequence
The Claygate Member is prone to seasonal shrink / swell (subsidence and heave)	Shrinkage and swelling of the underlying soil may result in structural damage of the buildings.
Site within 5 m of a highway or pedestrian right of way	Excavation of basement could lead to damage
The site is located above a Secondary ‘A’ Aquifer	The basement may extend into the underlying aquifer and affect the groundwater flow regime
The basement is likely to extend below the groundwater table	This may affect the groundwater flow regime
The development will increase the foundation depths relative to the neighbouring properties to a relatively significant extent.	Excavation may lead to structural damage to neighbouring properties if there is a significant differential depth between adjacent properties

These potential impacts have been further assessed through the ground investigation, as detailed below.

4.2 Exploratory Work

In order to meet the objectives described in Section 1.2 and to assess the potential impacts identified in the screening exercise of the BIA, three cable percussion boreholes were advanced, to depths of 10.0 m, 15.0 m and 20.0 m. Standard Penetration Tests (SPTs) were carried out at regular intervals in the cable percussion boreholes to provide quantitative data on the strength of soils encountered.

Groundwater monitoring standpipes were installed in three of the boreholes to depths of 8.0 m, 7.0 m and 4.0 m, and have been monitored on six occasions to date, over a period of roughly one month.

In addition, a further four window sampler boreholes were drilled to a maximum depth of 5.50 m to provide additional coverage of the site. Three of the window sampler boreholes were carried out through trial pits using hand held window sampling equipment.

In addition to the boreholes, seven trial pits were manually excavated to investigate the foundations of the existing building. Probing with a 'Hilti' drill was carried out through the base of Trial Pit No 7 to determine the thickness of the toe of the existing retaining wall.

All of the above work was carried out under the supervision of a geotechnical engineer from GEA.

A selection of the disturbed and undisturbed samples recovered from the boreholes and trial pits were submitted to a soil mechanics laboratory for a programme of geotechnical testing and an analytical laboratory for a programme of contamination testing.

The borehole and trial pit records and results of the laboratory analyses are appended together with a site plan indicating the exploratory positions. The Ordnance Datum (OD) levels shown on the borehole and trial pit records have been interpolated from spot heights shown on a drawing by EDI Surveys Limited, which was provided by the consulting engineers.

4.3 Sampling Strategy

The borehole and trial pit positions were agreed at an initial site meeting between GEA and the consulting engineers to provide optimum coverage of the site with due regard to the proposed development.

Laboratory geotechnical classification and strength tests were undertaken on samples of the natural soil.

Three samples of the made ground were subjected to analysis for a range of common industrial contaminants and contamination indicative parameters. For this investigation the analytical suite for the soil included a range of metals, speciation of total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), total cyanide and monohydric phenols. The soil samples were selected to provide a general view of the chemical conditions of the soils that are likely to be involved in a human exposure or groundwater pathway and to provide advice in respect of re-use or for waste disposal classification.

The contamination analyses were carried out at an MCERTs accredited laboratory with the majority of the testing suite accredited to MCERTS standards. Details of the MCERTs accreditation and test methods are included in the Appendix together with the analytical results.

5.0 GROUND CONDITIONS

The investigation has confirmed the expected ground conditions in that, below a moderate thickness of made ground, the Claygate Member was encountered overlying the London Clay, which was proved to the full depth investigated.

5.1 Made Ground

The made ground / topsoil was encountered to depths of between 0.15 m (97.61 m OD) and 1.50 m (95.95 m OD) and generally comprised grey silty clay with gravel and very rare fragments of brick and charcoal or light orange-brown silty sandy clay with very rare fragments of brick. The greatest thickness of made ground was encountered within the vicinity of the existing foundations.

Fine rootlets were noted in the topsoil in Borehole Nos 1 and 2, located in the rear garden to depths of 0.3 m.

No visual or olfactory evidence of contamination was noted in the made ground, apart from the presence of extraneous material such as charcoal and ash fragments, which can commonly contain elevated concentrations of PAH, including benzo(a)pyrene. Three samples of the made ground have been sent for contamination testing as a precautionary measure and the results are presented in Section 6.5.

5.2 Claygate Member

The Claygate Member initially comprised soft becoming firm brown mottled grey silty sandy clay with rare carbonaceous material, which extended to depths of between 3.50 m (92.90 m OD) and 4.50 m (92.95 m OD). Below this depth, firm brownish grey silty sandy clay with occasional partings of orange-brown silt and fine sand was encountered, which extended to depths between 4.00 m (92.40 m OD) and 5.00 m (92.72 m OD), and was in turn underlain by stiff dark grey silty sandy clay, which became less sandy with depth and extended to depths of between 8.00 m (89.68 m OD) and 9.00 m (87.40 m OD).

Plant remains were noted within the Claygate Member in Borehole No 3 to a depth of 3.0 m, although the clay was not noted to be desiccated. In Borehole No 2 the clay of the Claygate Member was noted to be stiff to a depth of about 2.0 m in Borehole No 2, in close proximity to an existing tree, possibly indicating signs of desiccation.

The results of laboratory testing indicate the clay to be of moderate volume change potential.

The results from the laboratory undrained triaxial compression tests, indicate the Claygate Member to be of medium strength and high strength. The undrained shear strength of the Claygate Member generally increases with depth, although slight variations in strength occur. These soils were observed to be free of any evidence of soil contamination.

5.3 London Clay

The London Clay comprised stiff becoming very stiff dark grey fissured silty clay, with rare partings of grey silt and fine sand and rare fragments of shells, which was proved to the maximum depth investigated of 20.00 m (77.72 m OD).

Atterberg limit tests indicate the clay to be of high volume change potential.

The laboratory strength tests have indicated the London Clay to be of high strength to very high strength with undrained shear strength generally increasing with depth.

These soils were observed to be free of any evidence of soil contamination.

5.4 Groundwater

Groundwater was encountered during drilling from within the silty sandy clay of the Claygate Member at a depth of 2.00 m (95.72 m OD and 96.40 m OD) in Borehole Nos 1 and 3 and at a depth of 5.10 m (92.66 m OD) in Borehole No 6. Water was also noted in Trial Pit Nos 3 and 5 standing at the base of the trial pit, perched around the base of the existing foundations at depths of 1.20 m (96.25 m OD) and 1.50 m (95.95 m OD) respectively.

Standpipes were installed in Borehole Nos 1 to 3 to depths of 8.00 m (89.72 m OD), 7.00 m (90.65 m OD) and 4.00 m (92.40 m OD) respectively. Subsequent groundwater monitoring has been carried out on six occasions to date over a period of roughly one month.

The results of the monitoring visits are shown in the table below:

Borehole No	Standpipe depth (m)	Depth to groundwater (m)					
		05/12/2012	07/12/2012	10/12/2012	12/12/2012	19/12/2012	03/01/2013
1	8.00	0.67	0.64	0.69	0.71	0.36	0.57
2	7.00	1.20	1.01	1.06	1.10	0.25	0.86
3	4.00	0.67	1.63	1.67	1.70	1.45	1.55

Rising head tests were carried out in Borehole Nos 1 and 2 at the time of the second groundwater monitoring visit to give a preliminary assessment of groundwater inflows into the basement excavation. A copy of these results is appended.

The results indicate the Claygate Member strata to have a very low bulk hydraulic permeability of between 1.1×10^{-8} m/s and 2.3×10^{-8} m/s, typical of clay dominated strata. The vertical permeability within the clay horizons would be significantly less than this. Rates of groundwater flow within the Claygate Member beneath the site are therefore very low.

5.5 Soil Contamination

The table below sets out the values measured within three samples of made ground analysed. All concentrations are in mg/kg unless otherwise stated.

Determinant	TP1: 0.15 m	TP5: 1.20 m	BH6: 0.10 m
Arsenic	11	12	22
Cadmium	<0.10	<0.10	0..52
Chromium	32	31	26
Copper	18	16	93
Mercury	<0.10	<0.10	0.26
Nickel	17	19	23
Lead	110	16	**610**
Selenium	<0.20	<0.20	0.45
Zinc	70	45	360
Total Cyanide	<0.5	<0.5	<0.5
Total Phenols	<0.3	<0.3	<0.3
Sulphide	9.4	4.9	4.2
Sodium Chloride g/l	0.016	<0.010	<0.010
Total PAH	<2	<2	**46**
Benzo(a)pyrene	<0.1	<0.1	**4.3**
Naphthalene	<0.1	<0.1	0.59
TPH	12	<10	140
Total Organic Carbon %	1.1	0.18	5.0

Notes: Figure in **bold** indicates concentration in excess of risk-based soil guideline values, as discussed in Part 2 of this report

5.5.1 Generic Quantitative Risk Assessment

The use of a risk-based approach has been adopted to provide an initial screening of the test results to assess the need for subsequent site-specific risk assessments. To this end contaminants of concern are those that have values in excess of a generic human health risk based guideline values which are either that of the CLEA[5] Soil Guideline Value where available, or is a Generic Guideline Value calculated using the CLEA UK Version 1.06 software assuming a residential end use. The key generic assumptions for this end use are as follows:

- that groundwater will not be a critical risk receptor;
- that the critical receptor for human health will be young female children aged zero to six years old;
- that the exposure duration will be six years;

5 *Updated Technical Background to the CLEA Model (Science Report SC050021/SR3) Jan 2009* and Soil Guideline Value reports for specific contaminants; all DEFRA and Environment Agency.

- that the critical exposure pathways will be direct soil and indoor dust ingestion, consumption of homegrown produce, consumption of soil adhering to homegrown produce, skin contact with soils and indoor dust, and inhalation of indoor and outdoor dust and vapours; and

- that the building type equates to a two-storey small terraced house.

It is considered that these assumptions are acceptable for this generic assessment of this site. The tables of generic screening values derived by GEA and an explanation of how each value has been derived are included in the Appendix.

Where contaminant concentrations are measured at concentrations below the generic screening value it is considered that they pose an acceptable level of risk and thus further consideration of these contaminant concentrations is not required. However where concentrations are measured in excess of these generic screening values there is considered to be a potential that they could pose an unacceptable risk and thus further action will be required which could include;

- additional testing to zone the extent of the contaminated material and thus reduce the uncertainty with regard to its potential risk;

- site specific risk assessment to refine the assessment criteria and allow an assessment to be made as to whether the concentration present would pose an unacceptable risk at this site; or

- soil remediation or risk management to mitigate the risk posed by the contaminant to a degree that it poses an acceptable risk.

This assessment is based upon the potential for risk to human health, which at this site is considered to be the critical risk receptor.

The chemical analyses has revealed elevated concentrations of lead, Total PAH including benzo(a)pyrene in a single sample of made ground from Borehole No 6 at a depth of 0.10 m.

No elevated concentrations of any other contaminants were measured in excess of the generic risk based screening values for a residential end-use with plant uptake.

These concentrations could thus pose a potentially unacceptable risk to human health through direct contact, accidental ingestion or inhalation of soil or soil derived dust.

The significance of these results is considered further in Part 2 of the report.

5.6 Existing Foundations

The trial pits have indicated that the footings of the existing house comprise brick corbels over concrete founded at depths of between 0.81 m and 1.54 m, bearing on firm brown mottled grey silty sandy clay of the Claygate Member. Probing with a 'Hilti' drill found the concrete toe of the retaining wall to be 500 mm thick.

The trial pit records and photographs are included in the Appendix.

Part 2: DESIGN BASIS REPORT

This section of the report provides an interpretation of the findings detailed in Part 1, in the form of a ground model, and then provides advice and recommendations with respect to foundation options and contamination issues.

6.0 INTRODUCTION

It is understood that it is proposed to construct a single level basement beneath the footprint of the entire house and into the rear garden. The basement will extend to a depth of approximately 4.5 m (about 93.0 m OD) below existing ground floor level.

7.0 GROUND MODEL

The desk study has revealed that the site and surrounding area have not had a potentially contaminative history, and on the basis of the fieldwork, the ground conditions at this site can be characterised as follows.

- Below a limited thickness of made ground, the Claygate Member was encountered overlying the London Clay, which was proved to the full depth investigated;
- the made ground / topsoil extends to depths of between 0.15 m (97.61 m OD) and 1.50 m (95.95 m OD) and comprises grey silty clay with gravel, fine rootlets and very rare fragments of brick and charcoal or light orange-brown silty sandy clay with very rare fragments of brick;
- the Claygate Member extends to depths of between 8.00 m (89.68 m OD) and 9.00 m (87.40 m OD) and initially comprises soft becoming firm brown mottled grey silty sandy clay with rare carbonaceous material, underlain by firm brownish grey silty sandy clay with occasional partings of orange-brown silt and fine sand, overlying stiff dark grey silty sandy clay;
- desiccation of the clay soils is expected close to trees to depths of about 2 m;
- the London Clay comprises stiff becoming very stiff fissured high strength to very high strength dark grey silty clay, with rare partings of grey silt and fine sand and rare fragments of shells, which was proved to the maximum depth investigated of 20.00 m (77.72 m OD);
- groundwater monitoring has measured groundwater at depths of between 0.25 m (97.43 m OD) and 1.70 m (94.7 m OD); and
- the chemical analyses have revealed elevated lead and Total PAH including benzo(a)pyrene, within a single sample of made ground.

8.0 ADVICE AND RECOMMENDATIONS

Formation level for the approximately 4.5 m deep basement will be about 93 m OD and will be within the Claygate Member. It can be assumed that all potentially desiccated soils will be removed as part of the basement excavation. The results of the groundwater monitoring to date indicate that it will not be possible to construct the basement without some form of groundwater control.

Excavations for the proposed basement structure will require temporary support to maintain stability of the excavation and surrounding structures at all times. The existing foundations will need to be underpinned prior to construction of the proposed new basement or will need to be supported by new retaining walls.

8.1 Basement Construction

8.1.1 Basement Excavation

It is proposed to construct a 4.5 m deep basement below the footprint of the existing house and extend into the rear garden. The investigation has indicated that formation level for the approximately 4.5 m deep basement, below existing ground floor level will be within the Claygate Member at a level of about 93 m OD.

It will be necessary to underpin the existing foundations of the existing house and retaining wall along the northern elevation prior to the construction of the new basement, or to design the new retaining walls to accommodate the load from the existing structures.

Groundwater was encountered during drilling within Borehole Nos 1 and 3 at a depth of 2.00 m (95.72 m OD and 96.40 m OD) and in Borehole No 6 at a depth of 5.10 m (92.66 m OD), from within sand and silt partings of the Claygate Member. Perched water was also noted in Trial Pit Nos 3 and 5 around the existing foundations at depths of 1.20 m (96.25 m OD) and 1.50 m (95.95 m OD) respectively. Subsequent groundwater monitoring has been carried out on six occasions to date, over a period of roughly one month and has been measured at depths of between 0.25 m (97.43 m OD) and 1.70 m (94.70 m OD). The fluctuations encountered during groundwater monitoring are presumably due to heavy rainfall and the water levels measured in the standpipes may not be representative of typical levels.

Whilst monitoring should be continued, it is not possible to draw entirely meaningful conclusions from the measurements made in the standpipes, as the level of the water table is not necessarily as significant as the volume of water that may flow into the excavation. For example, a high level of water measured in a standpipe may not be significant if this represents only a small volume of water.

The permeability of the Claygate Member is likely to vary across the site although results from the investigation indicate that it is likely to be between 1.1×10^{-8} m/s and 2.3×10^{-8} m/s. On this basis inflow rates into the excavation are therefore expected to be slow, although as the basement extends below the water table they are likely to be prolonged. Inflow rates will also be higher where more permeable layers within the Claygate Member are encountered and, as the basement excavation will cover a much larger area than that covered by the investigation, it is possible that larger pockets or inter-connected layers of groundwater could be encountered. If the adopted method of temporary support during excavations is not watertight, it would be prudent for the chosen contractor to have a contingency plan in place to deal with more significant inflows as a precautionary measure. It would also be prudent, once access is available, to carry out a number of trial excavations, to depths as close to the full basement depth as possible, to provide an indication of the likely ground water conditions.

Shallow inflows of perched water may also be encountered from within the made ground, particularly within the vicinity of existing foundations, although such inflows are unlikely to be significant and should be adequately dealt with through sump pumping

The design of basement support in the temporary and permanent conditions needs to take account of the need to maintain the stability of the existing house and surrounding structures and the extent to which groundwater inflows need to be prevented.

There are a number of methods by which the sides of the basement excavations could be supported in the temporary and permanent conditions. The choice of wall may be governed to a large extent by whether it is to be incorporated into the permanent works and have a load bearing function, and the extent to which groundwater inflows need to be prevented.

It is understood that consideration is being given to sheet piles as a permanent retaining wall, which is a feasible option, provided that access restrictions can be dealt with, although consideration should be given to the deflections that may arise. A permanent sheet piled wall should provide a water tight excavation and be capable of carrying axial loads.

Consideration will need be given to noise and vibrations associated with the installation of sheet piles as a temporary or permanent measure and if these are deemed unacceptable a pressing technique may need to be adopted, although pressing techniques that use water jetting should be treated with caution in view of the risk of causing heave or settlement of the surrounding structures.

Alternatively consideration could be given to the use of a bored pile wall, which is also capable of being incorporated into the permanent works and can provide support for structural loads. Although the monitoring carried out to date would suggest that groundwater will be encountered within the excavation, it may be possible to adopt a contiguous bored pile wall if trial excavations confirm that inflows are unlikely to be significant. It is important to bear in mind that higher inflows may result from the presence of larger and / or interconnected pockets of water, which may be present within the basement excavation; however, once the piled wall is in place, it may be possible to deal with any areas of higher inflow through localised grouting or pumping. Careful control of pumping will be required to ensure that it does not lead to undermining and settlement of the adjacent buildings to the east and west.

If however trial excavations indicate that groundwater cannot be adequately controlled through localised grouting and sump pumping, then a secant bored pile wall will be required, which has the advantage of maximising the usable space within the basement area as it would not require a secondary waterproofing inside the wall, which would be the case with a contiguous bored pile wall.

The ground movements associated with the basement excavation will depend on the method of excavation and support and the overall stiffness of the basement structure in the temporary condition. Thus, a suitable amount of propping will be required to provide the necessary rigidity. In this respect the timing of the provision of support to the wall will have an important effect on movements.

Excavation of a 4.5 m deep basement will result in settlement and lateral displacement behind the basement wall and consideration will need to be given to a retention system that maintains the stability of the existing house and adjacent buildings at all times. The existing foundations will need to be underpinned prior to the construction of the new basement or will need to be supported by new retaining walls.

8.1.2 Basement Retaining Walls

The following parameters are suggested for the design of the new retaining walls.

Stratum	Bulk Density (kg/m^3)	Effective Cohesion (c' – kN/m^2)	Effective Friction Angle (' – degrees)
Made Ground	1700	Zero	20
Claygate Member	1850	Zero	25
London Clay	1950	Zero	25

Groundwater has been measured at depths of between 0.25 m (97.43 m OD) and 1.70 m (94.70 m OD) to date and is likely to be encountered within the 4.5 m deep basement excavation, with a formation level at about 93 m OD. Monitoring should be continued to determine an appropriate design groundwater level.

At this stage, it is recommended that the basement is designed with a water level assumed to be two-thirds of the basement depth, unless a fully effective drainage system can be ensured. It may however be possible to review this requirement following additional investigation by means of trial excavations and further monitoring and the advice in BS8102:2009[6] should be followed in this respect.

8.1.3 Basement Heave

The proposed construction of a 4.5 m deep basement beneath the existing house and rear garden will result in an approximate unloading of roughly 80 kN/m^2, which will result in an elastic heave and long term swelling of the Claygate Member. The effects of the longer term swelling movement will be mitigated to some extent by the load applied by the new foundations and the continued presence of the existing house. The movements in the garden area are likely to be more significant as no structure is proposed above ground level. Consideration will need to be given to the effects of differential movement between the existing house and rear garden.

It is recommended that the basement slab is suitably reinforced to withstand heave and groundwater pressures or that a void is incorporated below the slab to allow the movement to take place. Tension piles could also be used to accommodate these movements.

It would be prudent to conduct a more detailed analysis of these movements once the basement design has been finalised.

8.2 Spread Foundations

All new foundations or underpins should bypass the made ground and potentially desiccated clay soils. Groundwater is likely to be encountered within the basement excavation and it may

6 BS8102 (2009) *Code of practice for protection of below ground structures against water from the ground*

not be possible to form spread foundations, although this will depend on the basement support system and the extent to which a water-tight excavation is maintained at formation level. The volume of groundwater anticipated in the basement excavation should be further investigated, as discussed in Section 9.1. Provided that a dry excavation can be maintained, spread foundations excavated from basement level to bear within the firm Claygate Member may be designed to apply a net allowable bearing pressure of 120 kN/m^2 below the level of basement floor, provided that groundwater inflows can be sufficiently controlled. This value incorporates an adequate factor of safety against bearing capacity failure and should ensure that settlement remains within normal tolerable limits.

The depth of the basement excavation should be such that foundations will be placed below the depth of actual or potential desiccation but this should be checked once the proposals have been finalised. Notwithstanding NHBC guidelines, all foundations should extend beyond the zone of desiccation. In this respect it would be prudent to have all foundation excavations inspected by a suitably experienced engineer. Due allowance should be made for future growth of the trees. The requirement for compressible material alongside foundations should be determined by reference to the NHBC guidelines.

If the required founding depths become uneconomic or it is not possible to construct spread foundations above the water table, piled foundations would provide a suitable foundation option.

8.3 Basement Raft Foundation

The suitability of a raft foundation will be governed by the net load of the new development, taking into consideration the effects of the basement excavation. On this site, in view of the depth of the proposed excavation and the estimated heave it is anticipated that the gross load on the raft will not be sufficient to balance the weight of soil removed and the raft may need to be anchored into the ground by piles to resist movements. The raft could be constructed so that it forms a rigid box with the retaining walls such that differential movements are minimised. Further analyses should be carried out once the proposed uniform distributed load is known.

8.4 Piled Foundations

For the ground conditions at this site, driven or bored piles could be adopted. Driven piles would have the advantage of minimising the spoil that is generated, but the effects of noise and vibrations on neighbouring sites are unlikely to be acceptable. Some form of bored pile may therefore be more appropriate. A conventional rotary augered pile is unlikely to be suitable, as temporary casing would need to be installed into the Claygate Beds to protect against ground water inflows. Therefore, to avoid the requirement for casing, bored piles installed using continuous flight auger (cfa) techniques are likely to be the most appropriate technique.

The following table of ultimate coefficients may be used for the preliminary design of bored piles, based on the measured SPT and Cohesion / level graph in the appendix.

Ultimate Skin Friction		**kN/m^2**
Made Ground and Claygate Member	approx. 97 m OD to 93 m OD	Ignore (basement excavation)
Claygate Member	93 m OD to 78 m OD	Increasing linearly

and London Clay ($\alpha = 0.5$)		from 35 to 85
Ultimate End Bearing		**kN/m^2**
Claygate Member and London Clay	88 m OD to 78 m OD	Increasing linearly from 930 to 1500

In the absence of pile tests, guidance from the London District Surveyors Association[7] (LDSA) suggests that a factor of safety of 2.6 should be applied to the above coefficients in the computation of safe theoretical working loads.

On the basis of the above coefficients and a factor of safety of 2.6, it has been estimated that a 450 mm extending to a depth of 10 m below basement level (approximately 83 m OD) should provide a safe working load of about 335 kN.

The above example is not intended to constitute any form of recommendation with regard to pile size or type, but merely serve to illustrate the use of the above coefficients. Specialist piling contractors should be consulted with regard to the design of a suitable piling scheme for this site. Their attention should be drawn to the presence of sand partings and associated groundwater seepage within the Claygate Member and London Clay.

Consideration may also need to be given to the effects of heave as a result of the basement excavation.

8.5 Basement Floor Slab

Following the excavation of the basement, it is likely that the floor slab for the proposed basement will need to be suspended over a void to accommodate the anticipated heave and any potential uplift forces from groundwater pressures unless the slab can be suitably reinforced to cope with these movements. This should be reviewed once the levels and loads are known.

8.6 Shallow Excavations

On the basis of the borehole findings and trial pits, it is considered that shallow excavations for foundations and services that extend through the made ground or Claygate Member should remain generally stable in the short term, although some instability may occur.

However, should deeper excavations be considered or if excavations are to remain open for prolonged periods it is recommended that provision be made for battered side slopes or lateral support. Where personnel are required to enter excavations, a risk assessment should be carried out and temporary lateral support or battering of the excavation sides considered in order to comply with normal safety requirements.

The investigation has indicated that groundwater inflows might be encountered within made ground, particularly within the vicinity of existing foundations and from silt and sand partings from within the Claygate Member. Any inflows of groundwater into excavations should be suitably controlled by sump pumping, although this should be confirmed by trial excavations to the full depth of the proposed basement.

7 LDSA (2009) *Foundations No 1 – Guidance notes for the design of straight shafted bored piles in London Clay*. LDSA Publication

8.7 Effect of Sulphates

Chemical analyses carried out on four samples have revealed concentrations of soluble sulphate and near-neutral pH in accordance with Class DS-1 to DS-2 conditions of Table C2 of BRE Special Digest 1 Part C (2005). The measured pH value of the samples show that a ACEC class of AC-1s of Table C2 would be appropriate for the site. This assumes a static water condition at the site. The guidelines contained in the above digest should be followed in the design of foundation concrete.

8.8 Site Specific Risk Assessment

The desk study has not indicated the site to have had a potentially contaminative history, having been occupied by the existing house for it entire developed history. However, the chemical analysis has revealed elevated concentrations of lead and total PAH including benzo(a)pyrene within one of the three samples of made ground tested, obtained from Borehole No 6, at a depth of 0.1 m, located within the existing rear garden. Other constituent PAHs were not elevated.

The likely source of the PAH and metal contamination is fragments of burnt coal and ash noted within the made ground. The metal and PAH compounds within the made ground are considered likely to be of low solubility and a risk to groundwater has not been identified.

The made ground will be removed by the basement construction and there will therefore be no risk to end users unless any of the excavated material is to be re-used in a reinstated garden above the basement. If this is proposed there is likely to be a requirement for testing of the retained soil.

Site workers will be protected from the contamination through adherence to normal high standards of site safety but there may be a requirement for protection of buried plastic services laid within the made ground.

8.8.1 Site Workers

Site workers should be made aware of the contamination and a programme of working should be identified to protect workers handling any soil. The method of site working should be in accordance with guidelines set out by HSE[8] and CIRIA[9] and the requirements of the Local Authority Environmental Health Officer.

8.8.2 Plastic Services

Elevated concentrations of PAH have been measured in the made ground and consideration will, therefore, need to be given to the protection of buried plastic services laid within the made ground. Details of the proposed protection measures for buried plastic services will in any case need to be approved by the EHO and the relevant service authority prior to the adoption of any scheme. It is possible that barrier pipe will be required or additional testing will need to be carried out.

8.9 Waste Disposal

Any spoil arising from excavations or landscaping works, which is not to be re-used in

8 HSE (1992) HS(G)66 *Protection of workers and the general public during the development of contaminated land* HMSO

9 CIRIA (1996) *A guide for safe working on contaminated sites* Report 132, Construction Industry Research and Information Association

accordance with the CL:AIRE guidance[10], will need to be disposed of to a licensed tip. Under the European Waste Directive, waste is classified as being either Hazardous or Non-Hazardous and landfills receiving waste are classified as accepting hazardous or non-hazardous wastes or the non-hazardous sub-category of inert waste in accordance with the Waste Directive. Waste going to landfill is subject to landfill tax at either the standard rate of £64 per tonne (about £120 per m^3) or at the lower rate of £2.50 per tonne (roughly £5 per m^3). However, the classifications for tax purposes and disposal purposes differ and currently all made ground and topsoil is taxable at the 'standard' rate and only naturally occurring rocks and soils, which are accurately described as such in terms of the 2011 Order[11], would qualify for the 'lower rate' of landfill tax.

Based upon on the technical guidance provided by the Environment Agency[12] it is considered likely that the made ground from this site, as represented by the three chemical analyses carried out, would be classified as NON-HAZARDOUS waste under the waste code 17 05 04 (soils and stones not containing dangerous substances) and would be taxable at the standard rate. It is likely that the natural soils, if separated out, could be classified as an INERT waste also under the waste code 17 05 04. This material would be taxable at the lower rate, if accurately described as naturally occurring clay in terms of the 2011 Order on the waste transfer note. As the site has never been used for the storage of potentially hazardous materials, it is likely that WAC leaching tests would not be required for such inert waste going to landfill. This would however need to be confirmed by the receiving landfill site.

Under the requirements of the European Waste Directive all waste needs to be pre-treated prior to disposal. The pre-treatment process must be physical, thermal, chemical or biological, including sorting. It must change the characteristics of the waste in order to reduce its volume, hazardous nature, facilitate handling or enhance recovery. The waste producer can carry out the treatment but they will need to provide documentation to prove that this has been carried out. Alternatively, the treatment can be carried out by an approved contractor. The Environment Agency has issued a position paper[13] which states that in certain circumstances, segregation at source may be considered as pre-treatment and thus excavated material may not have to be treated prior to landfilling if the soils can be "segregated" onsite by sufficiently characterising the soils in-situ prior to excavation.

The above opinion with regard to the classification of the excavated soils and its likely landfill taxable rate is provided for guidance only and should be confirmed by the receiving landfill once the soils to be discarded have been identified.

The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material but may require further testing.

If consideration were to be given to the re-use of the soil as a structural fill on this or another site, in accordance with the Code of Practice for the definition of waste, it would be necessary to confirm its suitability for use, its certainty of use and to confirm that only as much material is to be used as is required for the specific purpose for which it was being used. A materials management plan could then be formulated and a tracking system put in place such that once placed the material would no longer be regarded as being a waste and thus waste management

10 CL:AIRE (2011) *The Definition of Waste: Development Industry Code of Practice* Version 2, March 2011
11 *Landfill Tax (Qualifying Material) Order 2011*
12 Environment Agency (2008) *Hazardous Waste: Interpretation of the definition and classification of hazardous waste. Technical Guidance* WM2 Second Edition Version 2.2, May 2008
13 Regulatory Position Statement (2007) *Treating non-hazardous waste for landfill - Enforcing the new requirement* Environment Agency 23 Oct 2007

licensing and landfill tax would not apply.

9.0 BASEMENT IMPACT ASSESSMENT

It is understood that it is proposed to construct a single level basement beneath the footprint of the entire house and into the rear garden. The basement will extend to a depth of approximately 4.5 m below existing ground floor level to a level of approximately 93 m OD.

Formation level of the 4.5 m deep basement will be within the Claygate Member, which has been found to extend to depths of between 8.00 m (89.68 m OD) and 9.00 m (87.40 m OD), and is underlain by London Clay, proved to the full depth investigated of 20.0 m (77.72 m OD).

Groundwater monitoring has measured groundwater at depths of between 0.25 m (97.43 m OD) and 1.70 m (94.7 m OD).

The results of the rising head tests indicated a very low bulk hydraulic permeability between 1.1 x 10^{-8} m/s and 2.3 x 10^{-8} m/s, typical of clay dominated strata. The vertical permeability within the clay horizons would be significantly less than this.

The Claygate Member is not capable of storing and transmitting water in usable amounts and receives very low levels of annual recharge due to its lowly permeable nature. The Claygate Member strata does not support flow to any ponds or watercourses within 100m of the site. The proposed basement would not significantly increase the existing hard standing.

On the basis of the results of the ground investigation, it is not considered that the proposed basement would result in a significant change to the groundwater flow regime in the vicinity of the proposal or on the amount of annual recharge into the Claygate Member.

The screening identified a number of potential impacts. The desk study and ground investigation information has been used below to review the potential impacts, to assess the likelihood of them occurring and the scope for reasonable engineering mitigation.

The table below summarises the previously identified potential impacts and the additional information that is now available from the site investigation in consideration of each impact.

Potential Impact	Site Investigation Conclusions
Seasonal shrink-swell can result in foundation movements	*Plasticity index tests indicate the Claygate Member to be of moderate volume change potential at the site. Shrinkable clay is present within a depth that can be affected by tree roots. The basement depth will however extend well below the potential depth of root action.*
Location of public highway – excavation of basement could lead to damage	*The highway is located within 5 m of the basement excavation. A retention system will maintain the stability of the highway.*
The basement will extend below the groundwater table – this may affect the groundwater flow regime	*The basement is likely to encounter water during excavation, however, the Claygate Member beneath the site is characterised by a very low permeability and cannot store or transmit significant quantities of groundwater. It is not considered that the proposed basement would result in a significant change to the groundwater flow regime in the vicinity of the proposal.*

Potential Impact	Site Investigation Conclusions
Site is underlain by Secondary Aquifer – the basement may extend into the underlying aquifer and affect the groundwater flow regime	*Groundwater was encountered at depths of between 0.25 m and 1.70 m and the excavation of a basement to 4.5 m will therefore extend into the groundwater.*
Founding depths relative to neighbours – excavation may lead to structural damage to neighbouring properties if there is a significant differential depth between adjacent properties	*The neighbouring properties are detached. The retention system will ensure the stability of the excavation and neighbouring properties at all times.*

The results of the site investigation have therefore been used below to review the remaining potential impacts, to assess the likelihood of them occurring and the scope for reasonable engineering mitigation.

Shrink / swell potential of Claygate Member

Shrinkable clay is present within a depth that can be affected by tree roots. There is no evidence of structural movement within the existing building. The basement depth will extend well below the potential depth of root action.

Location of public highway

The proposed basement excavation will be located within 5 m of Frognal. A retention system will need to be adopted that maintains the stability of the excavation at all times to protect the highway. This is however standard construction practice.

Proposed basement structure is located over Secondary Aquifer and will extend below groundwater table

The ground investigation has confirmed the presence of Claygate Member strata beneath the site to a depth of between 8.00 m and 9.00 m and groundwater has been measured at depths of between 0.25 m and 1.70 m. The proposed 4.50 m deep basement will have a formation level within the Claygate Member and will not extend into the London Clay. Rising head tests have confirmed that the Claygate Member has very low bulk hydraulic permability. Flow within the silty sandy clay of the Claygate Member is very slow and is not capable of storing and transmitting water in usable amounts, and receives very low levels of annual recharge due to its lowly permeable nature and this stratum does not support flow to any ponds or watercourses within 100 m of the site. On the basis of the above, the proposed basement will not affect the amount of annual recharge into the Claygate Member. On this basis, it is not considered that the proposed basement would result in a significant change to the groundwater flow regime in the vicinity of the proposal.

Increase in the differential depth of neighbouring foundations

The stability of neighbouring properties and structures will be ensured at all times, through a suitable retention system. There is nothing unusual or exceptional in the proposed development or the findings of the investigation that give rise to any concerns with regard to stability over and above any development of this nature.

10.0 OUTSTANDING RISKS AND ISSUES

This section of the report aims to highlight areas where further work is required as a result of limitations on the scope of this investigation, or where issues have been identified by this investigation that warrant further consideration. The scope of risks and issues discussed in this section is by no means exhaustive, but covers the main areas where additional work is considered to be required.

The ground is a heterogeneous natural material and variations will inevitably arise between the locations at which it is investigated. This report provides an assessment of the ground conditions based on the discrete points at which the ground was sampled, but the ground conditions should be subject to review as the work proceeds to ensure that any variations from the Ground Model are properly assessed by a suitably qualified person.

Further groundwater monitoring should be carried out to establish equilibrium levels and the extent of any seasonal fluctuations. It would be prudent to carry out a number of trial excavations, to depths as close to the full basement depth to provide an indication of the likely groundwater conditions.

It is recommended that heave movements are checked by further analysis once the loadings and final levels are known.

Desiccation was not encountered during the investigation. However, due to the close proximity of semi-mature and mature trees along the boundary of the site with the neighbouring gardens, desiccation may be present. It is assumed that the basement will extend beneath the depth of any potential desiccation; however it is recommended that the basement excavation is inspected by a qualified and experienced geotechnical engineer.

If during ground works any visual or olfactory evidence of contamination is identified it is recommended that further investigation be carried out and that the risk assessment is reviewed. These areas of doubt should be drawn to the attention of prospective contractors and further investigation will be required or sufficient contingency should be provided to cover the outstanding risk.

APPENDIX

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, AL4 0PG	Site: 63 Frognal, Hampstead, London, NW3 6XD	Borehole Number: BH 1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 5.50m	97.72	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates** 29/11/2012	**Engineer** Conisbee	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.35)	Topsoil (dark grey silty sandy clay with occasional gravel and fine rootlets)		
0.20	D1				97.37	0.35			
0.50	D2						Soft becoming firm medium strength brown mottled grey and orange-brown silty sandy CLAY, with rare flint gravel and carbonaceous material. Fine rootlets noted to a depth of 0.5 m		
1.00-1.45	SPT N=6			1,0/1,1,2,2					
1.00	D3								
1.00-1.45	D4								
1.75	D5								∇1
2.00-2.45	U6			Slow(1) at 2.00m. 34 blows					
						(4.15)			
2.75	D7								
3.00-3.45	SPT N=9			1,1/2,2,2,3					
3.00-3.45	D8								
3.75	D9								
4.00-4.45	U10			35 blows					
				Water strike(2) at 4.30m.					∇2
					93.22	4.50			
						(0.50)	Firm brownish grey with rare orange-brown mottling silty sandy CLAY		
4.75	D11								
5.00-5.45	D12			29/12/2012:DAMP	92.72	5.00			
5.00-5.45	SPT N=17			30/12/2012:4.40m 1,2/2,3,6,6			Stiff high strength dark grey silty sandy CLAY with rare shell fragments		
6.00	D13								
6.50-6.95	U14			35 blows					
						(4.00)			
7.50	D15								
8.00-8.45	SPT N=20			3,3/4,4,6,6					
8.00-8.45	D16								
				Water strike(3) at 8.50m.					∇3
9.00	D17				88.72	9.00	Stiff becoming very stiff fissured high strength becoming very high strength dark grey silty CLAY with rare lenses of grey silt and fine sand and shell fragments		
9.50-9.95	U18			45 blows					

Remarks
Five hours spent manhandling equipment to borehole position and re-assembling rig
Hand-dug service pit to a depth of 1.2 m
Standpipe installed to a depth of 8.0 m and subsequent groundwater monitoring has been carried out on six occasions, over a period of one month - see separate sheet for results
Rising head test carried out on 07/12/2012 - see separate sheet for results

Scale (approx)	Logged By
1:50	HD

Figure No. J12288.BH 1

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, AL4 0PG		**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Borehole Number** BH 1
Boring Method Cable Percussion	**Casing Diameter** 150mm cased to 5.50m	**Ground Level (mOD)** 97.72	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 29/11/2012	**Engineer** Conisbee	**Sheet** 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.50	D19								
11.00-11.45	SPT N=23			3,4/5,5,6,7					
11.00-11.45	D20								
12.00	U21								
12.50-12.95	D22			50 blows					
13.50	D23								
14.00-14.45	SPT N=25			4,4/5,6,7,7					
14.00-14.45	D24								
15.00	D25					(11.00)			
15.50-15.95	U26			55 blows					
16.50	D27								
17.00-17.45	SPT N=28			3,4/6,6,8,8					
17.00-17.45	D28								
18.00	D29								
18.50-18.95	U30			60 blows					
19.25	D31								
19.55-20.00	SPT N=33			4,5/6,7,8,12					
19.55-20.00	D32			30/12/2012:8.50m					
					77.72	20.00			

Remarks	**Scale (approx)** 1:50	**Logged By** HD
	Figure No. J12288.BH 1	

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Borehole Number** **BH 2**

Boring Method	**Casing Diameter**	**Ground Level (mOD)**	**Client**	**Job Number**
Cable Percussion	150mm cased to 3.00m	97.68	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates** 03/12/2012	**Engineer** Conisbee	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.30)	MADE GROUND (dark brownish grey silty sand clay with abundant flint gravel, rare fragments of charcoal and fine rootlets)		
0.20	D1				97.38	0.30			
0.50	D2						'Stiff' high strength brown mottled grey and orange-brown silty sandy CLAY with rare carbonaceous material - suspected desiccated soil		
1.00-1.45	SPT N=9			1,1/2,2,2,3					
1.00	D3								
1.00-1.45	D4								
1.75	D5								
2.00-2.45	U6								
						(4.10)			
2.75	D7								
3.00-3.45	SPT N=10			1,1/2,2,3,3					
3.00-3.45	D8								
3.75	D9								
4.00-4.45	U10			30 blows					
					93.28	4.40			
						(0.60)	Firm high strength brownish grey with rare orange-brown mottling silty sandy CLAY		
4.75	D11								
					92.68	5.00			
5.00-5.45	SPT N=14			2,2/3,3,4,4			Stiff high strength dark grey silty sandy CLAY with rare shell fragments		
5.00-5.45	D12								
6.00	D13								
6.50-6.95	U14			35 blows		(3.00)			
7.50	D15								
					89.68	8.00			
8.00-8.45	SPT N=20			3,4/4,5,5,6			Stiff becoming very stiff fissured high strength becoming very high strength dark grey silty CLAY with rare lenses of grey silt and fine sand and shell fragments		
8.00-8.45	D16								
9.00	D17								
9.50-9.95	U18			40 blows					

Remarks
Hand-dug service pit to a depth of 1.2 m
Groundwater not encountered during drilling
Standpipe installed to a depth of 7.0 m and subsequent monitoring has been carried out on six occasions to date over a period of one month - see separate sheet for results
Rising head test carried out on 07/12/2012 - see separate sheet for results

Scale (approx)	Logged By
1:50	HD

Figure No. J12288.BH 2

GEA Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Albans
AL4 0PG

Site	Borehole Number
63 Frognal, Hampstead, London, NW3 6XD	BH 2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 3.00m	97.68	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		03/12/2012	Conisbee	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.50	D19								
11.00-11.45	SPT N=25			4,4/5,6,7,7					
11.00-11.45	D20								
12.00	D21								
						(7.00)			
12.50-12.95	U22			45 blows					
13.50	D23								
14.55-15.00	SPT N=27			3,4/6,7,6,8					
14.55-15.00	D24								
					82.68	15.00			
							Complete at 15.00m		

Remarks	Scale (approx)	Logged By
	1:50	HD
	Figure No.	
	J12288.BH 2	

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Borehole Number** **BH 3**

Boring Method	**Casing Diameter**	**Ground Level (mOD)**	**Client**	**Job Number**
Cable Percussion	150mm cased to 1.70m	96.40	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates** 04/12/2012	**Engineer** Conisbee	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.30)	Paving slab over concrete		
					96.10	0.30	Soft becoming firm medium strength becoming high strength brown mottled grey amd orange-brown silty sandy CLAY with very rare flint gravel and rare carbonaceous material. Decomposing roots noted to a depth of 1.0 m		
0.50	B1								
1.00-1.45	U2			20 blows					
1.75	D3					(3.20)			
2.00-2.45	D4			seepage(1) at 2.00m.					∇1
2.00-2.45	SPT N=19			3,2/2,3,3,11					
2.75	D5								
3.00-3.45	U6			34 blows					
					92.90	3.50	Firm brownish grey with rare orange-brown mottling silty sandy CLAY		
3.75	D7					(0.50)			
					92.40	4.00	Stiff high strength dark grey silty sandy CLAY with rare shell fragments		
4.00-4.45	SPT N=14			1,2/2,3,4,5					
4.00-4.45	D8								
4.75	D9								
5.00-5.45	U10			45 blows					
6.00	D11								
6.50-6.95	SPT N=18			2,2/3,5,5,5		(5.00)			
6.50-6.95	D12								
7.50	D13								
8.00-8.45	U14			50 blows					
				slow(2) at 8.50m.					∇2
9.00	D15				87.40	9.00	Stiff dark grey fissured silty CLAY with rare lenses of grey silt and fine sand		
9.55-10.00	SPT N=22			2,3/4,5,6,7		(1.00)			
9.55-10.00	D16								
					86.40	10.00			

Remarks
Hand-dug service pit to a depth of 1.2 m
Standpipe installed to a depth of 4.0 m and subsequent groundwater monitoring has been carried out on six occasions over a period of one month - see separate sheet for results
Two hours spent demobilising equipment and tidying

Scale (approx)	Logged By
1:50	HD

Figure No. J12288.BH 3

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Number** **BH 4**

Excavation Method	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number**
Drive-in Window Sampler		97.45	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates** 07/12/2012	**Engineer** Conisbee	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records
1.20	D1		
1.50	D2		
2.00	D3		
2.50	D4		
3.00	D5		
3.50	D6		
4.00	D7		
4.50	D8		
5.00	D9		

Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
97.44	(0.01) 0.01	Laminate flooring		
97.39	(0.05) 0.06	Ply board		
97.36	(0.03) 0.09	Wooden floor board		
97.26	(0.10) 0.19	Wooden joist		
97.02	(0.24) 0.43	Void		
96.85	(0.17) 0.60	Concrete		
96.30	(0.55) 1.15	MADE GROUND (light orange-brown mottled greenish grey silty sandy clay with rare medium subrounded gravel and very rare fragments of brick)		
92.95	(3.35) 4.50	Firm light orange-brown mottled greenish grey silty sandy CLAY		
92.65	(0.30) 4.80	Firm brownish grey silty sandy CLAY with occasional orange-brown partings of fine sand and silt		
92.25	(0.40) 5.20	Stiff dark grey fissured silty sandy CLAY with occasional partings of orange-brown fine sand and silt		

Complete at 5.20m

Remarks
Borehole carried out through base of Trial Pit No 4
Groundwater not encountered

Scale (approx)	**Logged By**
1:50	HD

Figure No.
J12288.BH 4

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD
Number	**BH 5**	

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		97.45	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		07/12/2012	Conisbee	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				97.44	(0.01) 0.01	Laminate flooring		
				97.3[illegible]	(0.05) 0.06	Ply wood		
				97.36	(0.03) 0.09	Wooden floor board		
				97.26	(0.10) 0.19	Wooden joist		
				97.01	(0.25) 0.44	Void		
				96.81	(0.20) 0.64	Concrete		
1.50	D1		Water strike(1) at 1.50m.	95.95	(0.86) 1.50	MADE GROUND (light orange-brown mottled greenish grey silty sandy clay with rare medium subrounded gravel and very rare fragments of brick)		∇1
2.00	D2				(1.00)	Firm light orange-brown mottled greenish grey silty sandy CLAY		
2.50	D3			94.95	2.50			
						Terminated at 2.50m		

Remarks
Borehole carried out through the base of Trial Pit No 5
Water standing at base of pit
Borehole terminated as joist unsupported and difficulties encountered when jacking out - borehole relocated through base of Trial Pit No 3

Scale (approx)	Logged By
1:50	HD

Figure No.
J12288.BH 5

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, AL4 0PG	Site: 63 Frognal, Hampstead, London, NW3 6XD	Number: **BH 5A**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		97.45	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		07/12/2012	Conisbee	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				97.44	(0.01)	Laminate flooring		
				97.39 / 97.38	0.01			
				97.26	(0.05)	Ply board		
				97.02	0.06			
				96.85	(0.03)	Wooden floor board		
					0.09			
					(0.10)	Wooden joist		
					0.19			
					(0.24)	Void		
				96.25	0.43			∇1
					(0.17)	Concrete		
					0.60			
					(0.60)	MADE GROUND (light orange-brown mottled greenish grey silty sandy clay with rare medium subrounded gravel and very rare fragments of fine brick)		
					1.20			
					(2.00)	Firm light orange-brown mottled greenish grey silty sandy CLAY		
				94.25	3.20			
					(1.10)	Stiff light orange-brown mottled greenish grey silty sandy CLAY		
				93.15	4.30			
					(0.40)	Stiff brownish grey silty sandy CLAY with occasional partings of orange-brown fine sand and silt		
				92.75	4.70			
					(0.50)	Stiff dark grey silty sandy CLAY with occasional partings of orange-brown fine sand and silt		
				92.25	5.20			
						Complete at 5.20m		

Depth (m)	Sample / Tests	Field Records
		Water strike(1) at 1.20m.
1.50	D1	
2.00	D2	
2.50	D3	
3.00	D4	
3.50	D5	
4.00	D6	
4.50	D7	
5.00	D8	

Remarks	Scale (approx)	Logged By
Borehole carried out through the base of Trial Pit No 3 Water standing at base of pit	1:50	HD
	Figure No. J12288.BH 5A	

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, AL4 0PG	Site	Number
		63 Frognal, Hampstead, London, NW3 6XD	BH 6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		97.76	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		07/12/2012	Conisbee	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	D1			97.61	(0.15) 0.15	MADE GROUND (grey silty sandy clay with rare medium rounded gravel and fine fragments of ash and brick)		
0.50	D2			97.31	(0.30) 0.45	Soft light orange-brown mottled greenish grey silty sandy CLAY		
1.00	D3					Firm light orange-brown mottled greenish grey silty sandy CLAY		
1.50	D4							
2.00	D5				(3.05)			
2.50	D6							
3.00	D7							
3.50	D8			94.26	3.50	Firm greyish brown silty sandy CLAY with occasional partings of orange-brown fine sand and silt		
					(0.50)			
4.00	D9			93.76	4.00	Stiff dark grey silty sandy CLAY with occasional partings of orange-brown fine sand and silt		
4.50	D10				(1.50)			
5.00	D11		Water strike(1) at 5.10m.					∇1
5.50	D12			92.26	5.50			
						Complete at 5.50m		

Remarks	Scale (approx)	Logged By
	1:50	HD
	Figure No. J12288.BH 6	

Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Albans
AL4 0PG

Standard Penetration Test Results

Site : 63 Frognal, Hampstead, London, NW3 6XD

Client : Azmil Khalid and Fuziah Hussein

Engineer: Conisbee

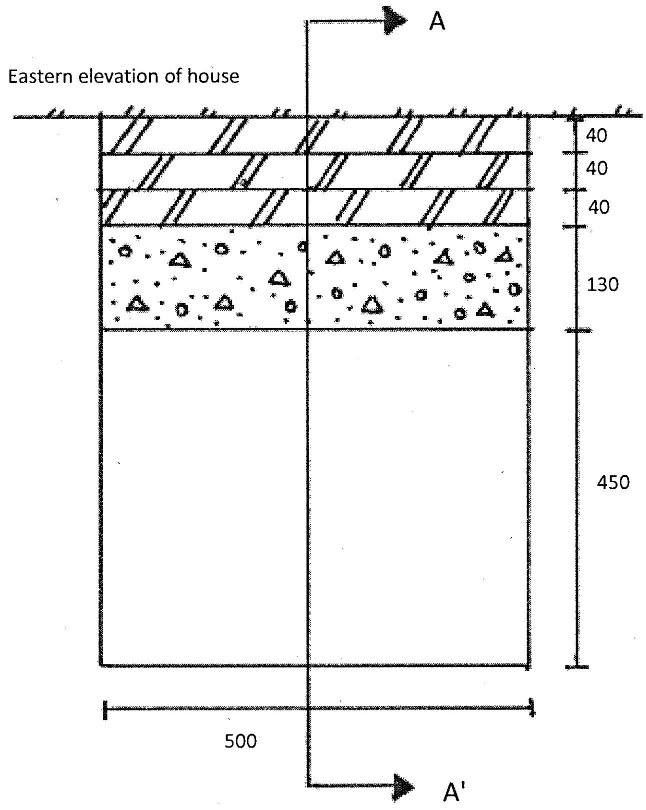
Job Number J12288

Sheet 1 / 1

Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
BH 1	1.00	1.15	1.45	SPT	1	0	1	1	2	2	N=6	
BH 1	3.00	3.15	3.45	SPT	1	1	2	2	2	3	N=9	
BH 1	5.00	5.15	5.45	SPT	1	2	2	3	6	6	N=17	
BH 1	8.00	8.15	8.45	SPT	3	3	4	4	6	6	N=20	
BH 1	11.00	11.15	11.45	SPT	3	4	5	5	6	7	N=23	
BH 1	14.00	14.15	14.45	SPT	4	4	5	6	7	7	N=25	
BH 1	17.00	17.15	17.45	SPT	3	4	6	6	8	8	N=28	
BH 1	19.55	19.70	20.00	SPT	4	5	6	7	8	12	N=33	
BH 2	1.00	1.15	1.45	SPT	1	1	2	2	2	3	N=9	
BH 2	3.00	3.15	3.45	SPT	1	1	2	2	3	3	N=10	
BH 2	5.00	5.15	5.45	SPT	2	2	3	3	4	4	N=14	
BH 2	8.00	8.15	8.45	SPT	3	4	4	5	5	6	N=20	
BH 2	11.00	11.15	11.45	SPT	4	4	5	6	7	7	N=25	
BH 2	14.55	14.70	15.00	SPT	3	4	6	7	6	8	N=27	
BH 3	2.00	2.15	2.45	SPT	3	2	2	3	3	11	N=19	
BH 3	4.00	4.15	4.45	SPT	1	2	2	3	4	5	N=14	
BH 3	6.50	6.65	6.95	SPT	2	2	3	5	5	5	N=18	
BH 3	9.55	9.70	10.00	SPT	2	3	4	5	6	7	N=22	

GEA Geotechnical & Environmental Associates — Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG			Site 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number 1
Excavation Method Manual	Dimensions 500 x 700 x 1600	Ground Level (mOD) approx. 97.07	Client Azmil Khalid and Fuziah Hussein	Job Number J12288
	Location	Dates 06/12/2012	Engineer Conisbee	Sheet 1/25

PLAN

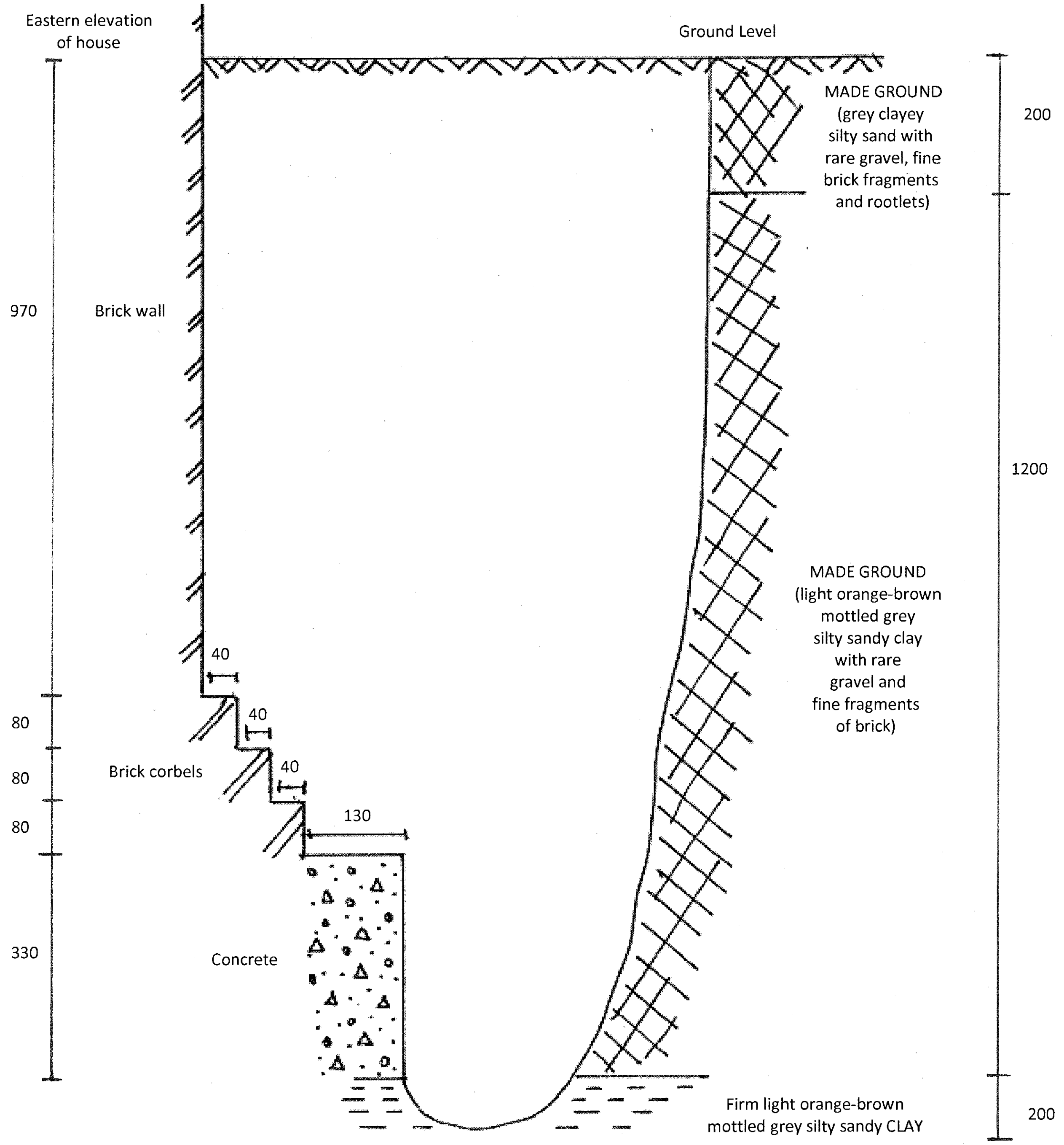


Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Trial Pit Number** 1

Excavation Method	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number**
Manual	500 x 700 x 1600	approx. 97.07	Axmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		06/12/2012	Conisbee	2/25

SECTION A - A'



Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

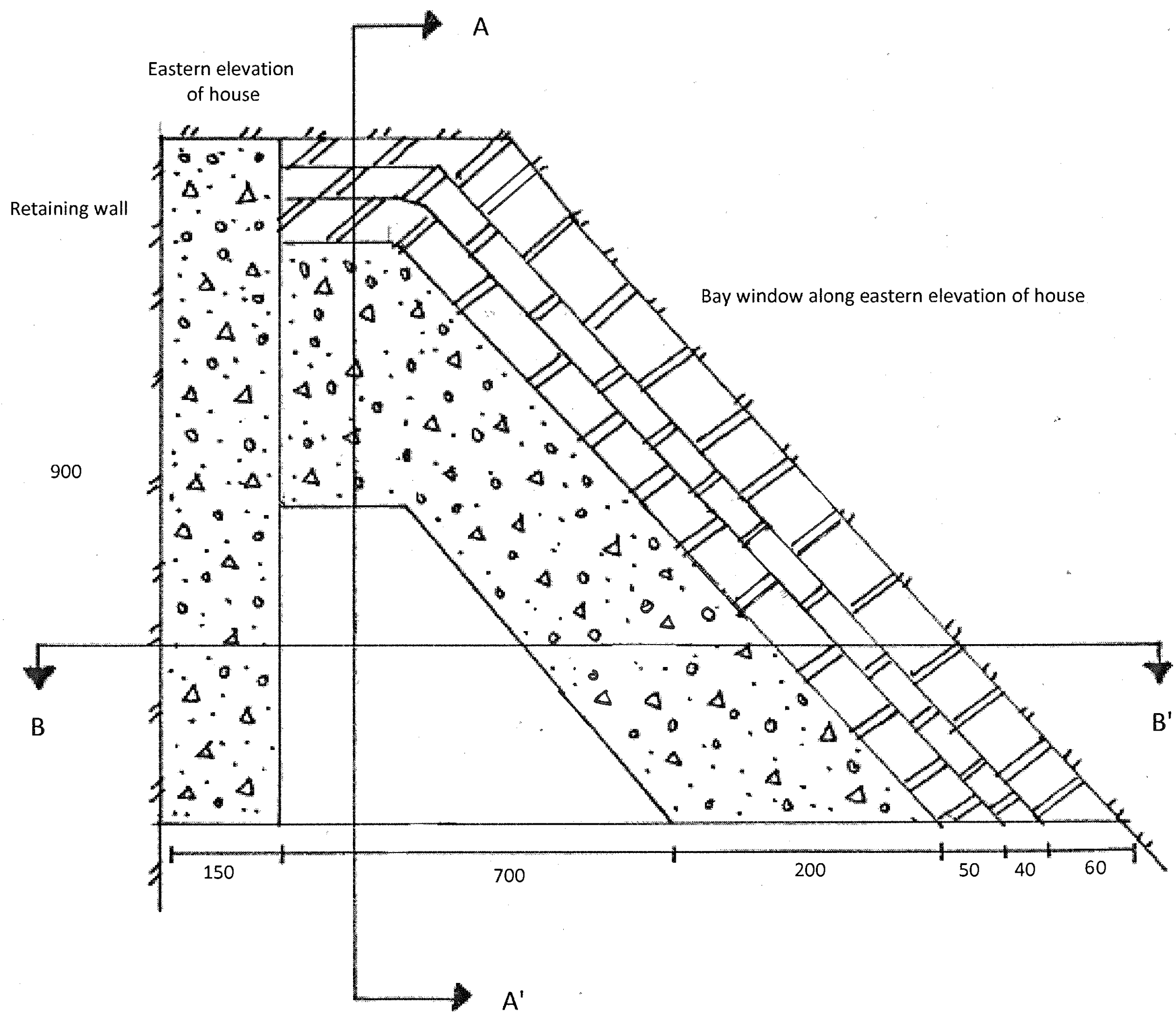
Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Alb	**Trial Pit No 1**

Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number** J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet** 3/25
Engineer	Conisbee	

Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG	Site: 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number: 2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Manual	900 x 1200 x 900	approx. 97.04	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		06/12/2012	Conisbee	4/25

PLAN

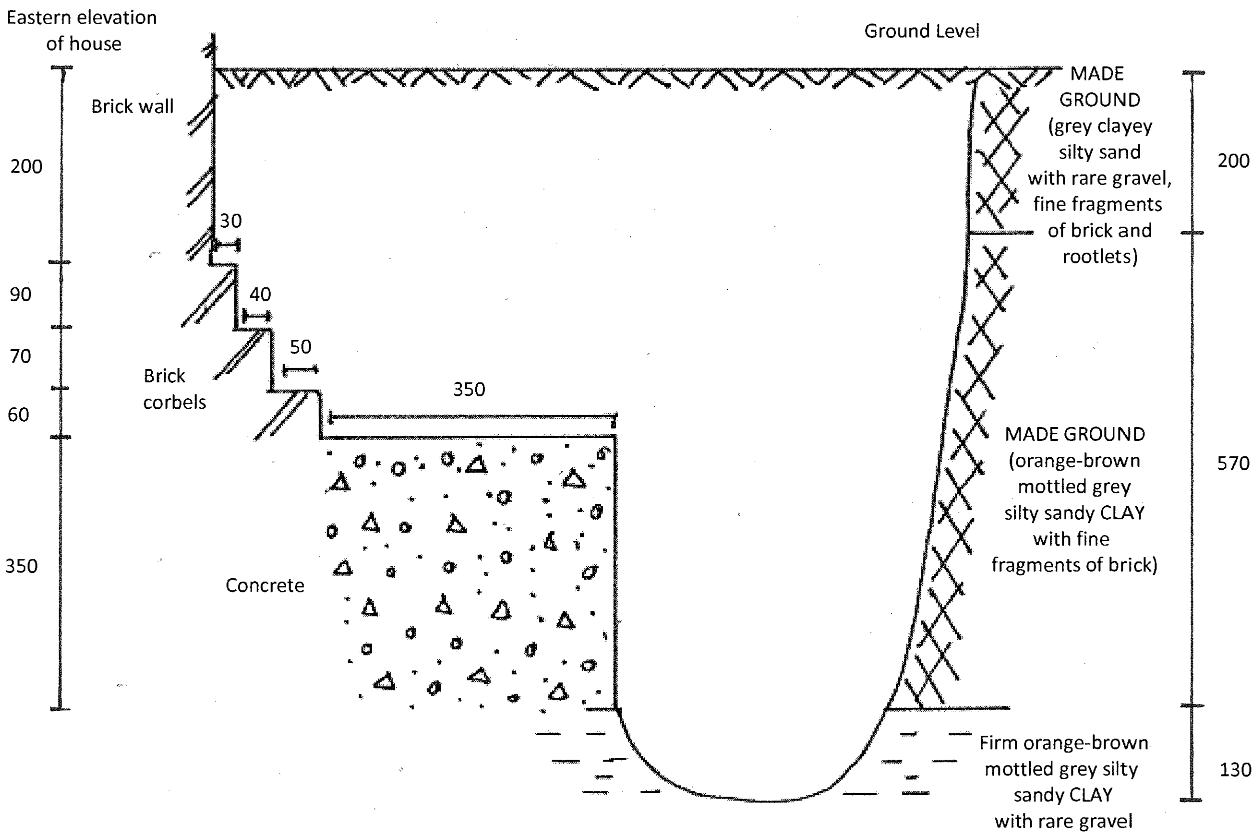


Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Trial Pit Number** 2

Excavation Method	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number**
Manual	900 x 1200 x 900	approx. 97.04	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		06/12/2012	Conisbee	5/25

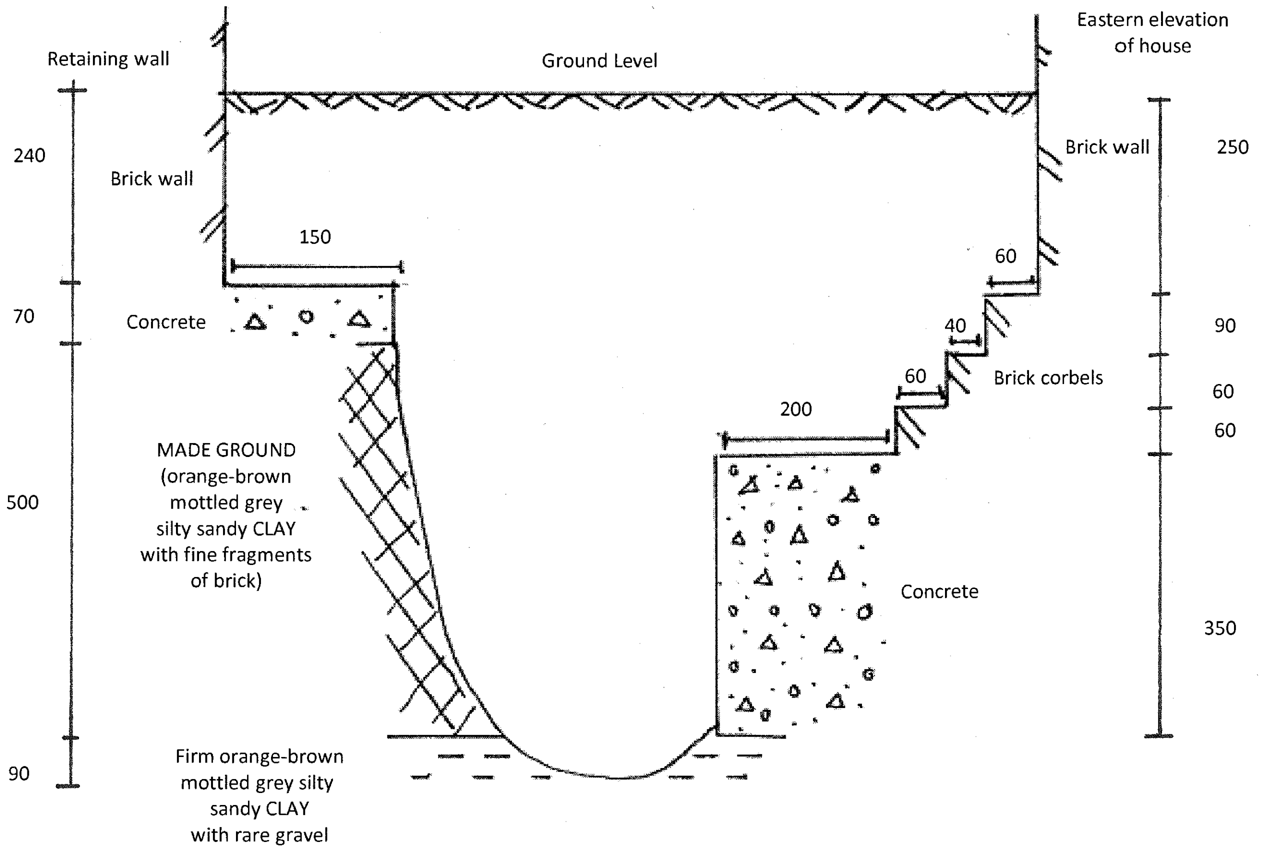
SECTION A - A'



Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

Geotechnical & Environmental Associates — Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG			**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Trial Pit Number** 2
Excavation Method Manual	**Dimensions** 900 x 1200 x 900	**Ground Level (mOD)** approx. 97.04	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 06/12/2012	**Engineer** Conisbee	**Sheet** 6/25

SECTION B - B'

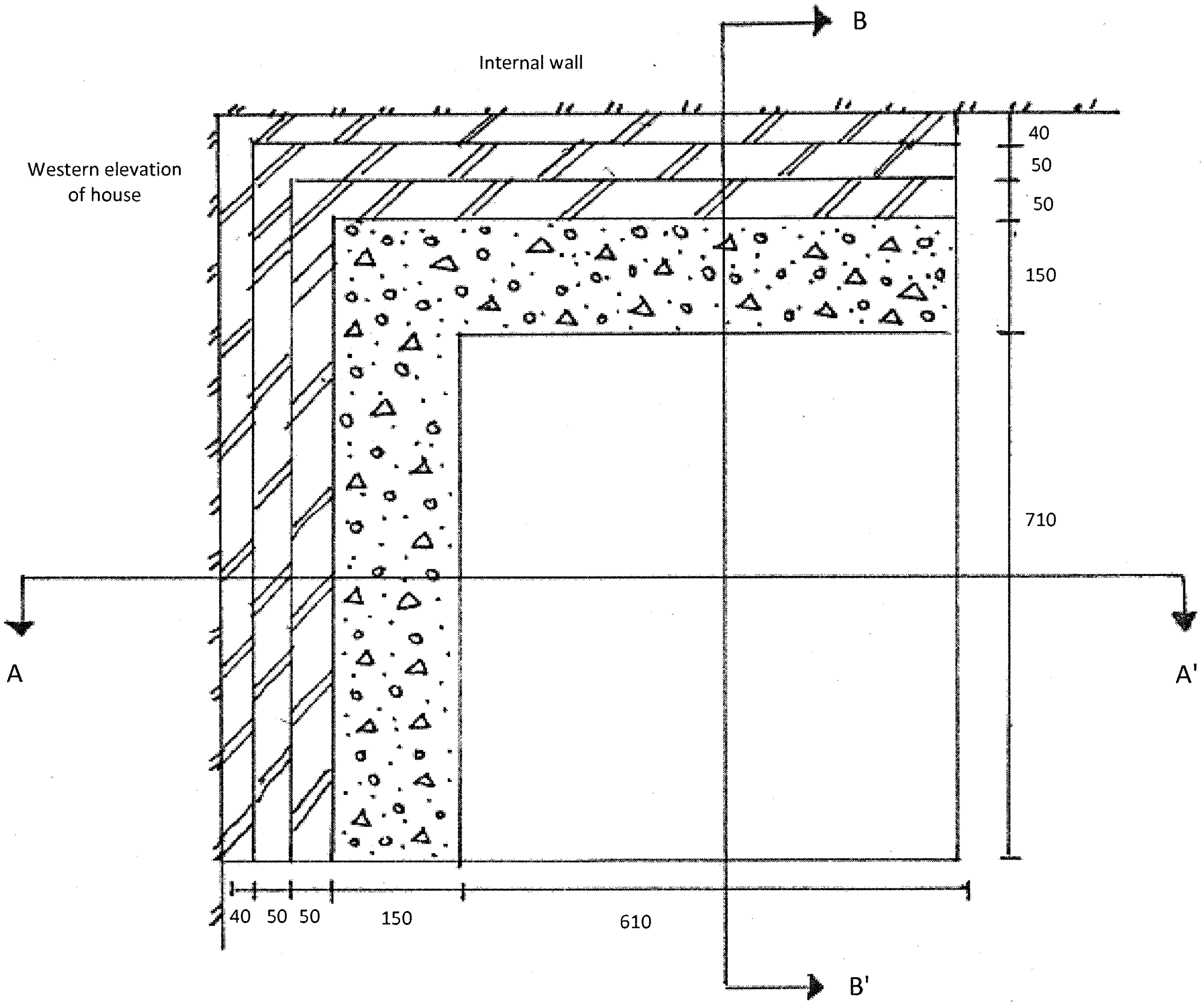


Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number 3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Manual	900 x 1000 x 1650	97.45	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		06/12/2012	Conisbee	8/25

PLAN

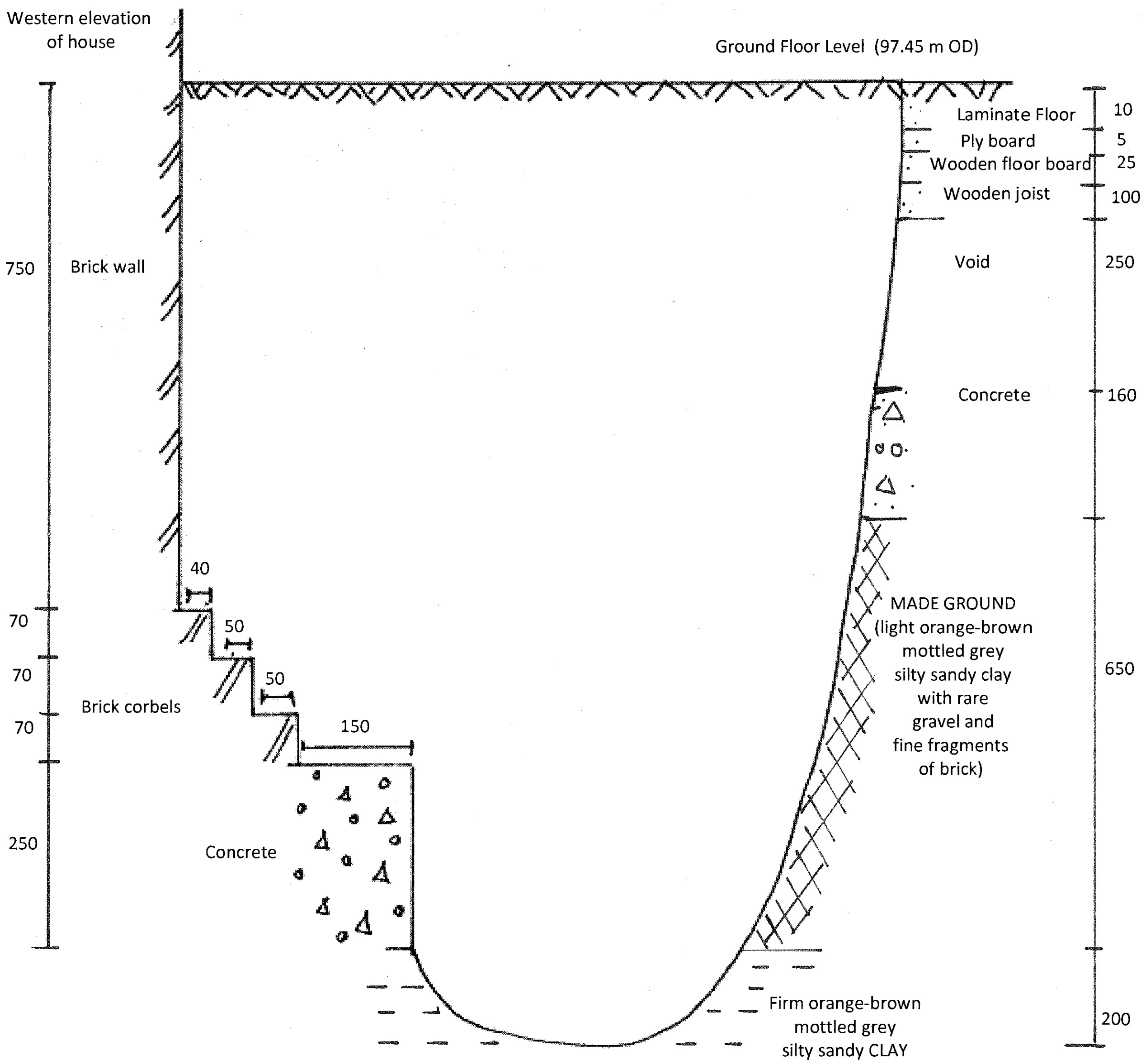


Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Perched water encountered at base of existing footings at a depth of 1.20 m	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number 3

Excavation Method Manual	**Dimensions** 900 x 1000 x 1400	**Ground Level (mOD)** 97.45	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 06/12/2012	**Engineer** Conisbee	**Sheet** 9/25

SECTION A - A'

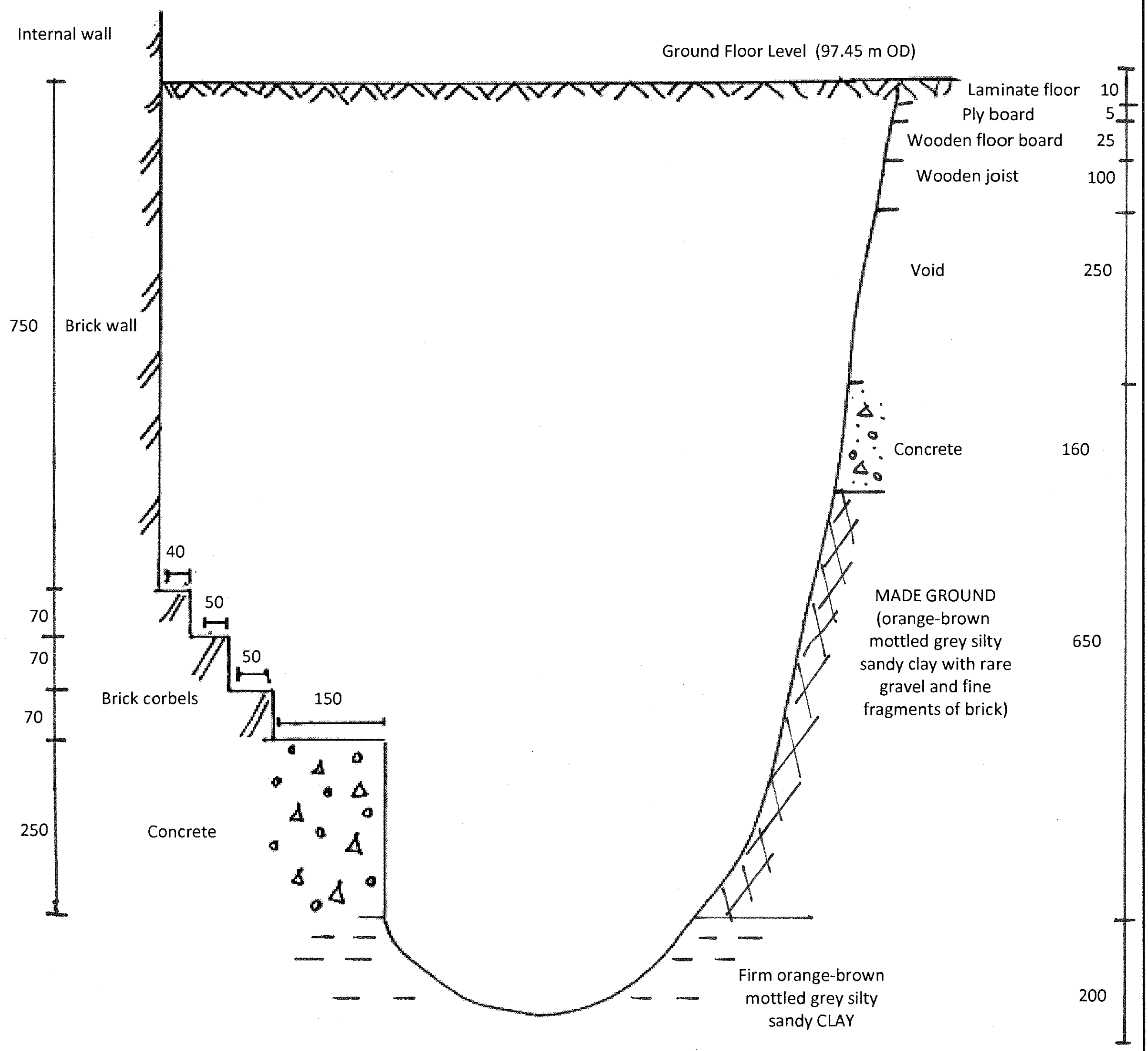


Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Perched water encountered at base of existing footings at a depth of 1.20 m	HD

Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Trial Pit Number** 3

Excavation Method	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number**
Manual	900 x 1000 x 1400	97.45	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		06/12/2012	Conisbee	10/25

SECTION B -B'



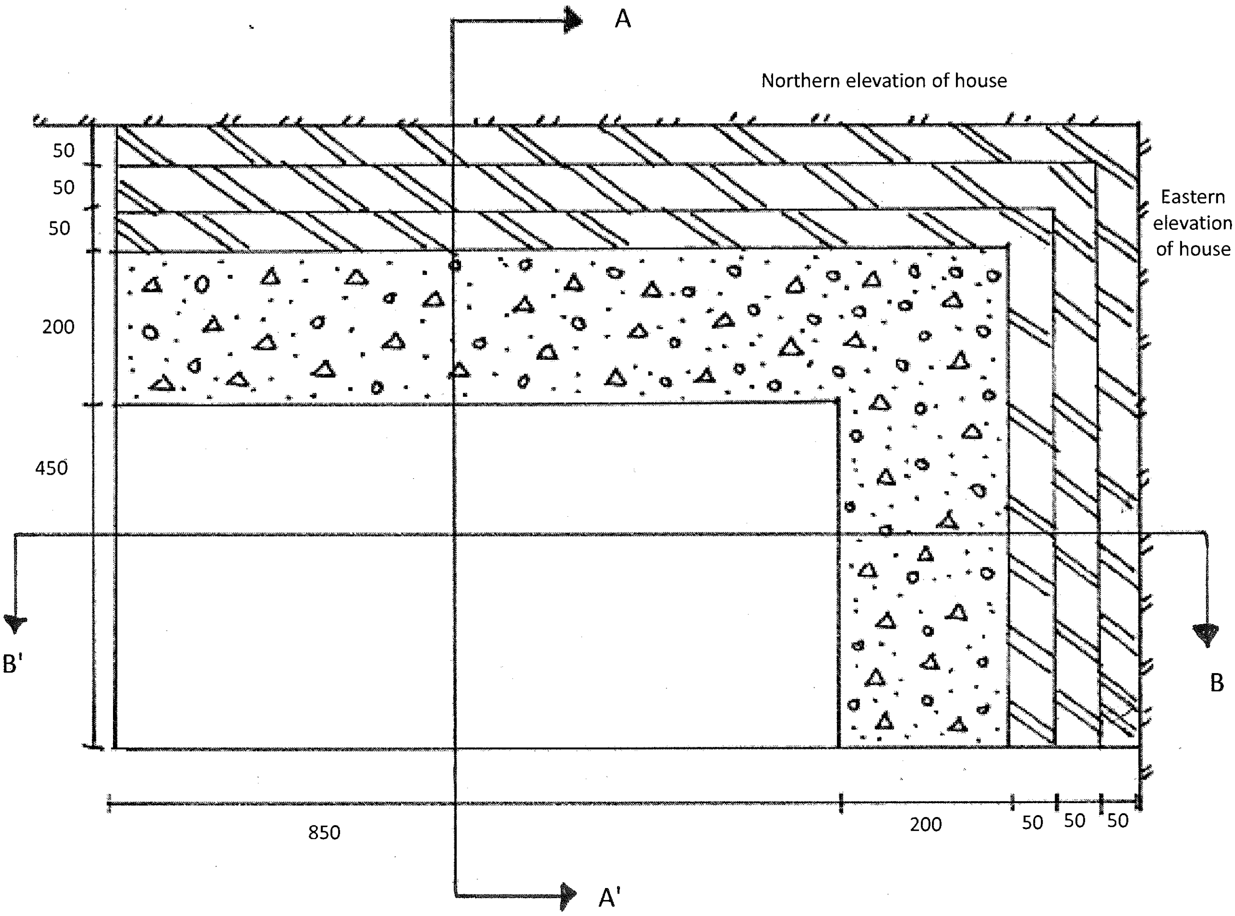
Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Perched water encountered at base of existing footings at a depth of 1.20 m	HD

Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Alb	**Trial Pit No 3**

Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number** J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet** 11/25
Engineer	Conisbee	

Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG	Site: 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number: 4
Excavation Method Manual	**Dimensions** 1200 x 800 x 1300	**Ground Level (mOD)** 97.45	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 06/12/2012	**Engineer** Conisbee	**Sheet** 12/25

PLAN



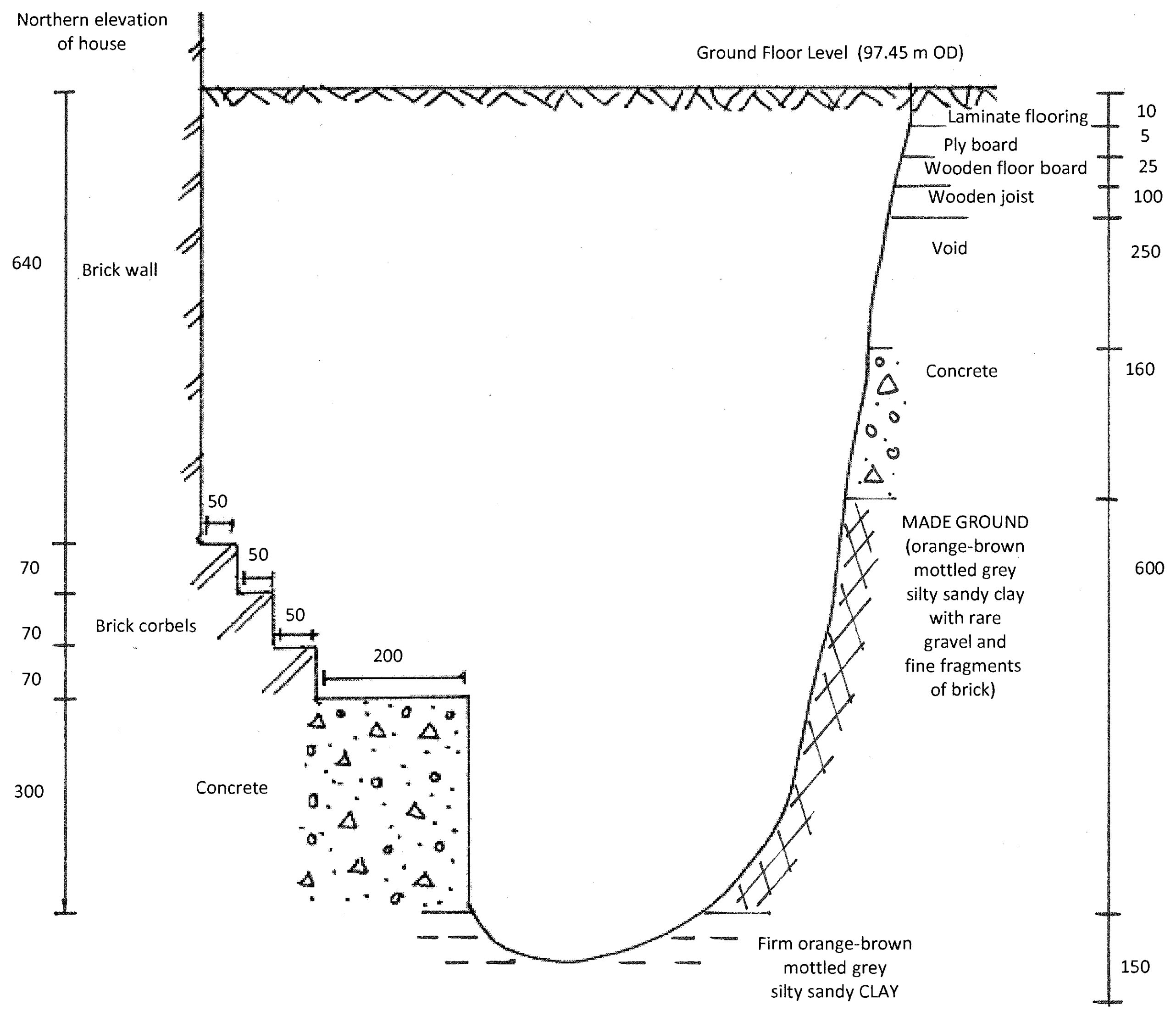
Remarks:
All dimensions in millimetres
Sides of trial pit remained stable during excavation
Groundwater not encountered

Scale: 1:10
Logged by: HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number 4

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Manual	1200 x 800 x 1300	97.45	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		06/12/2012	Conisbee	13/25

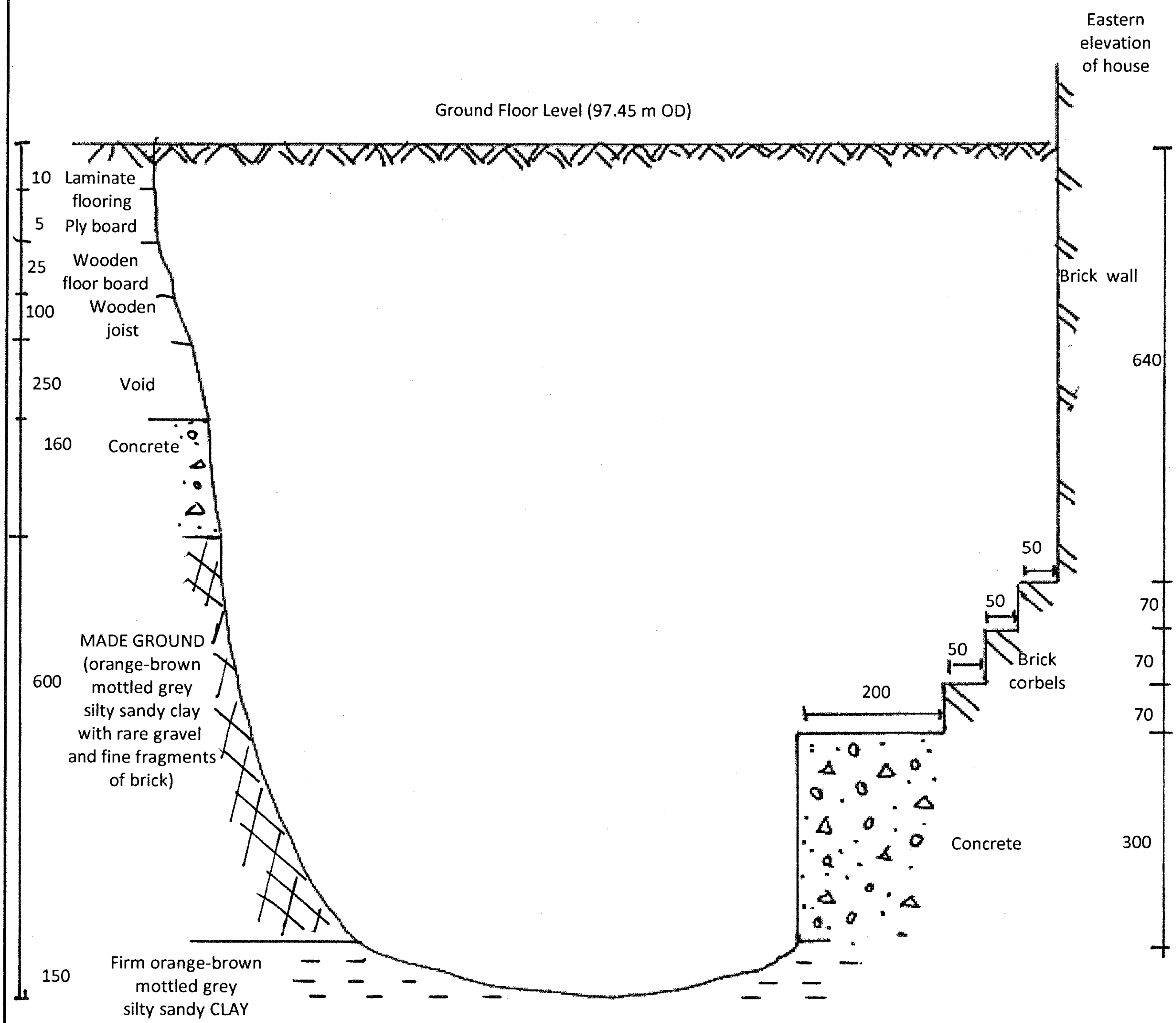
SECTION A - A'



Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD	**Trial Pit Number** 4
Excavation Method Manual	**Dimensions** 1200 x 800 x 1300	**Ground Level (mOD)** 97.45	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 06/12/2012	**Engineer** Conisbee	**Sheet** 14/25

SECTION B - B'



Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

Geotechnical & Environmental Associates

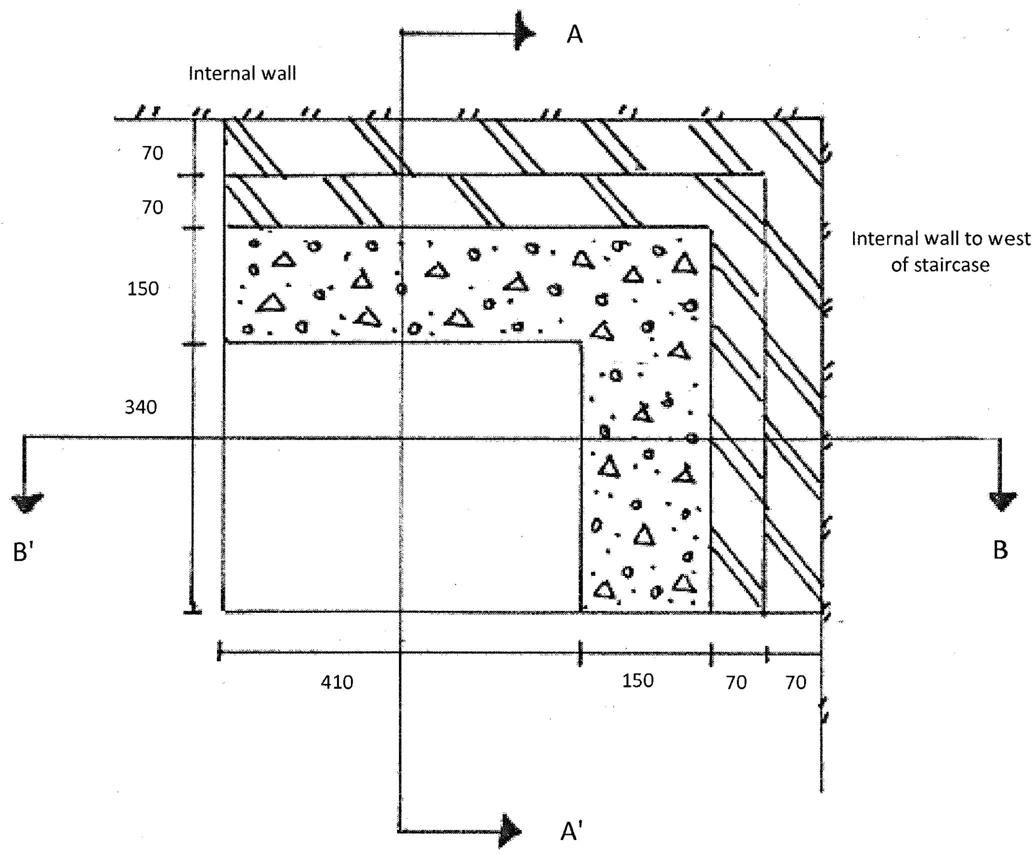
Tyttenhanger House
Coursers Road
St Alb

Trial Pit No 4

Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number** J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet** 15/25
Engineer	Conisbee	

GEA Geotechnical & Environmental Associates		Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD		**Trial Pit Number** 5
Excavation Method Manual	**Dimensions** 630 x 700 x 1600	**Ground Level (mOD)** 97.45	**Client** Azmil Khalid and Fuziah Hussein		**Job Number** J12288
	Location	**Dates** 07/12/2012	**Engineer** Conisbee		**Sheet** 16/25

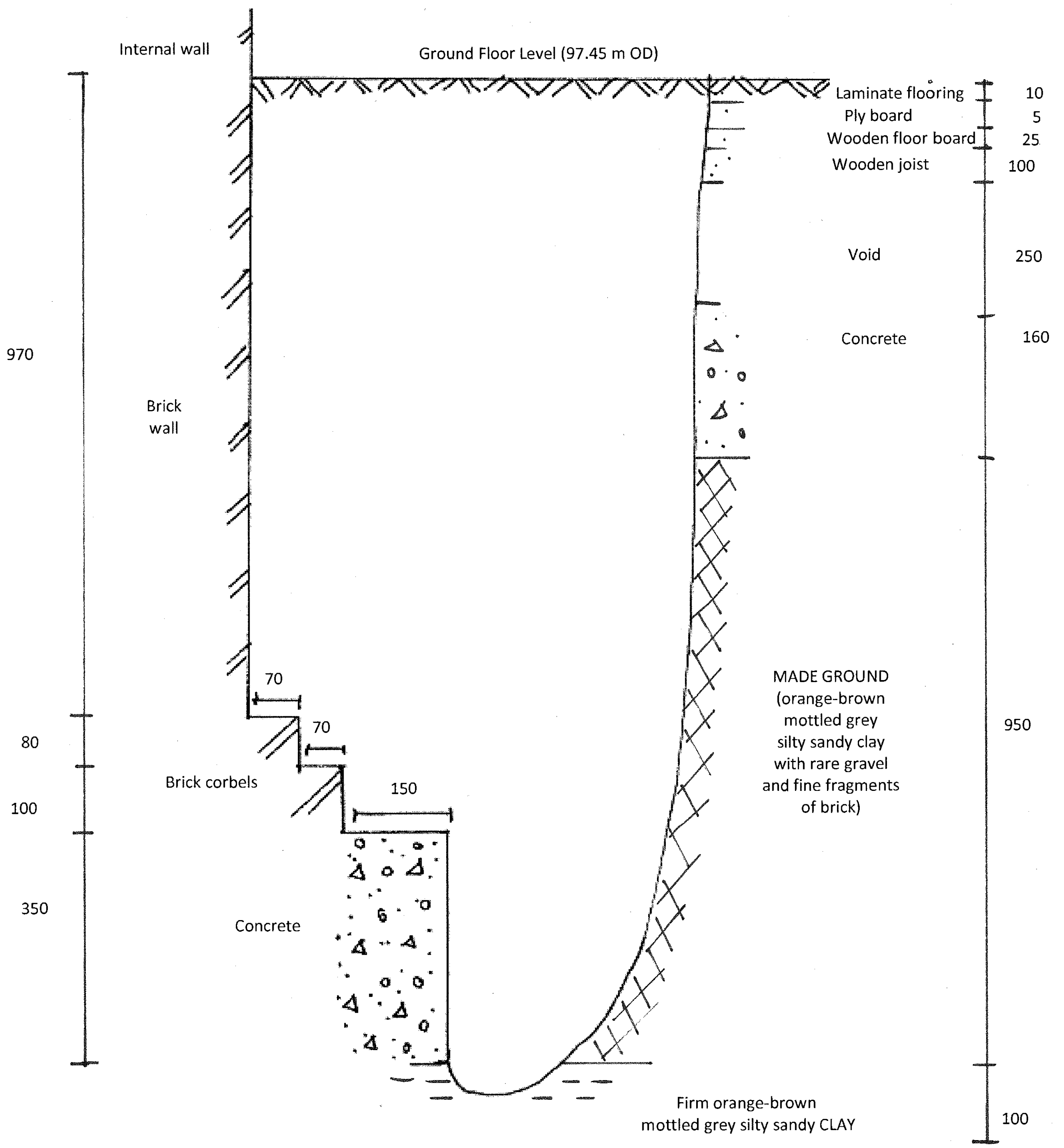
PLAN



Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Perched water encountered at base of existing footings at a depth of 1.50 m	HD

Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	**Site** 63 Frognal, Hampstead, London, NW3 6XD		**Trial Pit Number** 5
Excavation Method Manual	**Dimensions** 630 x 700 x 1600	**Ground Level (mOD)** 97.45	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 07/01/2012	**Engineer** Conisbee	**Sheet** 17/25

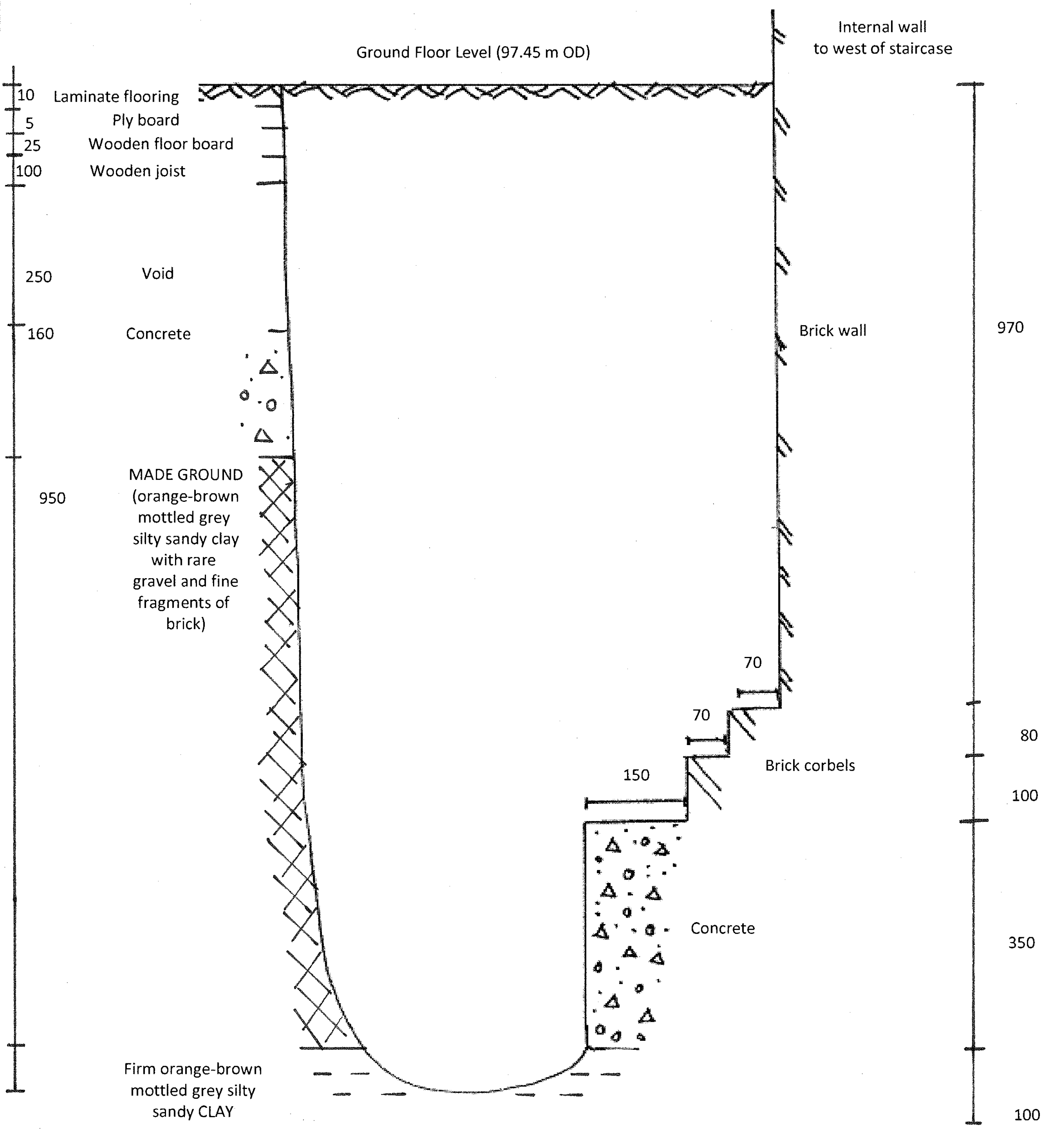
SECTION A - A'



Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Perched water encountered at base of existing footings at a depth of 1.50 m	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG	Site: 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number: 5
Excavation Method Manual	**Dimensions** 630 x 700 x 1600	**Ground Level (mOD)** 97.45	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 07/01/2012	**Engineer** Conisbee	**Sheet** 18/25

SECTION B -B'



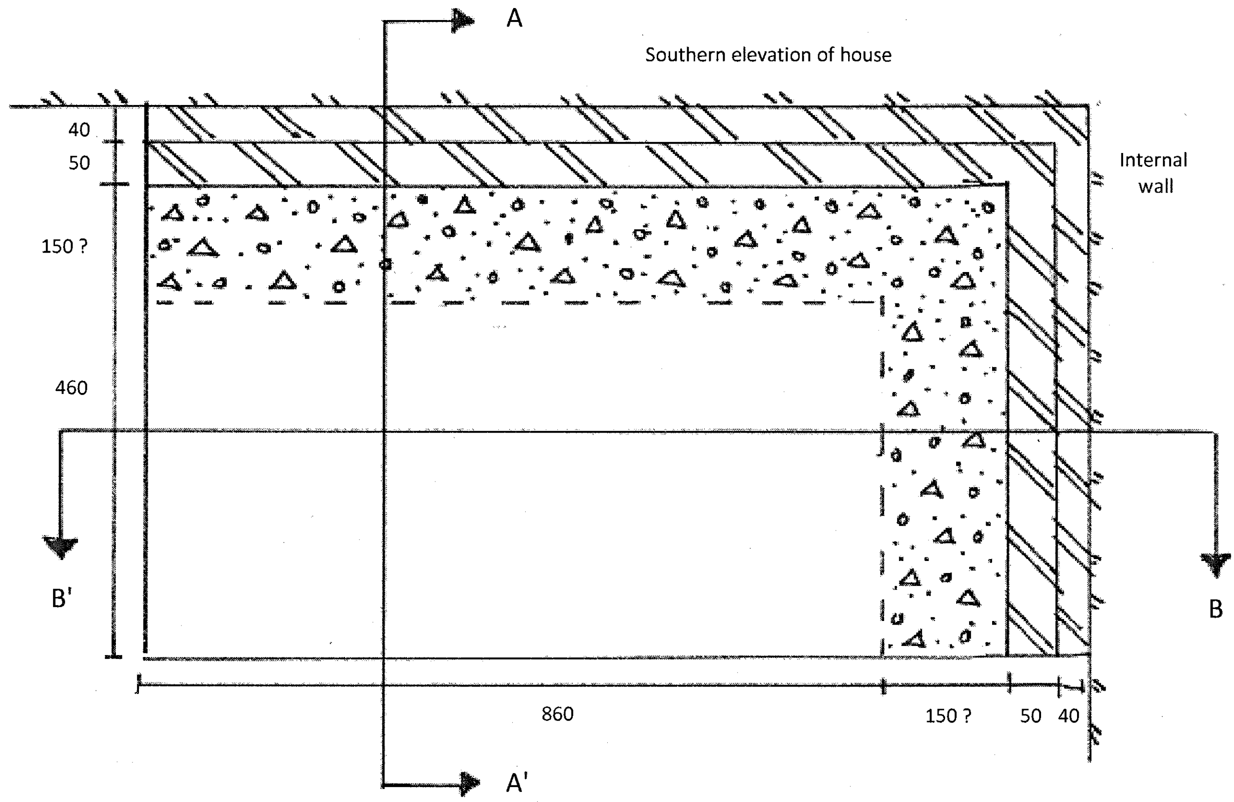
Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Perched water encountered at base of existing footings at a depth of 1.50 m	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Alb	**Trial Pit No 5**

Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number** J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet** 19/25
Engineer	Conisbee	

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number 6
Excavation Method Manual	**Dimensions** 700 x 1100 x 1380	**Ground Level (mOD)** 97.45	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 07/12/2012	**Engineer** Conisbee	**Sheet** 20/25

PLAN



Remarks:

All dimensions in millimetres

Sides of trial pit remained stable during excavation

Groundwater not encountered

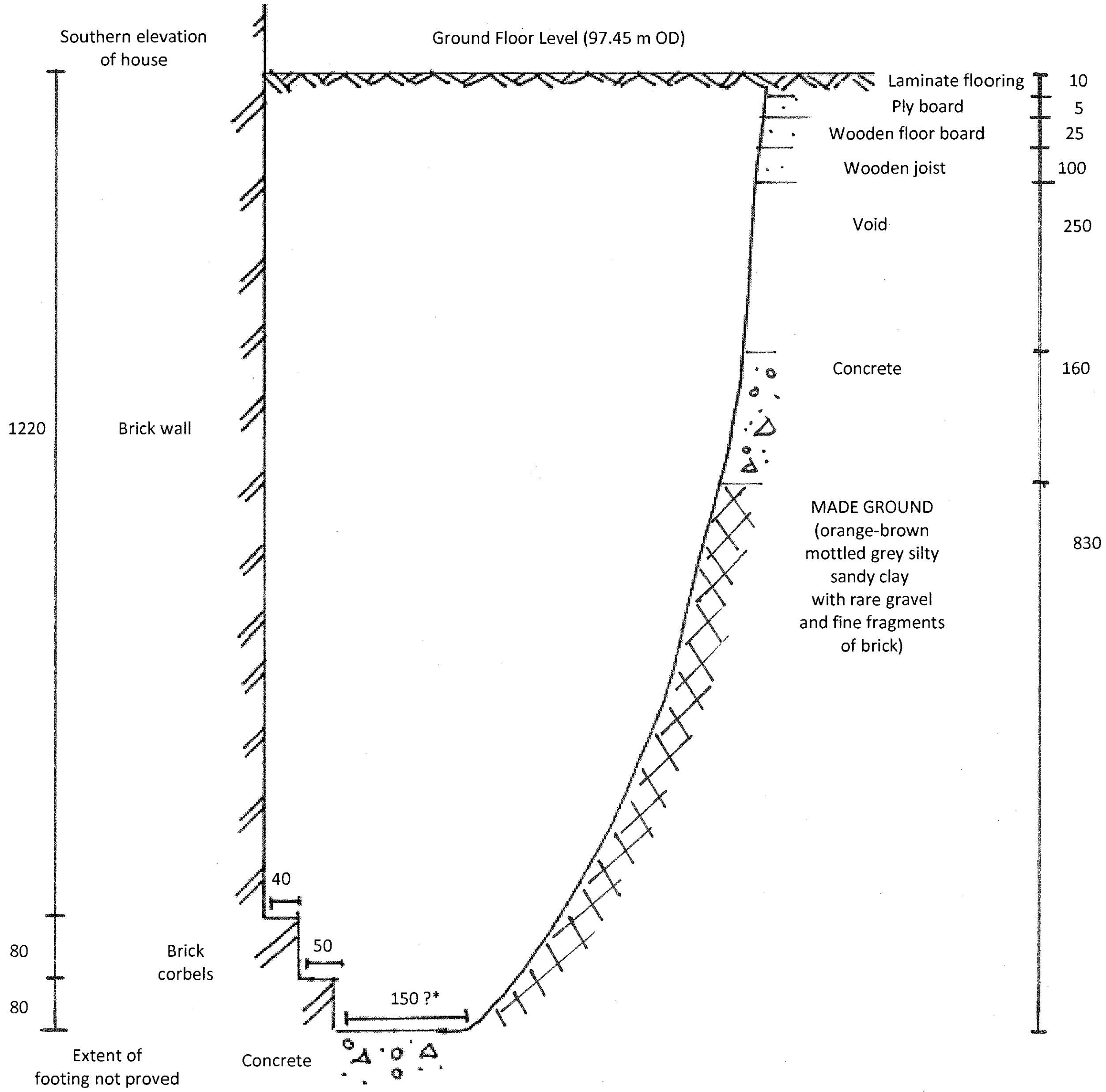
Scale: 1:10

Logged by: HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number 6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Manual	700 x 1100 x 1380	97.45	Azmil Khalid and Fuziah Hussein	J12288
	Location	**Dates**	**Engineer**	**Sheet**
		07/12/2012	Conisbee	21/25

SECTION A - A'

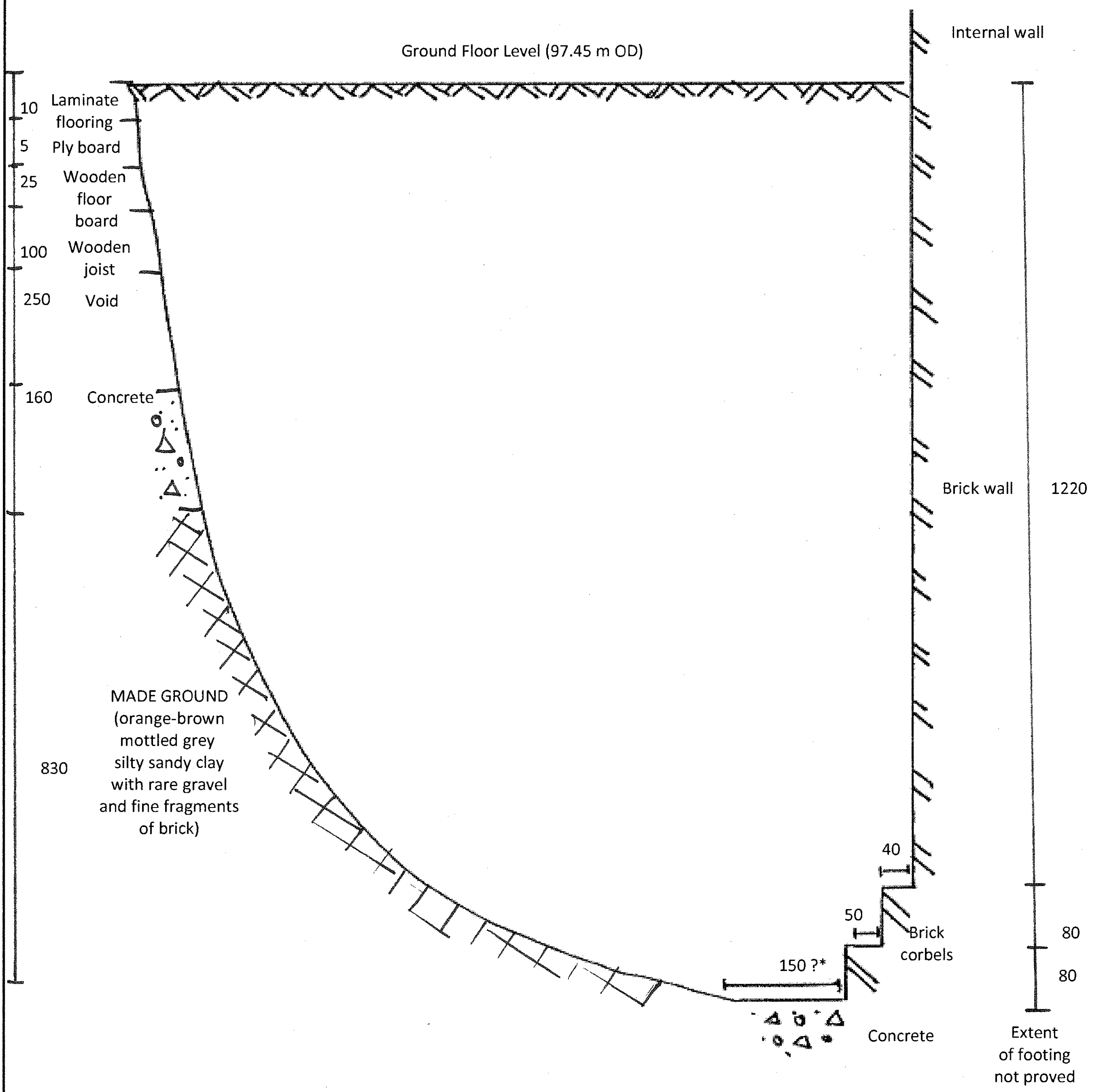


*Services located in the pit limited access to determine the extent and thickness of the concrete footing

Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, Herts AL4 0PG	Site: 63 Frognal, Hampstead, London, NW3 6XD		Trial Pit Number: 6
Excavation Method Manual	**Dimensions** 700 x 1100 x 1380	**Ground Level (mOD)** 97.45	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 07/12/2012	**Engineer** Conisbee	**Sheet** 22/25

SECTION B - B'



*Services located in the pit limited access to determine the extent and thickness of the concrete footing

Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

Geotechnical & Environmental Associates

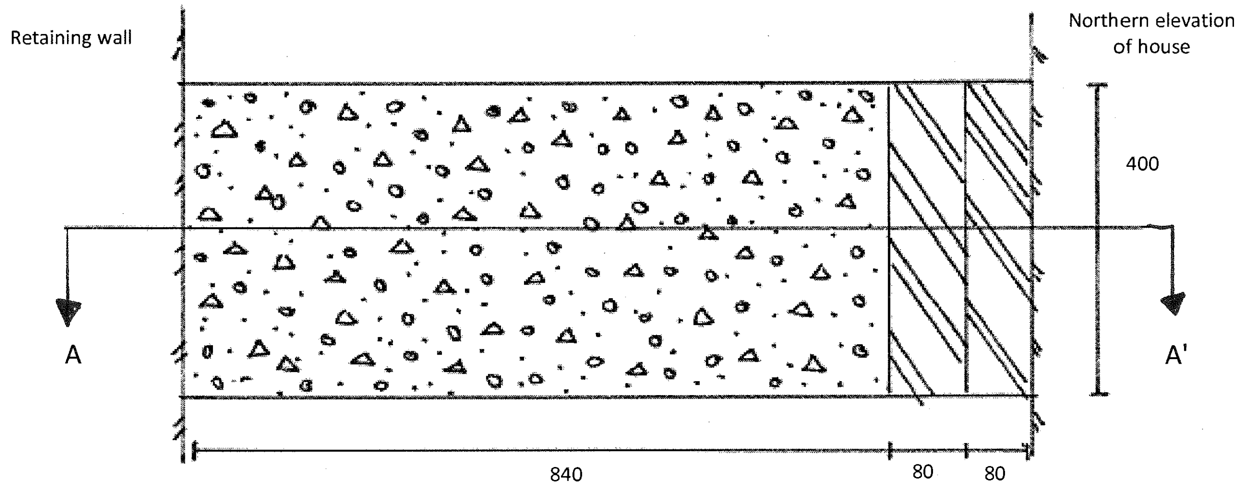
Tyttenhanger House
Coursers Road
St Alb

Trial Pit No 6

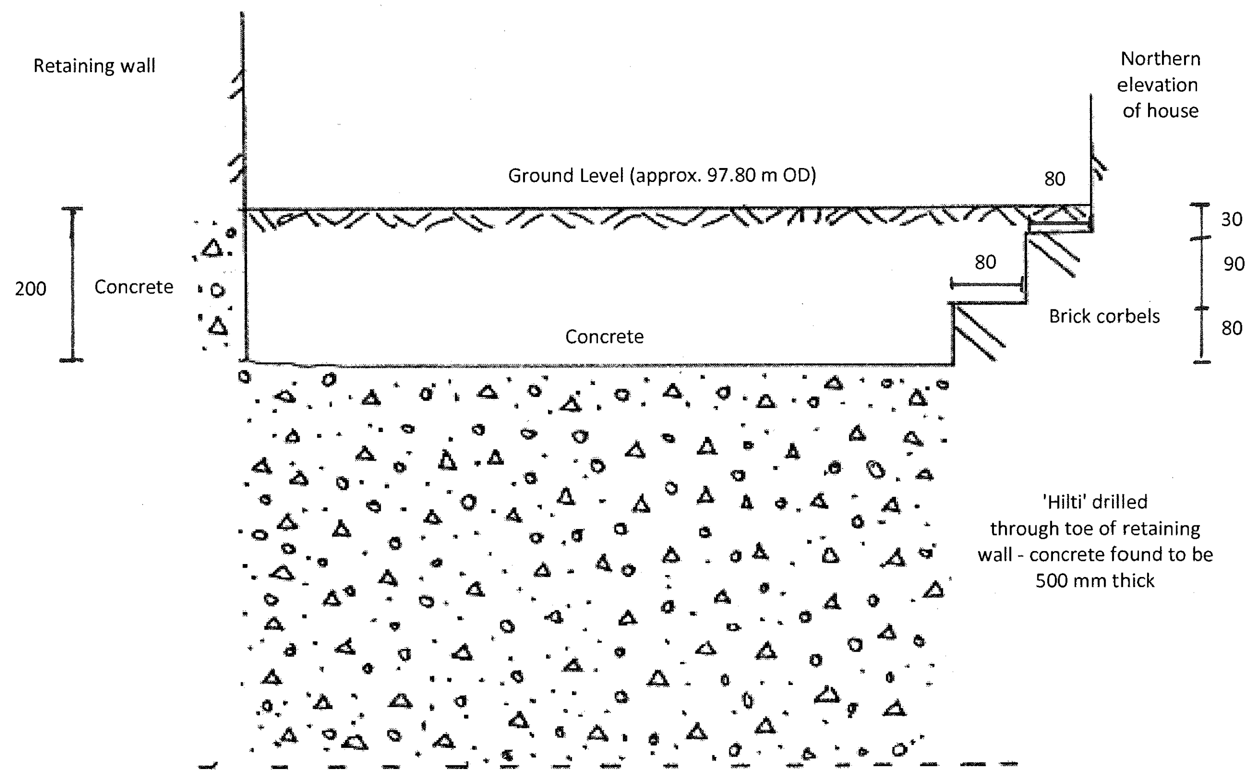
Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number** J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet** 23/25
Engineer	Conisbee	

Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans Herts AL4 0PG	Site 63 Frognal, Hampstead, London, NW3 6XD	Trial Pit Number 7
Excavation Method Manual	**Dimensions** 1000 x 400 x 200	**Ground Level (mOD)** approx. 97.80	**Client** Azmil Khalid and Fuziah Hussein	**Job Number** J12288
	Location	**Dates** 07/12/2012	**Engineer** Conisbee	**Sheet** 24/25

PLAN



SECTION A - A'



Remarks:	Scale:
All dimensions in millimetres	1:10
Sides of trial pit remained stable during excavation	Logged by:
Groundwater not encountered	HD

Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Alb	**Trial Pit No 7**

Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number** J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet** 25/25
Engineer	Conisbee	

Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Albans
Herts AL4 0PG

Groundwater Monitoring Results

Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number**	J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet**	1 / 1
Engineer	Conisbee		

Borehole No	Standpipe depth (m)	Depth to groundwater (m)					
		05/12/2012	07/12/2012	10/12/2012	12/12/2012	19/12/2012	03/01/2013
1	8.00	0.67	0.64	0.69	0.71	0.36	0.57
2	7.00	1.20	1.01	1.06	1.10	0.25	0.86
3	4.00	0.67	1.63	1.67	1.70	1.45	1.55

Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Albans
Herts AL4 0PG

Rising Head Test

Site	63 Frognal, Hampstead, London, NW3	**Job Number**	J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet**	1/2
Engineer	Conisbee		

BOREHOLE No	1
TEST NO	1
DATE	07/12/2012

AT START OF TEST	
BH Depth	7.70
Casing Depth	
Water Level	0.64

TIME (minutes)	*WATER LEVEL (m)*
0	3.84
3	3.73
10	3.48
23	2.00
83	1.44
177	1.20
206	1.06

Borehole Depth at End of Test	7.70

REMARKS

Geotechnical & Environmental Associates
Tyttenhanger House
Coursers Road
St Albans
Herts AL4 0PG

Rising Head Test

Site	63 Frognal, Hampstead, London, NW3
Client	Azmil Khalid and Fuziah Hussein
Engineer	Conisbee
Job Number	J12288
Sheet	2/2

BOREHOLE No	2
TEST NO	1
DATE	07/12/2012

AT START OF TEST	
BH Depth	7.00
Casing Depth	
Water Level	1.01

TIME (minutes)	*WATER LEVEL (m)*
0	5.47
3	5.42
7	5.35
13	5.27
31	5.07
48	4.88
59	4.80
129	4.16
186	3.73
225	3.47
255	3.28

Borehole Depth at End of Test	7.00

REMARKS

Project Name:	63 Frognal, Hampstead, London, NW3 6XD	Samples Received:	10/12/2012
		Project Started:	19/12/2012
Client:	GEA	Testing Started:	09/01/2013
Project No:	J12288 — Our job/report no: 13846	Date Reported:	11/01/2013

K4 SOILS

Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
BH1	D4	1.00	Brown sandy CLAY with clay pockets	27	47	20	27	100	
BH1	D5	1.75	Brown and occasional orange and blue-grey CLAY with sandy clay pockets	25					
BH1	U6	2.00	Medium strength brown, pale grey brown and orange brown mottled silty sandy CLAY	31					
BH1	D7	2.75	Brown and occasional orange and pale grey CLAY with sandy clay inclusions	27	50	22	28	100	
BH1	D8	3.00	Brown and occasional orange and blue-grey CLAY with sandy clay pockets	33					
BH1	U10	4.00	Medium strength brown mottled and pale blue grey silty fine sandy CLAY	26					
BH2	D2	0.50	Brown, orange and pale grey slightly sandy slightly gravelly CLAY with rootlets (gravel is fmc and angular to rounded)	27					
BH2	D3	1.00	Brown, orange and occasional pale grey CLAY with sandy clay pockets	31					
BH2	D4	1.00	Brown, orange and pale grey CLAY with sandy clay pockets	28	51	20	31	100	
BH2	D5	1.75	Brown, orange and pale grey CLAY with sandy clay pockets	30					
BH2	U6	2.00	High strength brown and orange brown mottled silty sandy CLAY	21					
BH2	D7	2.75	Brown and orange CLAY with sandy clay pockets	31					
BH2	D8	3.00	Brown and occasional orange CLAY with sandy clay pockets	31	48	21	27	100	
BH2	D9	3.75	Brown and orange CLAY with sandy clay pockets	32					
BH2	U10	4.00	High strength brown silty fissured CLAY with orange brown fine sandy potches	21					
BH2	D19	10.50	Grey CLAY	29	66	26	40	100	
BH4	D1	1.20	Brown, orange and pale grey slightly sandy CLAY	28					
BH4	D2	1.50	Brown, orange and pale grey CLAY with sandy clay pockets	27					
BH4	D3	2.00	Brown, orange and pale grey CLAY with sandy clay pockets	28					

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: 11/01/2013

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)

Project Name:	63 Frognal, Hampstead, London, NW3 6XD		Samples Received:	10/12/2012	K4 SOILS
			Project Started:	19/12/2012	
Client:	GEA		Testing Started:	09/01/2013	
Project No:	J12288	Our job/report no: 13846	Date Reported:	11/01/2013	

Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
BH4	D4	2.50	Brown, orange and occasional pale grey slightly sandy CLAY	25					
BH4	D5	3.00	Brown, orange and pale grey CLAY with sandy clay pockets	27					
BH4	D6	3.50	Brown and occasional orange and pale grey CLAY with sandy clay pockets	27	47	20	27	100	
BH4	D7	4.00	Brown and occasional orange CLAY with sandy clay pockets	26					

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: 11/01/2013

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)

Project Name:	63 Frognal, Hampstead, London, NW3 6XD	
Client:	GEA	Project no: J12288
		Our job no: 13846

K4 SOILS

Borehole No:	Sample No:	Depth m	Description	pH	Sulphate content (g/l)
BH1	D1	0.20	Dark grey slightly gravelly sandy CLAY with trace of brick fragments and rottlets (gravel is fm and sub-angular to sub-rounded)	7.2	0.15
BH1	U10	4.00	Medium strength brown mottled and pale blue grey silty fine sandy CLAY	7.8	0.15
BH1	D17	9.00	Dark grey slightly sandy CLAY	7.8	0.66

Date	Summary of Test Results	Checked and Approved
11/01/2013	BS 1377 : Part 3 :Clause 5 : 1990 Determination of sulphate content of soil and ground water : gravimetric method	Initials : kp

Client :	GEA	Our Job/report no:	13846	Samples Rec :	10/12/2012	Testing Started:	07/01/2013
Project name:	63 Frognal, Hampstead, London, NW3 6XD	Project No:	J12288	Project Started:	19/12/2012	Date reported:	11/01/2013

BH / TP No	Sample no / ref	Sample depth (m)	Description	Moisture content (%)	Bulk Density (Mg/m3)	Dry density (Mg/m3)	Cell Pressure (kPa)	Strain at failure (%)	Max Deviator Stress (kPa)	Mode of failure	Shear Strength (kPa)	Phi (deg)
BH1	U6	2.00	Medium strength brown, pale grey brown and orange brown mottled silty sandy CLAY	31	1.86	1.42	40	7.5	113	Brittle	57	NA
BH1	U10	4.00	Medium strength brown mottled and pale blue grey silty fine sandy CLAY	26	1.91	1.52	80	20	135	Brittle	68	NA
BH1	U14	6.50	High strength grey silty sandy fissured CLAY	28	1.90	1.49	130	17	261	Plastic	131	NA
BH1	U18	9.50	High strength grey brown silty fissured CLAY	26	1.96	1.55	190	2.5	195	Brittle	98	NA
BH1	U21	12.00	High strength grey brown silty fissured CLAY	29	2.00	1.56	240	5.5	184	Brittle	92	NA
BH1	U26	15.50	High strength grey brown silty fissured CLAY	28	1.97	1.54	310	3.5	176	Brittle	88	NA
BH1	U30	18.50	Very high strength grey brown silty fissured CLAY	26	2.00	1.59	370	7.0	326	Brittle	163	NA
BH2	U6	2.00	High strength brown and orange brown mottled silty sandy CLAY	21	1.95	1.61	40	7.0	275	Brittle	138	NA
BH2	U10	4.00	High strength brown silty fissured CLAY with orange brown fine sandy potches	21	1.96	1.62	80	9.0	244	Brittle	122	NA
BH2	U14	6.50	High strength grey brown silty fine sandy CLAY	23	2.00	1.62	130	11	197	Brittle	99	NA
BH2	U18	9.50	High strength grey brown silty fissured CLAY	26	1.98	1.57	190	6.5	216	Brittle	108	NA
BH2	U22	12.50	Very high strength grey brown silty fissured CLAY	26	2.01	1.59	250	7.0	308	Brittle	154	NA
BH3	U2	1.00	Medium strength rusty brown mottled pale blue-grey silty fine sandy CLAY	29	1.94	1.51	20	20	145	Brittle	73	NA

K4 SOILS

Summary of Undrained Triaxial Compression Testing

BS 1377 : Part 7 : Clause 8 : 1990

Checked and approved

Initials kp

Test Results relate only to the sample numbers shown above. All samples connected with this report, incl any on 'hold' will be stored and disposed off according to company policy. A copy of this policy is available on request.

UKAS TESTING 2519

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford WD18 9RU Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Client :	GEA	Our Job/report no:	13846	Samples Rec :	10/12/2012	Testing Started:	07/01/2013
Project name:	63 Frognal, Hampstead, London, NW3 6XD	Project No:	J12288	Project Started:	19/12/2012	Date reported:	11/01/2013

BH / TP No	Sample no / ref	Sample depth (m)	Description	Moisture content (%)	Bulk Density (Mg/m3)	Dry density (Mg/m3)	Cell Pressure (kPa)	Strain at failure (%)	Max Deviator Stress (kPa)	Mode of failure	Shear Strength (kPa)	Phi (deg)
BH3	U6	3.00	High strength brown mottled orange brown silty fine sandy fissured CLAY	27	1.96	1.54	60	14	174	Brittle	87	NA
BH3	U10	5.00	Medium strength grey silty sandy CLAY with occasional pale grey partings	23	2.02	1.64	100	12	136	Brittle	68	NA
BH3	U14	8.00	High strength grey brown silty fine sandy fissured CLAY	26	1.98	1.58	160	10	190	Brittle	95	NA

K4 SOILS

Summary of Undrained Triaxial Compression Testing

BS 1377 : Part 7 : Clause 8 : 1990

Checked and approved

Initials kp

K4 SOILS	Report of Undrained Triaxial Compression Test
	BS 1377 : Part 7 : 1990 Clause 8.0

Project name: 63 Frognal, Hampstead, London, NW3 6XD		**Samples Received:**	10/12/2012
		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH1	**Sample no:** U6	**Depth (m):**	2.00

Soil Description: Medium strength brown, pale grey brown and orange brown mottled silty sandy CLAY

Sample Details — Specimen 1

		1
Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	31
Bulk Density	Mg/m³	1.86
Dry Density	Mg/m³	1.42

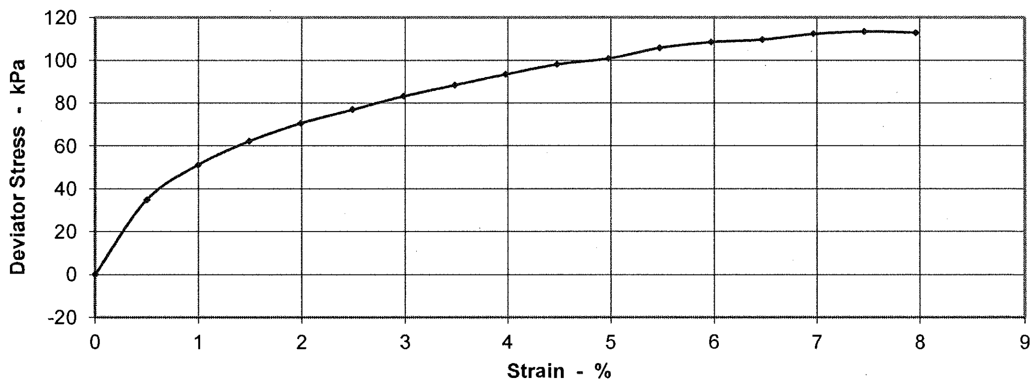
Test Details

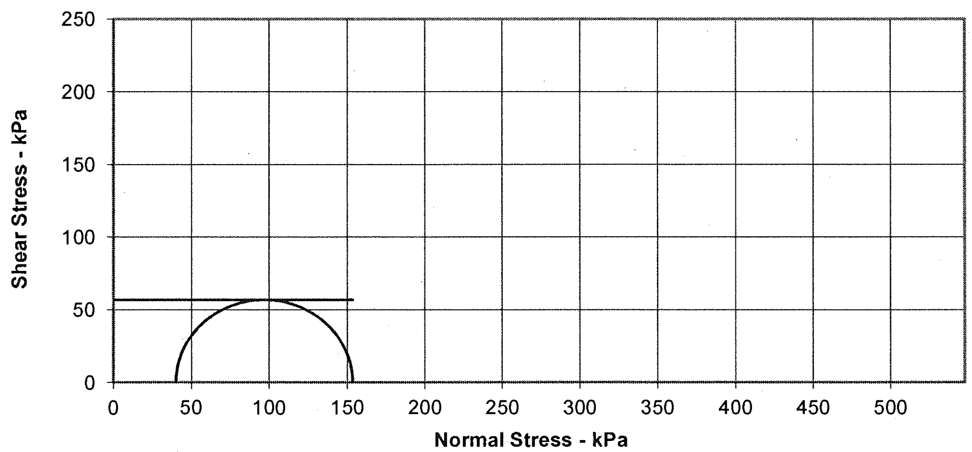
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.35
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	40
Strain at Failure	%	7.5
Maximum Deviator Stress	kPa	113
Shear Strength	kPa	57
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	57 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

Approved Signatories: K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)

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Date: 11/01/2013

2519

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

Project name:	63 Frognal, Hampstead, London, NW3 6XD			**Samples Received:**	10/12/2012
				Project Started:	19/12/2012
Client:	GEA			**Testing Started:**	07/01/2013
Project no:	J12288	**Our job /report no:**	13846	**Date Reported:**	11/01/2013
BH / TP no:	BH1	**Sample no:**	U10	**Depth (m):**	4.00

Soil Description: Medium strength brown mottled and pale blue grey silty fine sandy CLAY

Sample Details **Specimen 1**

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	26
Bulk Density	Mg/m^3	1.91
Dry Density	Mg/m^3	1.52

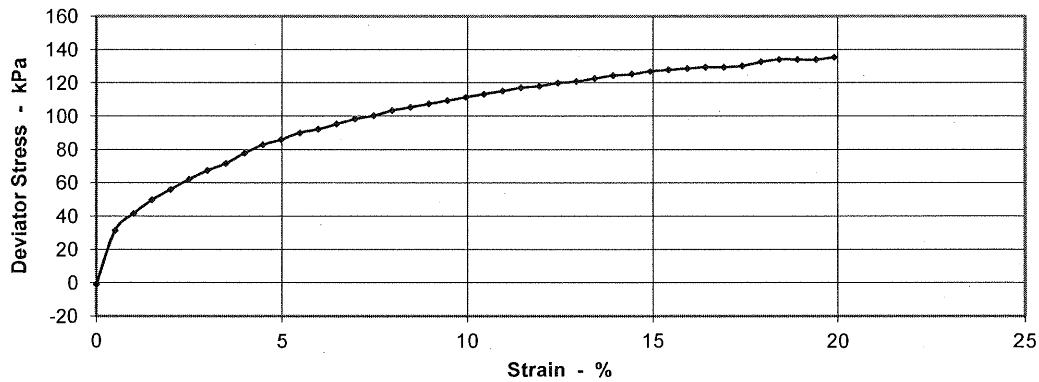
Test Details

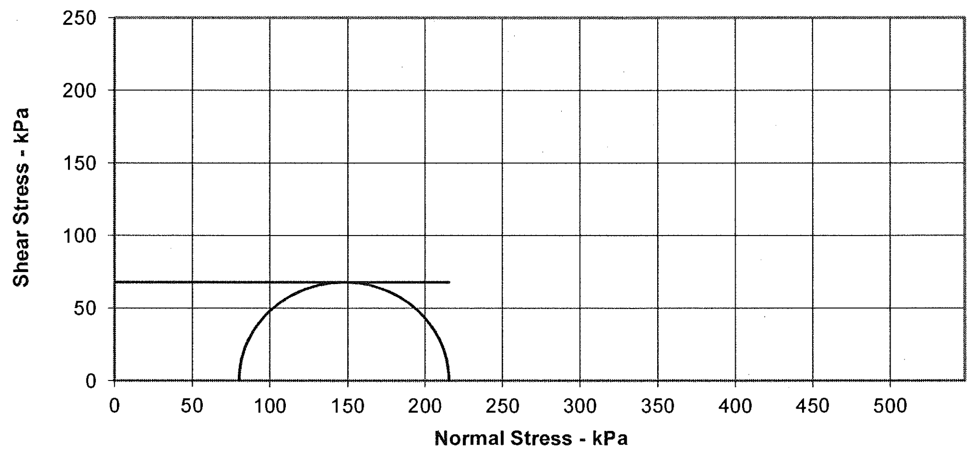
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.74
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	80
Strain at Failure	%	19.9
Maximum Deviator Stress	kPa	135
Shear Strength	kPa	68
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	68 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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UKAS TESTING 2519

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

Project name: 63 Frognal, Hampstead, London, NW3 6XD		**Samples Received:**	10/12/2012
		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH1	**Sample no:** U14	**Depth (m):**	6.50

Soil Description: High strength grey silty sandy fissured CLAY

Sample Details — Specimen 1

Sample Details		Specimen 1
Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	27
Bulk Density	Mg/m³	1.90
Dry Density	Mg/m³	1.49

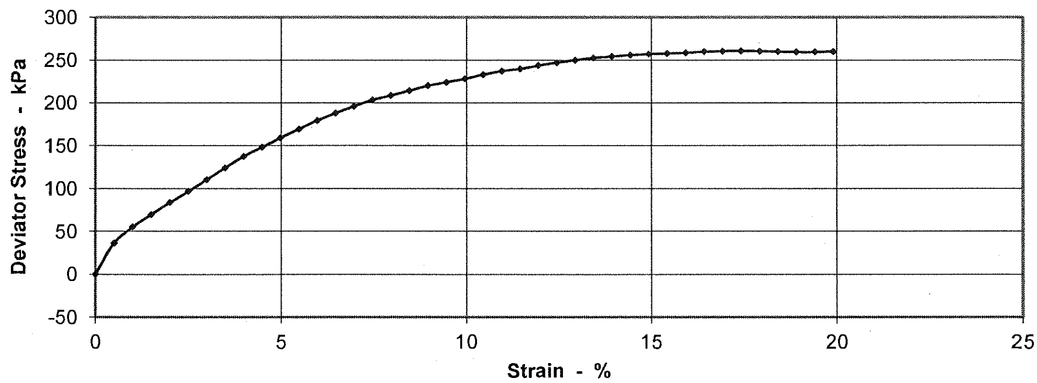
Test Details

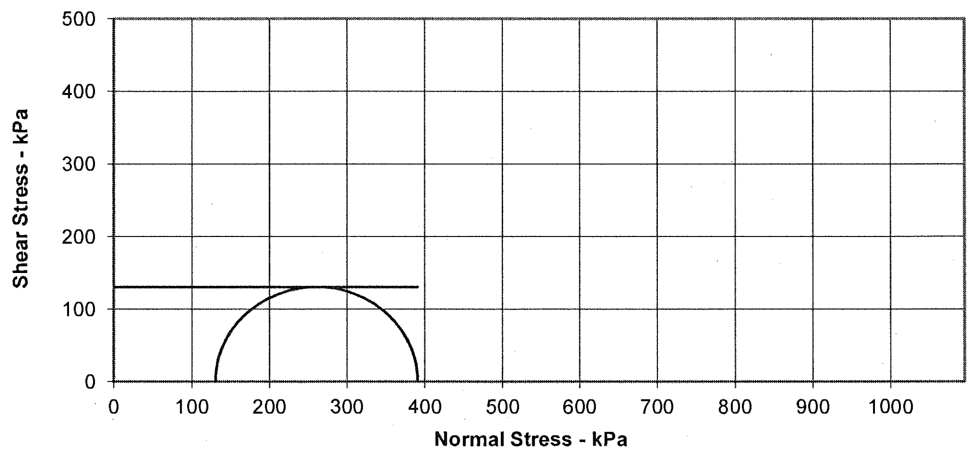
Test Details		
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.68
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	130
Strain at Failure	%	17.4
Maximum Deviator Stress	kPa	261
Shear Strength	kPa	130
Mode of Failure		Plastic

Position and orientation within the original sample

Shear Strength Parameters	
C	130 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

Project name: 63 Frognal, Hampstead, London, NW3 6XD		**Samples Received:**	10/12/2012
		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH1	**Sample no:** U18	**Depth (m):**	9.50

Soil Description: High strength grey brown silty fissured CLAY

Sample Details — Specimen 1

Sample Details	Unit	1
Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	26
Bulk Density	Mg/m^3	1.96
Dry Density	Mg/m^3	1.55

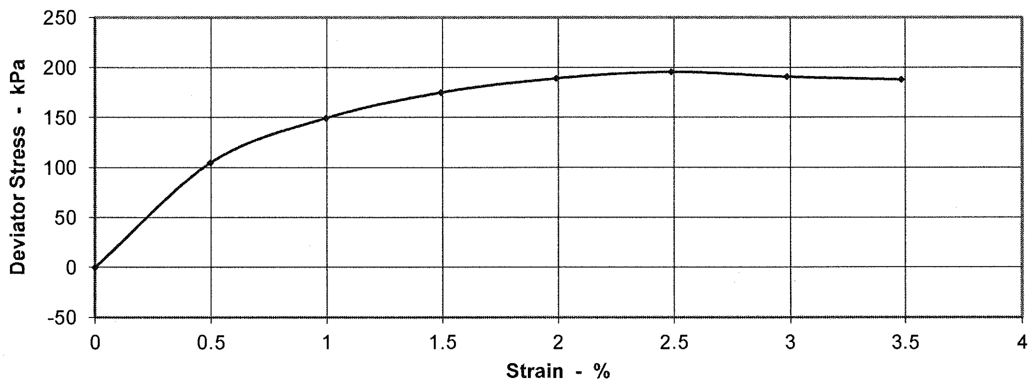
Test Details

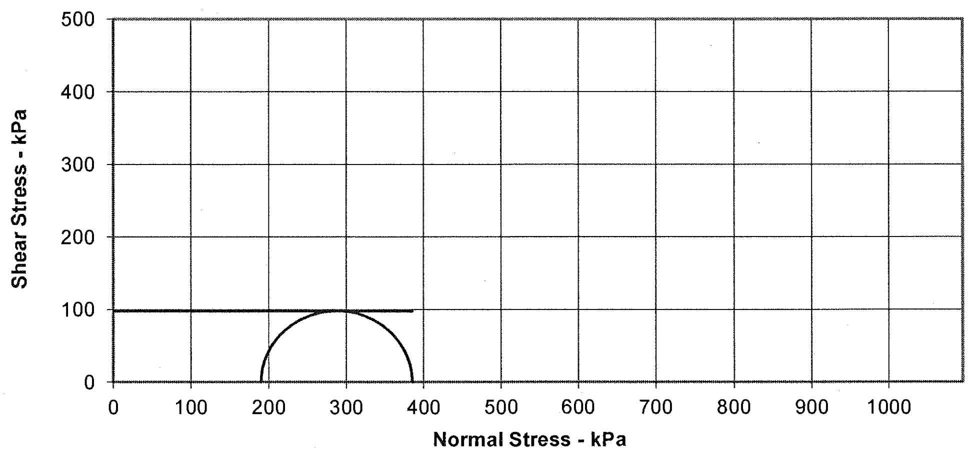
Test Details	Unit	1
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.14
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	190
Strain at Failure	%	2.5
Maximum Deviator Stress	kPa	195
Shear Strength	kPa	98
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	98 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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J.Phaure(Lab.Mgr)

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UKAS TESTING 2519

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

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		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH1	**Sample no:** U21	**Depth (m):**	12.00

Soil Description: High strength grey brown silty fissured CLAY

Sample Details

Specimen		1
Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	28
Bulk Density	Mg/m^3	2.00
Dry Density	Mg/m^3	1.56

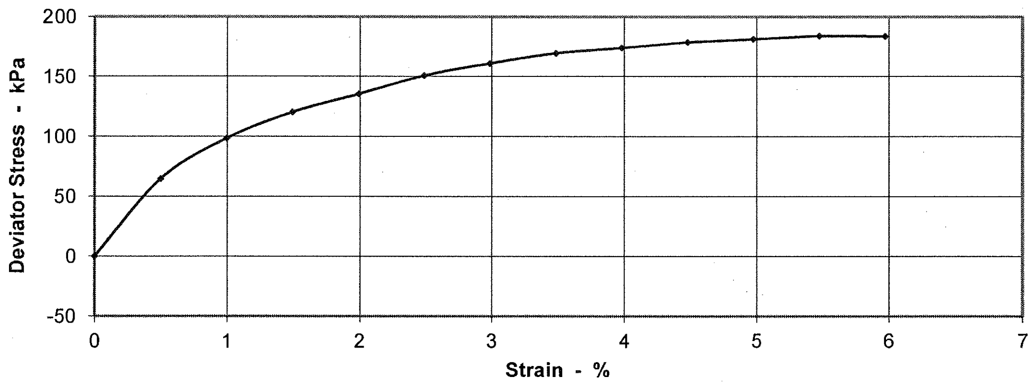
Test Details

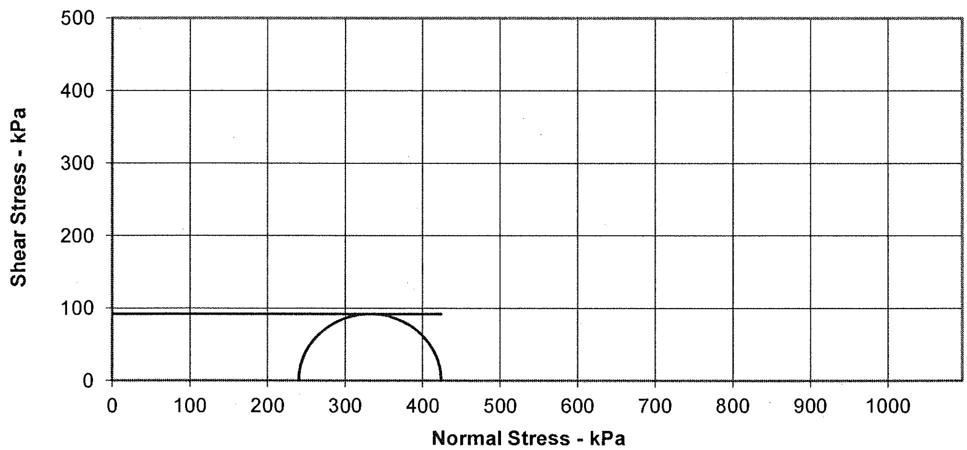
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.27
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	240
Strain at Failure	%	5.5
Maximum Deviator Stress	kPa	184
Shear Strength	kPa	92
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	92 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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UKAS TESTING 2519

K4 SOILS	Report of Undrained Triaxial Compression Test
	BS 1377 : Part 7 : 1990 Clause 8.0

Project name: 63 Frognal, Hampstead, London, NW3 6XD		**Samples Received:**	10/12/2012
		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH1	**Sample no:** U26	**Depth (m):**	15.50

Soil Description: High strength grey brown silty fissured CLAY

Sample Details **Specimen 1**

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	28
Bulk Density	Mg/m^3	1.97
Dry Density	Mg/m^3	1.54

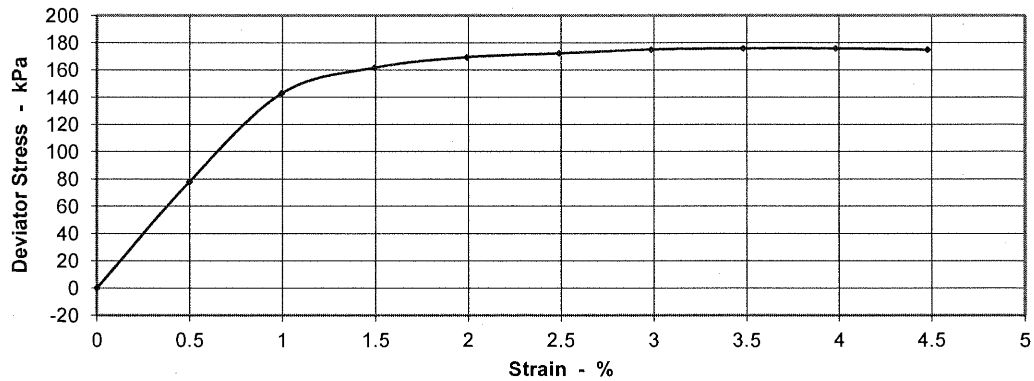
Test Details

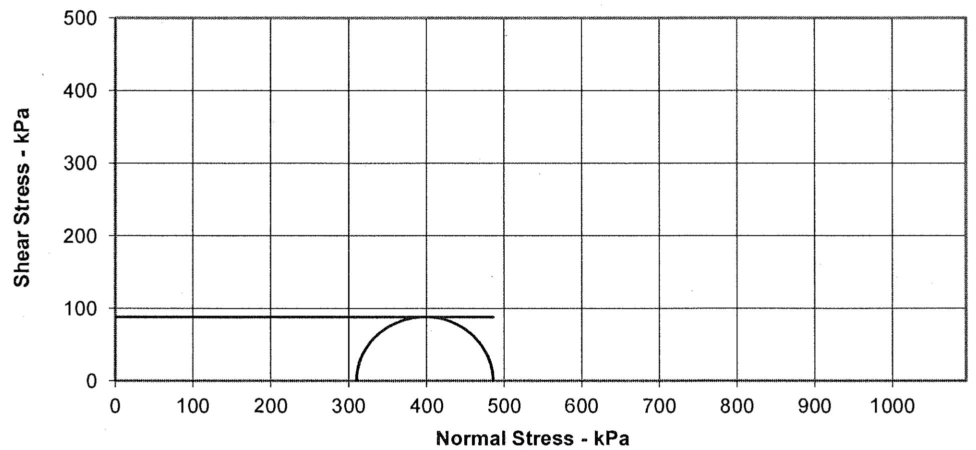
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.18
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	310
Strain at Failure	%	3.5
Maximum Deviator Stress	kPa	176
Shear Strength	kPa	88
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	88 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
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UKAS TESTING 2519

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

Project name: 63 Frognal, Hampstead, London, NW3 6XD		**Samples Received:**	10/12/2012
		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH1	**Sample no:** U30	**Depth (m):**	18.50

Soil Description: Very high strength grey brown silty fissured CLAY

Sample Details — Specimen 1

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	26
Bulk Density	Mg/m^3	2.00
Dry Density	Mg/m^3	1.59

Test Details

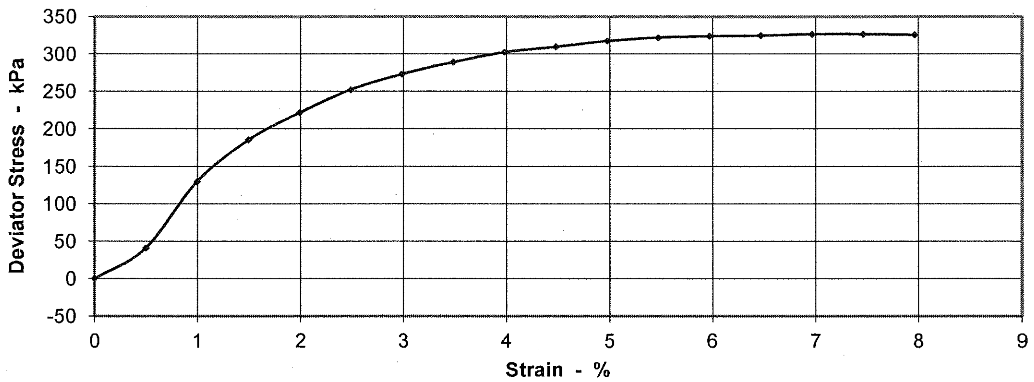
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.33
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	370
Strain at Failure	%	7.0
Maximum Deviator Stress	kPa	326
Shear Strength	kPa	163
Mode of Failure		Brittle

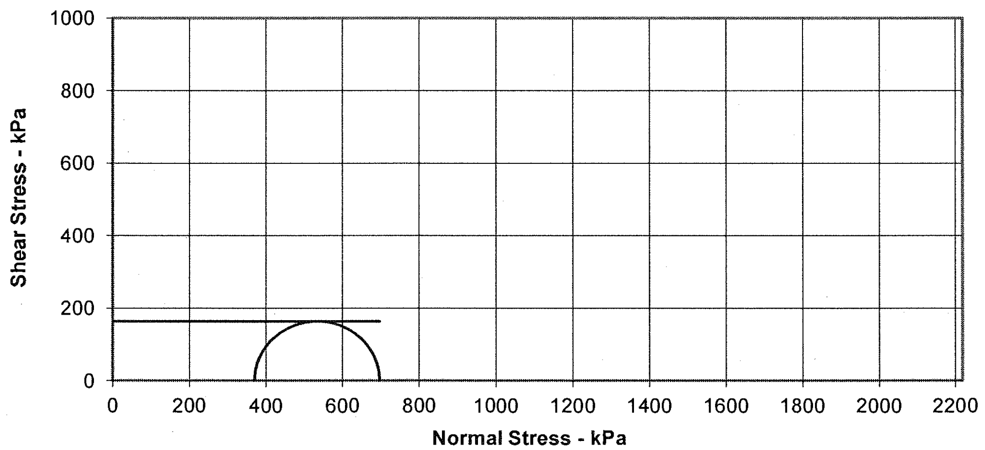
Position and orientation within the original sample

Shear Strength Parameters

C	163 kPa
Phi	0.0 °

Specimen 1





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Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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UKAS TESTING 2519

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

Project name:	63 Frognal, Hampstead, London, NW3 6XD			**Samples Received:**	10/12/2012
				Project Started:	19/12/2012
Client:	GEA			**Testing Started:**	07/01/2013
Project no:	J12288	**Our job /report no:**	13846	**Date Reported:**	11/01/2013
BH / TP no:	BH2	**Sample no:**	U6	**Depth (m):**	2.00

Soil Description: High strength brown and orange brown mottled silty sandy CLAY

Sample Details — Specimen 1

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	21
Bulk Density	Mg/m³	1.95
Dry Density	Mg/m³	1.61

Test Details

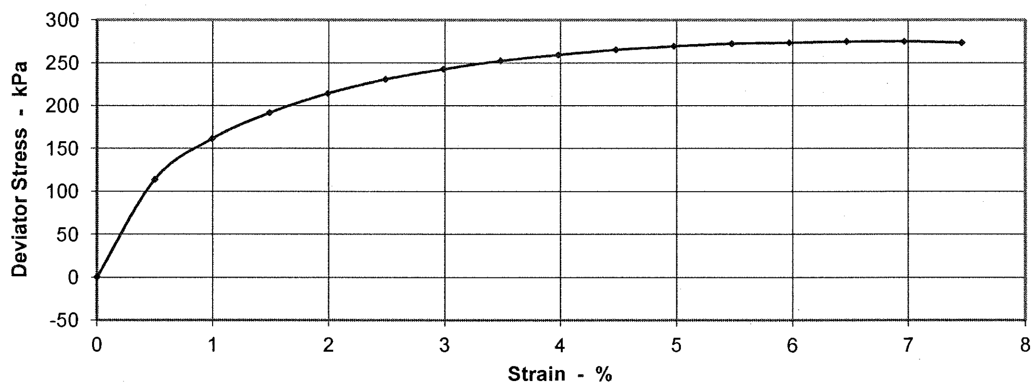
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.33
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	40
Strain at Failure	%	7.0
Maximum Deviator Stress	kPa	275
Shear Strength	kPa	137
Mode of Failure		Brittle

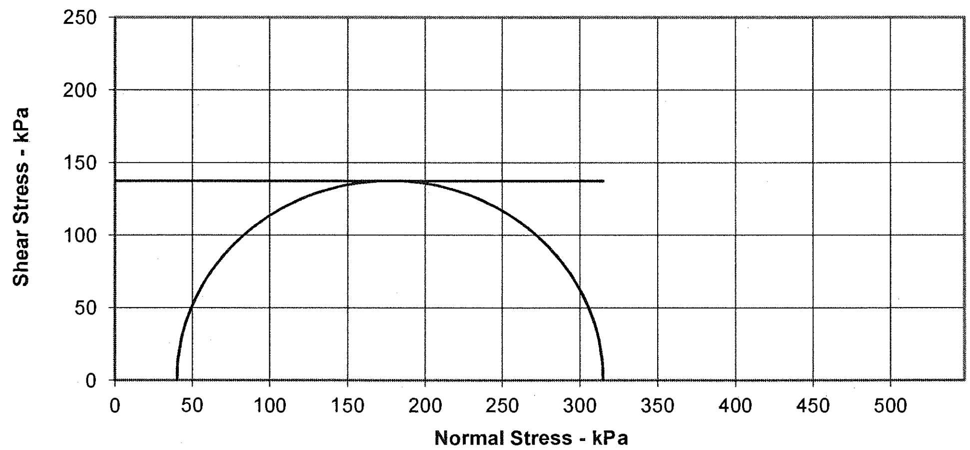
Position and orientation within the original sample

Shear Strength Parameters

C	137 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
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UKAS TESTING 2519

 MSF-11/R9 Sheet 2/2

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

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		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH2	**Sample no:** U10	**Depth (m):**	4.00

Soil Description: High strength brown silty fissured CLAY with orange brown fine sandy potches

Sample Details **Specimen 1**

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	21
Bulk Density	Mg/m³	1.96
Dry Density	Mg/m³	1.62

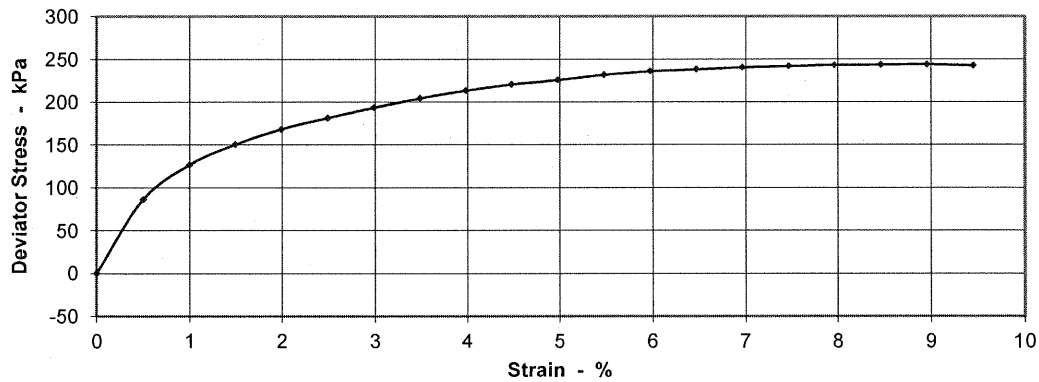
Test Details

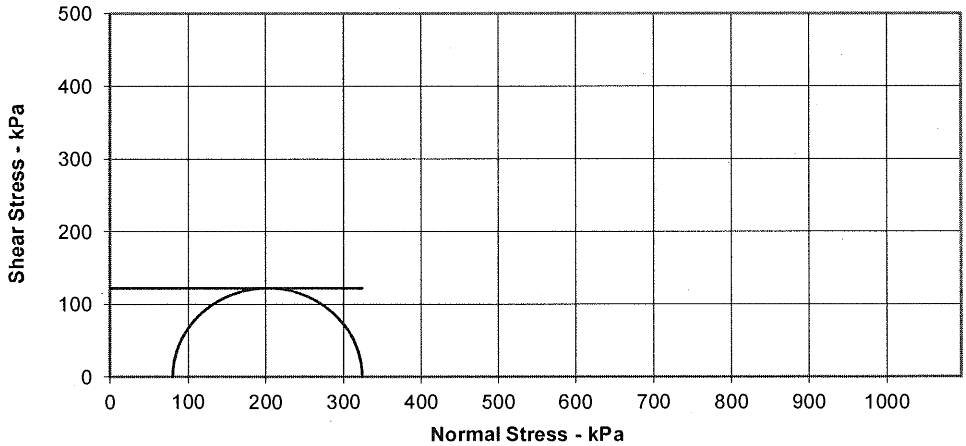
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.41
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	80
Strain at Failure	%	9.0
Maximum Deviator Stress	kPa	244
Shear Strength	kPa	122
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	122 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
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		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH2	**Sample no:** U14	**Depth (m):**	6.50

Soil Description: High strength grey brown silty fine sandy CLAY

Sample Details — Specimen 1

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	23
Bulk Density	Mg/m³	2.00
Dry Density	Mg/m³	1.62

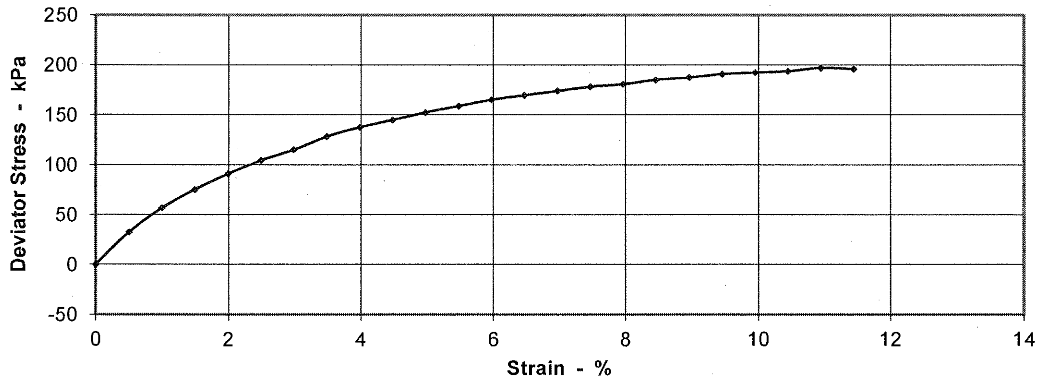
Test Details

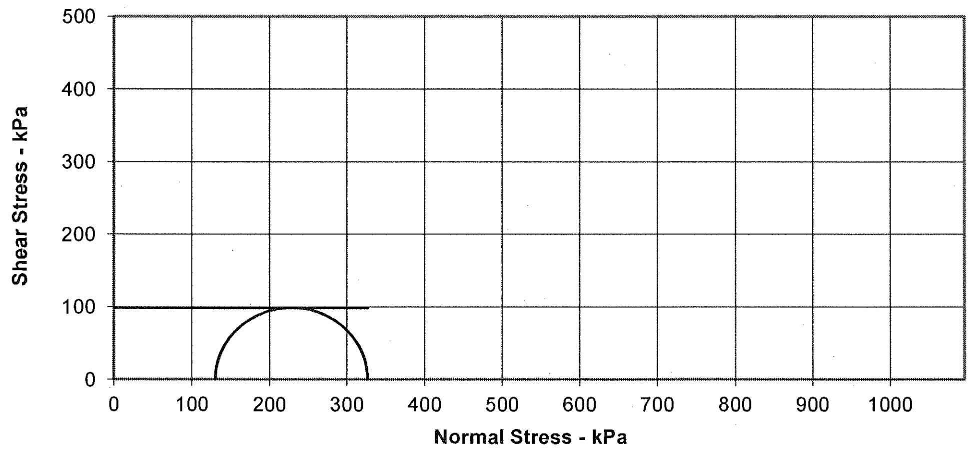
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.47
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	130
Strain at Failure	%	10.9
Maximum Deviator Stress	kPa	197
Shear Strength	kPa	98
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	98 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

Approved Signatories: **K.Phaure(Tech.Mgr)** J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 11/01/2013

2519

K4 SOILS	Report of Undrained Triaxial Compression Test
	BS 1377 : Part 7 : 1990 Clause 8.0

Project name:	63 Frognal, Hampstead, London, NW3 6XD			**Samples Received:**	10/12/2012
				Project Started:	19/12/2012
Client:	GEA			**Testing Started:**	07/01/2013
Project no:	J12288	**Our job /report no:**	13846	**Date Reported:**	11/01/2013
BH / TP no:	BH2	**Sample no:**	U18	**Depth (m):**	9.50

Soil Description: High strength grey brown silty fissured CLAY

Sample Details

		Specimen 1
Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	26
Bulk Density	Mg/m³	1.98
Dry Density	Mg/m³	1.57

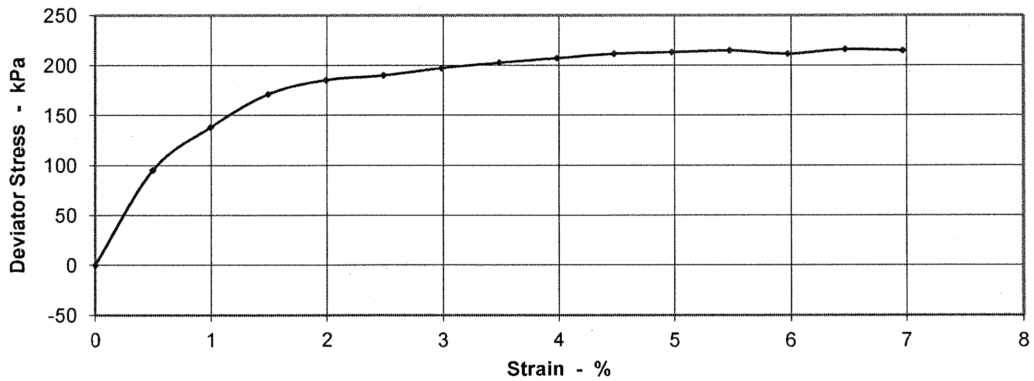
Test Details

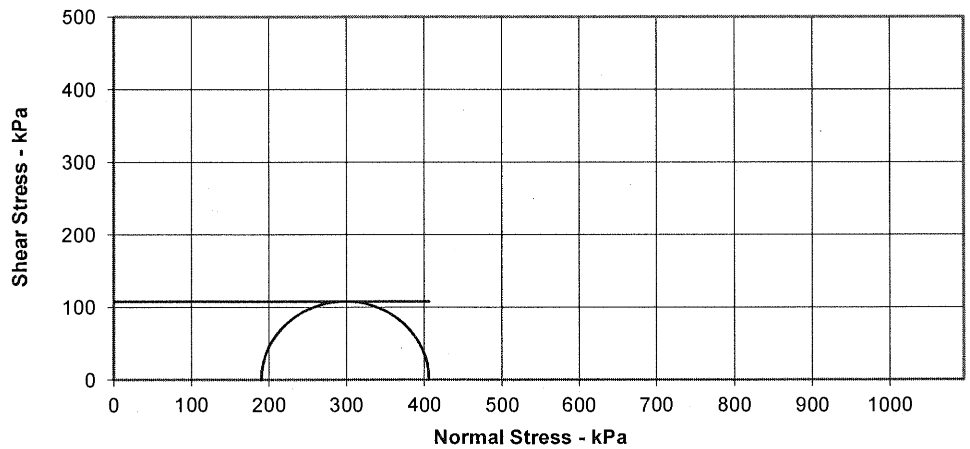
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.31
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	190
Strain at Failure	%	6.5
Maximum Deviator Stress	kPa	216
Shear Strength	kPa	108
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	108 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

Approved Signatories: K.Phaure(Tech.Mgr)
J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 11/01/2013

UKAS TESTING 2519

 MSF-11/R9 Sheet 2/2

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

Project name:	63 Frognal, Hampstead, London, NW3 6XD			**Samples Received:**	10/12/2012
				Project Started:	19/12/2012
Client:	GEA			**Testing Started:**	07/01/2013
Project no:	J12288	**Our job /report no:**	13846	**Date Reported:**	11/01/2013
BH / TP no:	BH2	**Sample no:**	U22	**Depth (m):**	12.50

Soil Description: Very high strength grey brown silty fissured CLAY

Sample Details **Specimen 1**

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	26
Bulk Density	Mg/m³	2.01
Dry Density	Mg/m³	1.59

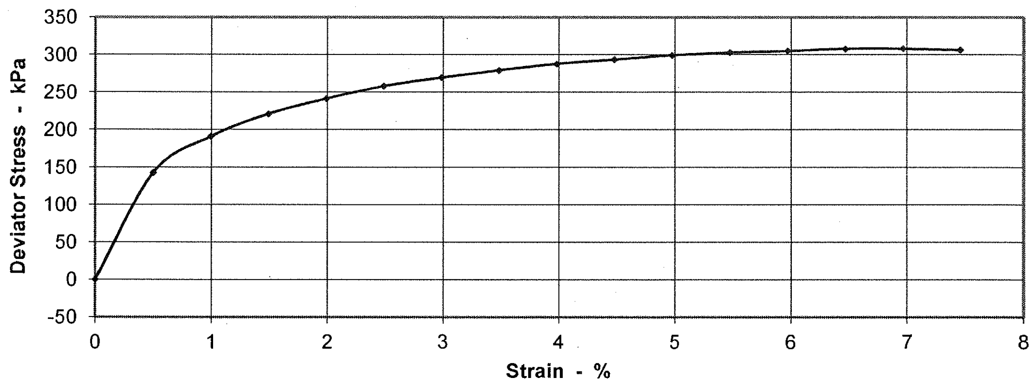
Test Details

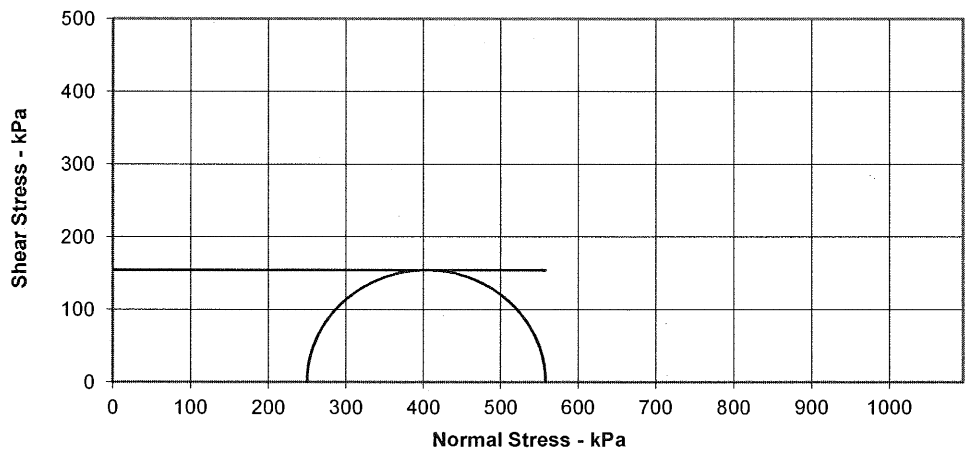
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.33
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	250
Strain at Failure	%	7.0
Maximum Deviator Stress	kPa	308
Shear Strength	kPa	154
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	154 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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Checked and Approved
Initials: kp
Date: 11/01/2013

UKAS TESTING 2519

 MSF-11/R9 Sheet 2/2

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

Project name:	63 Frognal, Hampstead, London, NW3 6XD			**Samples Received:**	10/01/2012
				Project Started:	19/12/2012
Client:	GEA			**Testing Started:**	07/01/2013
Project no:	J12288	**Our job /report no:**	13846	**Date Reported:**	11/01/2013
BH / TP no:	BH3	**Sample no:**	U2	**Depth (m):**	1.00

Soil Description: Medium strength rusty brown mottled pale blue-grey silty fine sandy CLAY

Sample Details — Specimen 1

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	29
Bulk Density	Mg/m³	1.94
Dry Density	Mg/m³	1.51

Test Details

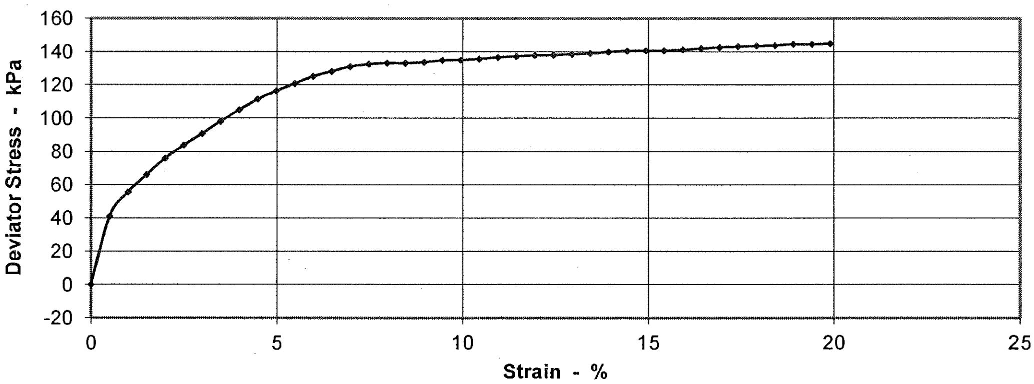
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.74
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	20
Strain at Failure	%	19.9
Maximum Deviator Stress	kPa	145
Shear Strength	kPa	72
Mode of Failure		Brittle

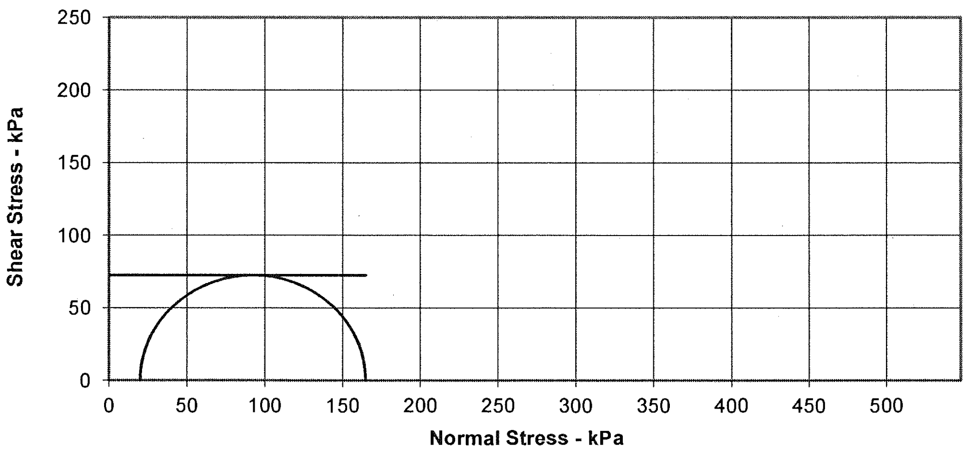
Position and orientation within the original sample

Shear Strength Parameters

C	72 kPa
Phi	0.0 °

Specimen 1





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Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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Checked and Approved
Initials: kp
Date: 11/01/2013

2519

K4 SOILS	Report of Undrained Triaxial Compression Test
	BS 1377 : Part 7 : 1990 Clause 8.0

Project name: 63 Frognal, Hampstead, London, NW3 6XD		**Samples Received:**	10/12/2012
		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH3	**Sample no:** U6	**Depth (m):**	3.00

Soil Description: High strength brown mottled orange brown silty fine sandy fissured CLAY

Sample Details — Specimen 1

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	27
Bulk Density	Mg/m³	1.96
Dry Density	Mg/m³	1.54

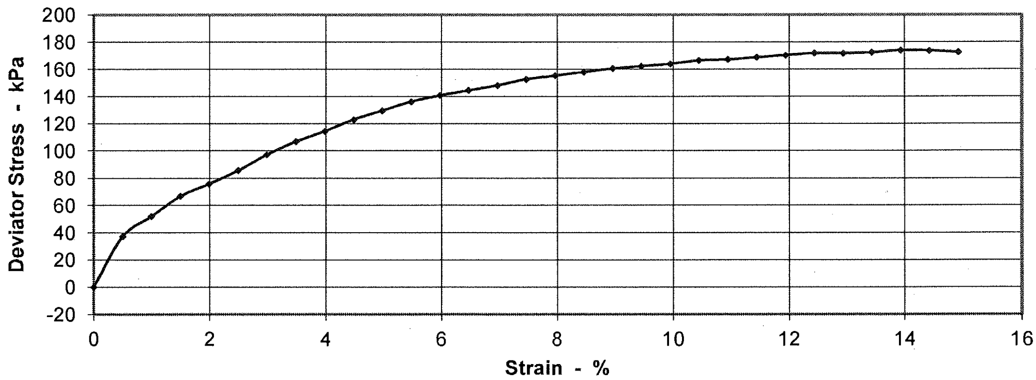
Test Details

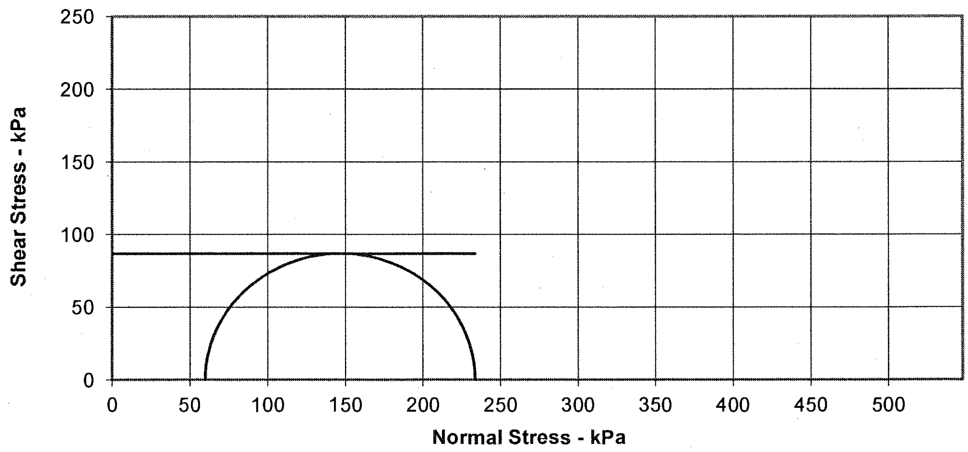
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.57
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	60
Strain at Failure	%	13.9
Maximum Deviator Stress	kPa	174
Shear Strength	kPa	87
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	87 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 11/01/2013

UKAS TESTING 2519

K4 SOILS	Report of Undrained Triaxial Compression Test
	BS 1377 : Part 7 : 1990 Clause 8.0

Project name:	63 Frognal, Hampstead, London, NW3 6XD			**Samples Received:**	10/12/2012
				Project Started:	19/12/2012
Client:	GEA			**Testing Started:**	07/01/2013
Project no:	J12288	**Our job /report no:**	13846	**Date Reported:**	11/01/2013
BH / TP no:	BH3	**Sample no:**	U10	**Depth (m):**	5.00

Soil Description: Medium strength grey silty sandy CLAY with occasional pale grey partings

Sample Details

Specimen		1
Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	23
Bulk Density	Mg/m^3	2.02
Dry Density	Mg/m^3	1.64

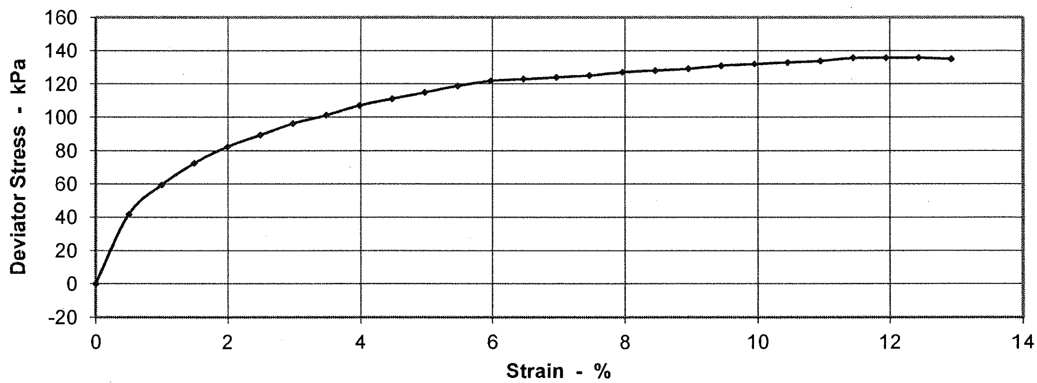
Test Details

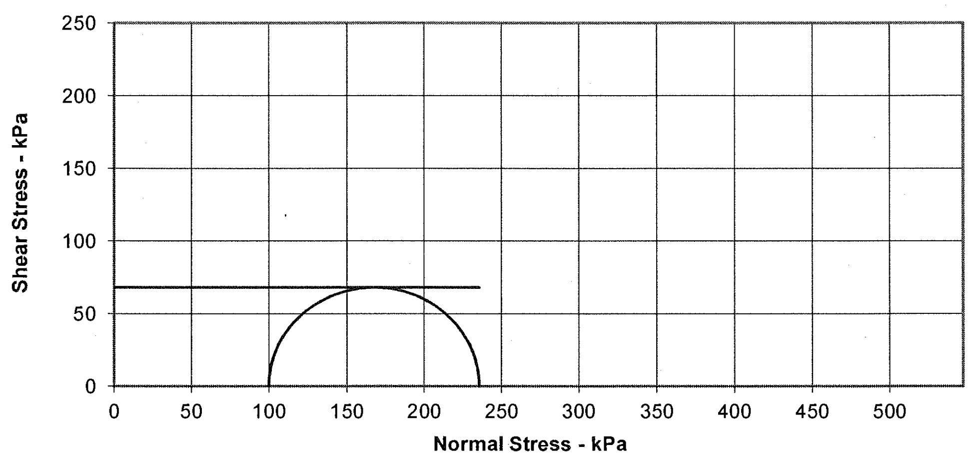
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.52
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	100
Strain at Failure	%	12.4
Maximum Deviator Stress	kPa	136
Shear Strength	kPa	68
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	68 kPa
Phi	0.0 °

Specimen 1





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Tel:01923711288 Fax:01923711311
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Checked and Approved
Initials: kp
Date: 11/01/2013

UKAS TESTING 2519

 MSF-11/R9

K4 SOILS	Report of Undrained Triaxial Compression Test
	BS 1377 : Part 7 : 1990 Clause 8.0

Project name: 63 Frognal, Hampstead, London, NW3 6XD		**Samples Received:**	10/12/2012
		Project Started:	19/12/2012
Client: GEA		**Testing Started:**	07/01/2013
Project no: J12288	**Our job /report no:** 13846	**Date Reported:**	11/01/2013
BH / TP no: BH3	**Sample no:** U14	**Depth (m):**	8.00

Soil Description: High strength grey brown silty fine sandy fissured CLAY

Sample Details **Specimen 1**

Sample Condition		Undisturbed
Height	mm	201.0
Diameter	mm	102.0
Moisture Content	%	25
Bulk Density	Mg/m^3	1.98
Dry Density	Mg/m^3	1.58

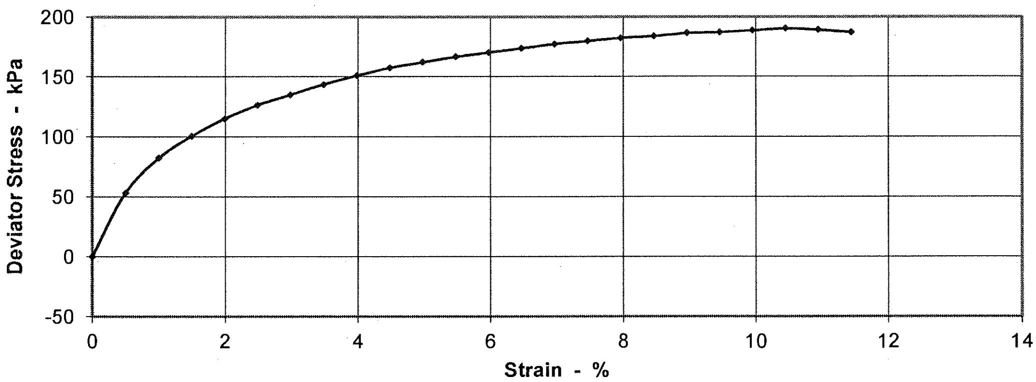
Test Details

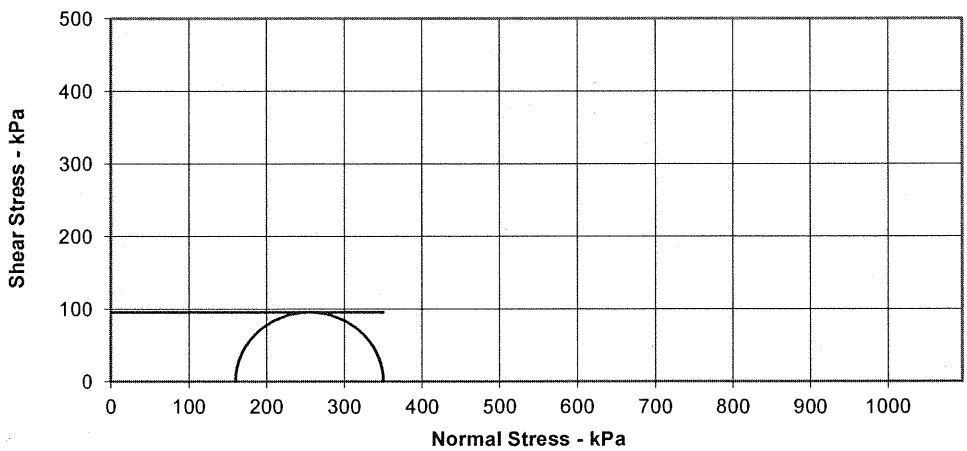
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.46
Rate of Axial Displacement	%/min	1.99
Cell Pressure	kPa	160
Strain at Failure	%	10.4
Maximum Deviator Stress	kPa	190
Shear Strength	kPa	95
Mode of Failure		Brittle

Position and orientation within the original sample

Shear Strength Parameters	
C	95 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
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Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 11/01/2013

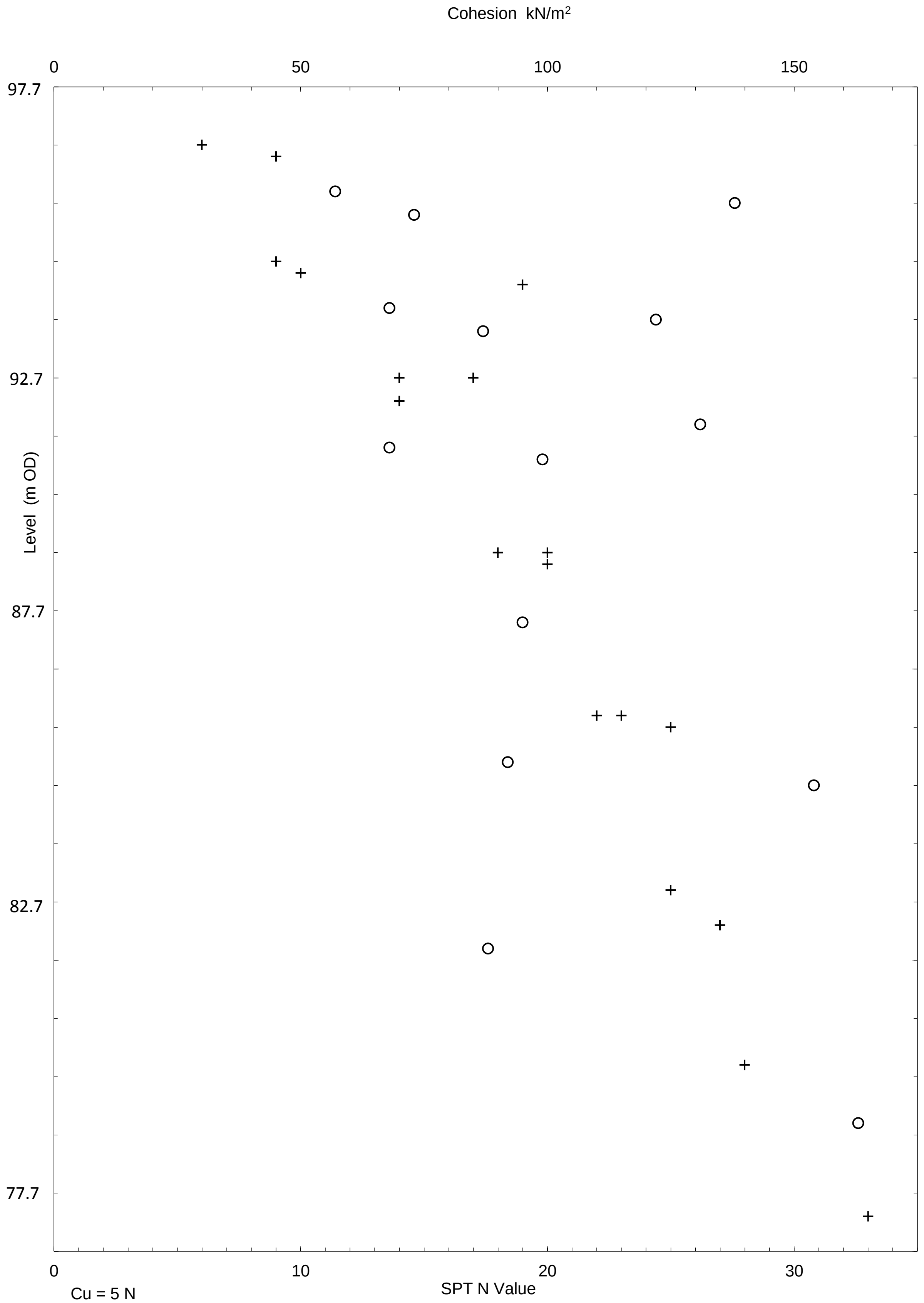
UKAS TESTING 2519

Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Albans
Herts AL4 0PG

SPT & Cohesion / Level Graph

Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number** J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet** 1 / 1
Engineer	Conisbee	



Cu = 5 N
o cohesion
+ SPT N Value

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO Hannah Dashfield

LABORATORY TEST REPORT

Chemtest
The right chemistry to deliver results

Results of analysis of 3 samples
received 21 December 2012

Report Date
10 January 2013

J12288 - 63 Frognal

Login Batch No					**219637**		
Chemtest LIMS ID					AI11073	AI11074	AI11075
Sample ID					TP1	TP5	BH6
Sample No							
Sampling Date					Not Provided	Not Provided	Not Provided
Depth					0.15m	1.20m	0.10m
Matrix					*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*			
2030	Moisture		%	n/a	25.1	21	25.9
	Stones content (>50mm)		%	n/a	<0.02	<0.02	<0.02
2040	Soil colour			M	brown	black	black
	Soil texture			M	clay	clay	clay
	Other material			M	stones	stones	stones
2010	pH			M	7.5	7.2	7.0
2300	Cyanide (total)	57125	mg kg-¹	M	< 0.5	< 0.5	< 0.5
2325	Sulfide (Easily Liberatable)	18496258	mg kg-¹	M	9.4	4.9	4.2
2625	Total Organic Carbon		%	M	1.1	0.18	5.0
2220	Chloride (extractable)	16887006	g l-¹	M	0.016	<0.010	<0.010
2430	Sulfate (total) as SO4		mg kg-¹	M	300	<100	1100
2450	Arsenic	7440382	mg kg-¹	M	11	12	22
	Cadmium	7440439	mg kg-¹	M	<0.10	<0.10	0.52
	Chromium	7440473	mg kg-¹	M	32	31	26
	Copper	7440508	mg kg-¹	M	18	16	93
	Mercury	7439976	mg kg-¹	M	<0.10	<0.10	0.26
	Nickel	7440020	mg kg-¹	M	17	19	23
	Lead	7439921	mg kg-¹	M	110	16	610
	Selenium	7782492	mg kg-¹	M	<0.20	<0.20	0.45
	Zinc	7440666	mg kg-¹	M	70	45	360
2670	TPH >C5-C6		mg kg-¹	U	< 0.1 [1]	< 0.1 [1]	< 0.1 [1]
	TPH >C6-C7		mg kg-¹	U	< 0.1 [1]	< 0.1 [1]	< 0.1 [1]
	TPH >C7-C8		mg kg-¹	M	< 0.1 [1]	< 0.1 [1]	< 0.1 [1]

[1]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised. The accreditation for these results remains unaffected.

All tests undertaken between 21/12/2012 and 10/01/2013
* Accreditation status
This report should be interpreted in conjuction with the notes on the accompanying cover page.

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO Hannah Dashfield

LABORATORY TEST REPORT

Results of analysis of 3 samples
received 21 December 2012

J12288 - 63 Frognal

Chemtest
The right chemistry to deliver results

Report Date
10 January 2013

					219637		
					AI11073	AI11074	AI11075
					TP1	TP5	BH6
					Not Provided	Not Provided	Not Provided
					0.15m	1.20m	0.10m
					SOIL	*SOIL*	*SOIL*
2670	TPH >C8-C10		mg kg-¹	M	< 0.1 [1]	< 0.1 [1]	< 0.1 [1]
	TPH >C10-C12		mg kg-¹	M	< 0.1 [1]	< 0.1 [1]	0.24 [1]
	TPH >C12-C16		mg kg-¹	M	0.72 [1]	< 0.1 [1]	6.6 [1]
	TPH >C16-C21		mg kg-¹	M	3.7 [1]	< 0.1 [1]	27 [1]
	TPH >C21-C35		mg kg-¹	M	7.7 [1]	< 0.1 [1]	110 [1]
	Total Petroleum Hydrocarbons		mg kg-¹	U	12 [1]	< 10 [1]	140 [1]
2700	Naphthalene	91203	mg kg-¹	M	< 0.1	< 0.1	0.59
	Acenaphthylene	208968	mg kg-¹	M	0.11	< 0.1	0.62
	Acenaphthene	83329	mg kg-¹	M	< 0.1	< 0.1	0.31
	Fluorene	86737	mg kg-¹	M	< 0.1	< 0.1	0.16
	Phenanthrene	85018	mg kg-¹	M	0.17	< 0.1	2.4
	Anthracene	120127	mg kg-¹	M	< 0.1	< 0.1	0.79
	Fluoranthene	206440	mg kg-¹	M	0.25	< 0.1	8.1
	Pyrene	129000	mg kg-¹	M	0.18	< 0.1	6.8
	Benzo[a]anthracene	56553	mg kg-¹	M	< 0.1	< 0.1	4.3
	Chrysene	218019	mg kg-¹	M	< 0.1	< 0.1	4.7
	Benzo[b]fluoranthene	205992	mg kg-¹	M	< 0.1	< 0.1	4.2
	Benzo[k]fluoranthene	207089	mg kg-¹	M	< 0.1	< 0.1	3.4
	Benzo[a]pyrene	50328	mg kg-¹	M	< 0.1	< 0.1	4.3
	Dibenzo[a,h]anthracene	53703	mg kg-¹	M	< 0.1	< 0.1	0.98
	Indeno[1,2,3-cd]pyrene	193395	mg kg-¹	M	< 0.1	< 0.1	2.9
	Benzo[g,h,i]perylene	191242	mg kg-¹	M	< 0.1	< 0.1	1.9
	Total (of 16) PAHs		mg kg-¹	M	< 2	< 2	46
2920	Phenols (total)		mg kg-¹	N	<0.3	<0.3	<0.3

[1]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised. The accreditation for these results remains unaffected.

All tests undertaken between 21/12/2012 and 10/01/2013
* Accreditation status
This report should be interpreted in conjuction with the notes on the accompanying cover page.

LIMS sample ID range AI11073 to AI11075

GEA Geotechnical & Environmental Associates	Tyttenhanger House Coursers Road St Albans AL4 0PG	**Generic Risk-Based Soil Guideline Values**

Site	63 Frognal, Hampstead, London, NW3 6XD	**Job Number** J12288
Client	Azmil Khalid and Fuziah Hussein	**Sheet** 1 / 1
Engineer	Price and Myers	

Proposed End Use Residential with plant uptake

Soil pH 7

Soil Organic Matter content % 6.0

Contaminant	Guideline Value mg/kg	Data Source
Metals		
Arsenic	32	SGV
Cadmium	10	SGV
Chromium (III)	3000	LQM/CIEH
Chromium (VI)	4.3	LQM/CIEH
Copper	2,330	LQM/CIEH
Lead	450	withdrawn SGV
Elemental Mercury	1	SGV
Inorganic Mercury	170	SGV
Nickel	130	LQM/CIEH
Selenium	350	SGV
Zinc	3,750	LQM/CIEH
Hydrocarbons		
Benzene	0.33	SGV
Toluene	610	SGV
Ethyl Benzene	350	SGV
Xylene	230	SGV
Aliphatic C5-C6	110	LQM/CIEH
Aliphatic C6-C8	370	LQM/CIEH
Aliphatic C8-C10	110	LQM/CIEH
Aliphatic C10-C12	540	LQM/CIEH
Aliphatic C12-C16	3000	LQM/CIEH
Aliphatic C16-C35	76,000	LQM/CIEH
Aromatic C6-C7	See Benzene	LQM/CIEH
Aromatic C7-C8	See Toluene	LQM/CIEH
Aromatic C8-C10	151	LQM/CIEH
Aromatic C10-C12	346	LQM/CIEH
Aromatic C12-C16	593	LQM/CIEH
Aromatic C16-C21	770	LQM/CIEH
Aromatic C21-C35	1230	LQM/CIEH
PRO (C_5 –C_{10})	1351	Calc
DRO (C_{12} –C_{28})	80,363	Calc
Lube Oil (C_{28} –C_{44})	77,230	Calc
TPH	**500**	Trigger for speciated testing

Contaminant	Guideline Value mg/kg	Data Source
Anions		
Soluble Sulphate	0.5 g/l	Structures
Sulphide	50	Structures
Chloride	400	Structures
Others		
Organic Carbon (%)	6	Methanogenic potential
Total Cyanide	140	WRAS
Total Mono Phenols	420	SGV
PAH		
Naphthalene	8.70	LQM/CIEH
Acenaphthylene	850	LQM/CIEH
Acenaphthene	1,000	LQM/CIEH
Fluorene	780	LQM/CIEH
Phenanthrene	380	LQM/CIEH
Anthracene	9,200	LQM/CIEH
Fluoranthene	670	LQM/CIEH
Pyrene	1,600	LQM/CIEH
Benzo(a) Anthracene	5.9	LQM/CIEH
Chrysene	9	LQM/CIEH
Benzo(b) Fluoranthene	7.0	LQM/CIEH
Benzo(k) Fluoranthene	10.0	LQM/CIEH
Benzo(a) pyrene	1.00	LQM/CIEH
Indeno(1 2 3 cd) Pyrene	4.2	LQM/CIEH
Dibenzo(a h) Anthracene	0.90	LQM/CIEH
Benzo (g h i) Perylene	47	LQM/CIEH
Total PAH	**6.7**	B(a)P / 0.15
Chlorinated Solvents		
1,1,1 trichloroethane (TCA)	28	LQM/CIEH
tetrachloroethane (PCA)	4.8	LQM/CIEH
tetrachloroethene (PCE)	4.8	LQM/CIEH
trichloroethene (TCE)	0.49	LQM/CIEH
1,2-dichloroethane (DCA)	0.014	LQM/CIEH
vinyl chloride (Chloroethene)	0.00099	LQM/CIEH
tetrachloromethane (Carbon tetrac	0.089	LQM/CIEH
trichloromethane (Chloroform)	2.7	LQM/CIEH

Notes

Concentrations measured below the above values may be considered to represent 'uncontaminated conditions' which do not pose a risk to human health. Concentrations measured in excess of these valuesindicate a potential risk, and thus require further, site specific risk assessment.

SGV - Soil Guideline Value, derived from the CLEA model and published by Environment Agency 2009

withdrawn SGV - Former SGV, derived from the CLEA 2000 model and published by DEFRA pending confirmation of new approach to modeling lead

LQM/CIEH - Generic Assessment Criteria for Human Health Risk Assessment 2nd edition (2009)derived using CLEA 1.04 model 2009

Calc - sum of nearest available carbon range specified including BTEX for PRO fraction

B(a)P / 0.15 - GEA experince indicates that Benzo(a) pyrene (one of the most common and most carcenogenic of the PAHs) rarely exceeds 15% of the total PAH concentration, hence this Total PAH threshold is regarded as being conservative

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
42875017_1_1

Customer Reference:
J12288

National Grid Reference:
526050, 185600

Slice:
A

Site Area (Ha):
0.09

Search Buffer (m):
1000

Site Details:

63 Frognal
LONDON
NW3 6XD

Client Details:

Mr S Branch
GEA Ltd
Tyttenhanger House
Coursers Road
St Albans
Herts
AL4 0PG

Contents

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

Report Version v47.0

GEA Geotechnical & Environmental Associates

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 1				2
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 1			1	12
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 3				Yes
Pollution Incidents to Controlled Waters					
Prosecutions Relating to Authorised Processes					
Prosecutions Relating to Controlled Waters					
Registered Radioactive Substances					
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register					
Water Abstractions	pg 3				(*1)
Water Industry Act Referrals					
Groundwater Vulnerability	pg 3	Yes	n/a	n/a	n/a
Bedrock Aquifer Designations	pg 3	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites	pg 4				1
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Recorded Landfill Sites					
Registered Landfill Sites					
Registered Waste Transfer Sites	pg 4				3
Registered Waste Treatment or Disposal Sites					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					
Geological					
BGS 1:625,000 Solid Geology	pg 6	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 6	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites					
BGS Urban Soil Chemistry	pg 8		Yes	Yes	Yes
BGS Urban Soil Chemistry Averages	pg 11	Yes			
Brine Compensation Area			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain				n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 11	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards				n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 11	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 11	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 12	Yes		n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 13		1	27	95
Fuel Station Entries	pg 23				2

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Discharge Consents** Operator: Thames Water Utilities Ltd Property Type: Reservoir/Borehole Site Location: Hampstead Authority: Environment Agency, Thames Region Catchment Area: Not Supplied Reference: Temp.0140 Permit Version: 1 Effective Date: 15th September 1989 Issued Date: 15th September 1989 Revocation Date: 5th October 2000 Discharge Type: Trade Effluent Discharge Environment: Freshwater Stream/River Receiving Water: River Thames **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 100m	A18SE (N)	503	1	526200 186100
2	**Discharge Consents** Operator: Thames Water Utilities Ltd Property Type: Reservoir/Borehole Site Location: Kidderpore Authority: Environment Agency, Thames Region Catchment Area: Not Supplied Reference: Temp.0165 Permit Version: 1 Effective Date: 15th September 1989 Issued Date: 15th September 1989 Revocation Date: 5th October 2000 Discharge Type: Trade Effluent Discharge Environment: Freshwater Stream/River Receiving Water: River Thames **Status: Authorisation revokedRevoked** Positional Accuracy: Located by supplier to within 100m	A12NE (NW)	698	1	525400 185900
3	**Local Authority Pollution Prevention and Controls** Name: Perkins Dry Cleaners Location: 40 Heath Street, London, Nw3 6te Authority: London Borough of Camden, Pollution Projects Team Permit Reference: PPC/DC9 Dated: 12th January 2007 Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning **Status: Permitted** Positional Accuracy: Located by supplier to within 10m	A13NE (E)	325	2	526374 185724
4	**Local Authority Pollution Prevention and Controls** Name: Cottontail Cleaners Location: 509 Finchley Road, London, Nw3 7bb Authority: London Borough of Camden, Pollution Projects Team Permit Reference: PPC/DC19 Dated: 5th February 2007 Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning **Status: Permitted** Positional Accuracy: Located by supplier to within 10m	A12SE (W)	589	2	525456 185484
4	**Local Authority Pollution Prevention and Controls** Name: Cottontail Cleaners Location: 509 Finchley Road, London, Nw3 7bb Authority: London Borough of Camden, Pollution Projects Team Permit Reference: PPC/DC48 Dated: 1st January 2007 Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning **Status: Permitted** Positional Accuracy: Manually positioned to the address or location	A12SE (W)	591	2	525454 185484
4	**Local Authority Pollution Prevention and Controls** Name: The London Dry Cleaning Company Location: 519a Finchley Road, London, Nw3 7bb Authority: London Borough of Camden, Pollution Projects Team Permit Reference: PPC/DC51 Dated: 1st March 2008 Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning **Status: Permitted** Positional Accuracy: Manually positioned to the address or location	A12SE (W)	608	2	525432 185511

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Local Authority Pollution Prevention and Controls				
10	Name: Fortune Green Filling Station (Texaco) Location: 63 Fortune Green Road, LONDON, NW6 1DR Authority: London Borough of Camden, Pollution Projects Team Permit Reference: Not Given Dated: 24th June 1998 Process Type: Local Authority Air Pollution Control Description: PG1/14 Petrol filling station **Status:** **Authorised** Positional Accuracy: Manually positioned to the address or location	A12SW (W)	950	2	525083 185596
	Local Authority Pollution Prevention and Controls				
11	Name: Cotton Club Dry Cleaners Location: 57 Mill Lane, London, Nw6 1nb Authority: London Borough of Camden, Pollution Projects Team Permit Reference: PPC/DC19 Dated: 5th February 2007 Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning **Status:** **Permitted** Positional Accuracy: Located by supplier to within 10m	A7NW (W)	986	2	525119 185231
	Nearest Surface Water Feature	A19NW (NE)	912	-	526560 186383
	Water Abstractions				
	Operator: London Borough Of Camden Licence Number: 28/39/39/0219 Permit Version: 1 Location: Swiss Cottage Open Space- Borehole Authority: Environment Agency, Thames Region Abstraction: Municipal Grounds: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Swiss Cottage Open Space, Winchester Road, London. Authorised Start: 01 January Authorised End: 31 December Permit Start Date: 1st April 2008 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A4NE (SE)	1498	1	526800 184280
	Groundwater Vulnerability				
	Soil Classification: Soils of High Leaching Potential (U) - Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst case vulnerability classification (H) assumed, until proved otherwise Map Sheet: Sheet 39 West London Scale: 1:100,000	A13NE (NE)	0	1	526053 185598
	Drift Deposits None				
	Bedrock Aquifer Designations Aquifer Desination: Secondary Aquifer - A	A13NE (NE)	0	3	526053 185598
	Superficial Aquifer Designations No Data Available				
	Extreme Flooding from Rivers or Sea without Defences None				
	Flooding from Rivers or Sea without Defences None				
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
12	**Historical Landfill Sites** Licence Holder: Not Supplied Location: London NW6 Name: Canfield Place Operator Location: Not Supplied Boundary Accuracy: As Supplied Provider Reference: EAHLD12043 First Input Date: Not Supplied Last Input Date: Not Supplied Specified Waste Type: Not Supplied EA Waste Ref: Not Supplied Regis Ref: Not Supplied WRC Ref: Not Supplied BGS Ref: Not Supplied Other Ref: DON009	A8SE (S)	769	1	526072 184813
	Local Authority Landfill Coverage Name: London Borough of Camden - Has no landfill data to supply		0	6	526053 185598
	Local Authority Landfill Coverage Name: London Borough of Barnet - Has supplied landfill data		890	7	525512 186326
13	**Registered Waste Transfer Sites** Licence Holder: P B Donoghue Licence Reference: DL140 Site Location: BR Goods Yard at 269 Finchley Road, CAMDEN, London, NW3 Operator Location: As Site Address Authority: Environment Agency - Thames Region, North East Area Site Category: Transfer Max Input Rate: Medium (Equal to or greater than 25,000 and less than 75,000 tonnes per year) Waste Source Restrictions: No known restriction on source of waste Licence Status: Licence lapsed/cancelled/defunct/not applicable/surrenderedCancelled Dated: 1st February 1992 Preceded By Licence: DL140 Superseded By Licence: Not Given Positional Accuracy: Manually positioned to the address or location Boundary Quality: Not Supplied Authorised Waste: Lwra Cat. A = Inert Wastes Lwra Cat. Bi Gen.Non-Putresc Max.Waste Permitted By Licence-Stated Prohibited Waste: Clinical - As In Coll/Disp.Regs Of '88 Liquid/Slurry/Sludge Wastes Poisonous, Noxious, Polluting Wastes Special Wastes Waste N.O.S.	A8SE (S)	817	1	526200 184780
13	**Registered Waste Transfer Sites** Licence Holder: P B Donoghue Licence Reference: DL140 Site Location: BR Goods Yard, 269 Finchley Road, CAMDEN, London, NW3 Operator Location: As Site Address Authority: Environment Agency - Thames Region, North East Area Site Category: Transfer Max Input Rate: Medium (Equal to or greater than 25,000 and less than 75,000 tonnes per year) Waste Source Restrictions: No known restriction on source of waste Licence Status: Record supersededSuperseded Dated: 1st August 1983 Preceded By Licence: Not Given Superseded By Licence: DL140 Positional Accuracy: Manually positioned to the address or location Boundary Quality: Not Supplied Authorised Waste: Commercial Waste Construction Ind. Wastes Max.Waste Permitted By Licence(Stated) Prohibited Waste: Clinical Waste -Clause 2 & 4 Hsc 1982 Notifiable Wastes Putrescible Waste Special Wastes	A8SE (S)	817	1	526200 184780

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Barton, Bracklesham and Bagshot Beds	A13NE (NE)	0	3	526053 185598
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic Concentration: no data Cadmium Concentration: no data Chromium Concentration: no data Lead Concentration: no data Nickel Concentration: no data	A13NE (NE)	0	4	526053 185598
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic Concentration: no data Cadmium Concentration: no data Chromium Concentration: no data Lead Concentration: no data Nickel Concentration: no data	A13NW (W)	33	4	526000 185598
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic Concentration: no data Cadmium Concentration: no data Chromium Concentration: no data Lead Concentration: no data Nickel Concentration: no data	A13NE (E)	91	4	526158 185634
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic Concentration: no data Cadmium Concentration: no data Chromium Concentration: no data Lead Concentration: no data Nickel Concentration: no data	A13NW (NW)	108	4	525993 185705
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic Concentration: no data Cadmium Concentration: no data Chromium Concentration: no data Lead Concentration: no data Nickel Concentration: no data	A13SW (SW)	163	4	525917 185475
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic Concentration: no data Cadmium Concentration: no data Chromium Concentration: no data Lead Concentration: no data Nickel Concentration: no data	A13SE (SE)	215	4	526207 185422

Map ID	Details		Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Measured Urban Soil Chemistry					
	Source:	British Geological Survey, National Geoscience Information Service	A8SE (S)	975	3	526344 184653
	Grid:	526344, 184653				
	Soil Sample Type:	Topsoil				
	Sample Area:	London				
	Arsenic Measured Concentration:	47.00 mg/kg				
	Cadmium Measured Concentration:	2.00 mg/kg				
	Chromium Measured Concentration:	111.00 mg/kg				
	Lead Measured Concentration:	1463.00 mg/kg				
	Nickel Measured Concentration:	71.00 mg/kg				
	BGS Urban Soil Chemistry Averages					
	Source:	British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	3	526053 185598
	Sample Area:	London				
	Count Id:	7189				
	Arsenic Minimum Concentration:	1.00 mg/kg				
	Arsenic Average Concentration:	17.00 mg/kg				
	Arsenic Maximum Concentration:	161.00 mg/kg				
	Cadmium Minimum Concentration:	0.30 mg/kg				
	Cadmium Average Concentration:	0.90 mg/kg				
	Cadmium Maximum Concentration:	165.20 mg/kg				
	Chromium Minimum Concentration:	13.00 mg/kg				
	Chromium Average Concentration:	79.00 mg/kg				
	Chromium Maximum Concentration:	2094.00 mg/kg				
	Lead Minimum Concentration:	11.00 mg/kg				
	Lead Average Concentration:	280.00 mg/kg				
	Lead Maximum Concentration:	10000.00 mg/kg				
	Nickel Minimum Concentration:	2.00 mg/kg				
	Nickel Average Concentration:	28.00 mg/kg				
	Nickel Maximum Concentration:	506.00 mg/kg				
	Coal Mining Affected Areas					
	In an area that might not be affected by coal mining					
	Non Coal Mining Areas of Great Britain					
	No Hazard					
	Potential for Collapsible Ground Stability Hazards					
	Hazard Potential:	Very Low	A13NE (NE)	0	3	526053 185598
	Source:	British Geological Survey, National Geoscience Information Service				
	Potential for Compressible Ground Stability Hazards					
	Hazard Potential:	No Hazard	A13NE (NE)	0	3	526053 185598
	Source:	British Geological Survey, National Geoscience Information Service				
	Potential for Ground Dissolution Stability Hazards					
	No Hazard					
	Potential for Landslide Ground Stability Hazards					
	Hazard Potential:	Very Low	A13NE (NE)	0	3	526053 185598
	Source:	British Geological Survey, National Geoscience Information Service				
	Potential for Landslide Ground Stability Hazards					
	Hazard Potential:	Low	A13SE (SE)	174	3	526193 185465
	Source:	British Geological Survey, National Geoscience Information Service				
	Potential for Running Sand Ground Stability Hazards					
	Hazard Potential:	Very Low	A13NE (NE)	0	3	526053 185598
	Source:	British Geological Survey, National Geoscience Information Service				
	Potential for Running Sand Ground Stability Hazards					
	Hazard Potential:	Low	A13NE (E)	92	3	526159 185635
	Source:	British Geological Survey, National Geoscience Information Service				

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	162	3	525918 185475
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	3	526053 185598
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NE (E)	92	3	526159 185635
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	3	526053 185598
	Radon Potential - Radon Affected Areas Affected Area: The property is in a lower probability radon area, as less than 1% of homes are above the action level Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	3	526053 185598

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
15	**Contemporary Trade Directory Entries** Name: All Rubbish Cleared Location: Redington Rd, London, NW3 7QX Classification: Rubbish Clearance **Status:** **Active** Positional Accuracy: Manually positioned to the road within the address or location	A13NW (NW)	145	-	525919 185694
16	**Contemporary Trade Directory Entries** Name: Hampstead Autos Location: 28, Perrins Walk, London, NW3 6TH Classification: Garage Services **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A13NE (E)	293	-	526365 185603
16	**Contemporary Trade Directory Entries** Name: Jeeves Of Belgravia Location: 11, Heath Street, London, NW3 6TP Classification: Dry Cleaners **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A13NE (E)	295	-	526365 185625
16	**Contemporary Trade Directory Entries** Name: Office Cleaning Services Location: 3, Heath Street, London, NW3 6TP Classification: Commercial Cleaning Services **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A13NE (E)	301	-	526373 185608
16	**Contemporary Trade Directory Entries** Name: Rubbish Collection Location: Heath St, London, NW3 6TP Classification: Waste Disposal Services **Status:** **Inactive** Positional Accuracy: Manually positioned to the road within the address or location	A13NE (E)	304	-	526372 185640
16	**Contemporary Trade Directory Entries** Name: Renew Medica Hampstead Location: 12, Heath Street, London, NW3 6TE Classification: Electrolysis **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A13NE (E)	315	-	526382 185649
17	**Contemporary Trade Directory Entries** Name: Perkins Dry Cleaners Location: 6, Holly Bush Vale, London, NW3 6TX Classification: Dry Cleaners **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A13NE (NE)	315	-	526343 185767
18	**Contemporary Trade Directory Entries** Name: Andrews Of Hampstead Location: 22, Heath Street, London, NW3 6TE Classification: Hardware **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A13NE (E)	317	-	526381 185666
19	**Contemporary Trade Directory Entries** Name: Perkins Group Location: 40, Heath Street, London, NW3 6TE Classification: Dry Cleaners **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A13NE (E)	324	-	526374 185724
20	**Contemporary Trade Directory Entries** Name: American Dry Cleaning Location: 47, Hampstead High Street, London, NW3 1QG Classification: Dry Cleaners **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A14NW (NE)	361	-	526400 185759
20	**Contemporary Trade Directory Entries** Name: Xyz Location: 10, Flask Walk, London, NW3 1HE Classification: Ceramic Manufacturers, Supplies & Services **Status:** **Inactive** Positional Accuracy: Manually positioned to the address or location	A14NW (E)	402	-	526445 185756
20	**Contemporary Trade Directory Entries** Name: Hillsdown Holdings Ltd Location: 32, Hampstead High Street, London, NW3 1QD Classification: Food Products - Manufacturers **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A14NW (E)	419	-	526475 185717

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
64	**Contemporary Trade Directory Entries** Name: Builder Depot Location: 14, Blackburn Road, London, NW6 1RZ Classification: Builders' Merchants **Status: Active** Positional Accuracy: Automatically positioned to the address	A7SE (SW)	985	-	525628 184687
65	**Contemporary Trade Directory Entries** Name: Cotton Club Location: 57, Mill Lane, London, NW6 1NB Classification: Dry Cleaners **Status: Active** Positional Accuracy: Automatically positioned to the address	A7NW (W)	987	-	525119 185229
66	**Contemporary Trade Directory Entries** Name: Cross Weir Ltd Location: Barkat House, 116-118, Finchley Road, London, NW3 5HT Classification: Valve Manufacturers & Suppliers **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A8SE (S)	991	-	526376 184647
67	**Fuel Station Entries** Name: Cavendish Motors Location: West End Lane, LONDON, Greater London, NW6 1XF Brand: OBSOLETE Premises Type: Not Applicable **Status: Obsolete** Positional Accuracy: Manually positioned to the road within the address or location	A7NE (SW)	736	-	525412 185197
68	**Fuel Station Entries** Name: Fortune Green Service Station Location: 63-65 Fortune Green Road, Fortune Green, LONDON, NW6 1DR Brand: Texaco Premises Type: Not Applicable **Status: Obsolete** Positional Accuracy: Manually positioned to the road within the address or location	A12NW (W)	920	-	525113 185609

Useful Contacts

Contact	Name and Address	Contact Details
1	**Environment Agency - National Customer Contact Centre (NCCC)** PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 08708 506 506 Email: enquiries@environment-agency.gov.uk
2	**London Borough of Camden - Pollution Projects Team** Seventh Floor, Town Hall Extension, Argyle Street, London, WC1H 8EQ	Telephone: 020 7278 4444 Fax: 020 7860 5713 Website: www.camden.gov.uk
3	**British Geological Survey - Enquiry Service** British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
4	**Landmark Information Group Limited** 5 - 7 Abbey Court, Eagle Way, Sowton, Exeter, Devon, EX2 7HY	Telephone: 01392 441761 Fax: 01392 441709 Email: cssupport@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk
5	**Natural England** Northminster House, Northminster Road, Peterborough, Cambridgeshire, PE1 1UA	Telephone: 0845 600 3078 Fax: 01733 455103 Email: enquiries@naturalengland.org.uk Website: www.naturalengland.org.uk
6	**London Borough of Camden** Town Hall, Judd Street, London, WC1H 9JE	Telephone: 020 7974 4444 Fax: 020 7974 6866 Email: info@camden.gov.uk Website: www.camden.gov.uk
7	**London Borough of Barnet - Land Charges** The Town Hall, The Burroughs, Hendon, LONDON, NW4 4BQ	Telephone: 0208 3592482 Fax: 0208 3592493 Website: www.barnet.gov.uk
-	**Health Protection Agency - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards** Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@hpa.org.uk Website: www.hpa.org.uk
-	**Landmark Information Group Limited** The Smith Centre, Henley On Thames, Oxfordshire, RG9 6AB	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Please note that the Environment Agency / SEPA have a charging policy in place for enquiries.