H Fraser CONSULTING
CONTAMINATED LAND AND HYDROGEOLOGY

Basement Impact Assessment
80 Greencroft Gardens, NW6 3JQ

Prepared for: Antony and Chris Charlton
80 Greencroft Gardens
London
NW6 3JQ

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CONTENTS

APPENDICES

1 INTRODUCTION

Antony and Chris Charlton has instructed H Fraser Consulting Ltd (HFCL) to provide the hydrogeological and geotechnical aspects of a Basement Impact Assessment at the following property:

80 Greencroft Gardens, NW6 3JQ

The site is in the London Borough of Camden.

1.1 Objective

The objective of this report is to provide the hydrogeological and geotechnical aspects of a Basement Impact Assessment to support a planning application for construction of a basement at 80 Greencroft Gardens, NW6 3JQ.

1.2 Scope of work

The following scope of work has been carried out:

- Review of relevant desk based information and data provided by the client
- Site investigation and geotechnical testing
- Hydrogeological assessment
- Geotechnical assessment
- Reporting.

This scope of work is limited to an assessment of the groundwater and geotechnical aspects of the proposed development and does not make any assessment of hydrology, surface water flooding, SUDS, contamination or pollution, design or construction issues.

The hydrogeological aspects of the work have been undertaken by Hannah Fraser, a Chartered Geologist with a MSc in Hydrogeology and 19 years' experience as a practising hydrogeologist. Geotechnical aspects of the work have been undertaken by Jon Smithson, a Chartered Geologist with 30 years' experience of engineering geology and geotechnical work.

Background information has been derived from a Groundsure report for a nearby site (on Priory Road, 300m northwest), which is presented as Appendix A. Site plans are presented in Appendix B. The scope of work has been reported as follows:

Appendix C Site Investigation Report (Ground and Water, 2016 Preliminary Summary – Ground Investigation Report, 80 Greencroft Gardens.)

Appendix D Groundwater BIA (H Fraser Consulting, 2016. Basement Impact assessment: Groundwater. 80 Greencroft Gardens. Ref 30132R1)

Appendix E Land Stability BIA (Ground and Project Consultants Ltd 80 Greencroft Gardens Basement Impact Assessment: Land Stability and Assessment of Ground Movement)

APPENDIX A

Groundsure Report

Contents Page

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
1.1.1 Records of historic IPC Authorisations	0	0	0	0
1.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
1.1.3 Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0
1.1.4 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0
1.1.5 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
1.1.6 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
1.1.7 Records of Part A(2) and Part B Activities and Enforcements	0	0	1	2
1.1.8 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
1.1.9 Records of Licensed Discharge Consents	0	0	0	0
1.1.10 Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0
1.2 Records of COMAH and NIHHS sites	0	0	0	0
1.3 Environment Agency Recorded Pollution Incidents				
1.3.1 National Incidents Recording System, List 2	0	0	0	0
1.3.2 National Incidents Recording System, List 1	0	0	0	0
1.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 2: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-5000
2.1 Landfill Sites						
2.1.1 Environment Agency Registered Landfill Sites	0	0	0	0	0	Not searched
2.1.2 Environment Agency Historic Landfill Sites	0	0	0	1	0	0
2.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0

Section 2: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-5000
2.1.4 Landfills from Local Authority and Historical Mapping Records	0	0	0	0	0	0
2.2 Landfill and Other Waste Sites Findings						
2.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	3	Not searched	Not searched
2.2.2 Environment Agency Licensed Waste Sites	0	0	0	0	0	0

Section 3: Current Land Use	On-site	0-50m	51-250	251-500
3.1 Current Industrial Sites Data	0	1	14	Not searched
3.2 Records of Petrol and Fuel Sites	0	0	0	0
3.3 National Grid Underground Electricity Cables	0	0	0	0
3.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 4: Geology	
4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	None
4.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 5: Hydrogeology and Hydrology	0-500m
5.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?	No
5.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
5.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	4
5.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
5.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
5.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
5.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
5.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	0	0	0	0	Not searched	Not searched

	On-site	0-50m	51-250	251-500	501-1000	1000-1500

Section 5: Hydrogeology and Hydrology	0-500m					
5.9 Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	No	No	No	No
5.10 Detailed River Network entries within 500m of the site	0	0	0	0	Not searched	Not searched
5.11 Surface water features within 250m of the study site	No	No	No	Not searched	Not searched	Not searched

Section 6: Flooding	
6.1 What is the highest risk of flooding within 25m of the centre of the study site?	Very Low
6.2 Are there any Flood Defences within 250m of the study site?	No
6.3 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.4 Are there any areas used for Flood Storage within 250m of the study site?	No
6.5 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Not Prone
6.6 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Not Applicable

Section 7: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
7.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
7.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
7.5 Records of Ramsar sites	0	0	0	0	0	0
7.6 Records of Ancient Woodlands	0	0	0	0	0	0
7.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	4
7.8 Records of World Heritage Sites	0	0	0	0	0	0
7.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0
7.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0

Section 7: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
7.11 Records of National Parks	0	0	0	0	0	0
7.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
7.13 Records of Nitrate Vulnerable Zones	0	0	0	0	0	0
7.14 Records of Green Belt Data	0	0	0	0	0	0

Section 8: Natural Hazards

8.1 What is the maximum risk of natural ground subsidence?	Moderate
8.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Moderate
8.1.2 What is the maximum Landslides hazard rating identified on the study site?	Very Low
8.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
8.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Negligible
8.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
8.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Negligible

Section 9: Mining

9.1 Are there any coal mining areas within 75m of the study site?	No
9.2 What is the potential for undermining as a result of underground mineral extraction, excluding coal and minerals extracted as a consequence of coal mining?	Unclassified
9.3 Are there any brine affected areas within 75m of the study site?	No

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

1. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

2. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

3. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

4. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

5. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

6. Flooding

Provides information on surface water flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

7. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

8. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence.

9. Mining

Provides information on areas of coal, “non-coal” mining and brine affected areas.

10. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

Note: Maps

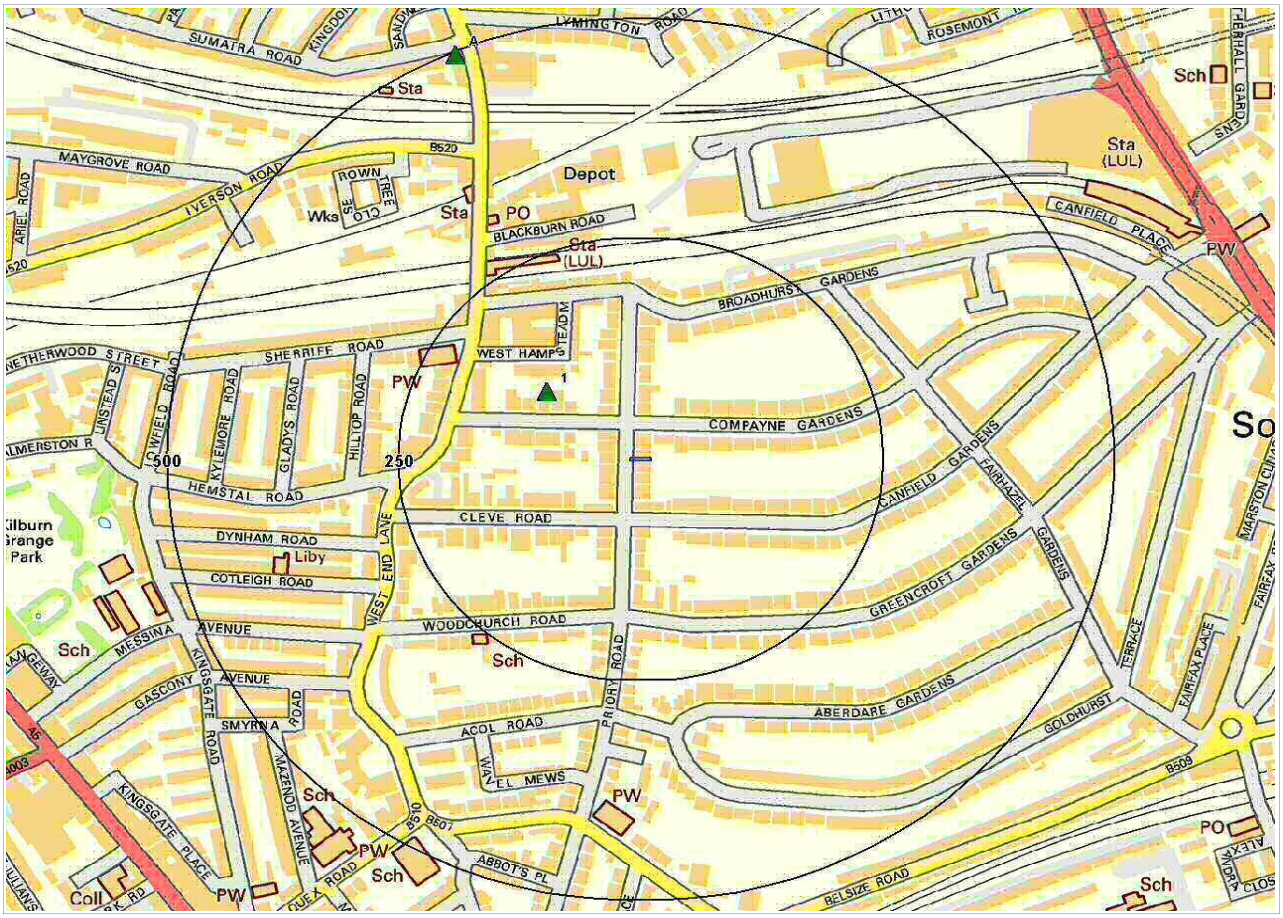
Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier “A” on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as “Not Shown”.

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Environmental Permits, Incidents and Registers Map

NW N NE



SW S SE

Environmental Permits, Incidents and Registers Legend

Mapping sourced from Ordnance Survey®

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- Site Outline
- 250 — 500 — Search Buffers (m)
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licensed Discharge Consents
- Red List Discharge Consents
- Radioactive Consents (Lower Risk)
- Part A(1) Authorised Processes & Historic IPC Authorisations
- Part A(2) and Part B Authorisations
- Sites Determined as Contaminated Land
- COMAH / NIHHS Sites
- Hazardous Substance Consents & Enforcements

1. Environmental Permits, Incidents and Registers

1.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency and Local Authorities reveal the following information:

1.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

1.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

0

Database searched and no data found.

1.1.3 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

1.1.4 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

1.1.5 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

1.1.6 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

1.1.7 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

3

The following Part A(2) and Part B Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance	Direction	NGR	Details	
1	117.0	NW	525600 184500	Address: Wj Humpage, Loudon Rd Coachworks, West Hampstead Mews, NW6 3BB Process: Vehicle Re-spray Process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
2A	495.0	N	525501 184883	Address: Madame George Dry Cleaners , 227 West End Lane, NW6 1XJ Process: Dry Cleaner Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
3A	495.0	N	525501 184883	Address: Madame George Dry Cleaners, 227 West End Lane, NW6 1XJ Process: Dry Cleaner Status: Current Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified

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1.1.8 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

1.1.9 Records of Licensed Discharge Consents within 500m of the study site:

0

Database searched and no data found.

1.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

0

Database searched and no data found.

1.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: 0

Database searched and no data found.

1.3 Environment Agency Recorded Pollution Incidents

1.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

0

Database searched and no data found.

1.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

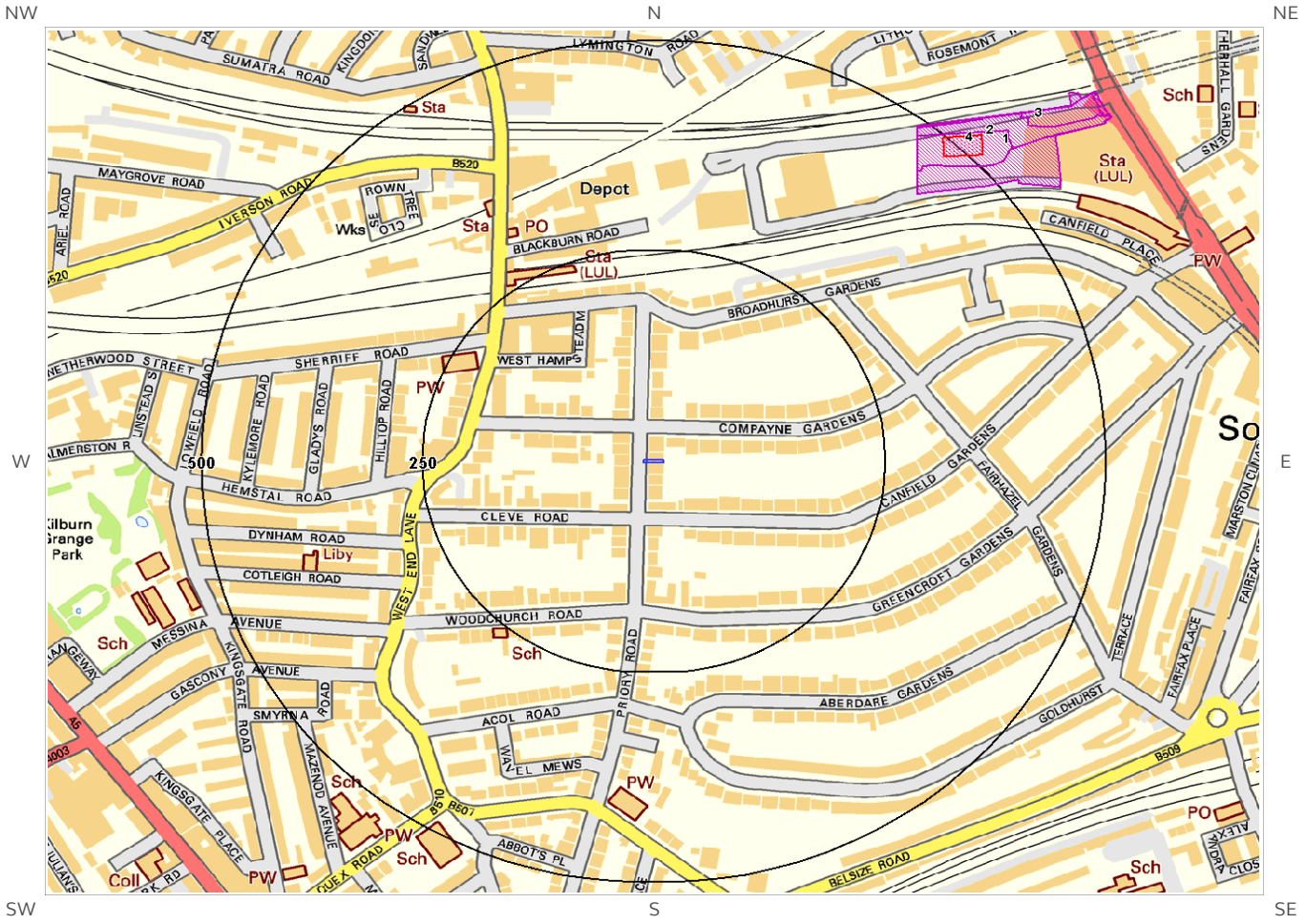
Database searched and no data found.

1.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site? 0

Database searched and no data found.

2. Landfill and Other Waste Sites Map



Landfill and Other Waste Sites Legend

Mapping sourced from Ordnance Survey

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- Site Outline
- 250 / 500 Search Buffers (m)
- E.A. Active Landfill
- E.A. Historic Landfill
- BGS / DoE Survey Landfill
- Historic and Planned Waste Sites
- E.A. Licensed Waste Site
- Local Authority/Historical Mapping Landfill Records

2. Landfill and Other Waste Sites

2.1 Landfill Sites

2.1.1 Records from Environment Agency landfill data within 1000m of the study site:

0

Database searched and no data found.

2.1.2 Records of Environment Agency historic landfill sites within 1500m of the study site:

1

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
4	481.0	NE	526000 184800	Site Address: Canfield Place, London NW6 Waste Licence: - Site Reference: DON009 Waste Type: - Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Hold Address: - Operator: - First Recorded Input: Last Recorded Input:

2.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

0

Database searched and no data found.

2.1.4 Records of Landfills from Local Authority and Historical Mapping records within 1500m of the study site:

0

Database searched and no data found.

2.2 Other Waste Sites

2.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

3

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details		
1	427.0	NE	526109 184803	Type of Site: Waste Transfer Station Site Address: N/A	Planning Application Reference: N/A Date: 1994	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
2	449.0	NE	526076 184811	Type of Site: Refuse Transfer Depot Site Address: N/A	Planning Application Reference: N/A Date: 1986	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
3	482.0	NE	526109 184831	Type of Site: Refuse Transfer Depot Site Address: N/A	Planning Application Reference: N/A Date: 1970	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon

2.2.2 Records of Environment Agency licensed waste sites within 1500m of the study site:

0

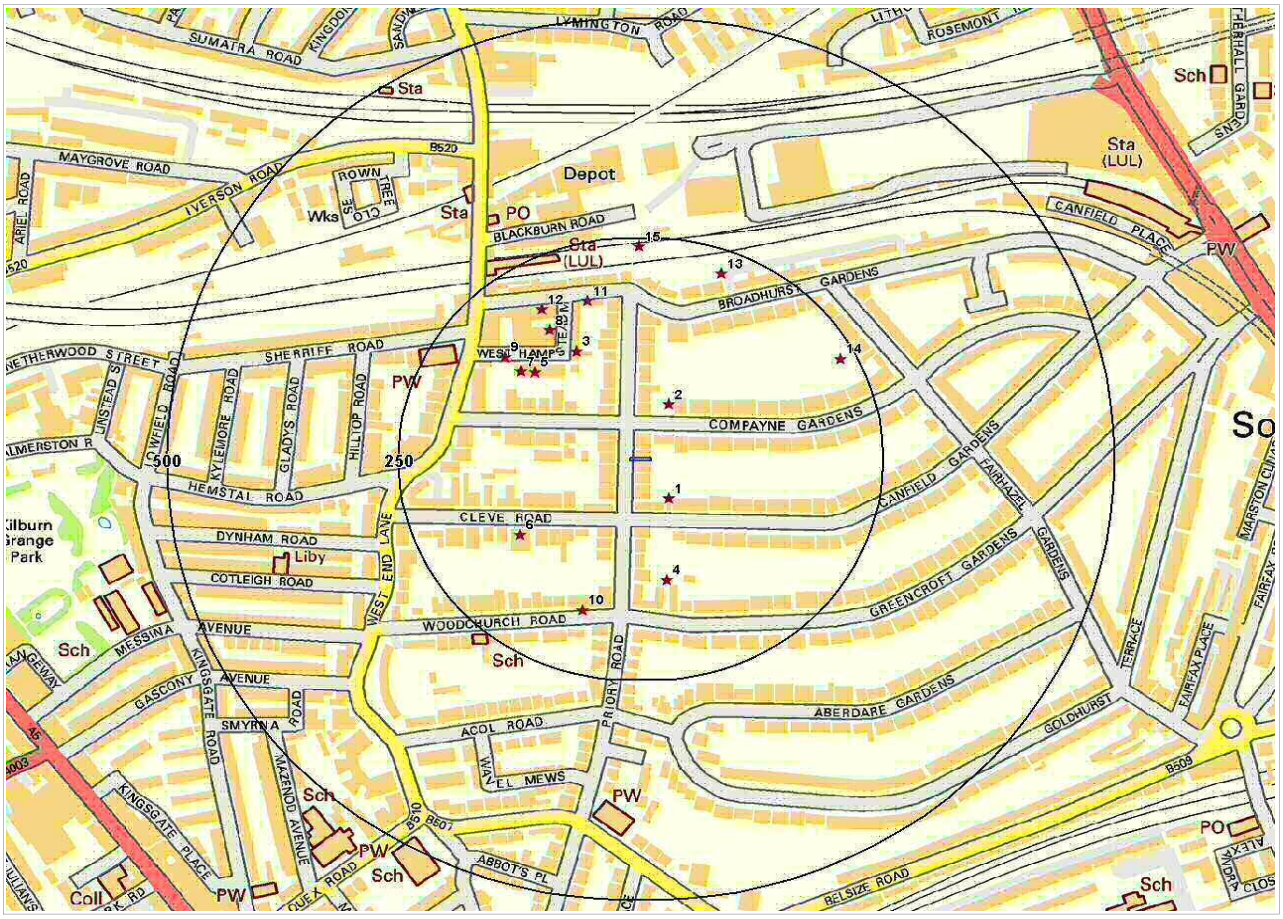
Database searched and no data found.

3. Current Land Use Map

NW N NE

W E

SW S SE



Current Land Use Legend

Mapping sourced from Ordnance Survey

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Site Outline

250 500 Search Buffers (m)

Current Industrial Sites

Petrol & Fuel Sites

Gas Transmission Pipeline

Electricity Transmission Cable

3. Current Land Uses

3.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 15

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	47.0	SE	Electricity Sub Station		NW6	Electrical Features	Infrastructure and Facilities
2	64.0	N	Electricity Sub Station		NW6	Electrical Features	Infrastructure and Facilities
3	134.0	NW	Hint of a Tint	184547	5, West Hampstead Mews, London, NW6 3BB	Industrial Coatings and Finishings	Industrial Products
4	137.0	S	Electricity Sub Station		NW6	Electrical Features	Infrastructure and Facilities
5	142.0	NW	Kwik Kar Service Centre	525587 184523	11, West Hampstead Mews, London, NW6 3BB	Vehicle Repair, Testing and Servicing	Repair and Servicing
6	146.0	SW	Wire Broadcast Ltd	525571 184338	Flat 1 Cleve House 7-9, Cleve Road, London, NW6 3RN	Civil Engineers	Engineering Services
7	154.0	NW	K & P Coachworks	184524	13, West Hampstead Mews, London, NW6 3BB	Vehicle Repair, Testing and Servicing	Repair and Servicing
8	169.0	NW	G M Deery	525602 184571	22, West Hampstead Mews, London, NW6 3BB	Vehicle Repair, Testing and Servicing	Repair and Servicing
9	177.0	NW	Electricity Sub Station		NW6	Electrical Features	Infrastructure and Facilities
10	178.0	S	Electricity Sub Station		NW6	Electrical Features	Infrastructure and Facilities
11	185.0	N	La Mer London Ltd	525643 184604	6-8 Broadwell Parade, Broadhurst Gardens, London, NW6 3BQ	Fish, Meat and Poultry Products	Foodstuffs
12	194.0	NW	Eclipse Td UK Ltd	184594	159, Broadhurst Gardens, London, NW6 3AU	Electronic Equipment	Industrial Products
13	223.0	N	Electricity Sub Station		NW6	Electrical Features	Infrastructure and Facilities
14	233.0	NE	Electricity Sub Station		NW6	Electrical Features	Infrastructure and Facilities
15	241.0	N	Gantry		NW6	Travelling Cranes and Gantries	Industrial Features

3.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: 0

Database searched and no data found.

3.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site: 0

Database searched and no data found.

3.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.

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4. Geology

4.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

4.2 Superficial Ground and Drift Geology

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

4.3 Bedrock and Solid Geology

The database has been searched on site, including a 50m buffer.

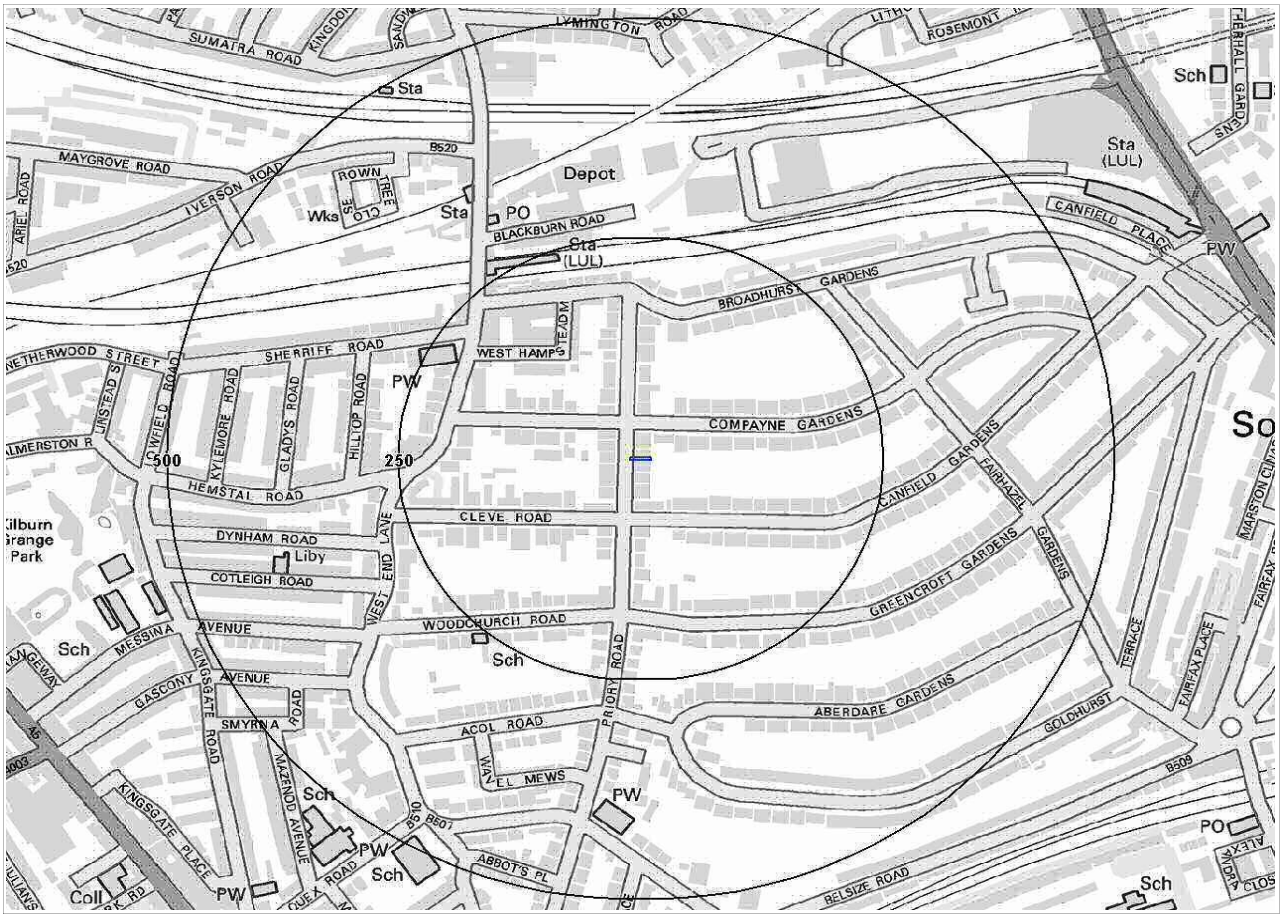
Lex Code	Description	Rock Type
LC-CLSISA	LONDON CLAY FORMATION	CLAY, SILT AND SAND

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

5. Hydrogeology and Hydrology

5a. Aquifer Within Superficial Geology

NW N NE



W E

SW S SE

Aquifer Within Superficial Geology

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Site Outline

250 Search Buffers (m)
500

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Secondary Aquifer - Undifferentiated Layers

Unproductive

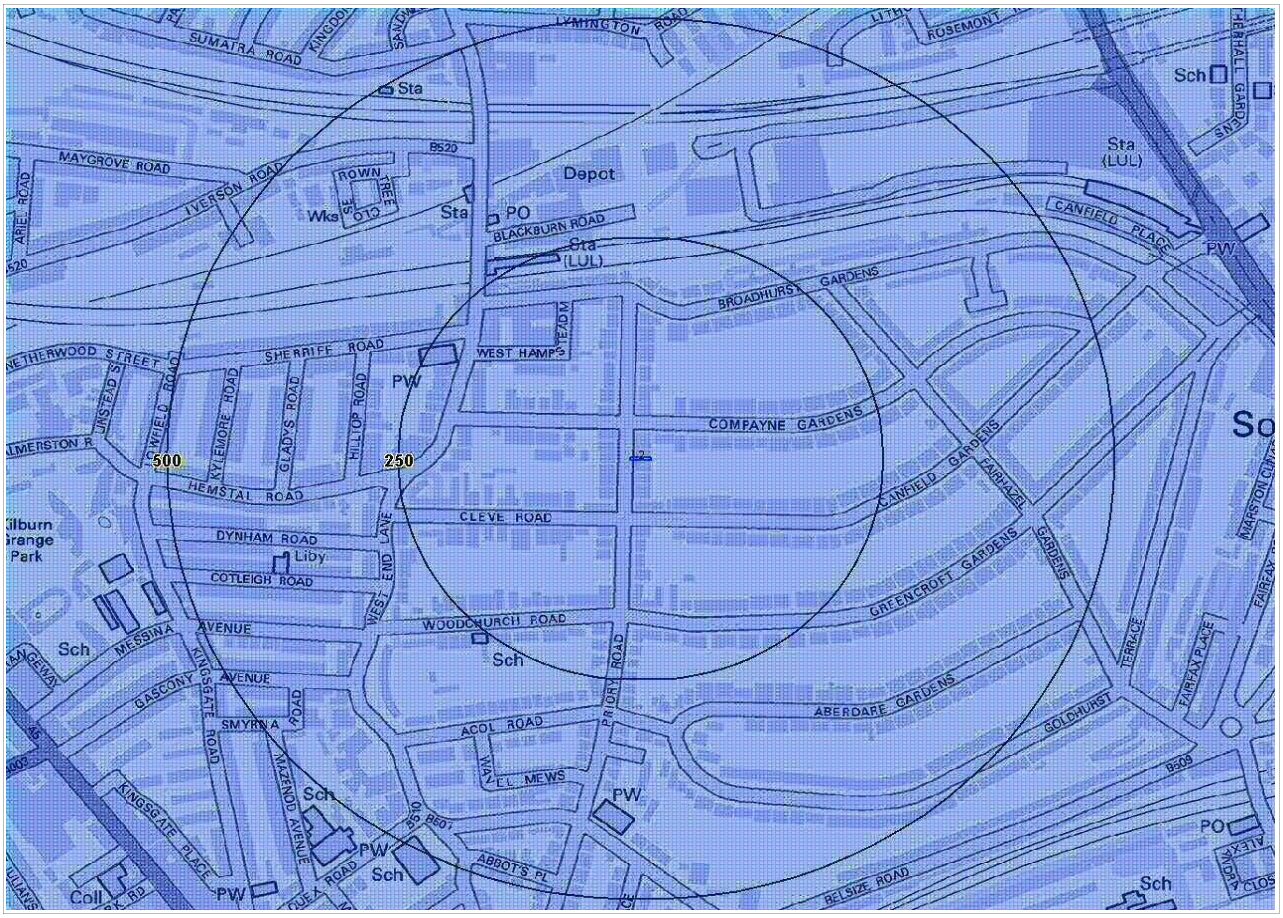
Unknown (lakes and landslip)

5b. Aquifer Within Bedrock Geology and Abstraction Licenses

NW N NE

W E

SW S SE



Aquifer Within Bedrock Geology and Abstraction Licenses

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Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Groundwater Abstraction Licence

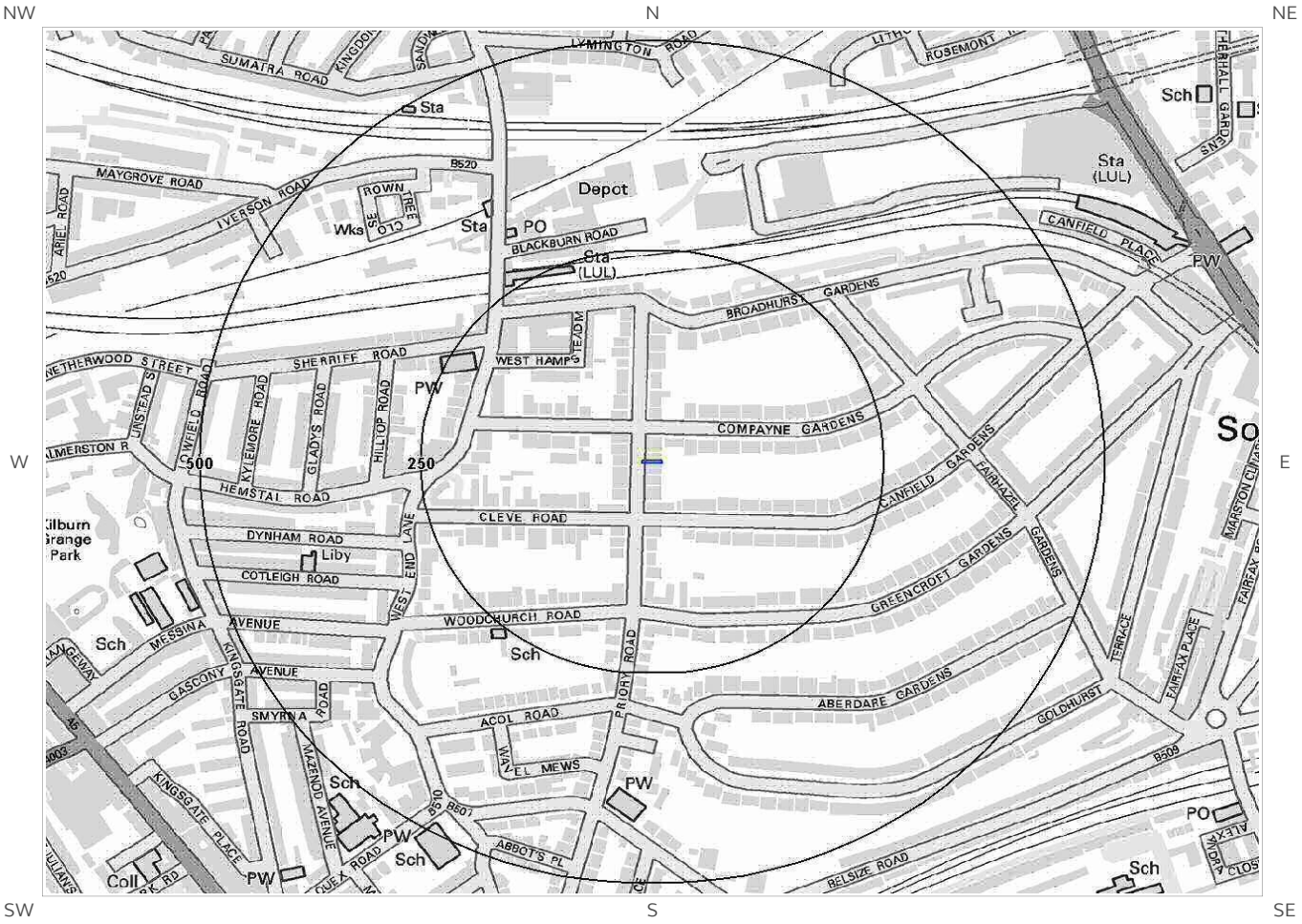
Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

5c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



Hydrogeology-Source Protection Zones and Potable Water Abstraction Licenses

Mapping sourced from Ordnance Survey

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Site Outline

250 — 500 — Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

Source Protection Zone 2 - Outer Catchment

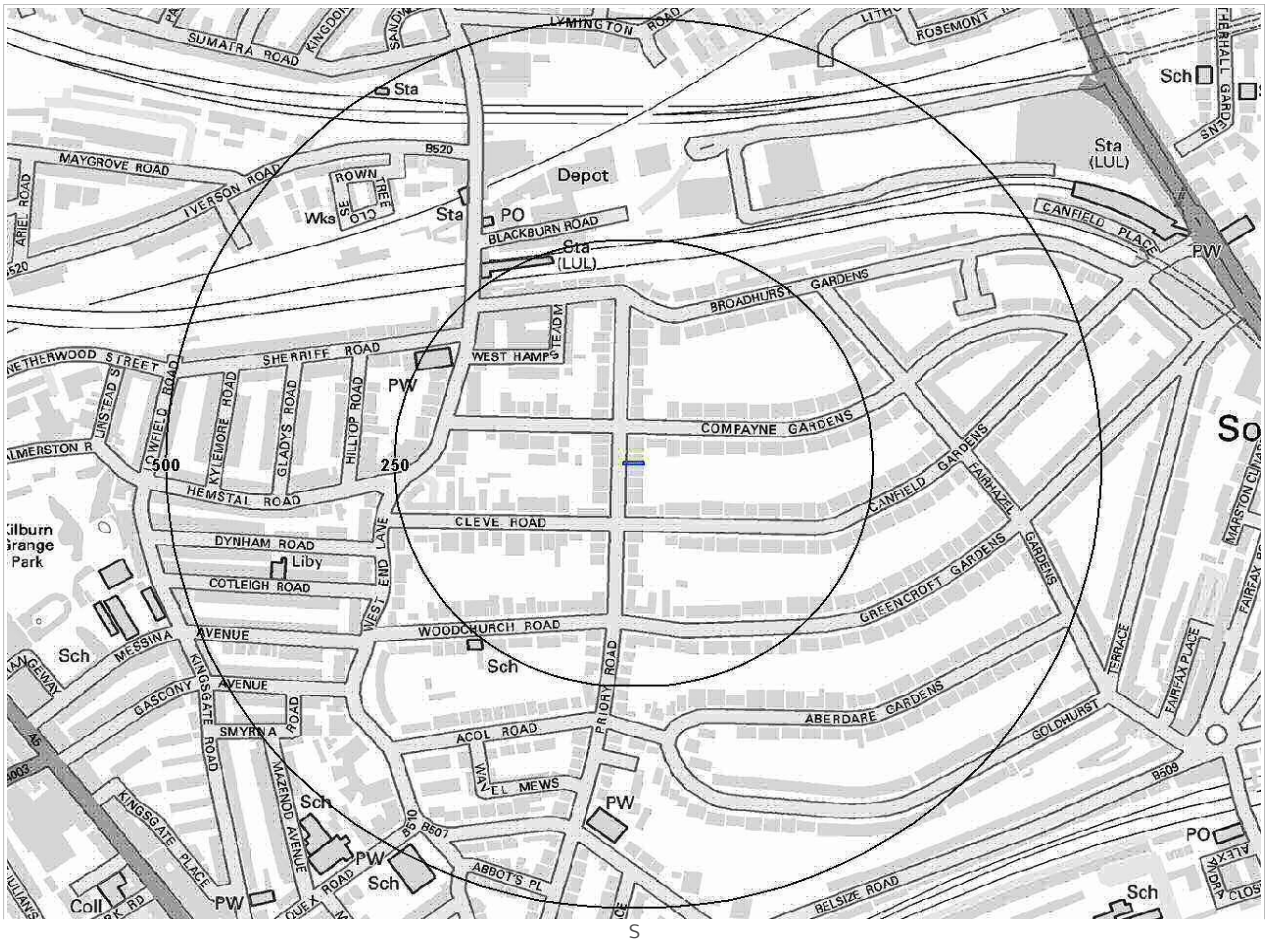
Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

Potable Water Abstraction Licence

5d. Hydrogeology - Source Protection Zones within confined aquifer

NW N NE



Hydrogeology Source Protection Zones

Mapping sourced from Ordnance Survey

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Site Outline

250 500 Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

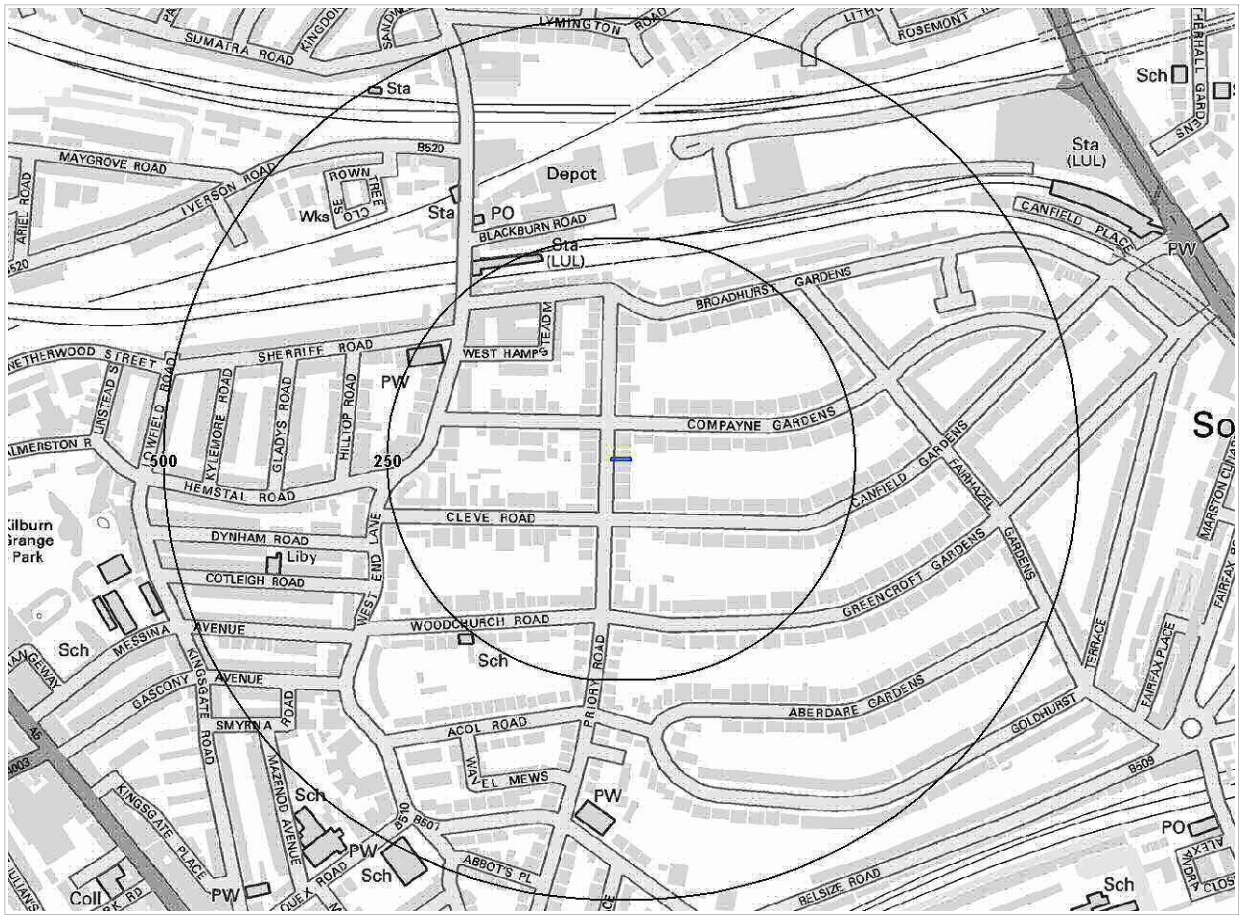
Source Protection Zone 2C - Outer Catchment within Confined Aquifer

Source Protection Zone 3C - Total Catchment within Confined Aquifer

Potable Water Abstraction Licence

5e. Hydrology – Detailed River Network and River Quality

NW N NE



W E

SW S SE

Hydrology – Detailed River Network and River Quality

Mapping sourced from Ordnance Survey

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- Site Outline
- 250 / 500 — Search Buffers (m)
- Primary River
- Secondary River
- Tertiary River
- Lake/Reservoir
- Underground River (inferred)
- General Quality Assessment: Biology
- General Quality Assessment: Chemistry
- Canal
- Canal Tunnel
- Culvert
- Multiple Channel Culvert
- Underground River (Potential Sewer)
- Underground River (local knowledge)

5. Hydrogeology and Hydrology

5.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? No

Database searched and no data found.

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviroinsight User Guide.

5.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (5b):

ID	Distance (m)	Direction	Designation	Description
2	0.0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

5.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (5b):

ID	Distance (m)	Direction	NGR	Name	Details	
Not shown	1050.0	E	526750 184261	LONDON BOROUGH OF CAMDEN	Licence No: TH/039/0039/087 Details: General Washing/Process Washing Direct Source: Thames Groundwater Point: Swiss Cottage Open Space- Borehole Data Type: Point	Annual Volume (m^3): 10512 Max Daily Volume (m^3): 28.8 Original Application No: NPS/WR/014567 Original Start Date: 5/12/2013 Expiry Date: 31/3/2025 Issue No: 1 Version Start Date: 5/12/2013 Version End Date:

ID	Distance (m)	Direction	NGR	Name	Details	
Not shown	1050.0	E	526750 184261	LONDON BOROUGH OF CAMDEN	Licence No: TH/039/0039/087 Details: Lake & Pond Throughflow Direct Source: Thames Groundwater Point: Swiss Cottage Open Space- Borehole Data Type: Point	Annual Volume (m^3): 10512 Max Daily Volume (m^3): 28.8 Original Application No: NPS/WR/014567 Original Start Date: 5/12/2013 Expiry Date: 31/3/2025 Issue No: 1 Version Start Date: 5/12/2013 Version End Date:
Not shown	1050.0	E	526750 184261	LONDON BOROUGH OF CAMDEN	Licence No: TH/039/0039/087 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: Swiss Cottage Open Space- Borehole Data Type: Point	Annual Volume (m^3): 10512 Max Daily Volume (m^3): 28.8 Original Application No: NPS/WR/014567 Original Start Date: 5/12/2013 Expiry Date: 31/3/2025 Issue No: 1 Version Start Date: 5/12/2013 Version End Date:
Not shown	1096.0	E	526800 184280	LONDON BOROUGH OF CAMDEN	Licence No: 28/39/39/0219 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: Swiss Cottage Open Space- Borehole Data Type: Point	Annual Volume (m^3): 10512 Max Daily Volume (m^3): 28.8 Original Application No: WRA/N/1407 Original Start Date: 12/8/2005 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 1/4/2008 Version End Date:

5.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

5.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

5.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? No

Database searched and no data found.

5.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site?

No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

5.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency information on groundwater vulnerability and soil leaching potential within 500m of the study site? No

Database searched and no data found.

5.9 River Quality

Is there any Environment Agency information on river quality within 1500m of the study site? No

---

5.9.1 Biological Quality:

Database searched and no data found.

5.9.2 Chemical Quality:

Database searched and no data found.

5.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? No

Database searched and no data found.

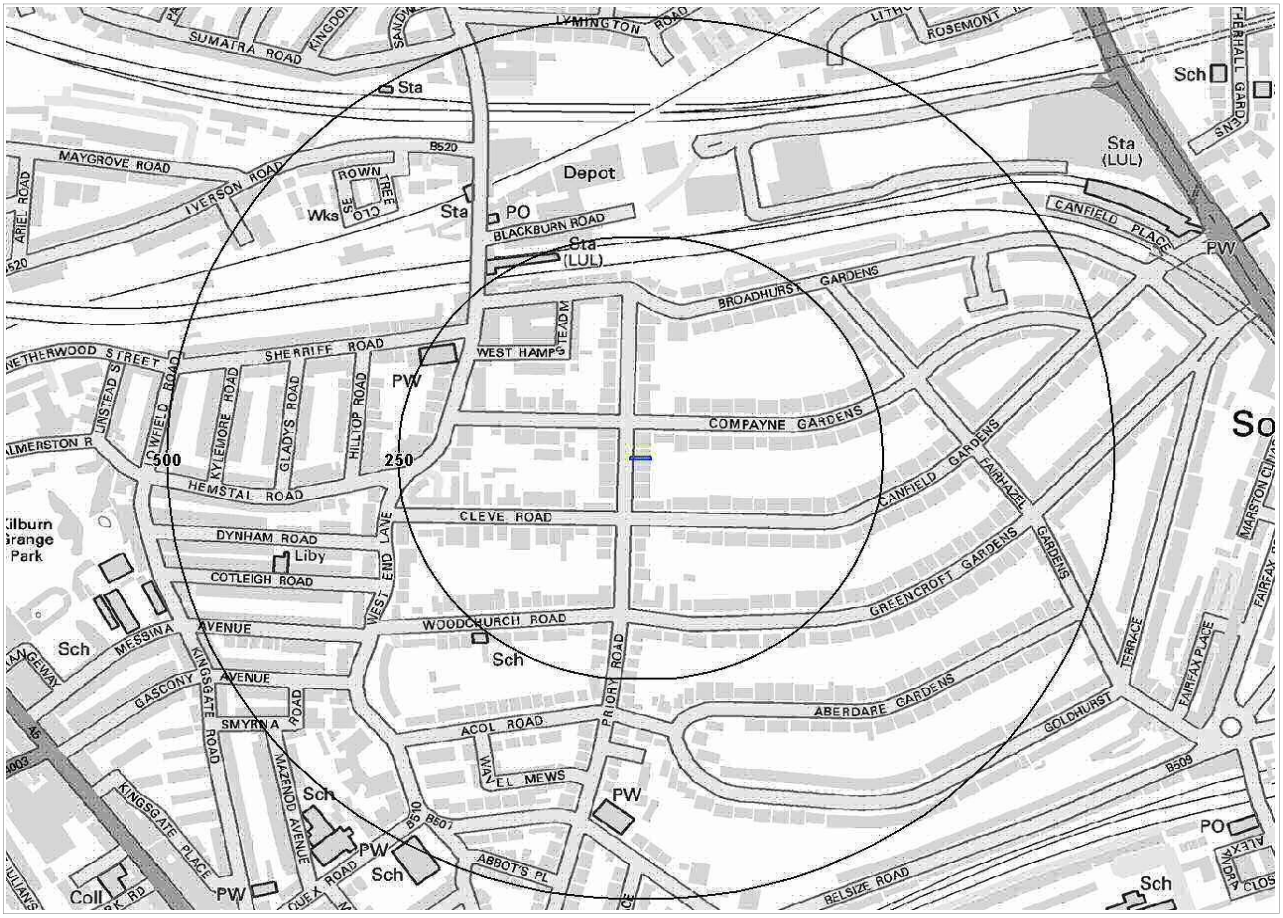
5.11 Surface Water Features

Are there any surface water features within 250m of the study site?	No

Database searched and no data found.

6. Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS) Map

NW N NE



W E

SW S SE

Environment Agency Risk of Flooding From Rivers and the Sea (RoFRaS)

Mapping sourced from Ordnance Survey®

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Site Outline

250 Search Buffers (m)
500

RoFRaS Rating

Very Low
Low
Medium
High

Flood Defences

Areas used for Flood Storage
Areas Benefiting from Flood Defences
Flood Defences

6. Flooding

6.1 Risk of Flooding from Rivers and the Sea (RoFRaS)

What is the risk of flooding at the centre of the study site?	Very Low
What is the highest risk of flooding within 25m of the centre of the study site?	Very Low

The Environment Agency RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid as used by many of the insurance companies. RoFRaS data is based on a 50m grid system, with the flood rating at the centre of the grid calculated and given below. The data considers the probability that the flood defences will overtop or breach, and the distance from the river or the sea.

RoFRaS data for the study site indicates the property has a Very Low (less than 1 in 1000) chance of flooding in any given year.

6.2 Flood Defences

Are there any Flood Defences within 250m of the study site?	No

Database searched and no data found.

6.3 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site?	No

6.4 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site?	No

6.5 Groundwater Flooding Susceptibility Areas

6.5.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site?

No

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

6.5.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Not Prone

The area is not considered to be prone to groundwater flooding based on rock type.

6.6 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? Not Applicable

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

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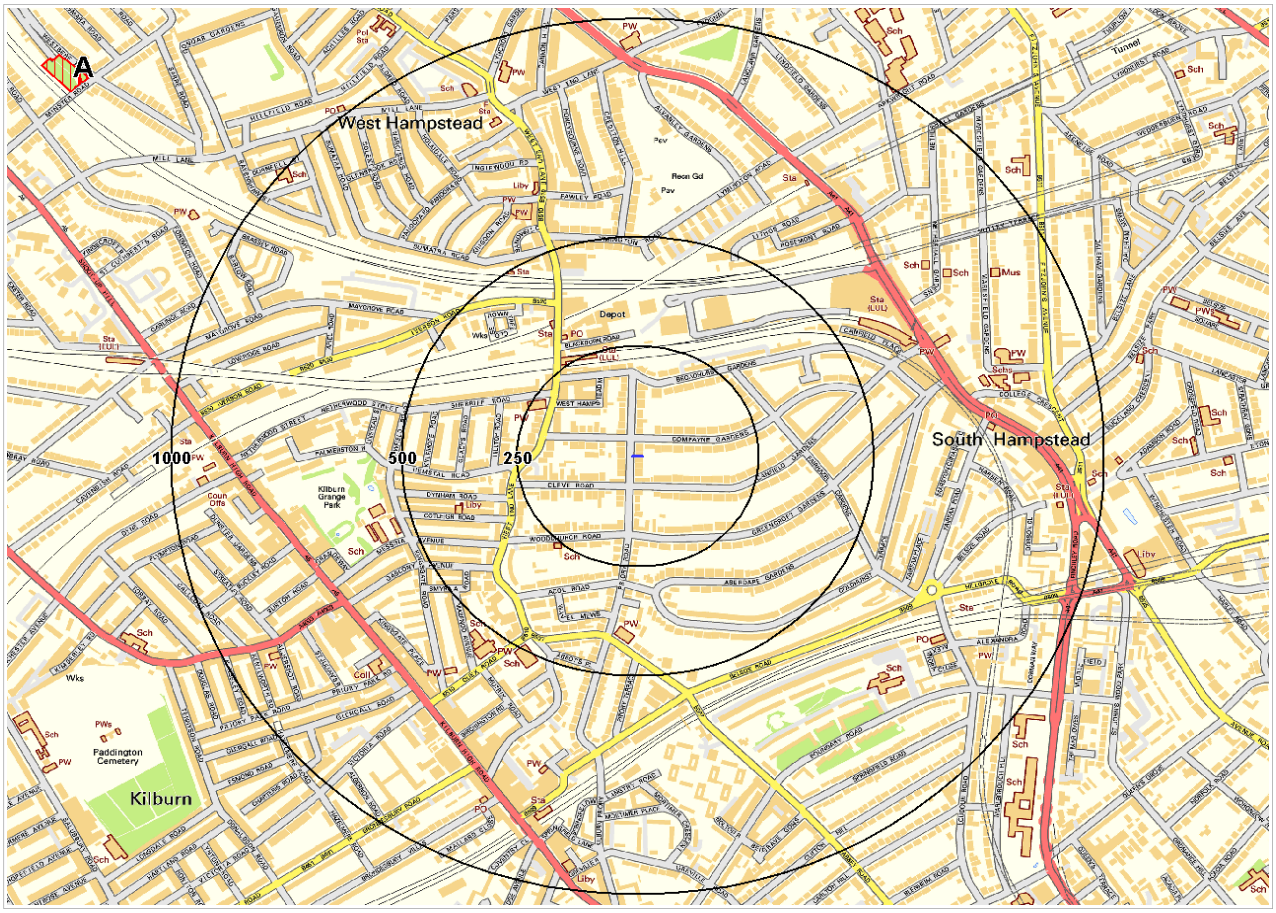
7. Designated Environmentally Sensitive Sites Map

NW N NE

W E

SW S SE



Designated Environmentally Sensitive Sites Map

Mapping sourced from Ordnance Survey

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Site Outline

100 250 Search Buffers (m)

AONB

National Park

SSSI

Special Protection Areas

Nitrate Vulnerable Zones

Green Belt

Environmentally Sensitive Areas

Special Areas of Conservation

World Heritage Sites

Nitrate Sensitive Areas

Ancient Woodland

National Nature Reserve

Local Nature Reserves

Ramsar Sites

7. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site?	Yes

7.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

0

Database searched and no data found.

7.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

7.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

7.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

7.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

7.6 Records of Ancient Woodland within 2000m of the study site:

0

Database searched and no data found.

7.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

4

The following Local Nature Reserve (LNR) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	LNR Name	Data Source
1A	1463.0	NW	Westbere Copse	Natural England
2A	1470.0	NW	Westbere Copse	Natural England
Not shown	1928.0	SE	St John's Wood Church Grounds	Natural England
Not shown	1942.0	NE	Belsize Wood	Natural England

7.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

7.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

7.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

7.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

7.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

7.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

0

Database searched and no data found.

7.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.

---

8. Natural Hazards Findings

8.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a Groundsure GeoInsight, available from our website. The following information has been found:

8.1.1 Shrink Swell

What is the maximum Shrink-Swell*[*] hazard rating identified on the study site? Moderate

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.

8.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

* This indicates an automatically generated 50m buffer and site.

8.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

8.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

8.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

8.1.6 Running Sand

What is the maximum Running Sand* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

* This indicates an automatically generated 50m buffer and site.

9. Mining

9.1 Coal Mining

Are there any coal mining areas within 75m of the study site? No

Database searched and no data found.

9.2 BGS Non Coal Mining Hazards

What is the potential for undermining as a result of underground mineral extraction, excluding coal and minerals extracted as a consequence of coal mining? Unclassified

Database searched and no data found.

9.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? No

Guidance: No Guidance Required.

Contact Details

Groundsure Helpline
Telephone: 08444 159 000
info@groundsure.com

British Geological Survey Enquiries

Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email: enquiries@bgs.ac.uk
Web:www.bgs.ac.uk
BGS Geological Hazards Reports and general geological enquiries

Environment Agency

National Customer Contact Centre, PO Box 544
Rotherham, S60 1BY
Tel: 08708 506 506
Web:**www.environment-agency.gov.uk**
Email:**enquiries@environment-agency.gov.uk**

Public Health England

Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe
Email:**enquiries@phe.gov.uk**
Main switchboard**: 020 7654 8000**

The Coal Authority

200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey

Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

Local Authority
Authority: London Borough of Camden
Phone: 020 7974 4444
Web: http://www.camden.gov.uk/
Address: Camden Town Hall, Judd Street, London, WC1H 9JE

Gemapping PLC

Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444

Acknowledgements: Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, Natural England who retain the Copyright and Intellectual Property Rights for the data.
PointX © Database Right/Copyright, Thomson Directories Limited © Copyright Link Interchange Network Limited © Database Right/Copyright and Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028].
This report has been prepared in accordance with the Groundsure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

I**n these terms and conditions unless the context otherwise requires:**

"Beneficiary" means the person or entity for whose benefit the Client has obtained the Services.

"Client" means the party or parties entering into a Contract with Groundsure.

"Commercial" means any building or property which is not Residential.

"Confidential Information" means the contents of this Contract and all information received from the Client as a result of, or in connection with, this Contract other than

(i) information which the Client can prove was rightfully in its possession prior to disclosure by Groundsure and

(ii) any information which is in the public domain (other than by virtue of a breach of this Contract).

"Support Services" means Support Services provided by Groundsure including, without limitation, interpreting third party and in-house environmental data, providing environmental support advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.

"Contract" means the contract between Groundsure and the Client for the provision of the Services, and which shall incorporate these terms and conditions, the Order, and the relevant User Guide.

"Third Party Data Provider" means any third party providing Third Party Content to Groundsure.

"Data Reports" means reports comprising factual data with no accompanying interpretation.

"Fees" has the meaning set out in clause 5.1.

"Groundsure" means Groundsure Limited, a company registered in England and Wales under number 03421028.

"Groundsure Materials" means all materials prepared by Groundsure and provided as part of the Services, including but not limited to Third Party Content, Data Reports, Mapping, and Risk Screening Reports.

"Intellectual Property" means any patent, copyright, design rights, trade or service mark, moral rights, data protection rights, know-how or trade mark in each case whether registered or not and including applications for the same or any other rights of a similar nature anywhere in the world.

"Mapping" means a map, map data or a combination of historical maps of various ages, time periods and scales.

"Order" means an electronic, written or other order form submitted by the Client requesting Services from Groundsure in respect of a specified Site.

"Ordnance Survey" means the Secretary of State for Business, Innovation and Skills, acting through Ordnance Survey, Adanac Drive, Southampton, SO16 0AS, UK.

"Order Website" means the online platform through which Orders may be placed by the Client and accepted by Groundsure.

"Report" means a Risk Screening Report or Data Report for Commercial or Residential property.

"Residential" means any building or property used as or intended to be used as a single dwelling.

"Risk Screening Report" means a risk screening report comprising factual data with an accompanying interpretation by Groundsure.

"Services" means any Report, Mapping and/or Support Services which Groundsure has agreed to provide by accepting an Order pursuant to clause 2.6.

"Site" means the area of land in respect of which the Client has requested Groundsure to provide the Services.

"Third Party Content" means data, database information or other information which is provided to Groundsure by a Third Party Data Provider.

"User Guide" means the user guide, as amended from time to time, available upon request from Groundsure and on the website (www.Groundsure.com) and forming part of this Contract.

2 Scope of Services, terms and conditions, requests for insurance and quotations

2.1 Groundsure agrees to provide the Services in accordance with the Contract.

2.2 Groundsure shall exercise reasonable skill and care in the provision of the Services.

2.3 Subject to clause 7.3 the Client acknowledges that it has not relied on any statement or representation made by or on behalf of Groundsure which is not set out and expressly agreed in writing in the Contract and all such statements and representations are hereby excluded to the fullest extent permitted by law.

2.4 The Client acknowledges that terms and conditions appearing on a Client's order form, printed stationery or other communication, or any terms or conditions implied by custom, practice or course of dealing shall be of no effect, and that this Contract shall prevail over all others in relation to the Order.

2.5 If the Client or Beneficiary requests insurance in conjunction with or as a result of the Services, Groundsure shall use reasonable endeavours to recommend such insurance, but makes no warranty that such insurance shall be available from insurers or that it will be offered on reasonable terms. Any insurance purchased by the Client or Beneficiary shall be subject solely to the terms of the policy issued by insurers and Groundsure will have no liability therefor. In addition you acknowledge and agree that Groundsure does not act as an agent or broker for any insurance providers. The Client should take (and ensure that the Beneficiary takes) independent advice to ensure that the insurance policy requested or offered is suitable for its requirements.

2.6 Groundsure's quotations or proposals are valid for a period of 30 days only unless an alternative period of time is explicitly stipulated by Groundsure. Groundsure reserves the right to withdraw any quotation or proposal at any time before an Order is accepted by Groundsure. Groundsure's acceptance of an Order shall be binding only when made in writing and signed by Groundsure's authorised representative or when accepted through the Order Website.

3 The Client's obligations

3.1The Client shall comply with the terms of this Contract and

(i) procure that the Beneficiary or any third party relying on the Services complies with and acts as if it is bound by the Contract and

(ii) be liable to Groundsure for the acts and omissions of the Beneficiary or any third party relying on the Services as if such acts and omissions were those of the Client.

3.2 The Client shall be solely responsible for ensuring that the Services are appropriate and suitable for its and/or the Beneficiary's needs.

3.3 The Client shall supply to Groundsure as soon as practicable and without charge all requisite information (and the Client warrants that such information is accurate, complete and appropriate), including without limitation any environmental information relating to the Site and shall give such assistance as Groundsure shall reasonably require in the provision of the Services including, without limitation, access to the Site, facilities and equipment.

3.4 Where the Client's approval or decision is required to enable Groundsure to carry out work in order to provide the Services, such approval or decision shall be given or procured in reasonable time and so as not to delay or disrupt the performance of the Services.

3.5 Save as expressly permitted by this Contract the Client shall not, and shall procure that the Beneficiary shall not, re-sell, alter, add to, or amend the Groundsure Materials, or use the Groundsure Materials in a manner for which they were not intended. The Client may make the Groundsure Materials available to a third party who is considering acquiring some or all of, or providing funding in relation to, the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.

3.6 The Client is responsible for maintaining the confidentiality of its user name and password if using the Order Website and the Client acknowledges that Groundsure accepts no liability of any kind for any loss or damage suffered by the Client as a consequence of using the Order Website.

4 Reliance

4.1The Client acknowledges that the Services provided by Groundsure consist of the presentation and analysis of Third Party Content and other content and that information obtained from a Third Party Data Provider cannot be guaranteed or warranted by Groundsure to be reliable.

4.2 In respect of Data Reports, Mapping and Risk Screening Reports, the following classes of person and no other are entitled to rely on their contents;

(i) the Beneficiary,

(ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate),

(iv) the first purchaser or first tenant of the Site, and

(v) the professional advisers and lenders of the first purchaser or tenant of the Site.

4.3 In respect of Support Services, only the Client, Beneficiary and parties expressly named in a Report and no other parties are entitled to rely on its contents.

4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise expressly agreed in writing, no other person or entity of any kind is entitled to rely on any Services or Report issued or provided by Groundsure. Any party considering such Reports and Services does so at their own risk.

5 Fees and Disbursements

5.1Groundsure shall charge and the Client shall pay fees at the rate and

frequency specified in the written proposal, Order Website or Order acknowledgement form, plus (in the case of Support Services) all proper disbursements incurred by Groundsure. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services (together "Fees").

5.2 The Client shall pay all outstanding Fees to Groundsure in full without deduction, counterclaim or set off within 30 days of the date of Groundsure's invoice or such other period as may be agreed in writing between Groundsure and the Client ("Payment Date"). Interest on late payments will accrue on a daily basis from the Payment Date until the date of payment (whether before or after judgment) at the rate of 8% per annum.

5.3 The Client shall be deemed to have agreed the amount of any invoice unless an objection is made in writing within 28 days of the date of the invoice. As soon as reasonably practicable after being notified of an objection, without prejudice to clause 5.2 a member of Groundsure's management team will contact the Client and the parties shall then use all reasonable endeavours to resolve the dispute within 15 days.

6 Intellectual Property and Confidentiality

6.1 Subject to

(i) full payment of all relevant Fees and

(ii) compliance with this Contract, the Client is granted (and is permitted to sub-licence to the Beneficiary) a royalty-free, worldwide, non-assignable and (save to the extent set out in this Contract) non-transferable licence to make use of the Groundsure Materials.

6.2 All Intellectual Property in the Groundsure Materials are and shall remain owned by Groundsure or Groundsure's licensors (including without limitation the Third Party Data Providers) the Client acknowledges, and shall procure acknowledgement by the Beneficiary of, such ownership. Nothing in this Contract purports to transfer or assign any rights to the Client or the Beneficiary in respect of such Intellectual Property.

6.3 Third Party Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.

6.4 The Client shall, and shall procure that any recipients of the Groundsure Materials shall:

(i) not remove, suppress or modify any trade mark, copyright or other proprietary marking belonging to Groundsure or any third party from the Services;

(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;

(iii) not create any product or report which is derived directly or indirectly from the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);

(iv) not combine the Services with or incorporate such Services into any other information data or service;

(v) not reformat or otherwise change (whether by modification, addition or enhancement), the Services (save that those acting for the Beneficiary in a professional capacity shall not be in breach of this clause 6.4(v) where such reformatting is in the normal course of providing advice based upon the Services);

(vi) where a Report and/or Mapping contains material belonging to Ordnance Survey, acknowledge and agree that such content is protected by Crown Copyright and shall not use such content for any purpose outside of receiving the Services; and

(vii) not copy in whole or in part by any means any map prints or run-on copies containing content belonging to Ordnance Survey (other than that contained within Ordnance Survey's OS Street Map) without first being in possession of a valid Paper Map Copying Licence from Ordnance Survey,

6.5 Notwithstanding clause 6.4, the Client may make reasonable use of the Groundsure Materials in order to advise the Beneficiary in a professional capacity. However, Groundsure shall have no liability in respect of any advice, opinion or report given or provided to Beneficiaries by the Client.

6.6 The Client shall procure that any person to whom the Services are made available shall notify Groundsure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

7.Liability: Particular Attention Should Be Paid To This Clause

7.1 This Clause 7 sets out the entire liability of Groundsure, including any liability for the acts or omissions of its employees, agents, consultants, subcontractors and Third Party Content, in respect of:

(i) any breach of contract, including any deliberate breach of the Contract by Groundsure or its employees, agents or subcontractors;

(ii) any use made of the Reports, Services, Materials or any part of them; and

(iii) any representation, statement or tortious act or omission (including negligence) arising under or in connection with the Contract.

7.2 All warranties, conditions and other terms implied by statute or common law are, to the fullest extent permitted by law, excluded from the Contract.

7.3 Nothing in the Contract limits or excludes the liability of the Supplier for death or personal injury resulting from negligence, or for any damage or liability incurred by the Client or Beneficiary as a result of fraud or fraudulent misrepresentation.

7.4 Groundsure shall not be liable for

(i) loss of profits;

(ii) loss of business;

(iii) depletion of goodwill and/or similar losses;

(iv) loss of anticipated savings;

(v) loss of goods;

(vi) loss of contract;

(vii) loss of use;

(viii) loss or corruption of data or information;

(ix) business interruption;

(x) any kind of special, indirect, consequential or pure economic loss, costs, damages, charges or expenses;

(xi) loss or damage that arise as a result of the use of all or part of the Groundsure Materials in breach of the Contract;

(xii) loss or damage arising as a result of any error, omission or inaccuracy in any part of the Groundsure Materials where such error, omission or inaccuracy is caused by any Third Party Content or any reasonable interpretation of Third Party Content;

(xiii) loss or damage to a computer, software, modem, telephone or other property; and

(xiv) loss or damage caused by a delay or loss of use of Groundsure's internet ordering service.

7.5 Groundsure's total liability in relation to or under the Contract shall be limited to £10 million for any claim or claims.

7.6 Groundsure shall procure that the Beneficiary shall be bound by limitations and exclusions of liability in favour of Groundsure which accord with those detailed in clauses 7.4 and 7.5 (subject to clause 7.3) in respect of all claims which the Beneficiary may bring against Groundsure in relation to the Services or other matters arising pursuant to the Contract.

8 Groundsure's right to suspend or terminate

8.1 If Groundsure reasonably believes that the Client or Beneficiary has not provided the information or assistance required to enable the proper provision of the Services, Groundsure shall be entitled to suspend all further performance of the Services until such time as any such deficiency has been made good.

8.2 Groundsure shall be entitled to terminate the Contract immediately on written notice in the event that:

(i) the Client fails to pay any sum due to Groundsure within 30 days of the Payment Date; or

(ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an administration order made against it or if a receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or

(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or

(iv) the Client or the Beneficiary breaches any term of the Contract (including, but not limited to, the obligations in clause 4) which is incapable of remedy or if remediable, is not remedied within five days of notice of the breach.

9. Client's Right to Terminate and Suspend

9.1 Subject to clause 10.1, the Client may at any time upon written notice terminate or suspend the provision of all or any of the Services.

9.2 In any event, where the Client is a consumer (and not a business) he/she hereby expressly acknowledges and agrees that:

(i) the supply of Services under this Contract (and therefore the performance of this Contract) commences immediately upon Groundsure's acceptance of the Order; and

(ii) the Reports and/or Mapping provided under this Contract are

(a) supplied to the Client's specification(s) and in any event

(b) by their nature cannot be returned.

10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination of the Contract:

(i) Groundsure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client and/or Beneficiary any property of the Client and/or Beneficiary in Groundsure's possession or control; and

(ii) the Client shall pay to Groundsure all and any Fees payable in respect of the performance of the Services up to the date of termination or suspension. In respect of any Support Services provided, the Client shall also pay Groundsure any additional costs incurred in relation to the termination or suspension of the Contract.

11 Anti-Bribery

11.1 The Client warrants that it shall:

(i) comply with all applicable laws, statutes and regulations relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010;

(ii) comply with such of Groundsure's anti-bribery and anti-corruption policies as are notified to the Client from time to time; and

(iii) promptly report to Groundsure any request or demand for any undue financial or other advantage of any kind received by or on behalf of the Client in connection with the performance of this Contract.

11.2 Breach of this Clause 11 shall be deemed a material breach of this Contract.

12 General

12.1 The Mapping contained in the Services is protected by Crown copyright and must not be used for any purpose other than as part of the Services or as specifically provided in the Contract.

12.2 The Client shall be permitted to make one copy only of each Report or Mapping Order. Thereafter the Client shall be entitled to make unlimited copies of the Report or Mapping Order only in accordance with an Ordnance Survey paper map copy license available through Groundsure.

12.3 Groundsure reserves the right to amend or vary this Contract. No amendment or variation to this Contract shall be valid unless signed by an authorised representative of Groundsure.

12.4 No failure on the part of Groundsure to exercise, and no delay in exercising, any right, power or provision under this Contract shall operate as a waiver thereof.

12.5 Save as expressly provided in this Contract, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.

12.6 The Secretary of State for Business, Innovation and Skills ("BIS") or BIS' successor body, as the case may be, acting through Ordnance Survey may enforce a breach of clause 6.4(vi) and clause 6.4(vii) of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.

12.7 Groundsure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:

(i) the Client or Beneficiary's failure to provide facilities, access or information;

(ii) fire, storm, flood, tempest or epidemic;

(iii) Acts of God or the public enemy;

(iv) riot, civil commotion or war;

(v) strikes, labour disputes or industrial action;

(vi) acts or regulations of any governmental or other agency;

(vii) suspension or delay of services at public registries by Third Party Data Providers;

(viii) changes in law; or

(ix) any other reason beyond Groundsure's reasonable control.

In the event that Groundsure is prevented from performing the Services (or any part thereof) in accordance with this clause 12.6 for a period of not less than 30 days then Groundsure shall be entitled to terminate this Contract immediately on written notice to the Client.

12.8 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.

12.9 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email (save to the extent such day is not a working day where it shall be deemed to have been delivered on the next working day) and on the second working day after the day of posting if sent by first class post.

12.10 The Contract constitutes the entire agreement between the parties and shall supersede all previous arrangements between the parties relating to the subject matter hereof.

12.11 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.

12.12 This Contract shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with this Contract shall be subject to the exclusive jurisdiction of the English courts.

12.13 Groundsure is an executive member of the Council of Property Search Organisation (CoPSO) and has signed up to the Search Code administered by the Property Codes Compliance Board (PCCB). All Risk Screening Reports shall be supplied in accordance with the provisions of the Search Code.

12.14 If the Client or Beneficiary has a complaint about the Services, written notice should be given to the Compliance Officer at Groundsure who will respond in a timely manner.

12.15 The Client agrees that it shall, and shall procure that each Beneficiary shall, treat in confidence all Confidential Information and shall not, and shall procure that each Beneficiary shall not (i) disclose any Confidential Information to any third party other than in accordance with the terms of this Contract; and (ii) use Confidential Information for a purpose other than the exercise of its rights and obligations under this Contract. Subject to clause 6.6, nothing shall prevent the Client or any Beneficiary from disclosing Confidential Information to the extent required by law.

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APPENDIX B

Site plans

80 Greencroft Gardens
pre app

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creative

planning
design &
refurbishment

call: +44(0) 20 7381 5937
mail: hello@catocreative.com
browse: www.catocreative.com
tweet: @catocreative

project: 80 Greencroft Gardens, NW6 3JQ
clients: CHC
address: as above

drawing: pre application layout
drawn by: Katie Underdown
scale: 1:50 (unless stated)

all dimensions to be checked on site
if in doubt - do not make it up
do not scale from this drawing
copyright & intellectual property laws apply
these are not structural or building control plans

revision
E
issue date: 24 February 2016

proposed elevations
1:100

front elevation

rear elevation

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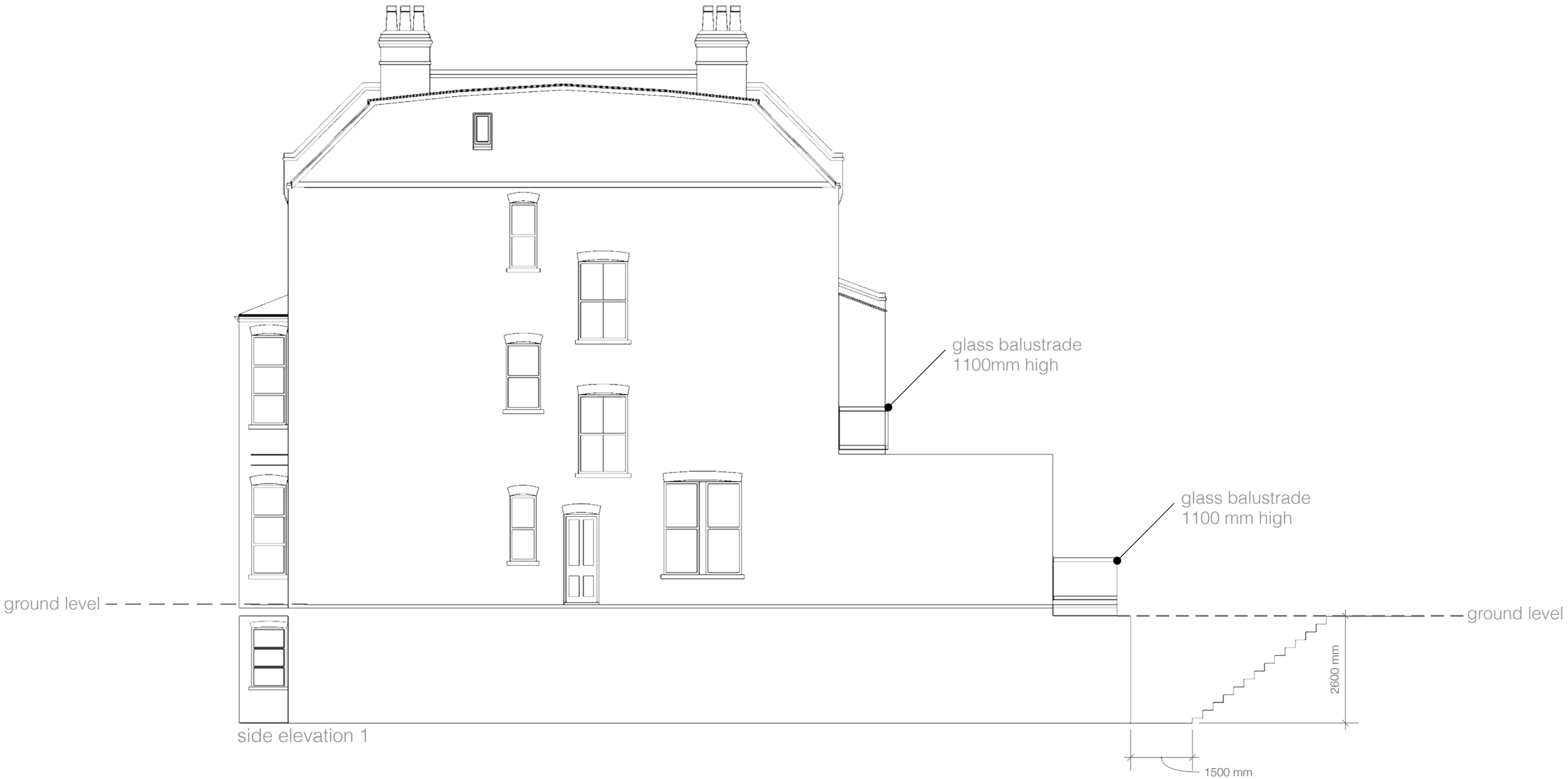
1:100



side elevation 1

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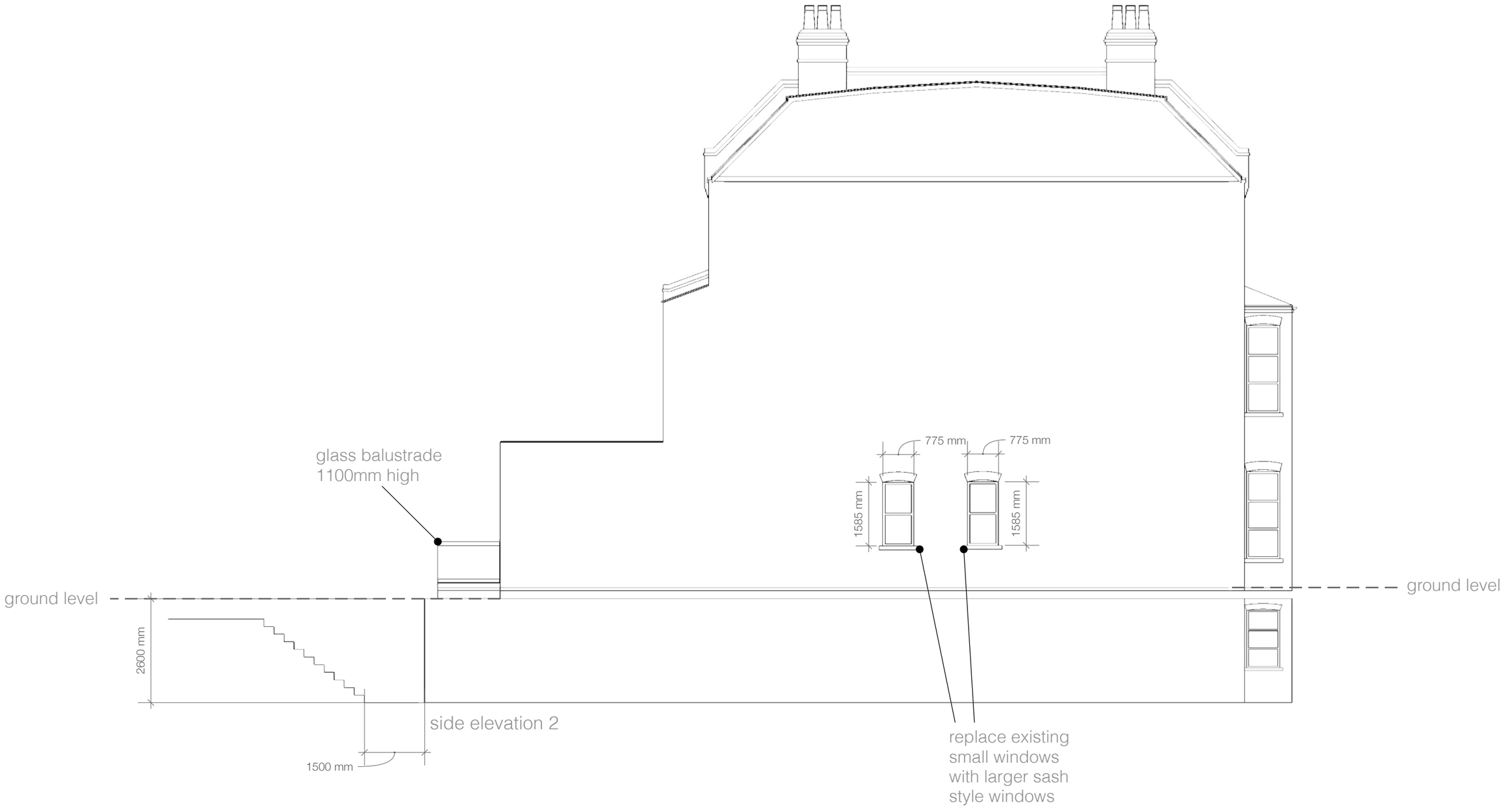

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proposed section
1:60

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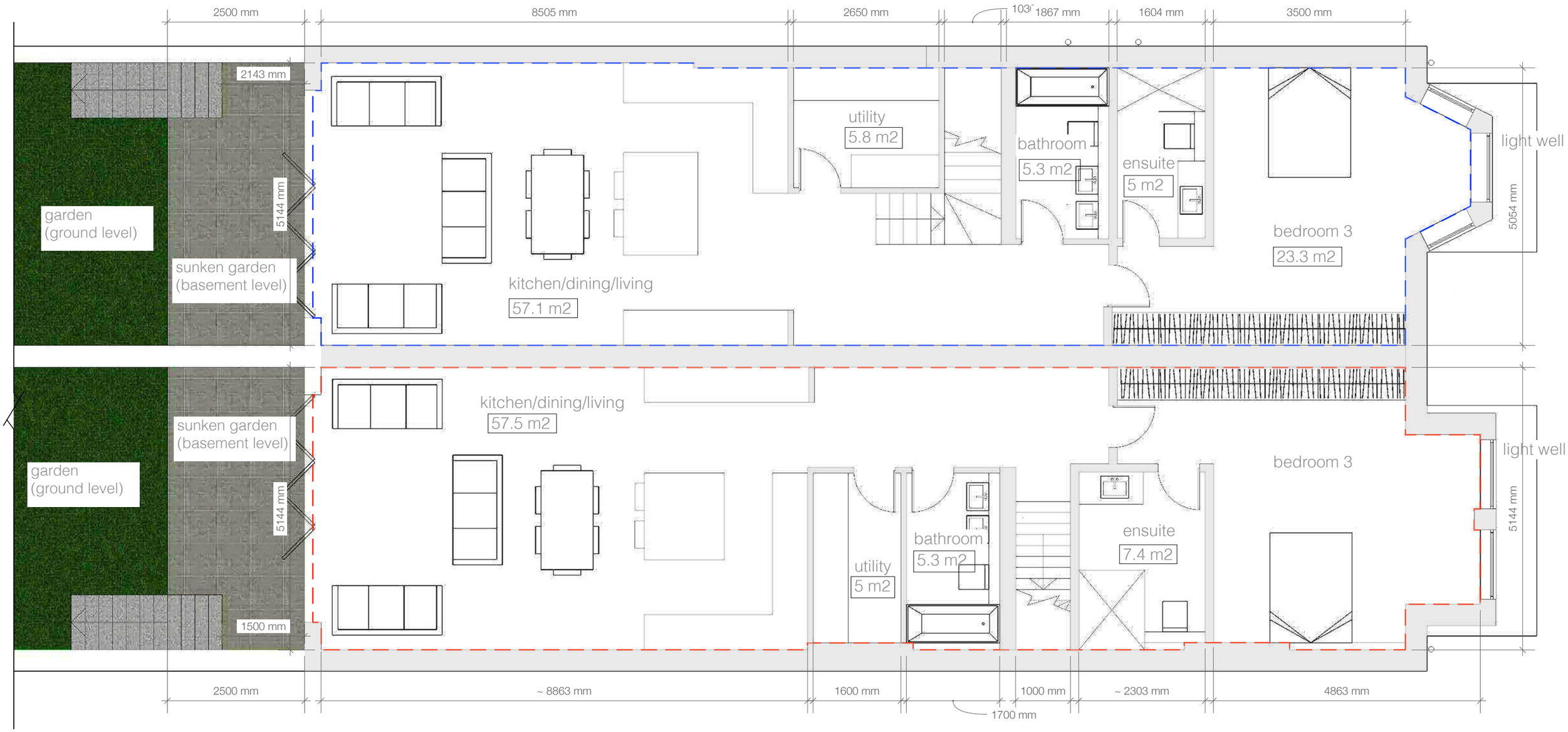
basement
flat 1&2 1:60

flat 1 — — — — flat 2 — — — —



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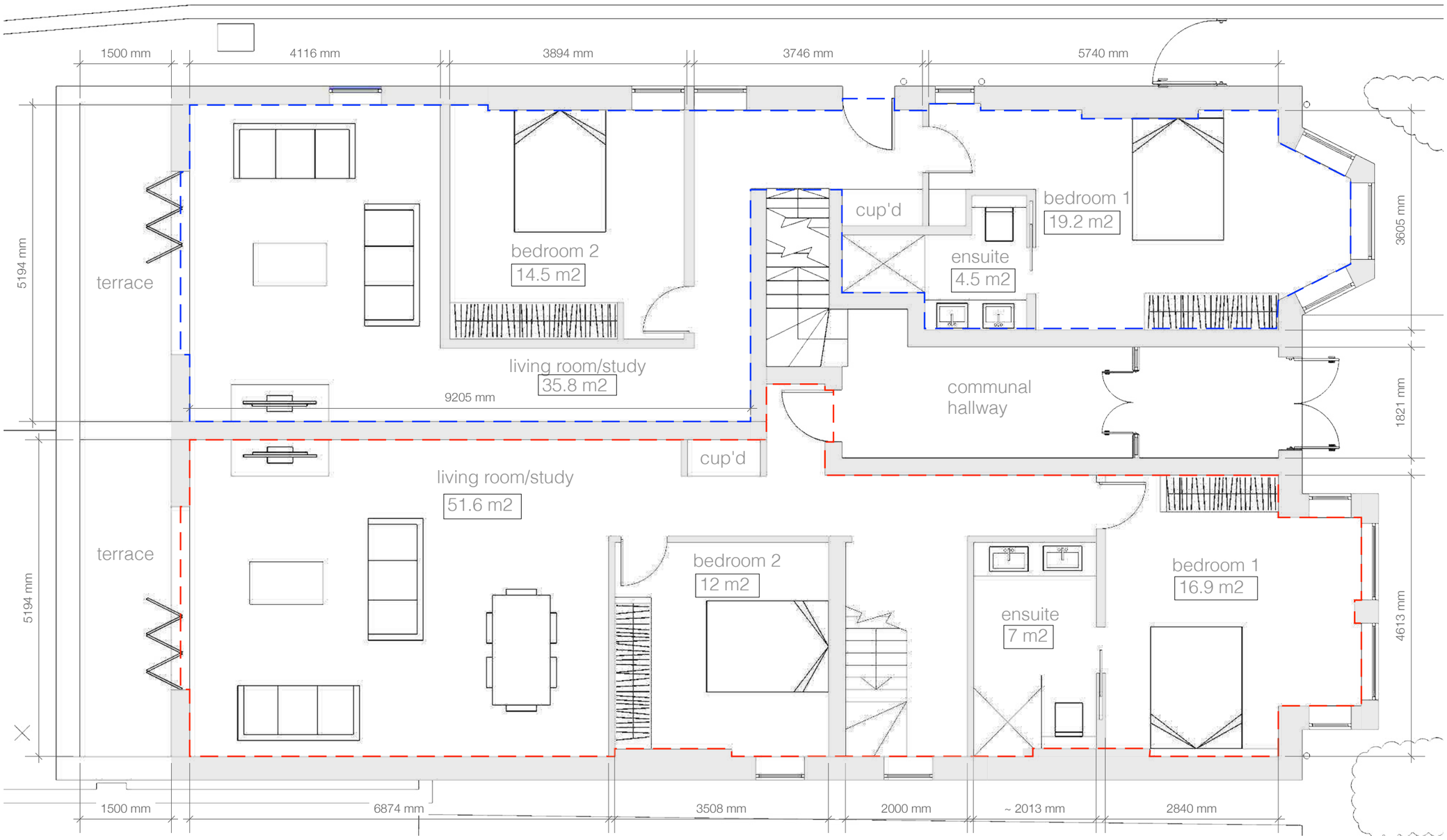
ground floor
flat 1&2 1:60

flat 1 — — — — flat 2 — — — —



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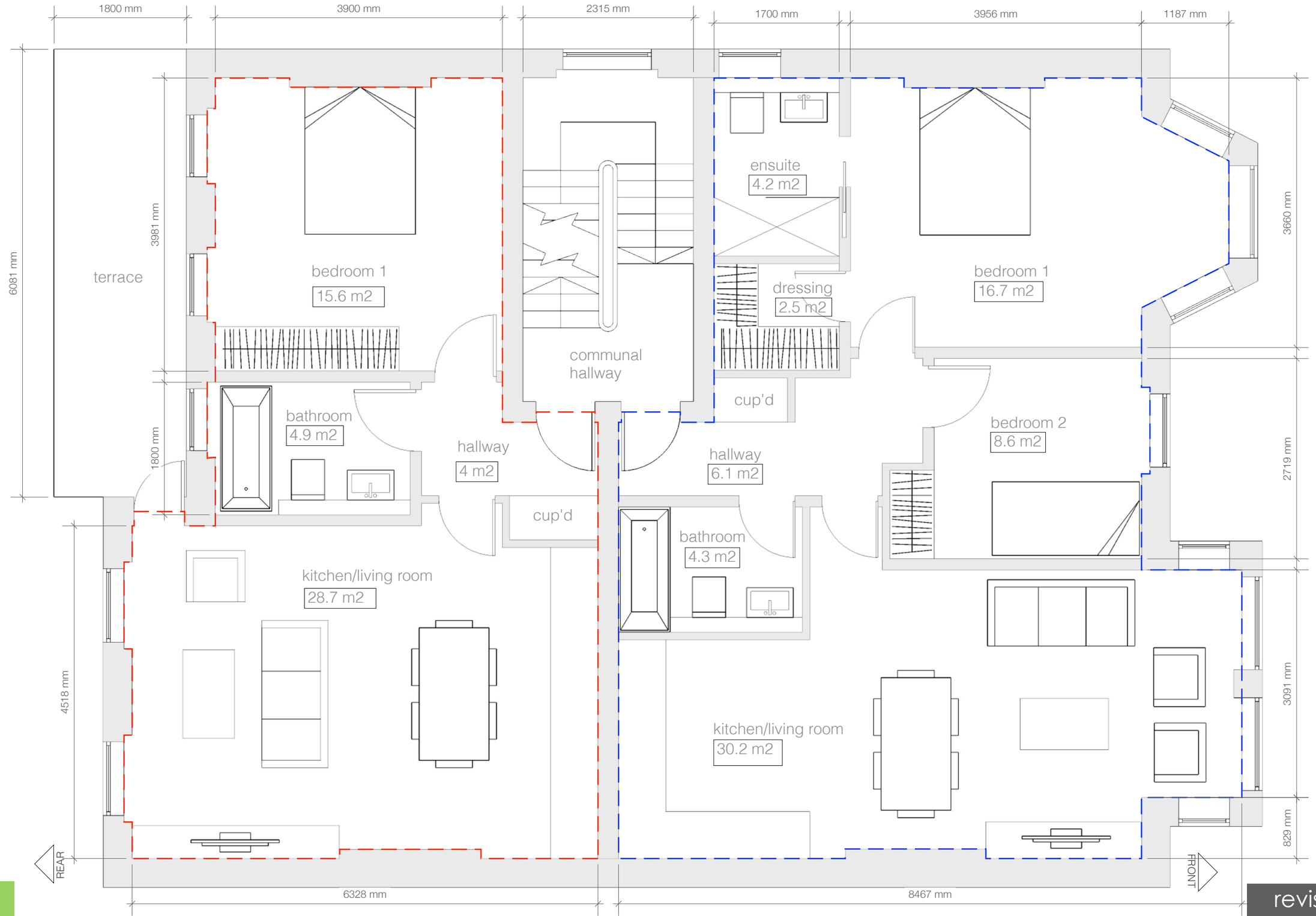
first floor
flat 3&4

flat 3 — — — — flat 4 — — — —



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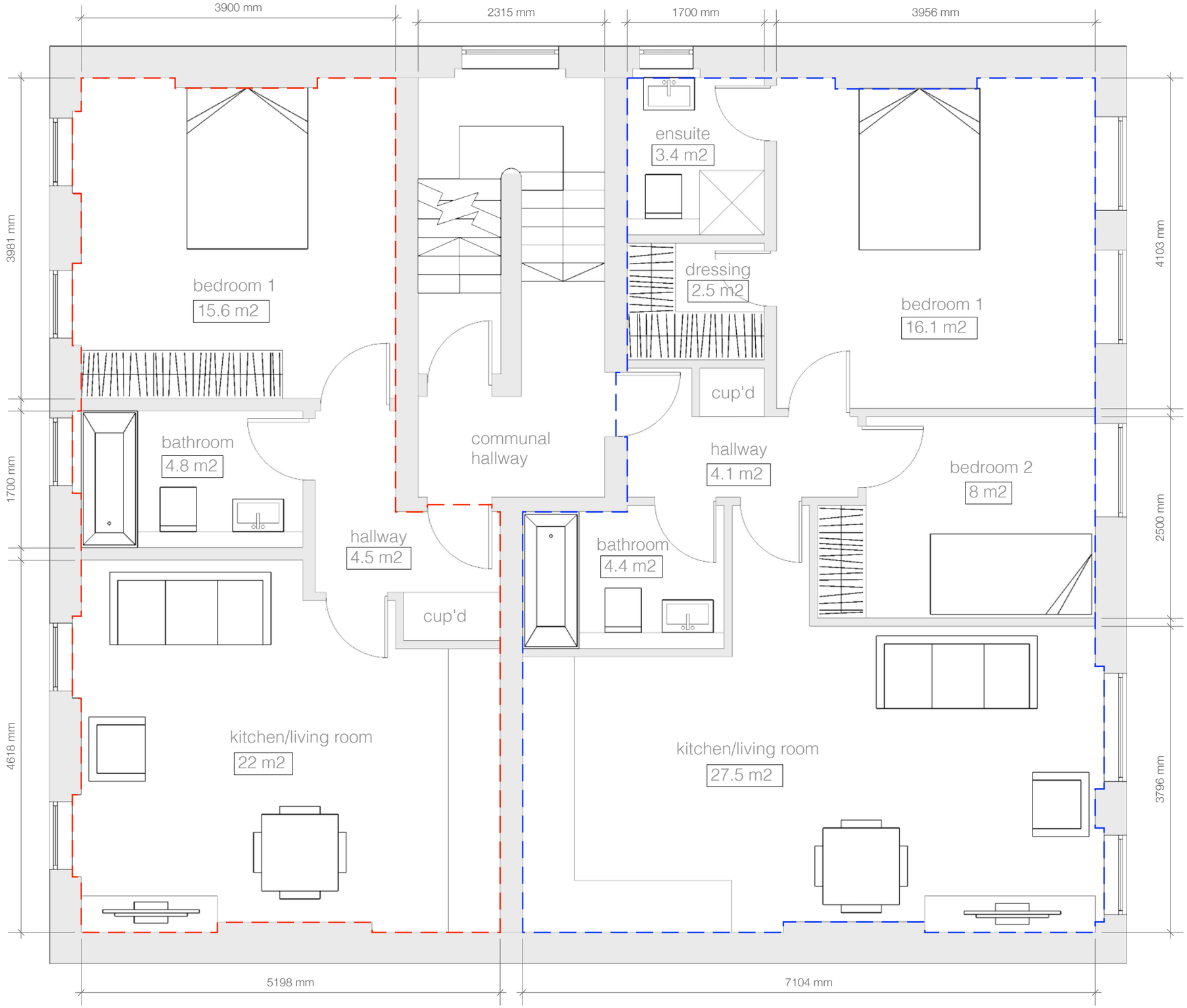
second floor
flat 5&6

flat 5 — — — — flat 6 — — — —



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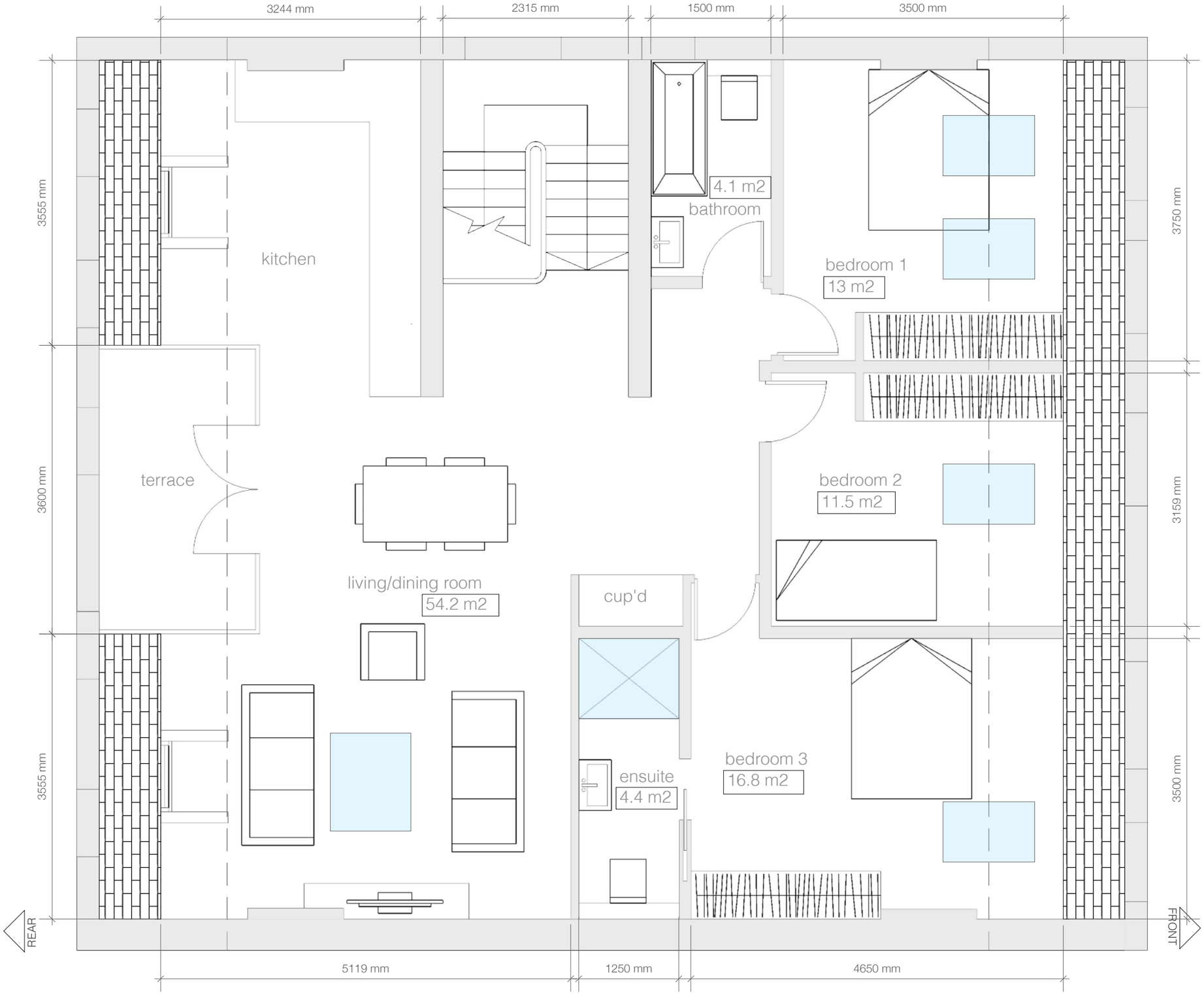
loft level
flat 7

skylight location



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issue date: 24 February 2016

APPENDIX C

Site investigation report

ground&water
geotechnical and environmental consultants

Ground and Water Limited
Unit 2
The Long Barn, Norton Farm
Selborne Road
Selborne, Alton
Hampshire
GU34 3NB

Tel: 0333 600 1221
E-mail: enquiries@groundandwater.co.uk/
megan.james@groundandwater.co.uk

Preliminary Summary – Ground Investigation Report

CLIENT	H Fraser Consulting Limited
SITE ADDRESS	80 Greencroft Gardens, South Hampstead, London NW6 3JQ
REPORT REFERENCE	GWPR1731
ENGINEER	Joshua Laite, Ground and Water Limited
INVESTIGATION LOCATIONS	Please see Figure 1 Attached. Site works were undertaken on the 11th July 2016 comprising the construction of one Dart Windowless Sampler Boreholes to a depth of 10.45m bgl (BH1) and a hand held window sampler borehole to 5.00m bgl (WS2). Two Trial Pit / Foundation Exposures were also carried out (TP/FE1 and TP/FE2). A groundwater/biogas monitoring well was installed to a depth of 5.00m bgl in BH1. Standard Penetration Tests (SPTs) were carried out in BH1 at 1.00m intervals to 10.45m bgl.
GROUND CONDITIONS ENCOUNTERED	See Summary of Strata Encountered (BH1, WS2 and TP1-TP2) below
IN-SITU STRENGTH TESTING (SPT's and DP1)	LONDON CLAY FORMATION: (encountered between 1.20 – 10.45m bgl in BH1): Low to very high undrained shear strength (30 - 185kPa).
GROUNDWATER	No groundwater was encountered.
ROOTS	Roots were noted to a depth of between 0.50 – 1.20m bgl in TP/FE2 and WS2. No roots were noted in BH1 or TP/FE1.
ANTICIPATED VOLUME CHANGE POTENTIAL	COHESIVE HEAD DEPOSITS: Likely to have **low to medium volume change potential** in accordance with BRE240 & NHBC Standards Chapter 4.2. Subject to confirmation of results of geotechnical classification testing. LONDON CLAY FORMATION: Likely to have **high volume change potential** in accordance with BRE240 & NHBC Standards Chapter 4.2. Subject to confirmation of results of geotechnical classification testing.
FOUNDATION RECOMMENDATIONS	It is understood the proposed development will comprise the construction of a full footprint basement (assumed depth of 3.00 – 3.50m bgl).

Summary of Strata Encountered (BH1, WS2 and TP1-TP2)

Strata	Depth Encountered (m bgl)	Thickness (m)
MADE GROUND (BH1, TP1/FE1 and TP/FE2): Block paving/concrete slab over sand/concrete sub-base.	GL	0.07 – 0.12
MADE GROUND (BH1, TP1/FE1 and TP/FE2): Mid to dark brown/mid brown/orange brown silty sandy gravelly clay. Sand is fine grained. Gravel is rare, fine to medium sub-rounded to sub-angular, flints, concrete, wood and brick.	GL – 0.12	0.65 - >0.80
HEAD DEPOSITS (BH1, WS2 and TP1): Dark brown/mid brown/ orange brown mottled silty gravelly CLAY. Gravel is rare, fine to coarse, rounded to sub-angular flints. Black inclusions noted.	0.50 - 0.80	0.40 – >0.60
LONDON CLAY FORMATION (BH1): Mottled Mid brown/orange CLAY. Clay became denser with depth. Lenses of grey clay noted from 1.90m bgl.	1.20	2.80
LONDON CLAY FORMATION (BH1 and WS2): Mid to dark brown/grey silty CLAY. Lenses of mottled orange brown/grey clay noted throughout WS2	1.20 - 4.00	>3.80 – >6.45

	Due to the soils having the potential for volume change foundations must not be placed within cohesive root penetrated and/or desiccated soils and the influence of the trees surrounding the site must be taken into account. The base of foundation excavations must extend at least 300mm into non-root penetrated soils. Roots were noted to a depth of between 0.50 – 1.20m bgl in TP/FE2 and WS2. No roots were noted in BH1 or TP/FE1. Hence foundations will by-pass root penetrated soils, resting on the soils of the London Clay Formation. Given an anticipated basement depth of 3.00 – 3.50m bgl foundations should be taken through any Made Ground and Head Deposits into the soils of the London Clay Formation, which were encountered from a depth 1.20m bgl. Foundations constructed on the soils of the London Clay Formation at 3.00 – 3.50m bgl can be designed based on a presumed safe bearing capacity of 125kN/m^2. This is based on trial hole records, inspection of samples recovered and referral to BS 8004:1986, *Code of Practice for Foundations,* the results of the SPT's, and based on a 5m long by 1m wide foundation and a maximum settlement of 25mm.

This preliminary information may be subject to amendment in the final report and no liability can be accepted for any actions based on this preliminary information.

Ground and Water Ltd

Borehole No
BH1
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
80 Greencroft Gardens,	GWPR1731		WLS
Location: South Hampstead, London NW6 3JQ		Level: -	Scale 1:50
Client: Ground and Project Consultants Limited		Dates: 11/07/2016	Logged By RT

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.07			Block Paving
		0.30	D					MADE GROUND: Dark brown silty sandy gravelly clay. Sand is fine grained. Gravel is rare, fine to medium, sub-angular to sub-rounded flint and brick.
		0.50	D		0.65			
		0.80	D					HEAD DEPOSITS: Dark brown/mid brown/orange brown mottled silty gravelly CLAY. Gravel is rare, fine to coarse, rounded to sub-angular flint.
		1.00	SPT	N=6 (1,1/ 2,1,1,2)				
		1.00	D		1.20			LONDON CLAY FORMATION: Mottled mid brown/orange brown silty CLAY. Clay becomes denser with depth. Lenses of grey clay noted from 1.90m bgl.
		1.50	D					
		2.00	SPT	N=11 (1,2/ 2,3,3,3)				
		2.00	D					
		2.50	D					
		3.00	SPT	N=13 (3,3/ 4,3,3,3)				
		3.00	D					
		3.50	D					
		4.00	SPT	N=17 (3,3/ 4,4,4,5)	4.00			LONDON CLAY FORMATION: Mid brown silty CLAY
		4.00	D					
		4.50	D					
		5.00	SPT	N=18 (3,4/ 5,4,4,5)				
		5.00	D					
		5.50	D					
		6.00	SPT	N=23 (4,5/ 5,6,6,6)				
		6.00	D					
		6.50	D					
		7.00	SPT	N=27 (7,6/ 6,7,7,7)				
		7.00	D					
		7.50	D					
		8.00	SPT	N=28 (7,8/ 7,7,7,7)	8.00			LONDON CLAY FORMATION: Dark brown to grey silty CLAY.
		8.00	D					
		8.50	D					
		9.00	SPT	N=34 (8,7/ 8,9,9,8)				
		9.00	D					
		9.50	D					
			Type	Results				Continued next sheet

Remarks: No groundwater encountered.
No roots noted.

AGS

Ground and Water Ltd

Borehole No
BH1
Sheet 2 of 2

Project Name 80 Greencroft Gardens,	Project No. GWPR1731	Co-ords: -	Hole Type WLS
Location: South Hampstead, London NW6 3JQ		Level: -	Scale 1:50
Client: Ground and Project Consultants Limited		Dates: 11/07/2016	Logged By RT

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		10.00 10.00	SPT D	N=37 (8,9/ 8,9,10,10)	10.45			LONDON CLAY FORMATION: Dark brown to grey silty CLAY. End of Borehole at 10.45 m
			Type	Results				

Remarks: No groundwater encountered.
No roots noted.

AGS

Ground and Water Ltd

Borehole No
WS2
Sheet 1 of 1

Project Name 80 Greencroft Gardens,	Project No. GWPR1731	Co-ords: -	Hole Type WLS
Location: South Hampstead, London NW6 3JQ		Level: -	Scale 1:50
Client: Ground and Project Consultants Limited		Dates: 11/07/2016	Logged By RT

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.30	D					MADE GROUND: Mid brown silty sandy gravelly clay. Sand is fine grained. Gravel is rare, fine to medium, sub-angular to sub-rounded flint and brick.
		0.50	D					
		0.80	D		0.80			HEAD DEPOSITS: Mid brown/orange brown gravelly CLAY. Gravel is rare, fine to medium, sub-rounded to sub-angular flint.
		1.00	D					
					1.20			LONDON CLAY FORMATION: Mid brown silty CLAY.
		1.50	D					
		2.00	D					
		2.50	D		2.50			LONDON CLAY FORMATION: Mid brown silty CLAY. Lenses of orange brown/grey mottling noted throughout.
		3.00	D					
		3.50	D					
		4.00	D					
		4.50	D					
		5.00	D		5.00			End of Borehole at 5.00 m
			Type	Results				

Remarks: No groundwater encountered.
Roots noted to 1.20m bgl.

AGS

Ground and Water Ltd

Trialpit No
TP1
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
80 Greencroft Gardens,	GWPR1731	Level: -	11/07/2016
Location: South Hampstead, London NW6 3JQ		Dimensions: -	Scale 1:25
		Depth 1.10m	
Client: Ground and Project Consultants Limited			Logged By RT

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.15			Block Paving.
0.30	D		0.30			MADE GROUND: Dark brown silty gravelly slightly sandy clay. Sand is fine grained. Gravel is rare, fine to medium, sub-rounded to angular flint, concrete and brick.
0.50	D		0.50			MADE GROUND: Mid brown silty sandy gravelly clay. Sand is fine grained. Gravel is rare, fine to medium, sub-rounded to sub-angular flint, brick and wood.
0.80	D					HEAD DEPOSITS: Mottled orange brown/mid brown gravelly CLAY. Gravel is rare, fine to medium, sub-angular flint.
1.10	D		1.10			Trialpit Complete at 1.10 m

Remarks: No roots noted.

Groundwater: No groundwater encountered.

AGS

HoleBASE 3.1 (Bld 422:20) Standard Trialpit Log v2 dated 27th Nov03

Ground and Water Ltd

Trialpit No
TP2
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
80 Greencroft Gardens,	GWPR1731	Level: -	11/07/2016
Location: South Hampstead, London NW6 3JQ		Dimensions: -	Scale 1:25
		Depth 0.80m	
Client: Ground and Project Consultants Limited			Logged By RT

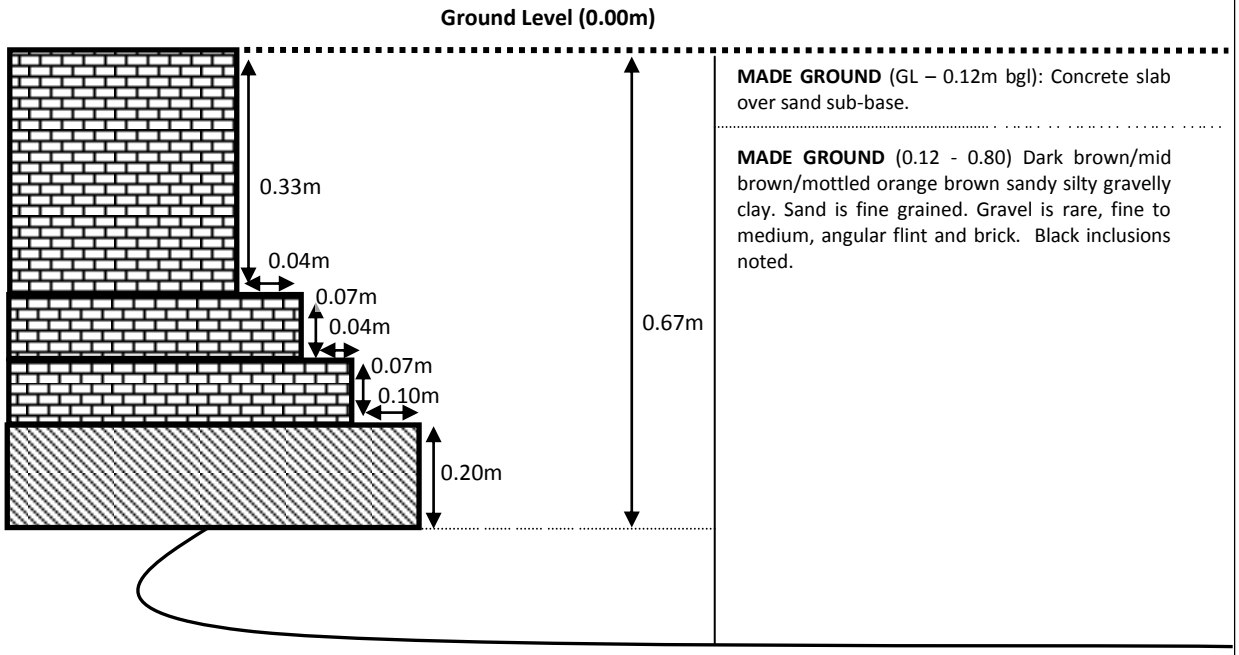
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.08			Slab
						MADE GROUND: Dark brown sandy silty gravelly clay. Sand is fine grained. Gravel is rare, fine to medium, sub-angular flint and brick.
0.30	D					
			0.40			
0.50	D					MADE GROUND: Orange brown/mid brown slightly sandy gravelly clay. Sand is fine grained. Gravel is rare, fine to medium, rounded to sub-angular flint and bricks. Black occlusions noted throughout.
0.80	D		0.80			Trialpit Complete at 0.80 m

Remarks: Roots noted to 0.50m bgl.

Groundwater: No groundwater encountered.

AGS

HoleBASE 3.1 (Bld 422.20) Standard Trialpit Log v2 dated 27th Nov03



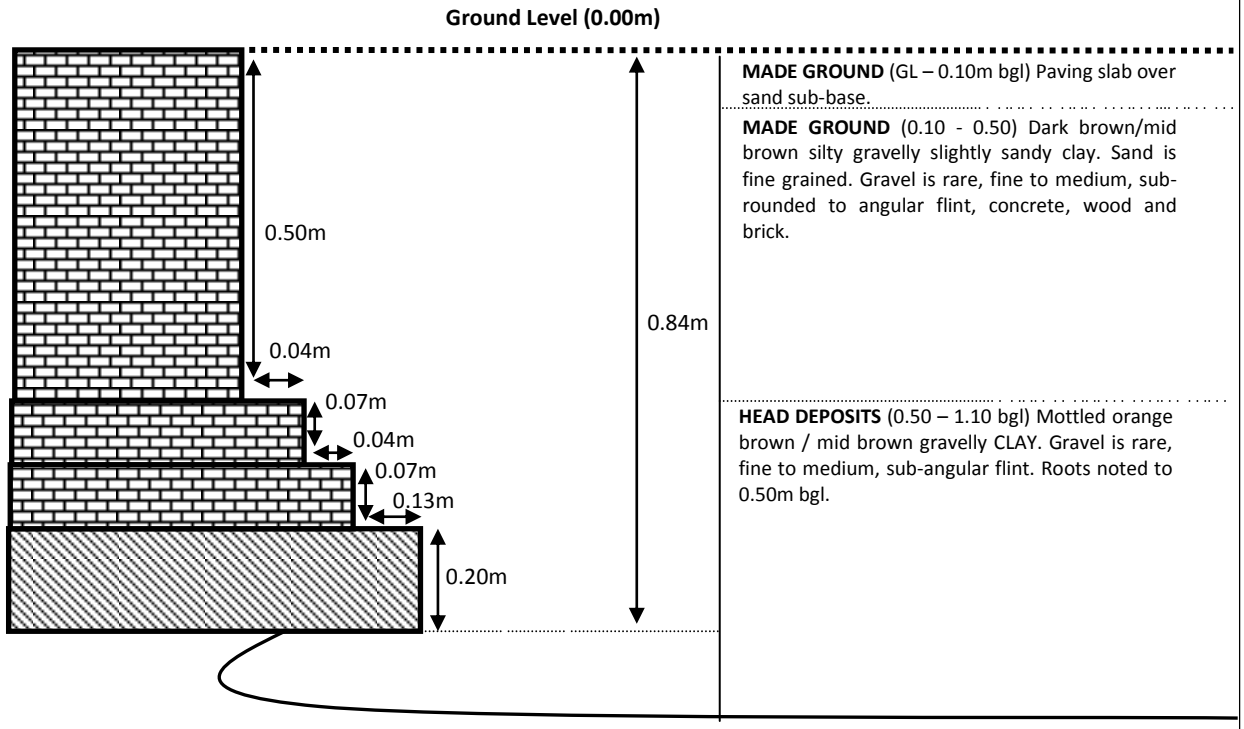
Concrete

Brick

NOTE: NOT TO SCALE

Project: **80 Greencroft Gardens, South Hampstead, London NW6 3JQ**	**Figure 3**
Client: **H Fraser Consulting Ltd**	**Date:** **July 2016**
Section Drawing: Foundation Exposure TP/FE2	**Ref:** **GWPR1731**

ground&water



Concrete

Brick

NOTE: NOT TO SCALE

Project: **80 Greencroft Gardens, South Hampstead, London NW6 3JQ**		**Figure 2**
Client: **H Fraser Consulting Ltd**	**Date:** **July 2016**	ground&water
Section Drawing: Foundation Exposure TP/FE1	**Ref:** **GWPR1731**	

Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
21312	80 Greencroft Gardens, South Hempstead, London	Samples received	26/07/2016
		Schedule received	25/07/2016
Project No.	Client	Project started	26/07/2016
GWPR1731	Ground and Water Ltd	Testing Started	05/08/2016

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
BH1	-	4.00	-	D	Brown silty CLAY with bluish-grey veins	35	100	83	34	49	
BH1	-	6.50	-	D	Brown silty CLAY with orangish-brown veins	30	100	77	29	48	
BH1	-	9.00	-	D	Dark grey silty CLAY	28	100	81	31	50	
WS2	-	3.00	-	D	Brown silty CLAY with bluish grey veins	34	100	78	32	46	
WS2	-	5.00	-	D	Brown silty CLAY	35	100	83	32	51	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

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

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials J.P

Date: 08/08/2016

Francis Williams
Ground & Water Ltd
2 The Long Barn
Norton Farm
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Alton
Hampshire
GU34 3NB

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 16-47188

Site Reference:	80 Greencroft Gardens, South Hempstead, London
Project / Job Ref:	GWPR1731
Order No:	None Supplied
Sample Receipt Date:	26/07/2016
Sample Scheduled Date:	26/07/2016
Report Issue Number:	1
Reporting Date:	01/08/2016

Authorised by:

Kevin Old
Associate Director of Laboratory

Authorised by:

Russell Jarvis
Associate Director of Client Services

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
QTS Environmental Report No: 16-47188	**Date Sampled**	13/07/16	13/07/16			
Ground & Water Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: 80 Greencroft Gardens, South Hempstead, London	**TP / BH No**	BH1	WS2			
Project / Job Ref: GWPR1731	**Additional Refs**	None Supplied	None Supplied			
Order No: None Supplied	**Depth (m)**	2.50	3.50			
Reporting Date: 01/08/2016	**QTSE Sample No**	219322	219323			

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.7	7.7			
Total Sulphate as SO_4	mg/kg	< 200	NONE	2990	26390			
Total Sulphate as SO_4	%	< 0.02	NONE	0.30	2.64			
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	280	2740			
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.28	2.74			
Total Sulphur	%	< 0.02	NONE	0.29	0.90			
Ammonium as NH_4	mg/kg	< 0.5	NONE	25.9	22.1			
Ammonium as NH_4	mg/l	< 0.05	NONE	2.59	2.21			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	24	37			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	11.8	18.5			
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	< 3	< 3			
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS	< 1.5	< 1.5			
W/S Magnesium	mg/l	< 0.1	NONE	16	140			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis $^{(S)}$

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 16-47188	
Ground & Water Ltd	
Site Reference: 80 Greencroft Gardens, South Hempstead, London	
Project / Job Ref: GWPR1731	
Order No: None Supplied	
Reporting Date: 01/08/2016	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 219322	BH1	None Supplied	2.50	22	Light brown clay
$ 219323	WS2	None Supplied	3.50	20.1	Brown clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

$ samples exceeded recommended holding times

QTS Environmental Ltd
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Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

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Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 16-47188
Ground & Water Ltd
Site Reference: 80 Greencroft Gardens, South Hempstead, London
Project / Job Ref: GWPR1731
Order No: None Supplied
Reporting Date: 01/08/2016

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

APPENDIX D

Hydrogeology Assessment

H Fraser CONSULTING
CONTAMINATED LAND AND HYDROGEOLOGY

80 Greencroft Gardens Basement Impact Assessment: Groundwater

Prepared for: Anthony and Chris Charlton

80 Greencroft Gardens

NW6 3QJ

Date: 17/08/2016
Status: Final
Reference: 30132R1
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Prepared by: H Fraser Consulting Ltd

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NON TECHNICAL SUMMARY

The proposed development is to deepen an existing cellar to a basement, with a sunken terrace at the rear and lightwells at the front. The total area of the basement, beneath the existing footprint of the property, is estimated as approximately 220 m^2, and the combined area of the rear terrace and front lightwells is estimated as approximately 45 m^2. The floor level of the basement is shown on plans as 2.6 m bgl, which indicates a likely excavation depth of approximately 2.9 m bgl. The neighbouring property, 78 Greencroft Gardens is understood to have a basement.

The underlying geology comprises the London Clay, overlain by approximately 0.5 m of head deposits and up to 0.8 m of made ground. The made ground is described as mid to dark brown/mid-orange/orange-brown silty sandy gravelly clay, and the head deposits are described as dark brown/mid brown/orange brown mottled silty gravelly Clay. Groundwater was not observed during recent drilling at the site, however, groundwater was observed at a subsequent monitoring visit at 4.7 m bgl, below the proposed basement floor level. However, groundwater monitoring at a local property 20 m west in the autumn of 2015 recorded groundwater at 1.08 m bgl and 0.95 m bgl.

There is the potential for groundwater inflow to the excavation during construction. The construction excavation should be protected against groundwater ingress and kept dry. Implications for land stability should be taken into account when designing groundwater control measures.

The proposed basement structure should be protected against groundwater ingress and permeation of soil moisture.

Engineering design of the subsurface structure should provide groundwater drainage to reduce backing up of groundwater around the structure, and to minimise the potential for groundwater flooding or impact on neighbouring properties. There are measures widely implemented in such situations and if correctly designed and constructed there should not be any significant groundwater back up around the new basement.

Neighbours' properties should be surveyed to establish whether there are basements or cellars. The condition of the basements or cellars, particularly with regard to damp and water ingress, should be noted. Ongoing groundwater level monitoring should be undertaken to assess the range in groundwater levels and provide a baseline against which to compare future groundwater levels.

Changes to surfacing and drainage that might affect recharge to groundwater should be appropriately designed so that groundwater levels are not adversely affected, and to ensure that groundwater flooding is not caused. Design of drainage systems should consider the requirements of sustainable urban drainage.

CONTENTS

FIGURES

TABLES

1. INTRODUCTION

Anthony and Chris Charlton have instructed H Fraser Consulting Ltd (HFCL) to provide the hydrogeological aspects of a Basement Impact Assessment at the following property:

80 Greencroft Gardens, NW6 3JQ.

The site is in the London Borough of Camden.

1.1 Objective

The objective of this report is to provide the hydrogeological aspects of a Basement Impact Assessment to support a planning application for construction of a basement at 80 Greencroft Gardens, NW6 3JQ.

1.2 Scope of works

The following works have been undertaken:

- Desk study
- Screening assessment with regards to groundwater
- Scoping assessment to identify potential impacts
- Impact assessment with regard to groundwater attributes
- Reporting

The work has been undertaken in accordance with the requirements of London Borough of Camden's (LBC) Planning Guidance CPG4 'Basements and Lightwells' (referred to as CPG4) and Arup's 'Geological Hydrogeological and Hydrological Study, Guidance for Subterranean Development' (Arup, 2012, referred to throughout this report as the GHHS).

This assessment is limited to an assessment of the hydrogeological aspects of the proposed development and does not purport to make any comment on surface water flooding, hydrology, contamination or pollution, engineering, slope stability, design or construction issues.

The work has been undertaken by Hannah Fraser, Director of HFCL, who is a Chartered Geologist with 19 years' experience as a hydrogeologist and consultant.

2 BACKGROUND INFORMATION

Background information has been derived from a Groundsure report for a nearby site (on Priory Road, 300 m west-northwest, see Appendix A); geological information has been derived from on-line BGS sources (Geology of Britain Viewer, GeoIndex, Lexicon); on-line mapping and aerial photography have been derived from Streetmap and GoogleEarth. Table 2.1 presents relevant background information for the site. The site location is shown in Figure 2.1.

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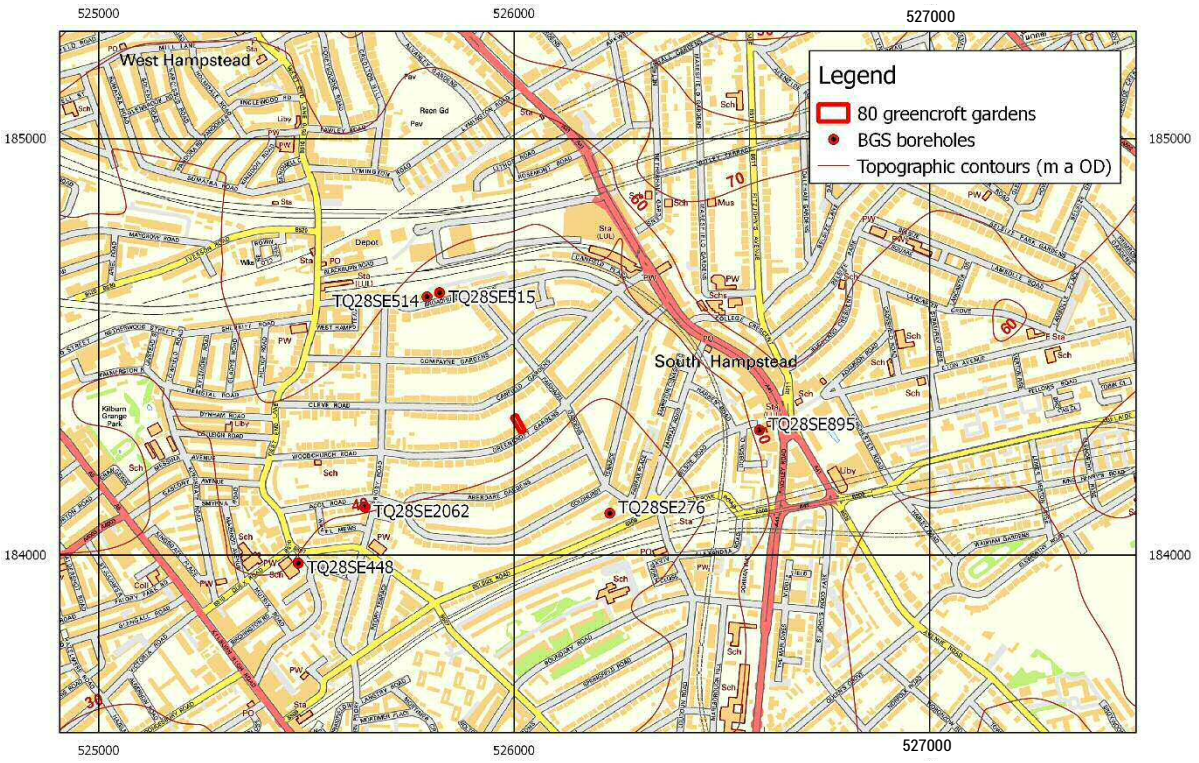

Figure 2.1 Site Location

Contains Ordnance Survey data © Crown copyright and database right 2016

Table 2.1 Background Information

Address	80 Greencroft Gardens, NW6 3JQ.
NGR	526012, 184311
Description	The property is a 3 storey brick built semi-detached property with an existing shallow (c.1.5 m bgl) cellar. Plans and sections are shown in Appendix B. Topography in the surrounding area falls from high ground on Hampstead Heath, 1700 m to the north. Ground contours show that locally the land falls to the southwest, with the site elevation estimated as approximately 41 m OD. Local topography is shown on Figure 2.1. LBC's planning portal has been searched to examine any planning applications of neighbouring properties, and any evidence of existing basements. A planning application for a rear extension at No 82 Greencroft Gardens in 2012 included plans that indicate there is no basement at No 82. In 2014, a planning application was submitted for extension of an existing cellar at 78 Greencroft Gardens to form a basement level at approximately 2.5 – 3.0 m bgl.

Proposed development	The proposed development is to extend an existing shallow (1.5 m bgl) basement to give a floor level depth of 2.6 m bgl, including a sunken terrace at the rear and lightwells at the front. The likely excavation depth of the basement is 2.9 m bgl. Plans and sections for the proposed basement are presented in Appendix B.
Geology	Geological mapping shows the area to be underlain by London Clay. The London Clay is extensive across the area; the overlying Claygate member and Bagshot Formation outcrop to form the elevated area of Hampstead Heath, with the closest outcrop of the Claygate member approximately 675 m northeast. The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occur in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels. There are no superficial deposits mapped at the site, the closest outcrop of superficial deposits is approximately 2.4 km to the southeast. Head Deposits, comprising gravel, sand and clay depending on upslope source and distance from source. These are poorly sorted and poorly stratified deposits formed mostly by solifluction and/or hillwash and soil creep. Table 2.2 presents geological data from selected BGS borehole records, and Figure 2.1 shows the location of the boreholes. The local borehole records confirm the presence of Made Ground underlain by London Clay. A site investigation was undertaken by Ground and Water Limited on 11 July 2016, and comprised the drilling of one deep borehole, one shallow window sample hole, and the excavation of two shallow trial pits to expose the foundations. The investigation confirmed that the site is underlain by Made Ground, Head deposits, and London Clay. Site investigation data are provided in Table 2.3.
Aquifer status	The London Clay is classified by the Environment Agency as unproductive strata (rock layers with low permeability and negligible significance for water supply or river base flow). The site is not within a source protection zone of a public water supply. All 7 of the local BGS borehole records shown in Table 2.2 recorded that the borehole was dry during drilling, or that groundwater was not observed. Groundwater was not observed during recent drilling on site, however subsequent groundwater monitoring detected groundwater at 4.7 m bgl. It is noted that site investigations at a local property approximately 60 m east recorded groundwater levels at 1.08m bgl and 0.95m bgl in the autumn of 2015.

Watercourses	Mapping shows a small water feature approximately 670 m east of the site, at Swiss Cottage. There are no surface water abstractions within 1625 m of the site. The old course of the headwaters of the River Kilburn (a former tributary of the former River Westbourne) lies adjacent to the south and east of the site. It is not known whether this river is now culverted or diverted, but there are no indications that there is a water feature present on current mapping or aerial photography.
Spring lines	There are no springs shown on OS mapping, and no known local geological features that might give rise to springs.
Wells	The closest groundwater abstraction is approximately 670 m east of the site. It is very likely that this abstraction is from the Chalk underlying the London Clay.
Groundwater flooding	British Geological Survey Groundwater flood risk mapping reports there to be no groundwater flooding susceptible areas within 50 m of the Priory Road site, and the area is not considered prone to groundwater flooding, based on rock type. Given that the hydrogeological conditions are similar, it is reasonable to conclude the same for the Greencroft Gardens site.

Table 2.2 BGS Borehole records

Reference	Name	Length (m)	Easting	Northing	Description
TQ28SE514	Broadhurst Gardens BH1	3.89	525790	184620	Made Ground to 0.61 m; London Clay soft to firm red brown mottled clay changing to brown and grey mottled clay. A few gypsum crystals at 12"9' to 3.9 m. Borehole dry.
TQ28SE515	Broadhurst Gardens BH2	3.81	525820	184630	Made Ground to 0.91 m; firm light brown Clay to 1.22 m; fine medium gravel in matrix of firm brown clay to 1.83 m; firm brown silty clay some gypsum crystals to 3.35 m; firm brown clay with blue streaks to 3.81 m. Borehole dry.
TQ28SE448	Kilburn Vale Est BH4	15	525480	183980	Made Ground to 0.45 m; firm becoming stiff brown fissured silty clay, occasional patches of fine sand and selenite crystals in fissures to 10.2 m; stiff blue fissured silty clay with some silt in fissures to 15.25 m. Water was not encountered during drilling.
TQ28SE2063	65 Priory Road Hampstead 2	10	525640	184115	Made Ground. Soft to firm brown clay with many broken bricks and decomposed mortar to 1.5 m; soft silty brown clay with extensive grey mottling. Very weathered. Becoming firm with many partings of sand and fine roots to 6.5 m; very stiff to hard slightly silty blue grey clay with many large fissures. Some sandy and silty partings to 10 m. Borehole dry.
TQ28SE2062	65 Priory Road Hampstead 1	10	525640	184115	Made Ground. Soft to firm brown clay with many broken bricks and decomposed mortar to 1.04 m; firm slightly silty brown mottled grey CLAY with extensive close fissuring. Occasional claystones. Becoming very stiff slightly silty dark brown slightly mottled grey clay with some fissures and fine partings of grey silt to 7.75 m; very stiff to hard slightly silty blue grey clay with many large fissures. Some sandy and silty partings to 10 m. Borehole dry.
TQ28SE276	Colridge Gardens Swiss Cottage	7.62	526230	184100	Topsoil to 0.45 m, Loamy Clay to 1.52 m, Brown Clay to 7.62 m, Borehole Dry
TQ28SE895	Swiss Cottage 4	12.19	526590	184300	Made ground (concrete and bricks) to 0.76 m, Stiff brown clay with occasional sulphate crystals to 6.86 m, Stiff to very stiff grey silty clay to 4.57 m, GL at 52.21 m, water - none.

Geological data from site investigations on 11 July 2016 are presented in Table 2.3 (after Ground & Water, 2016).

Table 2.3 Site investigation data

Strata	Depth Encountered (m bgl)	Thickness (m)
MADE GROUND Block paving/concrete slab over sand/concrete sub-base.	GL	0.07 – 0.12
MADE GROUND: mid to dark brown/mid-orange/orange-brown silty sandy gravelly clay. Sand is fine grained. Gravel is rare fine to medium sub-rounded to sub-angular flints, concrete, wood and brick	GL – 0.12	0.65 - >0.8
HEAD DEPOSITS: Dark brown/mid brown/orange brown mottled silty gravelly CLAY. Gravel is rare fine to coarse rounded to sub-angular flints. Black inclusions noted	0.5 – 0.8	0.4 - >0.6
LONDON CLAY FORMATION Mottled mid-brown/orange CLAY. Clay became denser with depth. Lenses of grey clay noted from 1.90 m bgl.	1.2	2.8
LONDON CLAY FORMATION: Mid to dark brown/grey silty CLAY. Lenses of mottled orange-brown/grey clay noted throughout WS2.	1.2 – 4.0	>3.8 - >6.45

No groundwater was observed during drilling on 11th July 2016. A piezometer was installed to 5 m bgl, and a groundwater reading was subsequently made on 3rd August as shown in Table 2.4.

Table 2.4 Groundwater readings

Date	Groundwater reading (m bgl)
11July 2016	No groundwater observed during drilling
3 August 2016	4.70

3 SCREENING

A screening assessment has been undertaken in accordance with the methodology set out in Section 6.2 and Appendix E2 of the GHHS (Arup, 2012). The results are presented in Table 3.1.

Table 3.1 Screening assessment

Ref	Question	Answer (yes/no/unknown)	Action
Q1a	Is the site located directly above an aquifer?	No	No further action
Q1b	Will the proposed basement extend beneath the water table surface?	Possibly	Take forward to scoping stage
Q2	Is the site within 100m of a watercourse, well (used/ disused) or potential spring line?	No	No further action
Q3	Is the site within the catchment of the pond chains on Hampstead Heath?	No	No further action
Q4	Will the proposed basement development result in a change in the proportion of hard surface/paved areas?	Yes	Take forward to scoping stage
Q5	As part of the 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)	Unknown	Take forward to scoping stage
Q6	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	No further action

4 SCOPING

This section of the report summarises the pertinent information as a Conceptual Model, and then describes the matters of concern that need to be considered in the Impact Assessment.

4.1 Conceptual model

The proposed development is to deepen an existing cellar to a basement, with a sunken terrace at the rear and lightwells at the front. The total area of the basement, beneath the existing footprint of the property, is estimated as approximately 220 m^2, and the combined area of the rear terrace and front lightwells is estimated as approximately 45 m^2. The floor level of the basement is shown on plans as 2.6 m bgl, which indicates a likely excavation depth of approximately 2.9 m bgl. The neighbouring property, 78 Greencroft Gardens is understood to have a cellar and planning permission to extend this to a basement, although it is not known whether this has been constructed.

The underlying geology comprises the London Clay, overlain by approximately 0.5 m of head deposits and up to 0.8 m of made ground. The made ground is described as mid to dark brown/mid-orange/orange-brown silty sandy gravelly clay, and the head deposits are described as dark brown/mid brown/orange brown mottled silty gravelly Clay.

The London Clay is classified as 'unproductive strata', and has low permeability. Groundwater flow within the London Clay is generally negligible, although some groundwater movement may occur on discrete sand partings or other discontinuities. Local borehole records confirm that groundwater was not observed during drilling to up to 15 m bgl in the local area. Groundwater was not observed during recent drilling at the site, however, groundwater was observed at a subsequent monitoring visit at 4.7 m bgl, well below the proposed basement floor level. However, groundwater monitoring at a local property 20 m west in the autumn of 2015 recorded groundwater at 1.08 m bgl and 0.95 m bgl.

The head deposits at the site may be variable in permeability and in thickness, although a lack of groundwater during drilling indicates a low permeability. It is considered that the groundwater observed at local properties represents groundwater derived from the London Clay and the Head deposits, which is likely to flow slowly through the strata due to low permeability but will accumulate in a borehole over time. Similarly, groundwater may flow slowly into an excavation below the groundwater table, or will accumulate against a barrier to groundwater flow such as a basement structure.

It is considered that the area of ground comprising the lightwells and the sunken terrace is small in proportion to the overall size of the property, and the net effect on recharge to the ground is likely to be small. In any case, recharge to the groundwater regime is likely to be low due to the low permeability of the ground. The effects of changing the proportion of hard surfacing at the property are therefore not considered further. Similarly, it is unlikely that the drainage proposals will result in increased discharge of water to the ground, due to the low permeability of the subsurface materials.

4.2 Matters of concern

Five attributes are considered as potential matters of concern, as discussed below.

1. Groundwater level – groundwater was observed during recent monitoring well below the proposed basement floor level, however groundwater levels of approximately 1 m bgl have been observed locally. The basement will extend below this level, and this is carried forward for further assessment.

2. Range of seasonal fluctuation in groundwater levels – the range of seasonal fluctuation in groundwater levels is not known, and this is carried forward for further assessment.

3. Spring/stream hydrographs – there is no evidence that local streams or springs are likely to be affected and these are not considered further.

4. Soil moisture – there is the potential for soil moisture content to affect the development, and this is carried forward for further assessment.

5. Water quality – there is no evidence that the development will affect water quality, provided good practice is followed with regard to pollution management. This is not considered further.

5 IMPACT ASSESSMENT

The impact assessment has been undertaken by considering groundwater attributes, how these are likely to change under the proposed development and the consequence of any predicted changes. The assessment is qualitative at this stage. The results are presented in Table 5.1.

Table 5.1 Impact assessment

Groundwater Attribute	Predicted Change	Consequence of change and mitigation
Groundwater levels	Groundwater was observed during recent monitoring at 4.7 m bgl, well below the proposed basement floor level, however groundwater elevations of approximately 1 m bgl have been observed locally There is the potential for the proposed basement to extend below the groundwater table during times of high groundwater elevation. There is the potential for groundwater inflow to the excavation during construction. Flows are likely to be low due to the low permeability of the clays, however both the London Clay and Head deposits can vary in their capacity to bear water. There is the potential for groundwater seepage into the proposed basement structure, post development. There is the potential for groundwater to 'back up' around the basement structure, with the potential to cause nuisance to neighbouring properties.	The construction excavation should be protected against groundwater ingress and kept dry. Implications for land stability should be taken into account when designing groundwater control measures. The proposed basement structure should be protected against groundwater ingress. Engineering design of the subsurface structure should provide groundwater drainage to reduce backing up of groundwater around the structure, and to minimise the potential for groundwater flooding or impact on neighbouring properties. There are measures widely implemented in such situations and if correctly designed and constructed there should not be any significant groundwater back up around the new basement. Neighbours' properties should be surveyed to establish whether there are basements or cellars. The condition of the basements or cellars, particularly with regard to damp and water ingress, should be noted. Ongoing groundwater level monitoring should be undertaken to assess the range in groundwater levels and provide a baseline against which to compare future groundwater levels. Changes to surfacing and drainage that might affect recharge to groundwater should be appropriately designed so that groundwater levels are not adversely affected, and to ensure that groundwater flooding is not caused. Design of drainage systems should consider the requirements of sustainable urban drainage.

Groundwater Attribute	Predicted Change	Consequence of change and mitigation
Range of seasonal fluctuation in groundwater levels	The range of seasonal groundwater fluctuation is not known. High groundwater levels may be exacerbated upstream of the basement if groundwater 'backs up' around the structure.	The engineering measures described above, which will be employed to reduce backing up of groundwater around the basement structure, should be designed to take account of seasonally high groundwater levels.
Soil moisture	Soil moisture has the potential to permeate the basement structure.	The proposed basement structure should be adequately protected against permeation of soil moisture.

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6 CONCLUSIONS

The proposed development is to deepen an existing cellar to a basement, with a sunken terrace at the rear and lightwells at the front. The total area of the basement, beneath the existing footprint of the property, is estimated as approximately 220 m^2, and the combined area of the rear terrace and front lightwells is estimated as approximately 45 m^2. The floor level of the basement is shown on plans as 2.6 m bgl, which indicates a likely excavation depth of approximately 2.9 m bgl. The neighbouring property, 78 Greencroft Gardens, is understood to have a basement.

The underlying geology comprises the London Clay, overlain by approximately 0.5 m of head deposits and up to 0.8 m of made ground. The made ground is described as mid to dark brown/mid-orange/orange-brown silty sandy gravelly clay, and the head deposits are described as dark brown/mid brown/orange brown mottled silty gravelly Clay. Groundwater was not observed during recent drilling at the site, however, groundwater was observed at a subsequent monitoring visit at 4.7 m bgl, below the proposed basement floor level. Groundwater monitoring at a local property 20 m west in the autumn of 2015 recorded groundwater at 1.08 m bgl and 0.95 m bgl.

There is the potential for groundwater inflow to the excavation during construction. The construction excavation should be protected against groundwater ingress and kept dry. Implications for land stability should be taken into account when designing groundwater control measures.

The proposed basement structure should be protected against groundwater ingress and permeation of soil moisture.

Engineering design of the subsurface structure should provide groundwater drainage to reduce backing up of groundwater around the structure, and to minimise the potential for groundwater flooding or impact on neighbouring properties. There are measures widely implemented in such situations and if correctly designed and constructed there should not be any significant groundwater back up around the new basement.

Neighbours' properties should be surveyed to establish whether there are basements or cellars. The condition of the basements or cellars, particularly with regard to damp and water ingress, should be noted. Ongoing groundwater level monitoring should be undertaken to assess the range in groundwater levels and provide a baseline against which to compare future groundwater levels.

Changes to surfacing and drainage that might affect recharge to groundwater should be appropriately designed so that groundwater levels are not adversely affected, and to ensure that groundwater flooding is not caused. Design of drainage systems should consider the requirements of sustainable urban drainage.

7 REFERENCES

Arup, 2012. Geological Hydrogeological and Hydrological Study, Guidance for subterranean development

Ground and Water, 2016. Preliminary Summary – Ground Investigation Report. 80 Greencroft Gardens, London NW3 3JQ

London Borough of Camden CPG4 'Basements and Lightwells'

APPENDIX E

Land stability assessment

Ground and Project
CONSULTANTS LTD

80 GREENCROFT GARDENS, NW6 3JQ

Basement Impact Assessment: Land Stability

July 2016

Client:

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Contents

Non-Technical Summary,

It is proposed to construct a 2.6m deep basement (2.9m excavated depth) at 80 Greencroft Gardens, London, NW6 3JQ. The basement will be built under the full footprint of the existing house plus a small sunken garden and lightwells.

The screening exercise identified a number of issues for further consideration as follows:

- London Clay is the shallowest natural geological strata
- There are trees and bushes in the rear garden
- A 'lost river' runs relatively close to the site
- Groundwater may be encountered during construction works
- The basement will be deeper than neighbouring properties

The published geology suggests London Clay at site with the possibility of Head Deposits, which are softer and weaker.

A ground investigation was carried out by Ground & Water consisting of two boreholes, one 10.45m and the other 5m deep. These encountered Made Ground (i.e. ground placed by human activity) overlying thin Head Deposits to 1.20m depth. London Clay was found beneath the Head Deposits as a brown and grey silty clay and of high shrinkage potential. Groundwater was encountered during the investigation in a monitoring well at 4.7m.

The scoping and assessment of the BIA concluded that:

- Groundwater inflow, if encountered, should be properly managed and controlled such that there is no significant wash out of fine material.
- The retaining structure to the basement should be appropriately designed.
- The construction of the basement is carried out by competent and experienced contractors and precautions are taken to maintain the stability of the excavations.
- Care should be taken to minimise the disturbance and damage to bushes and their roots. Should bushes be removed then an assessment of the potential for swelling of the London Clay soils should be carried out.
- Concrete should be designed accounting for the sulphate conditions anticipated.
- Monitoring of the structures should be carried out before and during construction. The exact nature of this monitoring should be determined by the structural engineer.

1. Introduction

Ground and Project Consultants Ltd have been instructed by H Fraser Consulting to undertake the land stability element of a Basement Impact Assessment compliant with CPG4, at 80 Greencroft Gardens, NW6 3JQ. The property is located in the London Borough of Camden in the Swiss Cottage ward, its location is indicated on Figure 1.

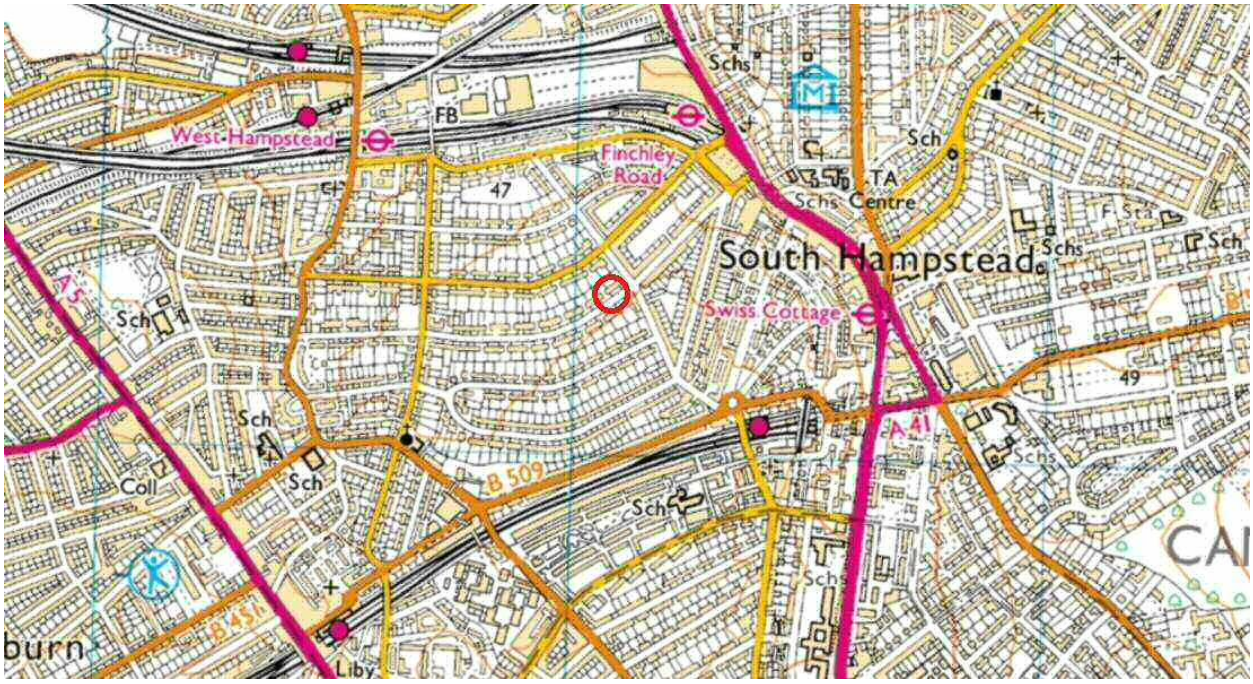

Figure 1: Site Location

Ordnance Survey Data © Crown copyright and database right 2016

2. Scope and Objective

The scope of this report and approach is as follows:

- A review of the existing data supplied by Croft has been carried out, including the proposal drawings produced to date, Ground Investigation data, desk study data from a Groundsure (Enviroinsight report), photos of the building and the background data available through LB Camden's website plus other freely available data such as BGS geological information.
- In line with the CPG4 guidance:
    - A detailed assessment of the published and encountered geology
    - Development of a ground model including an assessment of geotechnical properties
    - An engineering interpretation including an assessment of slope stability and commentary and assessment regarding ground movements.
- Recommendations for additional work/ monitoring and observation have been provided.

An assessment of potential ground movement for adjacent properties has not been undertaken at this stage.

This report does not consider contaminated land aspects of the proposed basement construction.

This report and the work to support it has been carried out by Jon Smithson who is a Director of Ground and Project Consultants Ltd and is a Chartered Geologist with over 30 years' experience.

3. BIA Screening for Slope/Land Stability

A screening exercise has been carried out as per the guidance in CPG4 as follows:

Question	Answer	Action/ Comment
Question 1: Does the existing site include slopes, natural or manmade, greater than 7 degrees? (approximately 1 in 8)	No. There are no slopes at the property	None
Question 2: Will the proposed reprofiling of landscaping at site change slopes at the property boundary to more than 7deg? (approximately 1 in 8)	No. There are no changes in surface profile planned.	None
Question 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7deg? (approximately 1 in 8)	No.	None
Question 4: Is the site within a wider hillside setting in which the general slope is greater than 7degrees? (approximately 1 in 8)	No, the general slope in the area is around 1 in 40 (2^{o}) based on Ordnance Survey data. The site is some distance from Hampstead Heath and steeper ground	None
Question 5: Is the London Clay the shallowest strata at the site?	Yes, the mapped surface deposit is LONDON CLAY. MADE GROUND is likely to be encountered with the possibility of HEAD deposits overlying the London Clay.	The presence of London Clay close to surface is further discussed in the Impact Assessment.
Question 6: Will any tree/s 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? (Note that consent is required from LB Camden to undertake work to any tree/s protected by a Tree	It is understood that there will not be a need to fell trees. However the sites sits within South Hampstead conservation area. Trees are present at and close to site.	Further discussed in the Impact Assessment.

Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).		
Question 7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	None known. However London Clay is relatively close to surface.	Further discussed in the Impact Assessment.
Question 8: Is the site within 100m of a watercourse or a potential spring line?	Possibly: Figure 11 of the Arup report indicates a 'Lost River' probably within 100m to the east and south of the property.	This is further discussed in the Impact Assessment.
Question 9: Is the site within an area of previously worked ground?	None known or suspected.	None
Question 10: Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No. The London Clay is classified by the Environment Agency as unproductive strata (rock layers with low permeability and negligible significance for water supply or river base flow). The site is not within a source protection zone of a public water supply. However the basement may extend into the water table.	This is further discussed in the Impact Assessment.
Question 11: Is the site within 50m of the Hampstead Heath ponds?	No.	None
Question 12: Is the site within 5m of a highway or pedestrian right of way?	No. The basement will be around 10m from the highway and pavement	Health Safety and environmental measures will be required to be integrated into the building contractors methods of working

Question 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	It is understood that basements are not present at no. 82. No. 78 has gone through the planning process, it is not known whether construction has taken place.	This is further discussed in the Impact Assessment.
Question 14: Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No.	None

4. Site Information

Existing Property and Basement Proposals

The property at 80 Greencroft Gardens, London, NW6 3JQ is located on the north side of the road, which is itself located approximately 2km north west of Regents Park and around 400m south of the Jubilee Line, 500m south west of Finchley Road and 600m south west of West Hampstead Stations. Swiss Cottage tube station is about 600m to the east.

The property has a footprint of approximately 220m^2. There is an existing low height cellar at the property. The overall property (house) is a double fronted three storey semi-detached building probably of late Victorian age. There is a narrow space between the property and the 'non-attached' property to the East.

Camden's planning portal indicates that there have been a number of successful basement applications on Greencroft Gardens in recent years. There has been a successful application for a basement next door at no. 78. It is not known whether this has been constructed.

The basement proposals are for a new basement beneath the full footprint of the property, plus a small sunken garden/lightwell area to the rear. The basement will have a dividing wall down the middle with a bedroom, en-suite and living area and utility room on each side. The wider plans are to modernise the house into a series of apartments. The finished floor level for the basement is indicated as 2.6m below ground level (bgl) with a likely excavated level of 2.9m bgl. The front of the basement will be approximately 6.5m from the pavement.

Topography

The property is located on gently sloping ground well below the base of Hampstead Heath. Its elevation estimated from the OS map is approximately 41mAOD. The OS map shows that the ground surface falls gently to the SE over a gradient of around 1 in 40 (i.e. less than 2^o). The National Grid Ref for the property is TQ 26018 84306.

Geology

The available geological mapping (Ref 1.) indicates that the site lies on London Clay (plain brown colour in Figure 2) which typically comprises a stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. The geological map (North London 256) indicates a 'propensity' for Head Deposits to be present reasonably close by (~200m) to the east and also further to the west of the site. These are indicated by the stippled areas on Figure 2 below. Typically they are thin (<2m) and consist of soft, ocherous brown silty clay with blue-grey mottling in places and angular, frost-shattered fragments of flint occur sporadically throughout. The base of the London Clay is likely to occur some depth below the property. See Figure 2 below.

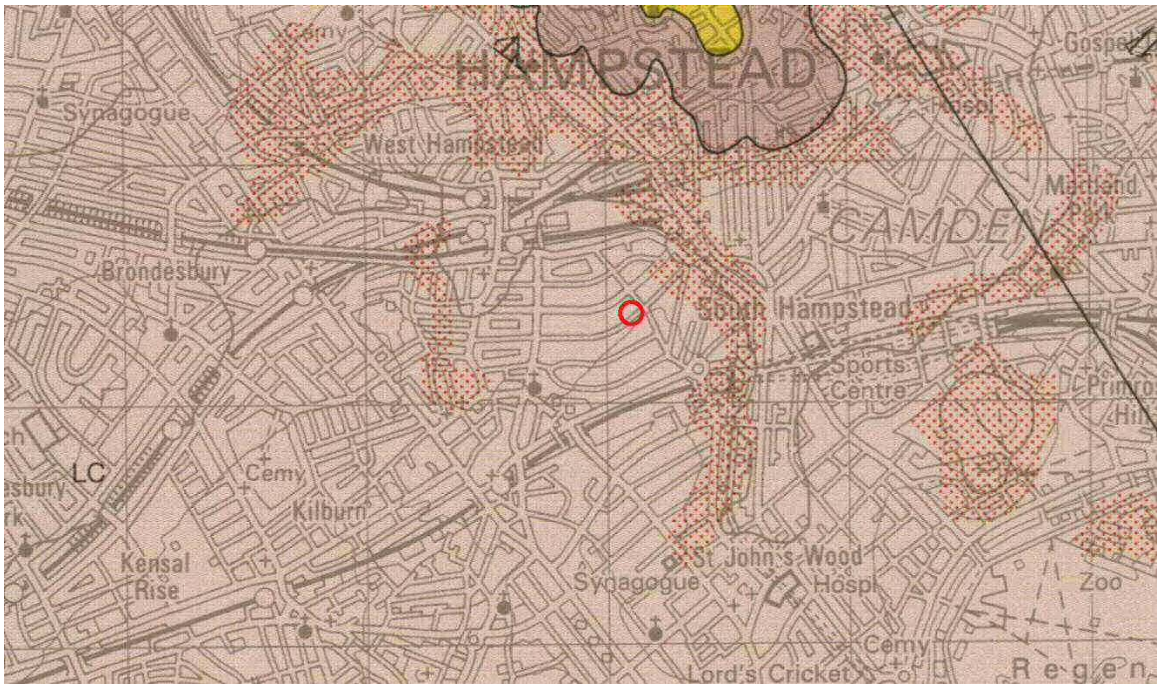

Figure 2: Geology Contains British Geological Survey materials © NERC 2006

Hydrology and Hydrogeology

The OS Map indicates that there are no surface water bodies in the vicinity of the site. The Grand Union Canal forms the northern boundary of Regents Parks some 1.5km to the SE. The Hampstead Ponds are approximately 3km to the NE. There are no springs shown on OS mapping.

The Arup study for Camden (Fig 11) indicates a 'Lost River' running southwards to the east and south of the property, probably within 100m. This appears to be a tributary of the River Westbourne and will have been culverted probably in the late nineteenth century.

The London Clay is classified by the Environment Agency as unproductive strata (rock layers with low permeability and negligible significance for water supply or river base flow). The site is not within a source protection zone of a public water supply. There are no groundwater abstraction licenses within 2 km of the site and no source protection zones within 500 m of the site. (Ref 5. Groundsure Report).

Other Environmental Data

A Groundsure report centred locally gives useful background data on local environmental issues and hazards. The key issues are summarised in the table below:

Drift Deposits	None are indicated on BGS mapping
Made Ground	None are indicated on BGS mapping
Shrink/ Swell	There is a moderate Hazard of shrink and swell from the London Clay soils

Landslide	Very Low Risk
Soluble Rocks	Negligible Risk
Compressible Ground	Negligible Risk
Collapsible Ground	Very Low Risk
Running Sand	Very Low Risk
Mining	None recorded

5. Ground Investigation

A ground investigation (GI) has been carried out at the site by Ground & Water Ltd and results of these have been made available by H Fraser Consulting. The GI was carried out in July 2016. The work comprised of two boreholes BH1 to 10.45m, drilled using a Terrier rig and WS2 to 5.00m drilled using hand held window sample equipment. Two trial pits were excavated in the front and rear of the property to expose the existing foundation of the property and adjacent property.

Borehole BH1 was drilled in the front garden of the property and WS2 in the rear garden. They encountered a thin cover of made ground (0.65 to 0.80m) which is probably reworked natural ground associated with the construction.

This was found to overlie a thin layer of Head Deposits in both boreholes. These represent reworked London Clay by natural processes and are summarised as mid brown/orange brown gravelly CLAY. Gravel is rare, fine to medium, sub-rounded to sub-angular flint. Note that given the proximity to a 'lost river' the head Deposits may be interpreted as Alluvium.

The surface of the London Clay was encountered in both boreholes at 1.20m bgl. The boreholes were both terminated within the London Clay. It was encountered as a mid-brown occasionally mottled grey silty CLAY becoming dark brown and grey with depth. Note that the Head Deposits may be interpreted as Alluvium associated with the River Westbourne Tributary. A standpipe piezometer was installed in BH1 with a response zone between 1.0 and 5.0m bgl. The works included Standard Penetration Tests (SPTs) in BH1 and disturbed samples were taken throughout both BHs.

The SPT'N' Values show a steady increase in depth from a value of 6 (taken across the Head Deposit/London Clay interface) to 11 and 13 within the basement depth. These latter values can be correlated with undrained shear strength. Using Stroud's correlation for high plasticity clays a factor of 4 or 5 suggests an undrained shear strength range within the basement depth of around 50 to 75kN/m^2. Below 3m the SPT 'N' values show a fairly linear increase from 17 at 4m to 34 at 9m, probably suggesting firm to stiff soils becoming stiff or very stiff with depth.

Two trial holes were dug by hand to expose the foundations at the front and rear of the property. TP1 was dug at the front of the property. It was excavated to 1.10m bgl and found that the house foundation of concrete at 0.84m bgl is located upon a Head Deposits. TP2 was excavated in the rear and similarly found a concrete foundation to the house but in this case was founded on Made Ground at 0.67m.

Groundwater was not encountered in the boreholes during drilling. A monitoring standpipe was installed in BH1. Monitoring indicated a level of 4.70m bgl on 3 August 2016.

Laboratory tests were carried out on the samples collected from the borehole. Testing consisted of the following:

5 No. Atterberg Limit test, including moisture content determination
2 No. Sulphate on Soil

The Atterberg tests were all performed on London Clay. The results are summarised as follows:

Moisture content: 28 to 35%

Plastic Limit:	29 to 34%
Liquid Limit:	77 to 83%
Plasticity Index:	48 to 51%
Liquidity Index	-0.06 to 0.06

The tests indicate that the moisture content is slightly higher than but close to the plastic limit, except at depth where the moisture content is below plastic limit. This is likely to indicate a firm to stiff consistency and corresponding shear strength at shallow depth and a stiff or very stiff consistency with depth. The atterberg results and SPT's therefore show reasonably good correlation.

The soils have a high Plasticity Index and high Liquid Limit which classifies the London Clay here as clay soil of very high plasticity, which means they are highly prone to swell and shrinkage with variations in Moisture content. Moisture contents at the time of testing are likely to be lower than their winter seasonal peak. Whilst foundations are likely to be below the seasonable variations, the presence of local trees means that design should account for the potential for volume change in the soils.

6. Conceptual Ground Model

From the above a conceptual Ground model has been developed and is presented in tabular form below:

Strata	**Typical Description**	**Depth at Property (based on GI boreholes)**	**Geotechnical Properties – Tentative Characteristic Values***	**Other**
Made Ground	Orange brown silty clay and sand MADE GROUND containing brick and gravel	Ground level to between 0.65m and 0.80m	N/A	Made Ground is unlikely to be encountered to a significant depth except around existing foundations. It should not be relied upon as a bearing strata.
Head Deposits	Mid brown/orange brown gravelly CLAY	From between 0.65 and 0.80m to 1.20m bgl		May be variable and contain 'perched' water.
London Clay	Firm to stiff brown silty CLAY, occasional sandy or silty zones, Dark grey at depth.	1.2m to base, full thickness unproven	C' =0 $\phi' = 20^o$ Cu = 75kN/m^2 at formation, increasing to 150kN/m^2 at 9m	Very high plasticity, high volume change potential
Groundwater		4.70m bgl (monitored level 3/8/16)		May exhibit significant variability seasonally or after prolonged wet or dry periods. Higher levels, e.g. ground level are advisable in structural design. Perched water may be present at or near the base of made ground and within Head Deposits.

Table 3: Summary of Strata Characteristics

*The determination of parameters is tentative due to the limited test data.

7. Impact Assessment

There are no major issues which should seriously affect the viability of the construction of the new basement. However the assessment of the geological environment of 70 Greencroft Gardens and the screening exercise indicate some areas for further discussion in this report with suggested mitigation where appropriate.

London Clay: The basement will be excavated through and founded in London Clay. The London Clay soils at this site are of very high plasticity and high volume change potential. The basement will be founded at around 2.9m bgl, therefore below any seasonal shrink and swell. The basement structure should be designed to account for swelling pressures. It will be important to account for the nature of the existing foundations at the property and its neighbours. Any change in drainage or significant interruption/change to groundwater levels and flow patterns will need to be assessed for its implication on soil water content and consequential effect on soil volume change. The London Clay soils are known for their high levels of soluble sulphate. The concrete mix design should take appropriate account of sulphate levels in accordance with BRE Special Digest 1.

Trees: Trees are located in the vicinity and the property is within the South Hampstead conservation area. There are trees and bushes in rear garden of the property and adjoining properties. There are some trees in the pavement and front gardens but these appear to be some distance from the property. Roots have been noted in the ground investigation to 0.8m bgl. Care should be taken to minimise root and tree damage during construction works. Tree or bush removal will cause changes in moisture conditions and may result in soil volume changes which could affect (in particular) shallow foundations.

Basement Depth: It is proposed to be construct the basement to a level of approximately 2.6m below the existing ground floor, with a likely excavated depth of 2.9m. The property is detached but very close to its neighbours on both sides. No. 78 may have a basement. The proposal to construct the basement is understood to be via underpinning at the party and rear and front walls. Underpinning proposals are likely to involve a 'hit and miss' approach in stages so each 'panel' is separated by 4-5 others from the next open one. It will be important that the building contractor is closely supervised and is experienced in this type of construction. It will be critical to prevent exposed faces from collapse and ground loss into the new excavation. Temporary face support should be maintained where practicable. It is understood the there are no deep basements in adjoin/adjacent properties. Most ground movement should occur during wall installation, excavation of the basement and construction so the adequacy of temporary support will be critical in limiting ground movements. Heave movements will occur due to removal of soils.

It is strongly recommended that an assessment of ground movements and a related assessment of building damage is carried out, to understand the effect on adjoining properties.

A number of factors will assist in limiting ground movements:

- The speed of propping and support
- Good workmanship
- Ensuring that adequate propping is in place at all times during construction
- Installation of the first (stiff) support quickly and early in the construction sequence.
- Avoidance of ground loss through the gaps between the piles.
- Avoid leaving ground unsupported.
- Minimise deterioration of the central soil mass by the use of blinding/ covering with a waterproof membrane.
- Avoid overbreak
- Control groundwater inflows and manage dewatering to minimise fines removal and drawdown.

Groundwater: Monitoring of the standpipe piezometer has indicated groundwater levels at 4.70m bgl. Groundwater levels can vary significantly on a seasonal basis or after prolonged wet weather and it should be noted that the reading was taken in the summer. It is possible that groundwater will be encountered during construction. It will be important to limit the size and time of face exposures left open during construction, to limit groundwater inflow and softening of exposed soils. Should significant flows be encountered during construction, for example from exposures of the sandy layers in the London Clay, measures must be taken to prevent wash out of fines. Settlement from any dewatering itself (i.e. if loss of fines is prevented) is likely to be of low magnitude. High groundwater levels should be used in design of the basement structure to account for seasonal variations, flooding and mains leakages. The excavation should be kept dry during construction. Design of drainage systems should consider the requirements of sustainable urban drainage. It is recommended that ongoing monitoring of groundwater levels is carried out during construction.

Lost River: There appears to be a 'lost river' within 100m to the east and south of the property. This will have been put into culvert probably in the late nineteenth century. Close examination of the map indicates that the course of the river is shown some distance and crosses Greencroft Gardens to the east of its junction with Fairhazel Gardens before turning west towards Aberdare Gardens. It is therefore considered the there is a low risk of the course of the river impacting on the construction of the basement.

8. Conclusions

The methodology and approach of CPG4 has been followed in developing this BIA with respect to Land stability. It is concluded that with the construction of the new basement at 70 Greencroft Gardens should not have significant impacts on land stability provided that:

- Groundwater inflow, if encountered, is reduced to a minimum and properly controlled such that there is no significant wash out of fine material. Groundwater levels should be monitored before and during construction. Pumping from a sump is likely to be the most effective way of dealing with groundwater inflow.
- The construction of the basement is carried out by a competent and experienced building contractor and precautions are taken to maintain the stability of the excavations. The adequacy of wall support in the temporary case should be strictly enforced as discussed in section 8.
- Care should be taken to minimise the disturbance and damage to trees and their roots.
- Concrete should be designed in accordance with BRE Special Digest 1 accounting for the sulphate conditions measured and anticipated.
- Monitoring of the structures and groundwater is carried out before and during construction. The exact nature of the structural monitoring should be determined by the structural engineer.

9. References

1. BGS open source mapping: http://mapapps2.bgs.ac.uk/geoindex/home.html
2. Arup: Camden Geological, Hydrogeological and Hydrological Study
3. Archian: Design drawings available at the time of reporting.
4. Ground&Water Ground investigation report, 80 Greencroft Gardens.
5. Groundsure Enviroinsight report GS-2103155.
6. CIRIA Report C580: Embedded Retaining Walls, Guidance for Economic Design.