BASEMENT IMPACT ASSESSMENT SCREENING AND SCOPING

AT

8 WELL WALK, CAMDEN
LONDON, NW3 1LD

FOR

S MALYNICZ

REPORT REF: SM 3381

Engineering Geologists and Environmental Scientists

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June 2019

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Ashton Bennett

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QUALITY MANAGEMENT FOR REPORT

Project	8 Well Walk, Camden, London, NW3 1LD		
Client	S Malynicz		
Date	January 2019		
Version	Issue 1		
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EXECUTIVE SUMMARY

Site Location	8 Well Walk, Camden, London, NW3 1LD
Site Description	Town house 4 storey house in conservation area.
Historical Land Use	Open land, militia barracks yard then 8 Well Walk constructed 1894
Current Land Use	Residential house
Potential Contamination	Low Risk
Archaeological Potential	Site does lie in an Archaeological Priority Area.
Geology	Claygate Beds overlying London Clay.Both strata are highly plastic.
Hydrogeology	Secondary (A) Aquifer, unproductive Aquifer within 100m to east.
Hydrology and Flooding	No risk of flooding from seas and rivers
Underground rivers	None that could affect the site or be affected by the basement
Critical Drainage Areas	Within a CDA. Not within a Local Flood Risk Zone. Low risk.
Surface Water Flooding	Low Risk
Flooding Incidents	None recorded on site. Willow Road Flooded 2002
Sewer Flooding	Low Risk
Reservoir Flooding	Low Risk
Groundwater Flooding	Low Risk
SUDS	Ground unlikely suitable for soakaways based on clay encountered.
Landfill gas potential	No landfill, but historic infilled land 111m to SW. No methane protective required, based on monitoring undertaken. Radon gas protection not required.
Contamination	Low risk of metals & hydrocarbons. Asbestos detected in soil
Geotechnical Properties	Claygate Beds/London Clay may shrink and swell. Allowable bearing capacity of 100kN/m2 to be used for design.
Extra hard cover	None, an increase in landscaped ground by removal of paving.
Groundwater	Groundwater lies at >80m bgl in Thanet Sand/Chalk aquifers. Groundwater monitoring detected perched water within Claygate Beds at 5m bgl.
Waste Disposal	Waste is likely to go as inert waste based on WACs tests.
Tunnels and Services	Underground National Grid High Voltage Electricity Transmission Cables 3m to the west of the site.

RECOMMENDATIONS

Recommended	Details
Waterproof Basement walls	To ensure water tight basement in case of rising groundwater.
Sump pump	For safety.
Non return valves in drains	To prevent drains backing into basement.
Concrete Design	BRE sulphate tests indicate design for underground concrete as DC-2 Ac-1s.
Foundations	Foundations to be constructed on medium strength clay at 3.00m bgl.
DPM	Methane membrane not required. Radon protection not required.
Party Wall Surveyor	Monitoring of No 8 and adjacent buildings.
Structural and Construction Method Statement	Report and drawings For temporary and permanent structural engineering design and method of construction.
Construction Transport Management Plan	Report and drawings To determine construction transport management to prevent causing problems to traffic and neighbours.

The development of the basement, provided it is constructed competently, will not harm neighbouring properties or have any significant effects on the stability or bearing capacity of adjacent land generally.

The development of the basement will not harm the water environment or ground permeability, will not have a cumulative impact on the water environment or flooding.

The development, provided it is constructed competently, will not impact on the structural stability of the property. The development will not detrimentally affect biodiversity.

The damage category for the neighbouring building is very slight. Monitoring should be undertaken of the building and adjacent properties for stability during and immediately after construction.

Risks include seepage of groundwater during and after heavy rainfall.

Recommendations include:

- The building should be constructed on reinforced concrete pins with a raft slab foundation.
- Underpinning to party walls to the lower ground level.
- Temporary propping of excavations.
- Monitoring of adjacent buildings during construction.
- Party Wall Surveyor to be employed.
- Service Drawings to be obtained.
- Compressible material beneath basement slab to accommodate heave.
- Foundation stratum to be medium strength clay.
- Proposed basement should be tanked and waterproofed to the height of the finished ground floor levels.
- The basement must provide internal access to higher ground.
- The basement must include a positive pumped device such as a sump pump, in line with the 2017 London Borough of Camden Basement Planning Guidance.
- A non-return valve should be installed at the foul water sewer manhole serving the property.
- Surface water should be managed by the use of SuDS where practicable.
- Construction Transport Management Plan should be followed to reduce inconvenience to neighbours.
- A Chartered Engineer should be employed to manage the Works.

In conclusion, the research and fieldwork undertaken for the Basement Impact Assessment indicate the site is suitable for development of living quarters in the basement, provided the recommendations are undertaken.

1. INTRODUCTION

1.1 Project

This report describes the results of the screening and scoping and ground investigation for a Basement Impact Assessment undertaken for the development of a residential partial basement extension and small ground floor rear extension at 8 Well Walk, Camden, London, NW3 1LD. The work was commissioned by Malcolm Fryer Architects and undertaken on behalf of their client Mr S Malynicz and was carried out by the Ashton Bennett Consultancy. Plans of the proposed development are provided in Appendix A.

It is proposed to extend and enlarge the existing basement, and to construct a small ground floor extension.

The purpose of this Report is to ascertain the potential impacts that the proposed basement extension will have on the ground stability, the hydrogeology and the hydrology in the vicinity

of the site in order to design any necessary mitigating measures and to design foundations and assess any potential ground movement. The site lies within the London Borough of Camden. The assessments were carried out in general accordance with the London Borough of Camden Development Policy 27 "Basements and Lightwells" and Camden Planning Guidance 1 "Design Note prepared by London Borough of Camden for New Basement Development and Extensions to Existing Basement Accommodation" (LBC, 2010), and Camden's Planning Guidance for Basements, March 2018.

As stated in Camden Development Policy DP27 paragraph 27.1, LB Camden "will only permit (basement and other underground development) that does not cause harm to the built and natural environment and local amenity and does not result in flooding or ground instability".

The approach followed in this report was initially to undertake screening of the site and provide a full site characterisation by a desk study of available geological, hydrological, hydrogeological, environmental and historical and topographic information. The results of the screening enabled scoping for further reporting of all intrusive investigations required to complete the Basement Impact Assessment. The screening and scoping and ground investigation has been undertaken in general accordance with the recommended methodologies highlighted in Arup document "Guidance for Subterranean Development", prepared for the London Borough of Camden and the URS Report 'Strategic Flood Risk Assessment', (2014) for LBC.

The project brief comprises of:

- Desk Study – Collection and interpretation of historic, geological, hydrogeological, hydrological and environmental data.
- Screening – Identification of matters of concern using checklists.
- Scoping – Definition of the matters of concern identified in the screening.
- Ground Movement Assessment – Calculations to determine Burland Scale of Damage to neighbouring properties.
- Ground Investigation, soil testing and gas and groundwater monitoring
- Impact Assessment.
- Conceptual Model – A model of the site characteristics.
- Structural Method Statement
- Construction and Transport Management Plan
- Recommendations.

A Site Location Plan is presented as Figure 1A and Topography as 1B and a Site Plan is presented as Figure 2. The Existing Basement Plan is presented as Figure 3A and Proposed Basement Floor Plan as Figure 3B. The Existing Ground Floor Plan is presented as Figure 4A and the Proposed Ground Floor Plan is presented as Figure 4B. A Section as Existing is presented as Figure 5 and A Section as Proposed is presented as Figure 6.

A World War 2 Bomb Location is presented as Figure 7. The Historic Land Use is presented as Figure 8 with the Current Land Use presented as Figure 9. Figure10 shows the Infrastructure. Figure 11 and 12 show the Superficial Deposits Geological Plan and Bedrock Geological Plan respectively. A Risk of Landslips is presented as Figure 13 and a Local Borehole Plan is presented as Figure 14. The Potential for Clay to Shrink and Swell is presented in Figure 15. Hydrogeology Plan of Bedrock is presented as Figure 16. The Potential for SUDS is presented as Figure 17. The Detailed River Network is presented as

Figure 18 and Lost Rivers in Camden as Figure 19. The Critical Drainage Areas and Flood Risk Zones are presented as Figure 20. The Camden Flood Risk from Surface Water and Flooded Streets in 1975 and 2002 is presented as Figure 21. A 1 in 1000 Year Flood is presented in Figure 22. The Risk of Flooding from Rivers and Seas is presented in Figure 23 and the Flood Risk from Reservoirs is presented in Figure 24. Internal Flooding from Sewers is presented as Figure 25 and External Flooding as Figure 26. A Borehole Location Plan is presented ad Figure 27.

Drawings of site proposals are presented in Appendix A and archival maps are presented in Appendix B. Ground Movement Calculations Methodology and a Monitoring Strategy is presented in Appendix C. Borehole Logs and Laboratory Test Results and Conceptual Model are presented in Appendix D. Structural Method Statement in Appendix E and Construction Transport Management Plan is presented in Appendix F.

1.2 Authors

This report was prepared by Frances A Bennett an engineering geologist who has a degree in Geology, a postgraduate qualification in Soil Mechanics and is a Chartered Geologist CGeol, Chartered Environmentalist CEnv and Chartered Water and Environmental Manager C.WEM with 43 years of experience in the fields of geology, geotechnical engineering, hydrogeology, contamination, mining and waste disposal.

1.3 Sources of Information

The following data have been referenced in relation to the proposed development in order to complete the BIA:

- Site Walkover with client on January 17th 2019.
- Historical and Current mapping from Ordnance Survey 1850 to date.
- Geological mapping from British Geological Survey Sheet 256, North London.
- Hydrogeological data from Environment Agency
- Hydrological data from Environment Agency.
- Flood Risk mapping from Environment Agency and LB Camden's Strategic Flood Risk Assessment. (URS,2014)
- LB Camden Planning Guidance for Basements, March 2018.
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study-Guidance for Subterranean Development, (ARUP, 2010).
- Foundation Design and Construction, MJ Tomlinson, 2001.
- North London Strategic Flood Risk Assessment, Mouchel, August 2008.
- Surface Water Management Plan, LB of Camden, Halcrow, 2011.
- Strategic Flood Risk Assessment, LB of Camden, URS, July 2014.
- Map of Archaeological Priority Areas in Camden, Historic England.
- World War II Bomb Locations. The National Image Library.
- EnviroInsight Report on 8 Well Walk. Centremaps, 2018.

2. THE SITE

2.1 Site Description

The site is located at number 8 Well Walk which lies to the north of Hampstead and west of Gospel Oak in the London Borough of Camden. This site is a 4 storey townhouse and lies

within a conservation area. The building has been viewed and a site walkover was undertaken on the 17th January 2019.

The site area comprises the four storey house and rear garden. The property is a private terraced residential house with hard covered front yard and hard cover/patio to immediate rear of house with a mature tree beyond. The house is attached on the south side by house no 6 and on the north side by No 10 Well Walk. The rear of the property is only accessible through the house.

The site fronts onto Well Walk to the immediate west.

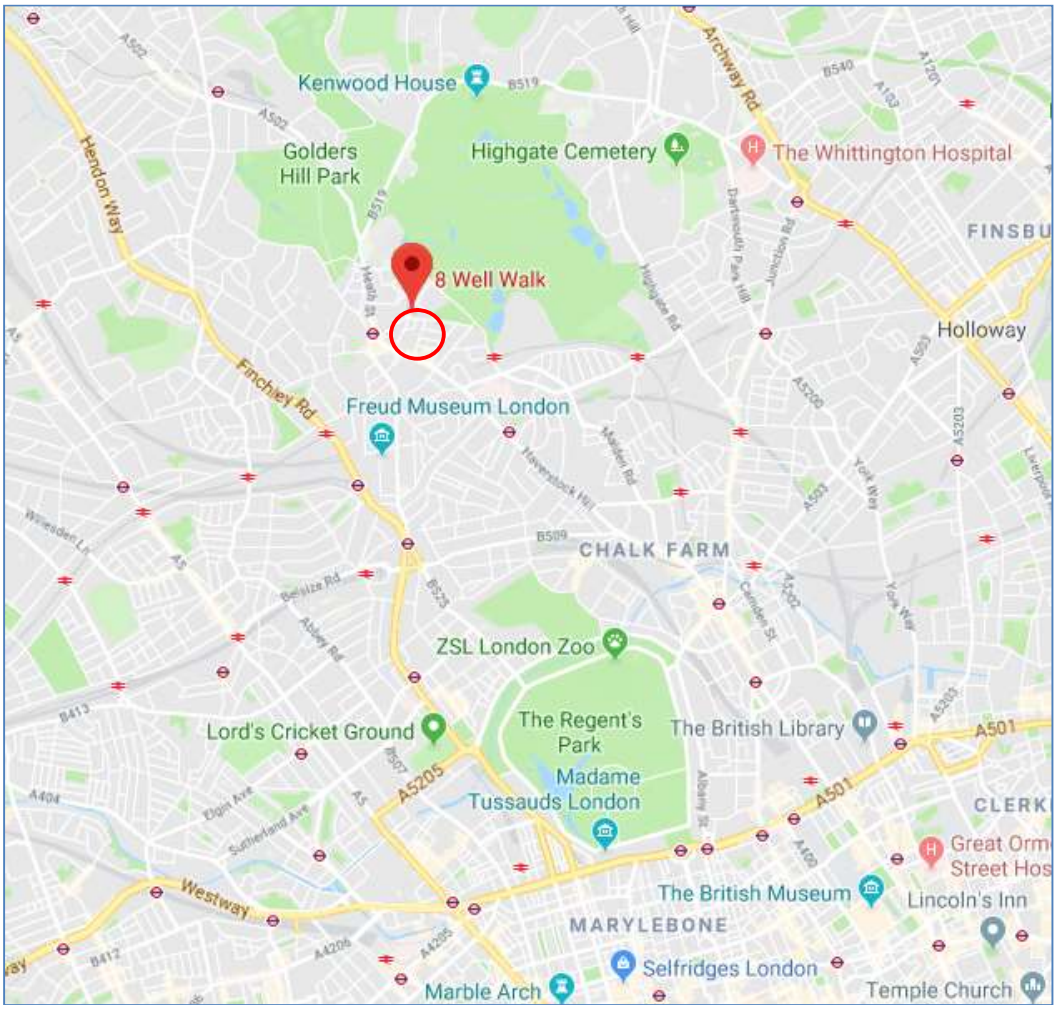


Figure 1A Site Location Plan

The site is bounded to the north by No 10 Well Walk and garden with residential properties beyond. The site is bounded to the east by fencing with residential properties beyond. The site is bounded to the west by Well Walk with Burgh House & Hampstead Museum beyond. The site is bounded to the south by No 6 Well Walk and garden with residential properties beyond and Willow Road beyond that. The house and adjacent properties are in good structural condition as comensurate with being in a conservation area.

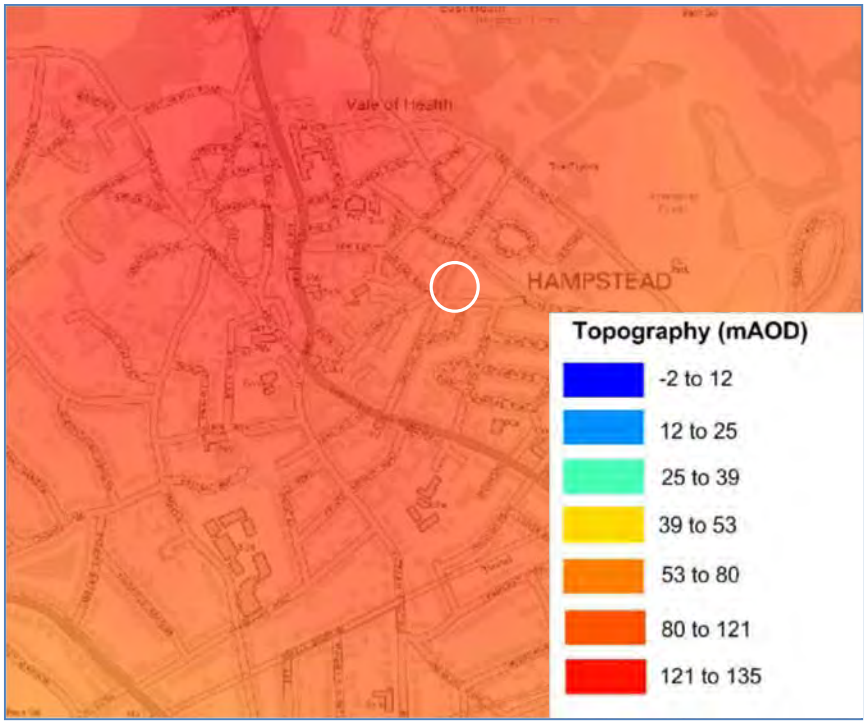


Figure 1B Topography

The site lies at National Grid Reference 526664^{E} 185918^{N}. All land on the site is relatively level. The topography of the local area is a height of 95m above OD. At a distance of 50m to the south east, the ground level is 87.5m above OD, indicating a ground slope of 1 in 5. There are no cuttings, embankments or retaining walls in the local vicinity.

Roof drainage from the existing property is taken via down pipes into a drainage system in the front of the property which is understood to run north to south collecting drainage from the adjoining properties.

Figure 2 Site Plan

2.2 Existing and Proposed Development

The existing house has a partial basement beneath the north side of the house with limited headroom and with a maximum width of 1.645m in the rear third of the basement. The basement height is 1.460m at its highest. The floor is concreted and the walls are brick construction.

It is proposed to extend the basement beneath the full footprint of the existing house and across its full width, with an increased head height of 2.30m. No 6 Well Walk already has an inhabited basement and the party wall between No 6 and No 8 is already underpinned. The party wall with No 10 will require underpinning subject to Party Wall Award.

It is proposed to construct a new lightwell at the front of the house with traditional sash windows to match the windows above.

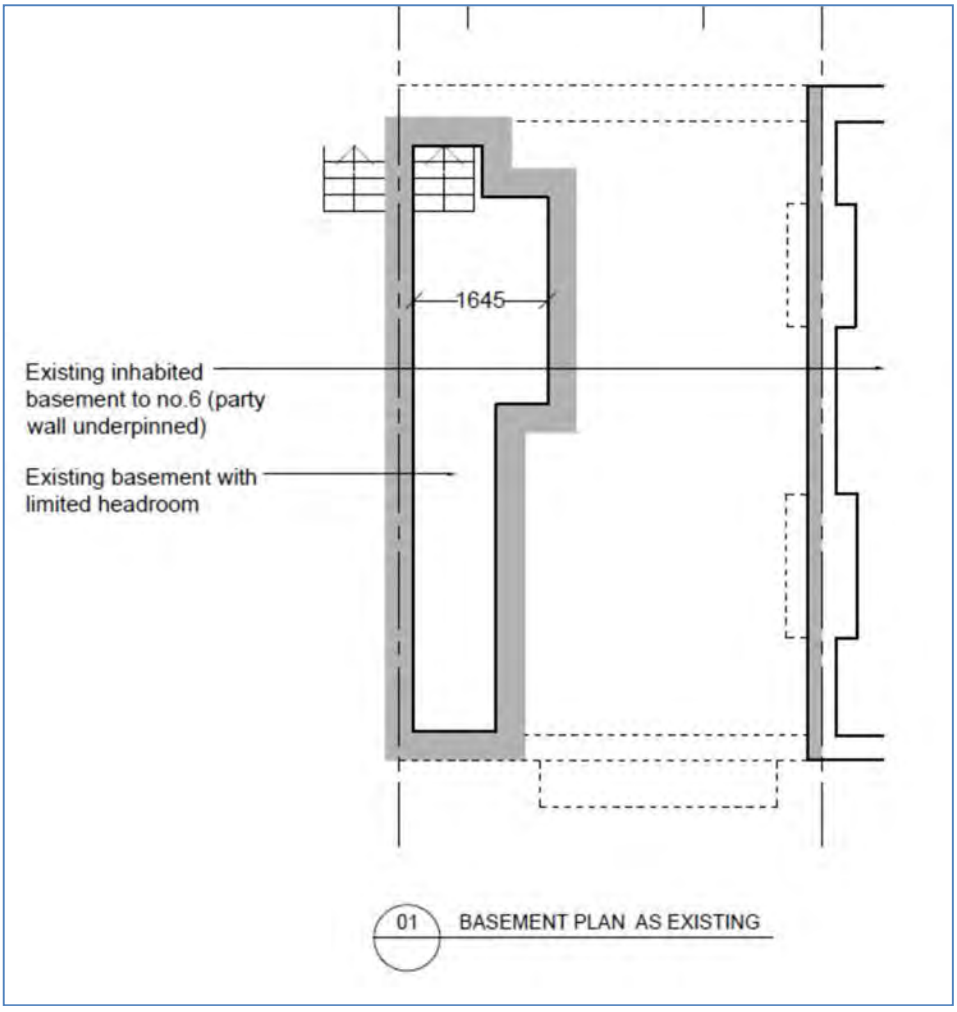


Figure 3A Existing Basement Floor

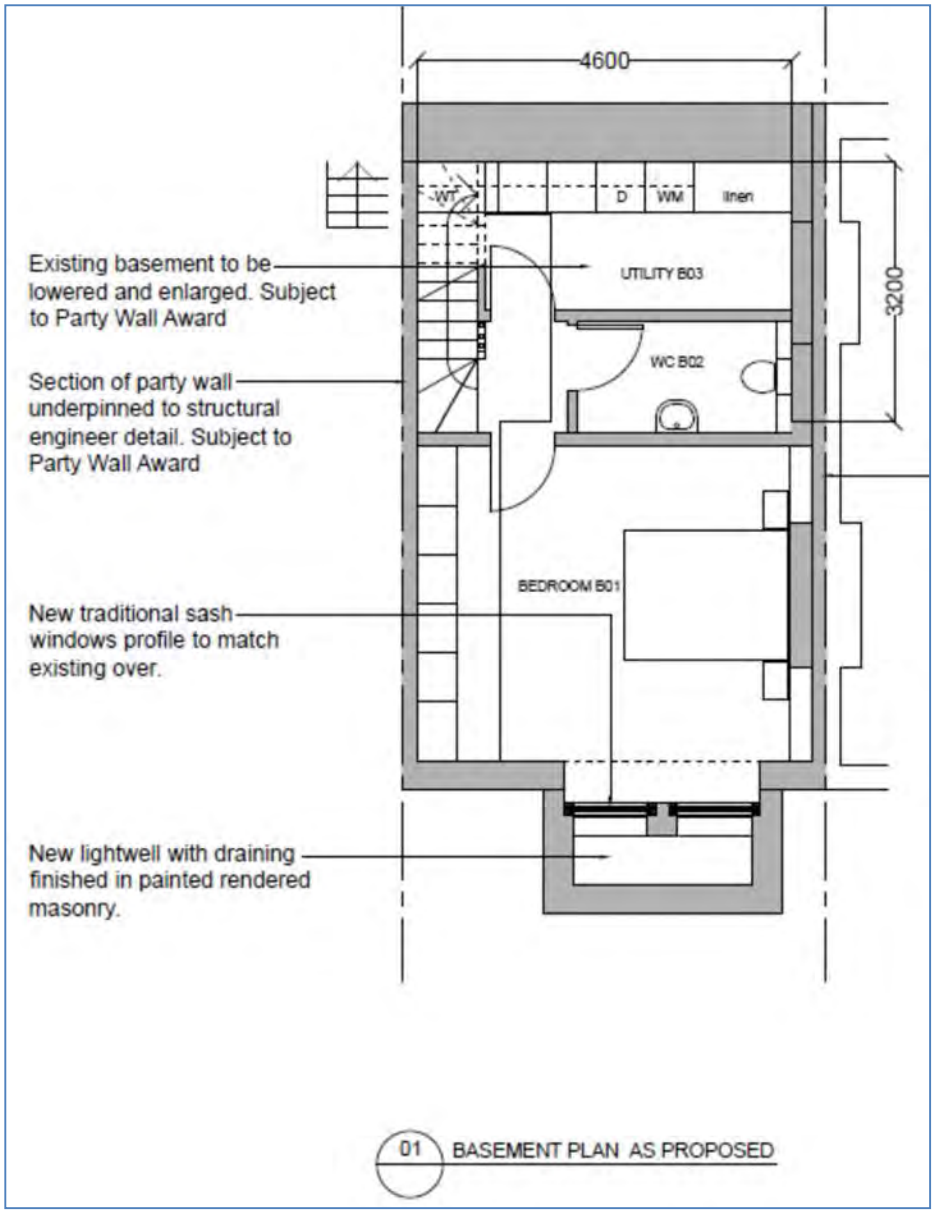


Figure 3B Proposed Basement Floor

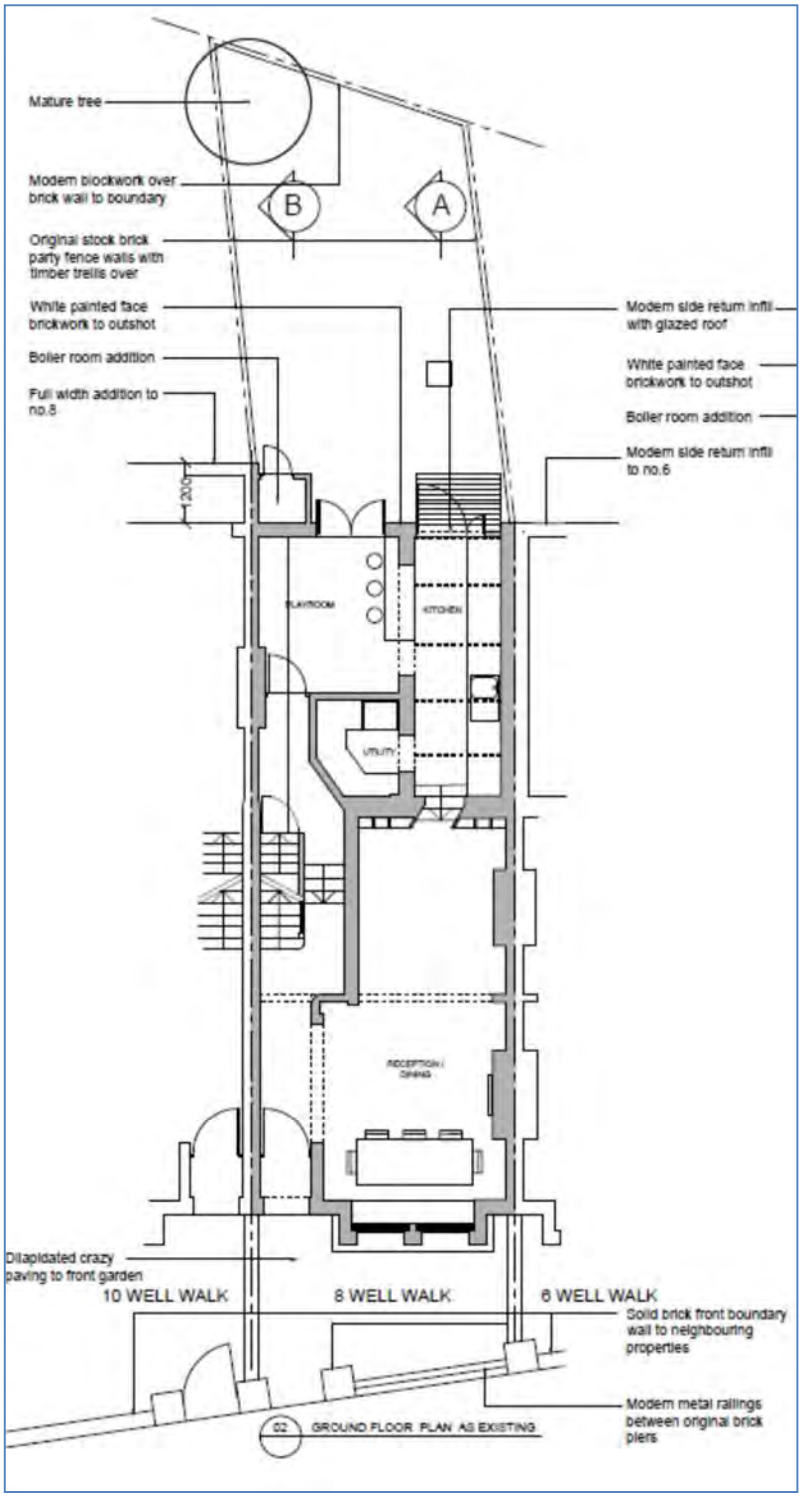


Figure 4A Existing Ground Floor

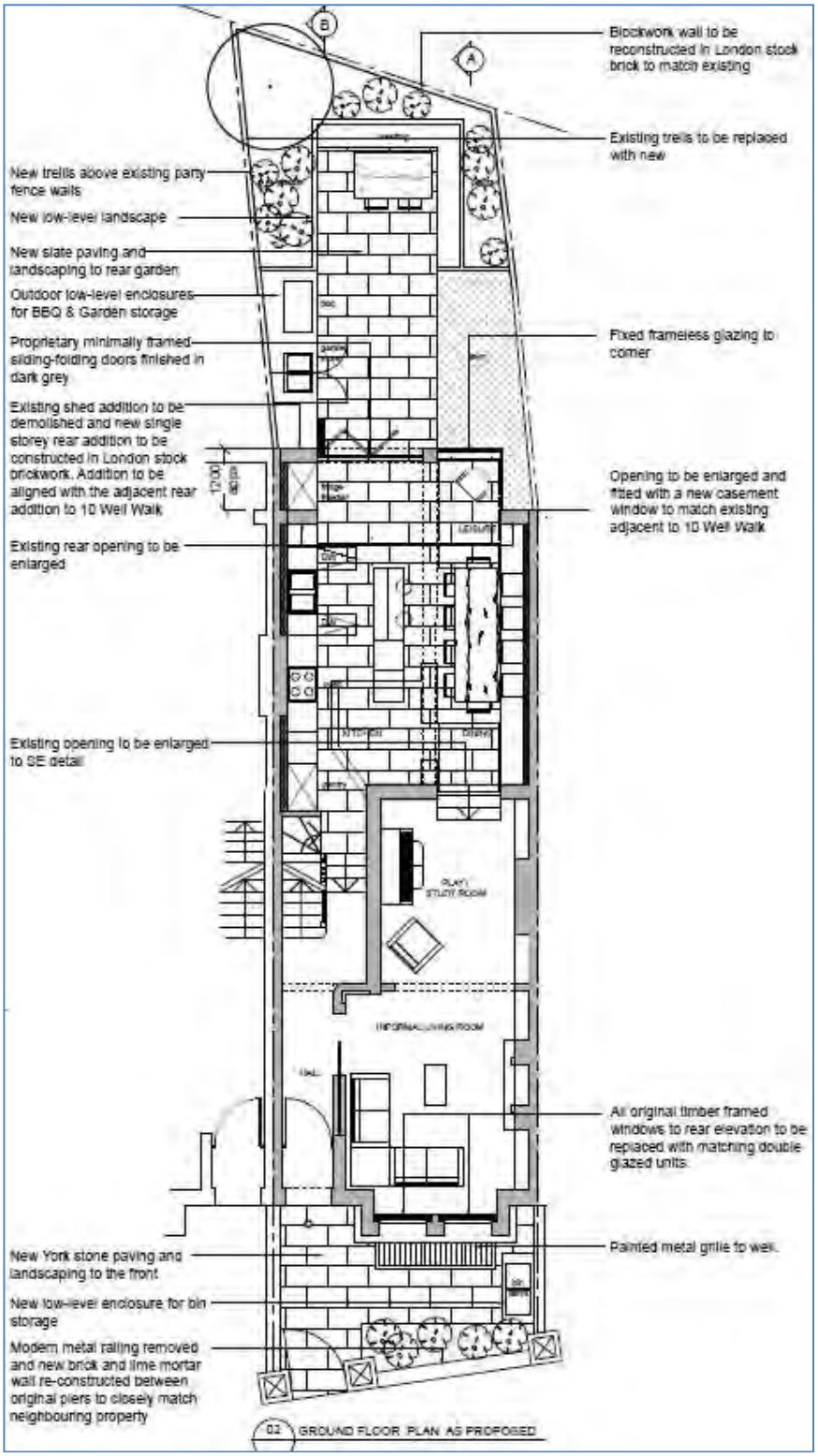


Figure 4B Proposed Ground Floor

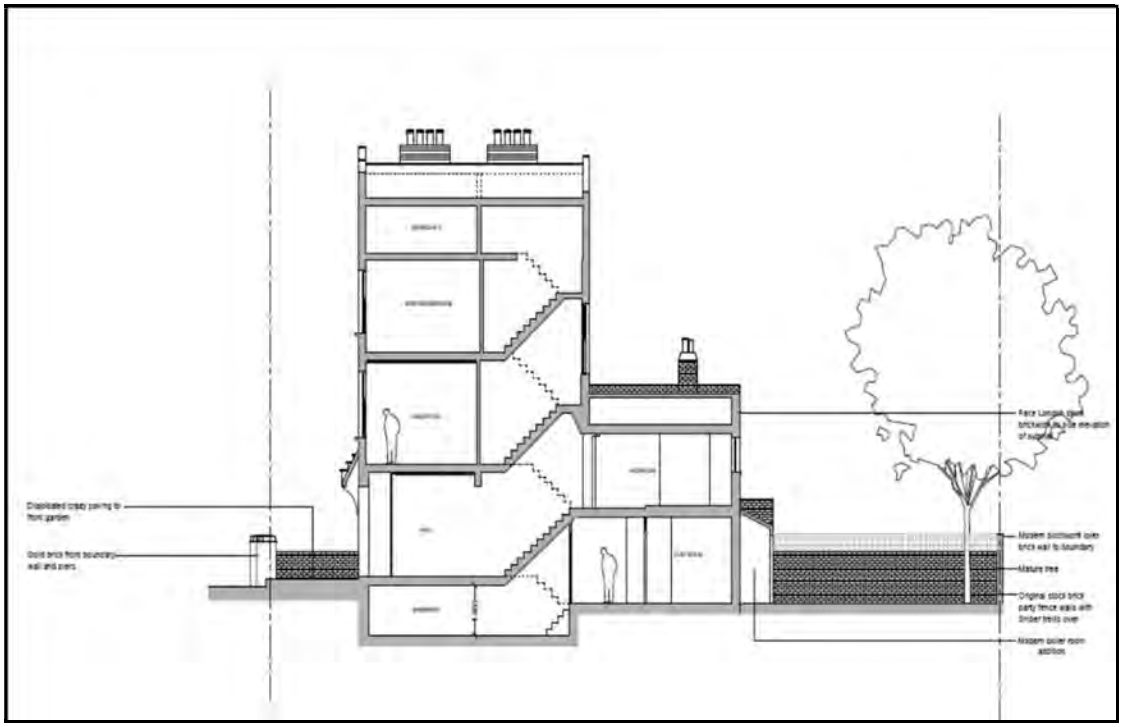


Figure 5 Section as Existing

It is also proposed to construct a ground floor extension by 1.20m to align with the extension to No 10 Well Walk.

Details of existing and proposed alterations are detailed on the Figures 3A to 6 inclusive.

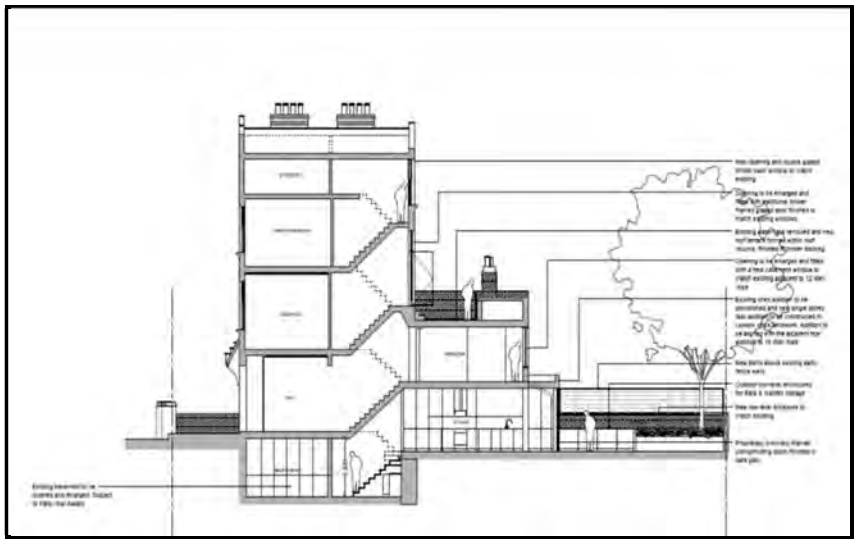


Figure 6 Section as Proposed

3 SITE HISTORY, HISTORIC AND CURRENT LAND USE

3.1 Archival Maps

The following maps and plans were inspected to assess the history of the site and its past environments. The archival Ordnance Survey maps are presented in Appendix B.

TABLE 1
Historical Maps Inspected

DATE	SCALE	DESCRIPTION	
		SITE	SURROUNDING AREA
1870, 1871 & 1873-4	1:2,500 1:1,056 & 1:10,560	The site is occupied by Militia Barracks during this time and more specifically the central court yard. No buildings occupy the site area.	The surrounding area are militia barrack buildings surrounded by residential properties to the north, west and south. Hampstead ponds are located to the far east of site. Several wells and local water features are annotated. Well Walk is constructed to the west of site, however it is annotated as Weatherall Place. Willow Road is annotated to the south.
1894 & 1896	1:2,500 1:1,056 & 1:10,560	The site is now occupied by the residential building 8 Well Walk	The surrounding area shows a much more populated residential area including the annotation of Well Walk to the immediate west of site.
1915 & 1920	1:2,500 & 1:10,560	No change to the site area.	Further residential development evident to the east of site and in the far surrounding area.
1938	1:10,.560	No significant change.	No significant change to the surrounding area.
1951, 1953 & 1957-8	1:10,560 1:1,250 & 1:2,500	No significant change.	No significant change to the surrounding area of site. Garages are annotated to the west and south west of site.
1965-8 1965 & 1966	1:10,56 1:2,500 & 1:1,250	No significant change.	No change to the surrounding area.
1973-4	1:10,000 & 1:1,250	No change to the site area.	To the immediate north of the property, the building opposite has been converted into a hospital.
1991 & 1986-91	1:1,250	No significant change.	Garages to the west and south west of site are no longer annotated. The surrounding area is predominantly residential.
2002	1:10,000	No significant change.	No change to the surrounding area.
2010 & 1014	1:10,000 & 1:10,000	No significant change.	No change to the surrounding area.

In summary, the site has been occupied by a militia barracks pre 1890. 8 Well Walk has existed on the site area since at least 1894. The surrounding area is predominantly residential.

3.2 World War II Bomb Locations

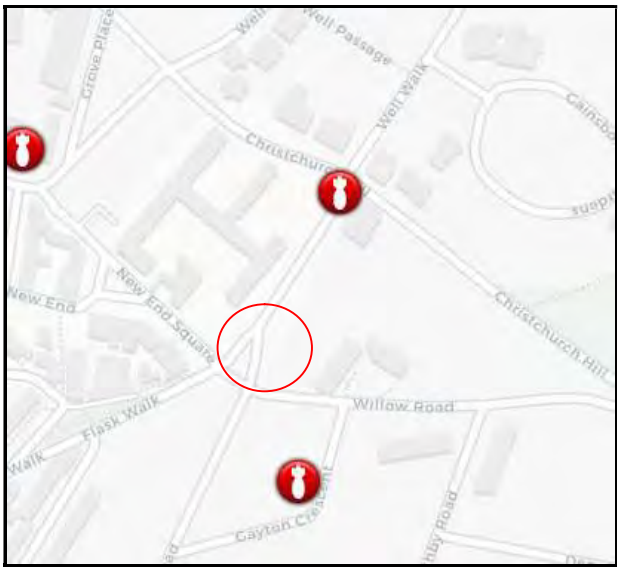


Figure 7 WW2 Bomb Location

The National Image Libraries map of World War 2 bombs shows that there are none that are likely to have affected 8 Well Walk.

3.3 Historic Land Use

Historic Land Use indicates the presence of several areas of infilled land in the form of two ponds located 11m to the south west and 136m, to the north east of site and a gravel pit 194m to the north. In total 24 historical garages and motor vehicle repair centres were located within 250m of the site, the closest being 49-51m west of site, active during the 1950s. 9 historical electricity sub stations are noted to have surrounded the site, the closest situated 46m to the south.

Militia barracks are listed to have occupied the site circa 1873 during which time a gravel pit was located 194m to the north. A hospital was located the west of site between 150m and 163m away, while an unspecified workhouse was located 163-4m to the west.

It is considered unlikely that any of these historical land uses have detrimentally affected the site.

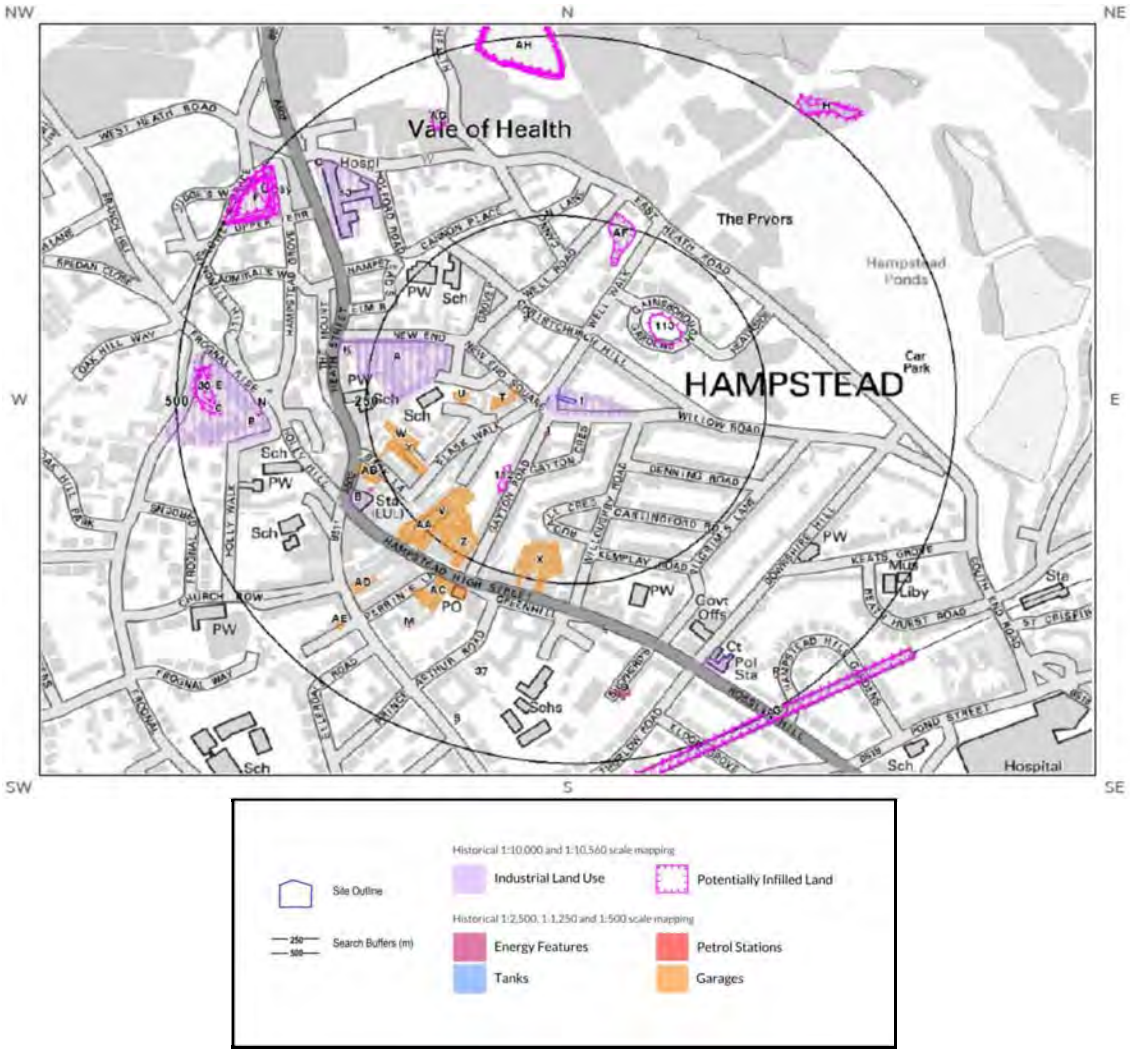


Figure 8 Historic Land Use

Potentially infilled land is annotated within 250m of the site and it is recommended that the site is monitored for landfill gas, and precautions adopted in construction if necessary.

3.4 Current Land Use

Current Land Use within 100m of the site is limited to a couple of electricity sub station 48m to the south and 104m to the north west, a vehicle repair, testing and servicing station 62m to the south east and a chimney located 169m to the west of site. There are records of 12 national grid high pressure transmission pipelines within 500m of the site. The cable is shown in Figure 9 to run along Willow Road to the south of site and up Well Walk immediately west of the site. At its closest the cable is noted to be 3m to the west.

It is considered unlikely that any current industrial land use within the vicinity of the No 8 is detrimentally affecting the site.

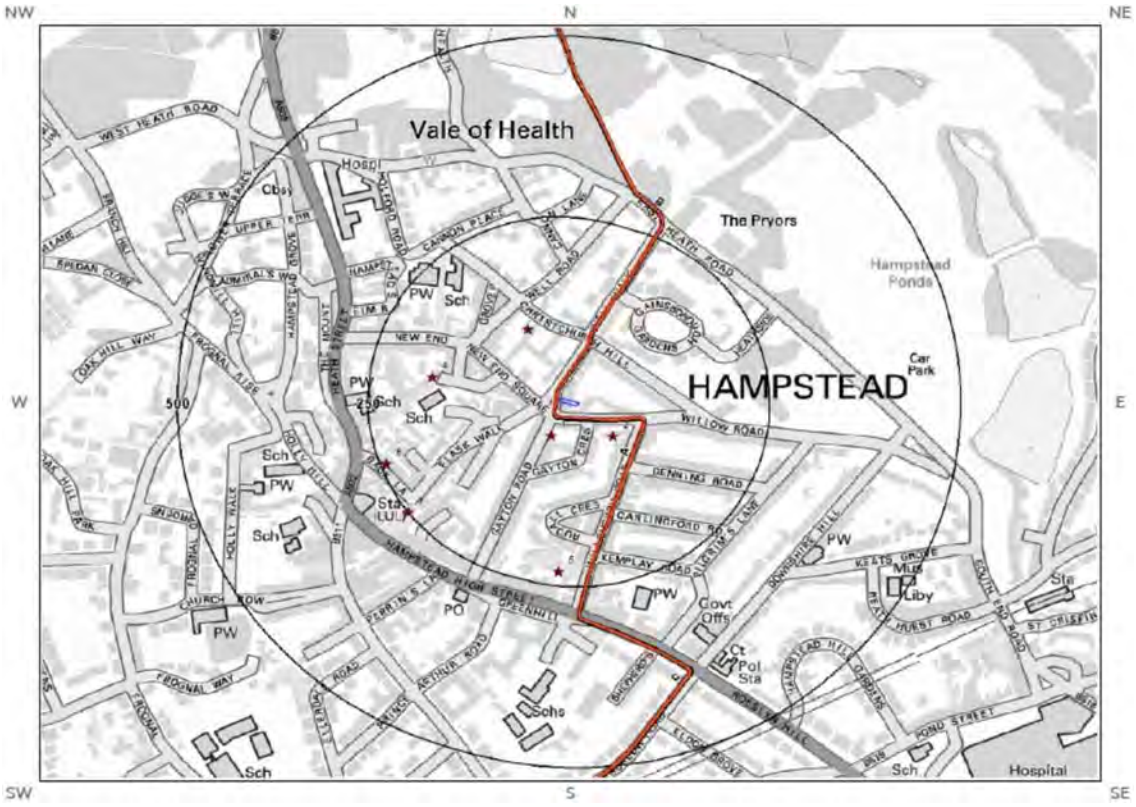


Figure 9 Current Land Use

Further details of the cable and its proximity to the proposed lightwell construction are presented in the services search pack.

4. REGULATED INDUSTRIES AND INFRASTRUCTURE

4.1 Regulated Industries

Results of searches for regulated industries are presented in Table 2.

Table 2
Regulated Industries

Regulated Industry	On SITE	Within 250m	DETAILS
Historic IPC Authorisations	None	None	-
Part A(1) and IPPC Authorised Activities	None	None	-
Water Industry Referrals	None	None	-

Records of Red List Discharge Consents	None	None	-
Records of List 1 Dangerous Substances Inventory Sites	None	None	-
Records of List 2 Dangerous Substances Inventory Sites	None	None	-
Records of Part A(2) and Part B activities and enforcements	None	None	
Records of Category 3 or 4 Radioactive Consents	None	None	-
Records of Licensed Discharge Consents	None	None	-
Records of Planning Hazardous Substance Consents and Enforcements	None	None	-
Records of COMAH and NIHHS sites	None	None	-
Records of National Incidents Recording System List 2	None	None	
Records of National Incidents Recording System List 1	None	None	-
Records of sites determined as contaminated land under Section 78R of EPA 1990	None	None	-
Records of Made Ground	None	Yes	3 areas of infilled ground within 250m
Records from EA landfill Data	None	None	-
Records of Operational Landfill Sites	None	None	-
Records of EA historic landfill sites	None	None	-
Records of non operational landfill sites	None	None	-
Records of local authority landfill sites	None	None	-
Records of operational and non operational waste treatment, transfer or disposal sites	None	None	-
Records of EA licensed waste sites	None	None	-
Current Industrial Land Use	None	7	48m S, 104m NW and 229m S of site. Electricity Sub Station 62m SE of site. Vehicle Repair, Testing and Servicing 104m NW of site. Electrical Features 169m W of site. Chimney 242m W of site. Leather Products 250m SW of site. Construction and Tool Hire.
Petrol and Fuel Sites	None	None	-
Underground High Pressure Oil and Gas Pipelines	None	None	-
NG High Voltage underground Electricity Transmission Cables	None	8	3m W, 4m W, 5m W, 48m N, 51m N and 55m N of site
Residential Property (within 250m)	Yes	Yes	Residential to the west, east, north and south
Radon Protection Required	No	-	The property is not in a Radon Affected Area, as <1% of properties lie above action level.

Results of searches for regulated industries, pollution incidents or registered authorisations are presented in Table 2 above and indicate that potentially contaminative land uses are not present on and within close vicinity to the site and there are no records of an environmentally sensitive nature which could be detrimentally affected by the extension of the basement.

4.2 Infrastructure

There is no known major infrastructure beneath the site or within 250m of the site area, as detailed on Figure 10.

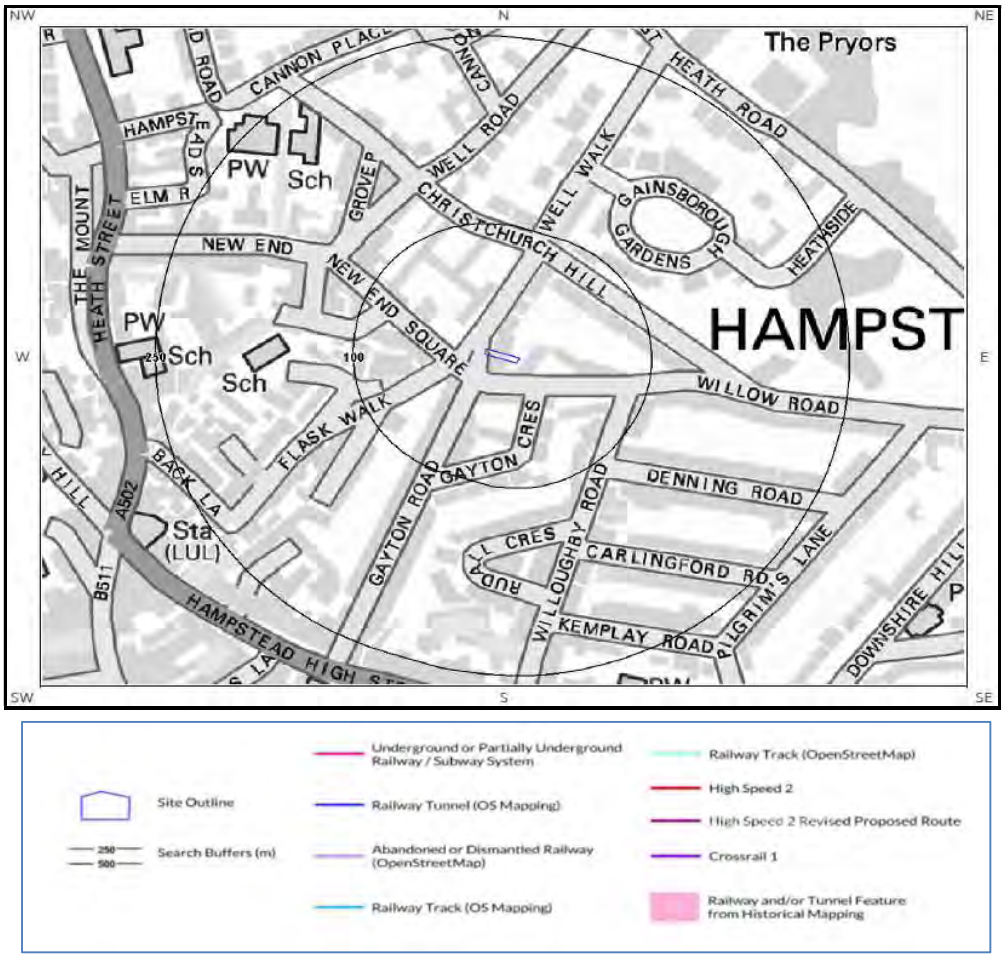


Figure 10 Infrastructure

5. LANDFILL AND RADON

5.1 Landfill

According to the Environment Agency there are no landfill sites within 1000m of the site. Potentially infilled land lies <250m to the west of the site.

Gases emitting from landfill sites rarely travel more than 250m in the strata and therefore there is considered a low risk from toxic gases from this landfill detrimentally affecting the site. However, due to the presence of infilled land within 250m the site was monitored for toxic gases.

5.2 Radon Gas

The site does not lie within a Radon Affected Area as less than 1% of properties are above the Action Level. No radon protection is required for development.

6. ARCHAEOLOGY AND SENSITIVE SITES

61 Archaeology

The site does lie just within the Hampstead Archaeological Priority Area. In accordance with the NPPF and Camden's Local Plan Policy D2, an Archaeological Assessment will be required for a planning application, as the ground will be disturbed.

6.2 Sensitive Sites

The site does not lie within 2000m of a Site of a National Nature Reserve, a Special Area of Conservation, a Special Protection Area, a Ramsar Site, a World Heritage Site, an Environmentally Sensitive Area, an Area of Outstanding Natural Beauty, a National Park, Nitrate Sensitive Area or Green Belt.

Areas of Special Scientific Interest lie 904m, 1110m and 1553m to the north of site, annotated as Hampstead Heath Woods. Ancient Woodland lies 745m to the north west, 909m and 1534m to the north of site, named as Bishops Wood and Ken Wood. The site has a Local Nature Reserve within 1007m of the site to the south east, Belsize Wood. The site does not lie within a Nitrate Vulnerable Zone.

The development of the basement is unlikely to detrimentally affect any local sensitive sites.

7. POTENTIAL CONTAMINATION

With the exception of made ground that may have been associated with construction of the surrounding barracks or residential development, the historical map search has not identified any potential sources of contamination that could be present on or in the near vicinity of the site.

A search of environmental databases via an EnviroInsight report (provided by Centremaps) did not reveal any offsite sources of contamination that are considered likely to pose a risk to the site and the proposed development. It was considered prudent to undertake screen tests for contamination for Health and Safety for workmen.

8. SITE GEOLOGY

8.1 Geology

The published 1:50,000 scale British Geological Survey (BGS) geological map of the area (Sheet 256 "North London") shows the site to be underlain by bedrock of the Claygate Beds, consisting of clay, silt and sand. The Claygate Beds are the youngest part of the London Clay Formation and form a transition between the clay and the overlying sandier Bagshot Beds. This is underlain to depth by the clay horizon of the London Clay Formation (around 80m thick in this area) of the Eocene geological epoch.

There are no superficial deposits underlying the site. Extracts of the BGS Geological Maps are provided in Figures 11 and 12 below.

Figure 11 Superficial Deposits Geological Plan

It was recommended that boreholes should be sunk on the site before development proceeds, to determine the sequence of strata and the thickness and strength of the strata in order to enable recommendation for allowable bearing capacity and to enable design of depth of foundations and floor slabs for the proposed development.

The Claygate Beds generally comprise clay, silt and sand horizons and the London Clay is generally of medium strength silty often sandy with selenite crystals and very thin bands of siltstone.

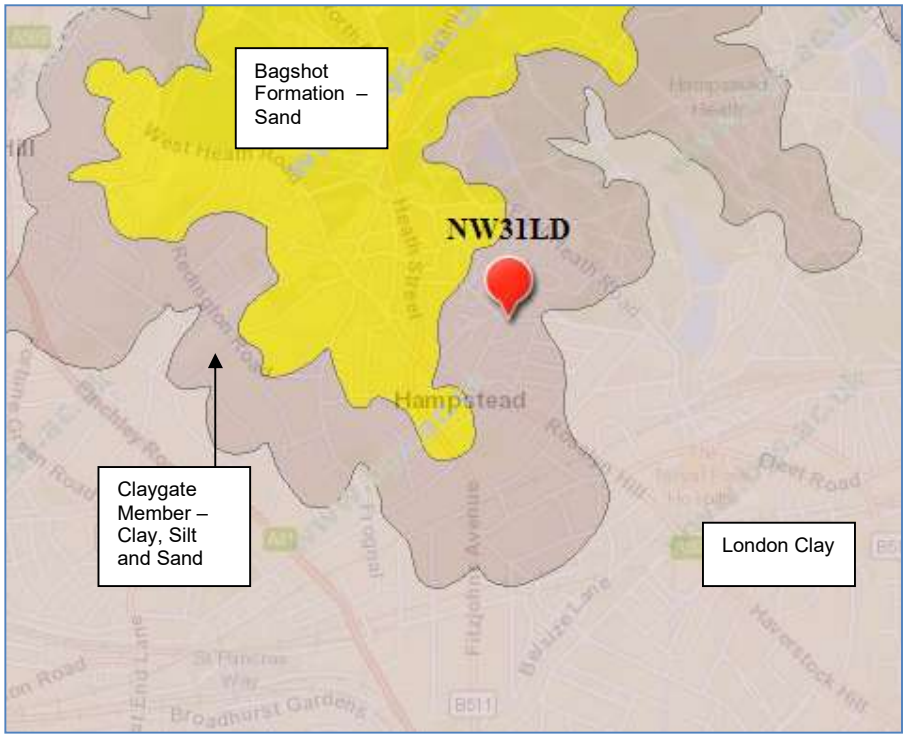


Figure 12 Bedrock Geological Plan

No geological faults are shown to be present within close proximity to the site.

8.2 Mining

There is no evidence of past or present mining or quarrying activity in the vicinity of the site. The site does not lie in a mining area for coal, tin, gypsum, chalk, stone or other recorded mineral works.

8.3 Landslips

The site is designated by the British Geological Survey as at a very low risk of a landslide as shown in Figure 13. The ground on site slopes at < 3 degrees to the horizontal. The risk of a landslip is very low.

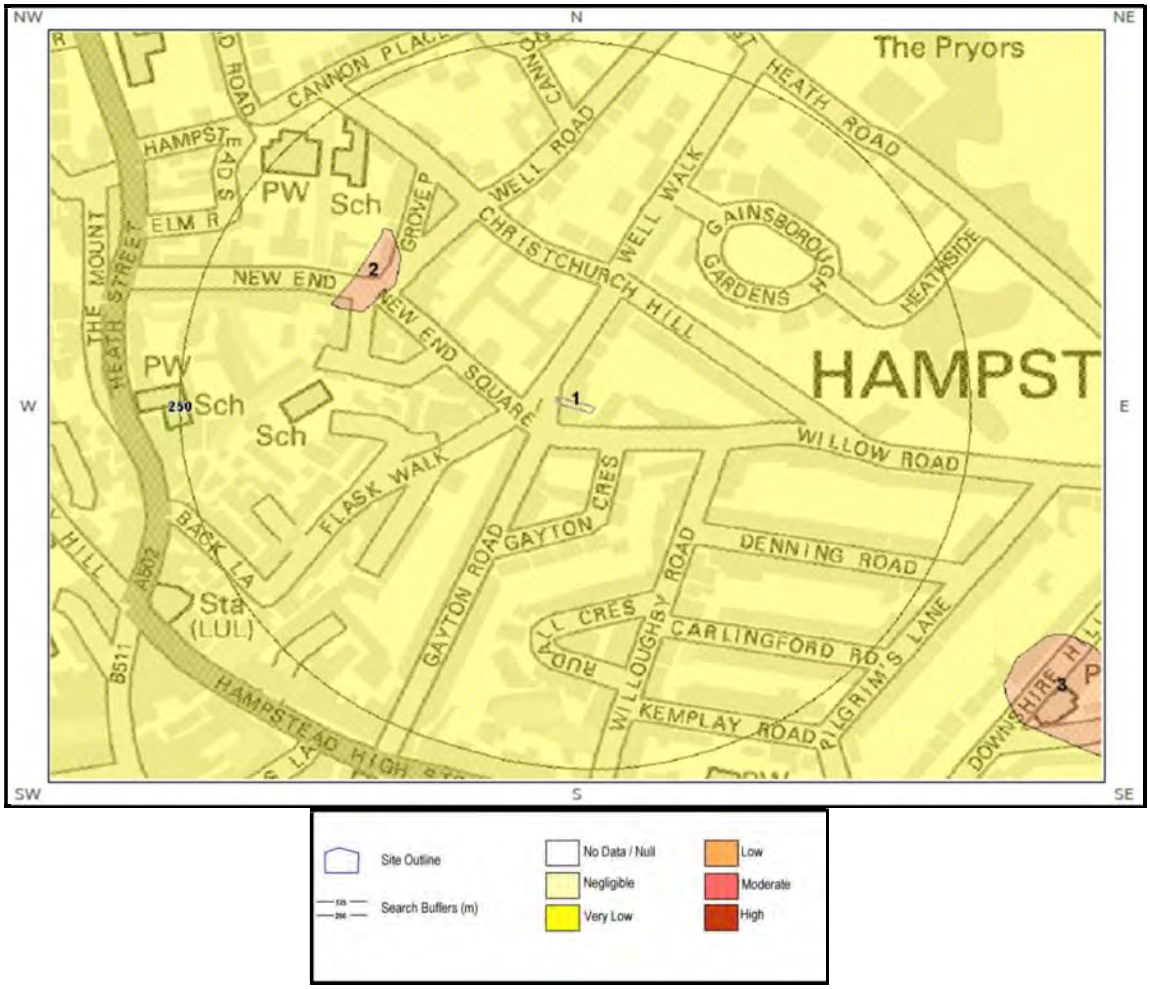


Figure 13 Risk of Landslips

8.4 Local Boreholes

A number of relevant available historic borehole logs have been obtained from the BGS and are summarised in Table 3 below. A plan showing the available local borehole locations is presented in Figure 14.

TABLE 3
Summary of Historical Borehole Logs

BGS Reference	Depth bgl in m	Brief Summary of Ground Conditions	Water Level
TQ28NE97	12.19m	GL – 1.22m Made Ground 1.22m – 4.57m Sandy Clay 4.57m – 10.67m Stiff silty clay 10.67m – 12.19m Silty Sand	Water found at 6.09m
TQ28NE6	182.88m	GL – 2.13m Made Ground 2.13m – 107.6m London Clay 107.6m – 125.88m Woolwich & Reading Beds 125.88m – 135.33m Thanet Sand 135.33m – 182.88m Chalk	-
TQ28NE449	135m	GL – 0.5m Made Ground	Water level recorded at

BGS Reference	Depth bgl in m	Brief Summary of Ground Conditions	Water Level
		0.5m – 125m London Clay 125m – 135m Thanet Sands	5m bgl, however likely to have risen up after drilling through Thanet Sand.

These boreholes confirm the geology of the area surrounding the site.

Figure 14 Local Borehole Plan

8.5 Engineering Geology

The Claygate Beds and the underlying London Clay usually provide good bearing strength for low rise housing. For the partial excavation of a basement it will be necessary to determine the nature of the strata beneath the site and undertake in situ strength tests for design of allowable bearing capacity, and type, and depth of foundations for the basement extension.

The Claygate Beds and the underlying London Clay may shrink and swell under varying moisture contents. The BGS classify the potential for clays to shrink and swell as moderate,

as shown in Figure 15. Plasticity tests were therefore undertaken to assess this potential on the site.

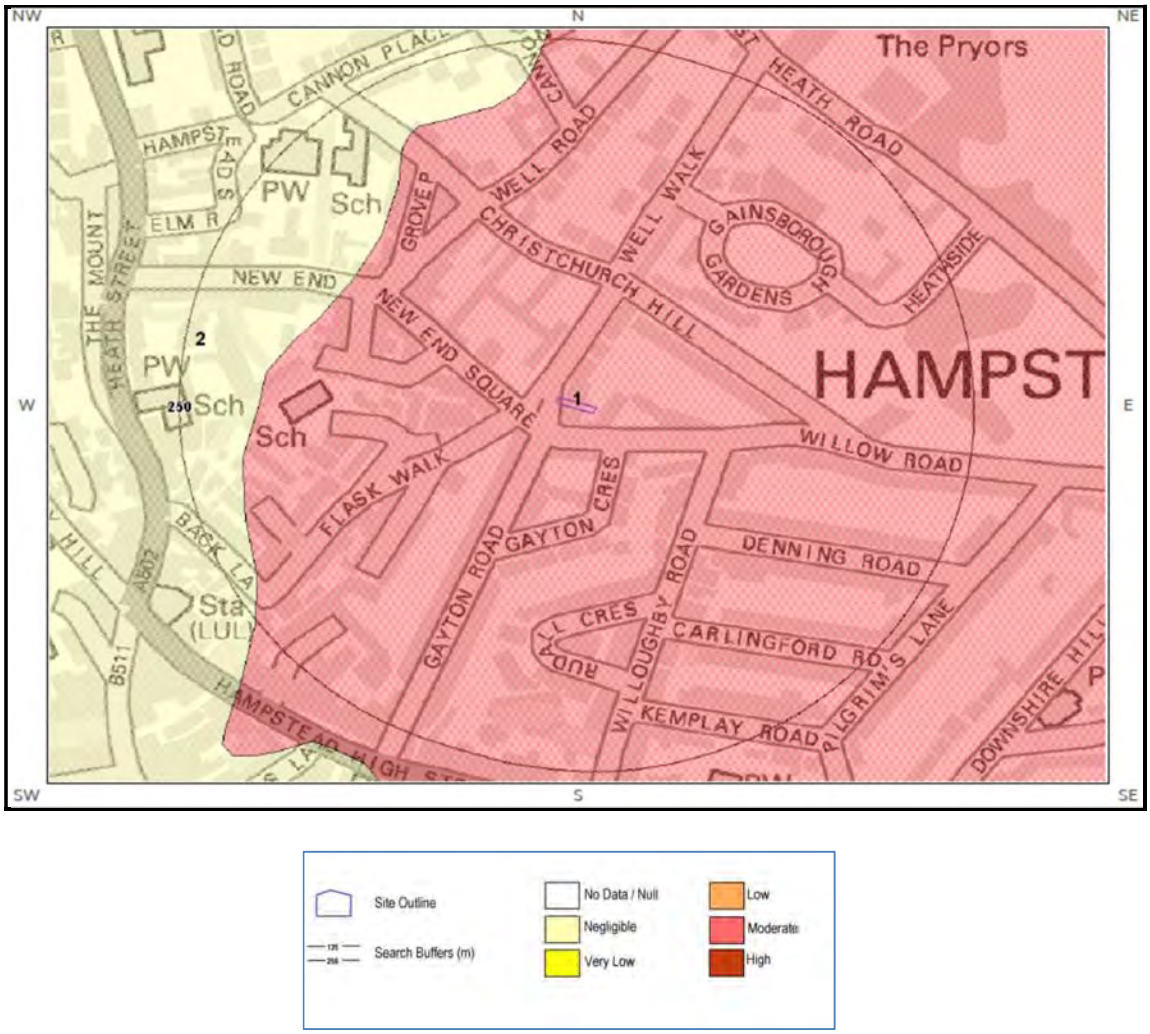


Figure 15 Potential for Clay to Shrink and Swell

8.6 Summary of Site Setting and Geology

The site lies within a residential conservation area and in an Archaeological Priority Area.

Historic and Current land uses are unlikely to have detrimentally affected the site. The risk of the site being contaminated is low and the basement construction is unlikely to detrimentally affect any sensitive sites or be detrimentally affected by any regulated industries.

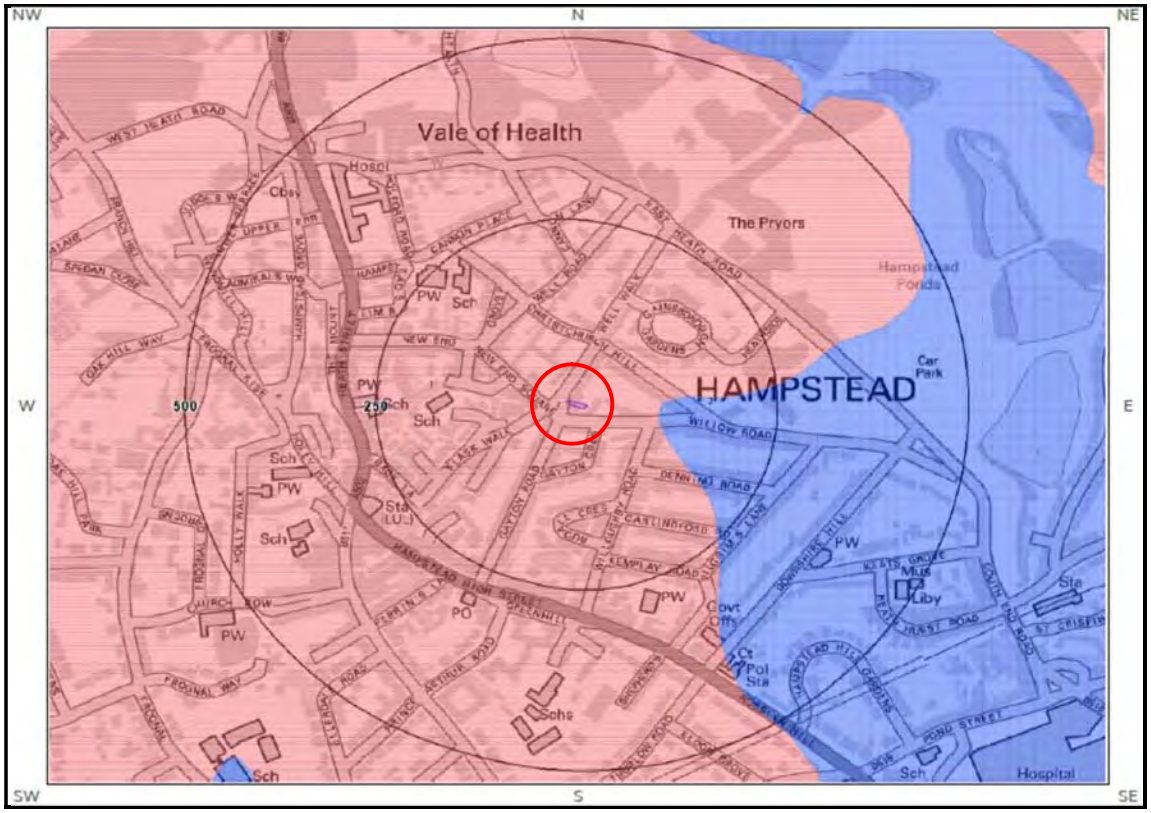
The site is underlain by the Claygate Beds with potential perched water table which are in turn underlain by the relatively impermeable London Clay.

9. HYDROGEOLOGY
9.1 Aquifers

The geological map indicates the site to be underlain by the Claygate Beds, overlying the London Clay. Both strata are relatively impermeable and while the London Clay classified as unproductive, the Claygate Beds classify as a Secondary (A) Aquifer. A Secondary (A) Aquifer is defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Therse are generally aquifers formerly classified as minor aquifers. Superficial deposits do not underlie the site. The Environment Agency have designated the London Clay beneath the Claygate Beds on the site as “Unproductive” which means the strata have a low permeability and negligible significance to water supply or base flow to rivers. Permeability of the London Clay varies from 5 x10^{-6} to 1 x10^{-10}m/sec. (BS 8004, 1986). The site does not lie on a Groundwater Vulnerability Zone.

The natural soils underlying the site are likely to comprise a superficial covering of made ground (potentially absent) overlying Claygate Beds, overlying London Clay (clay soils). The London Clay has very low permeability and does not readily permit the downwards transfer of surface water or percolating groundwater while the overlying Claygate Beds have a limited potential to permit downwards transfer of surface water. The sand bands in the Claygate Beds and thin siltstone bands in the London Clay may hold small volumes of water.

Standpipes were installed in boreholes in order to determine the water levels beneath the site to determine any groundwater flows and the requirement for sump pumping or dewatering during construction.



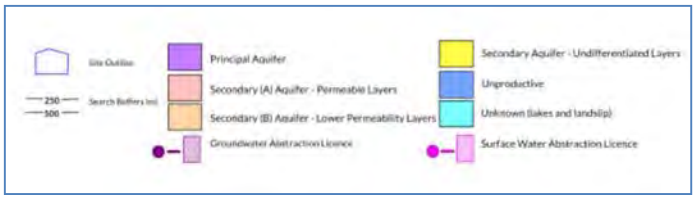


Figure 16 Hydrogeology Plan of Bedrock

9.2 Groundwater Depth and Flow

The development of the existing basement is unlikely to detrimentally affect any groundwater in bedrock as the phreatic surface lies > 80m bgl in the Thanet Sands and Woolwich and Reading Beds or underlying Chalk Aquifer.

Water levels were encountered at 6.08m and 5m bgl in local boreholes researched, noting borehole depths at 12.19m, 135m and 182.88m bgl. Water levels may reflect thin pockets of groundwater within Claygate Beds/London Clay or rising water from deeper Thanet Sand. Some boreholes were sunk some years ago and water levels now may be different. It is recommended that monitoring of groundwater levels is undertaken in installed standpipes to determine any shallow water levels and flow. It is expected that a higher water level may be encountered during and after heavy rainfall and therefore sump pumping may be required for construction. The standpipes were monitored initially on a monthly basis to determine groundwater levels. Groundwater should be taken as ground level for structural design as recommended by Eurocode 7.

Groundwater within the Claygate Beds/London Clay is generally contained in isolated thin bands of silt or gravel of limited extent. It would be prudent to waterproof the basement and take into consideration the potential uplift pressures in structural design in case groundwater rises.

No 8 already has a basement and No 6 already has an occupied basement. There is unlikely therefore to be a cumulative effect on groundwater flow and it is unlikely that construction of the basement will alter groundwater flow.

9.3 Abstraction Wells, Wells and Springs

There are no active groundwater water abstraction licenses within 1600m of the site. There are 3 active and 1 historic groundwater abstraction licences between 1600m and 1700m from the site, all located to the south. The site does not lie within or within 500m of a Source Protection Zone for a potable water supply.

There are no springs recorded on the OS maps in the local vicinity. Wells are recorded to the south of the site on the OS map of 1871, indicating perched water may be present in the Claygate Beds.

9.4 Potential for Sustainable Drainage System (SUDS)

Camden's assessment is that the local area is probably compatible for infiltration of SUDS as determined in Figure 17. However based on the clay soils encountered it is unlikely that soakaways will be feasible.

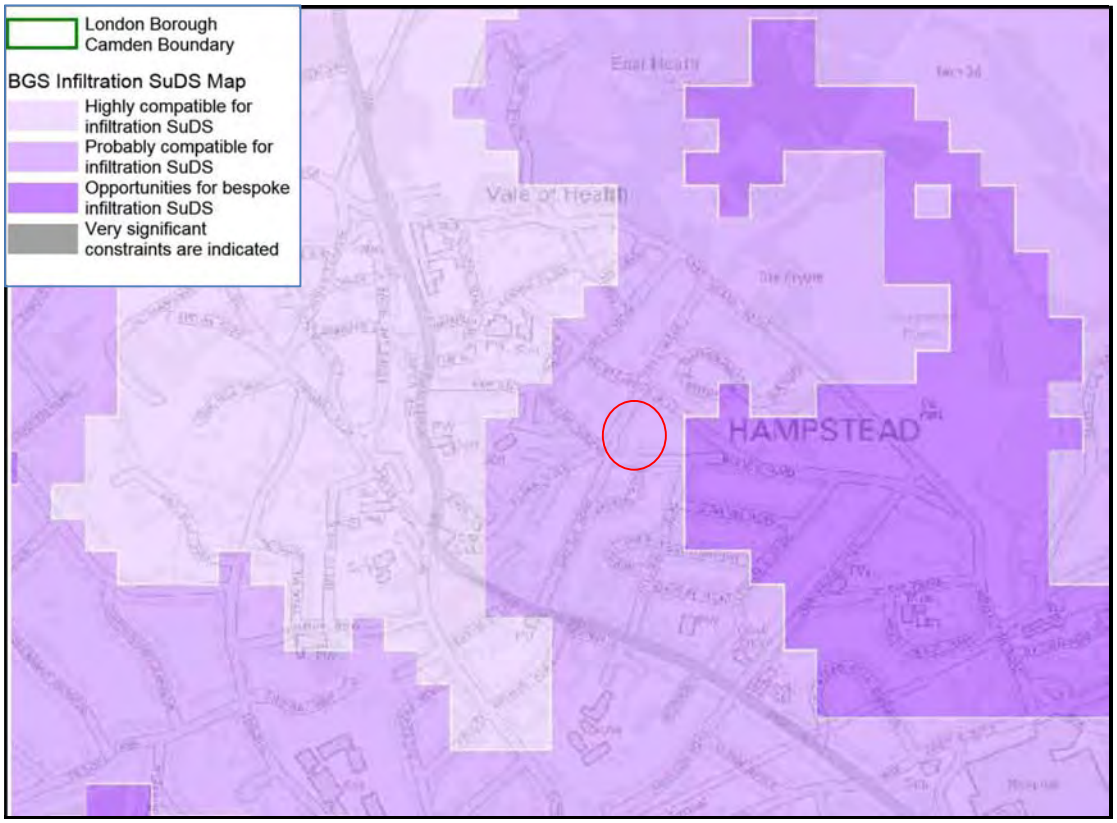


Figure 17 Potential for SUDS

9.5 Summary of Hydrogeology

The phreatic surface lies within strata beneath the London Clay, perched water may be present in the overlying Claygate Beds.

Based on the potential for groundwater within small lenses of water with the Claygate Beds/London Clay, groundwater monitoring was undertaken during the ground investigation. It is considered unlikely however, based on the evidence provided that the addition of a basement extension will detrimentally affect the local hydrogeology.

10. HYDROLOGY

10.1 Surface Water Drainage

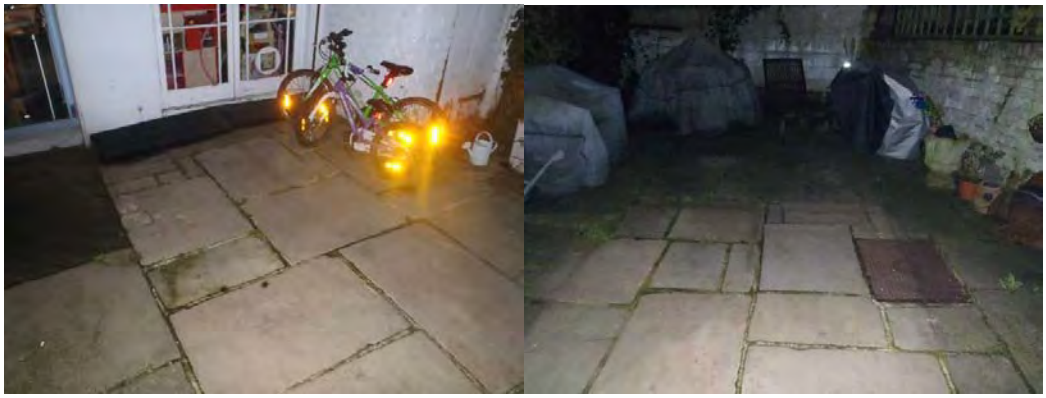
The site does not lie within the Hampstead Chain Catchment or within the Hampstead Heath Extension Chain Catchment Areas, which are 250m to the north east of the site.

Prior to the commencement of the redevelopment of the site, the rainfall over the area of the site drains in one of the following ways:

Surface water from the rear roof drains into the drainage system via underground pipes leading to the front of the site. Surface water from the front roof drains into the drainage system that runs under the front area and to the south of the site. Surface water on the rear

hard covered yard drains and surface water on the front hard covered yard drains into town drains.

On completion of redevelopment the rainfall will drain in the same manner to public drains. Despite development of the basement and ground floor extension, there will be no increase in hard cover and no increase in surface water runoff, as the extension will replace hard cover paving, as illustrated by photos below. Some existing hard cover in the rear yard will be replaced by a lawn.



10.2 Local Rivers

There are no river quality assessments by the Environment Agency within 1500m of the site. The site does not lie within 500m of a canal or a river.

The site is unlikely to be affected or to affect any rivers or canals.

10.3 Lost Rivers

There are no lost rivers within the local vicinity of the site. The basement is unlikely to affect or be affected by any lost/culverted rivers.

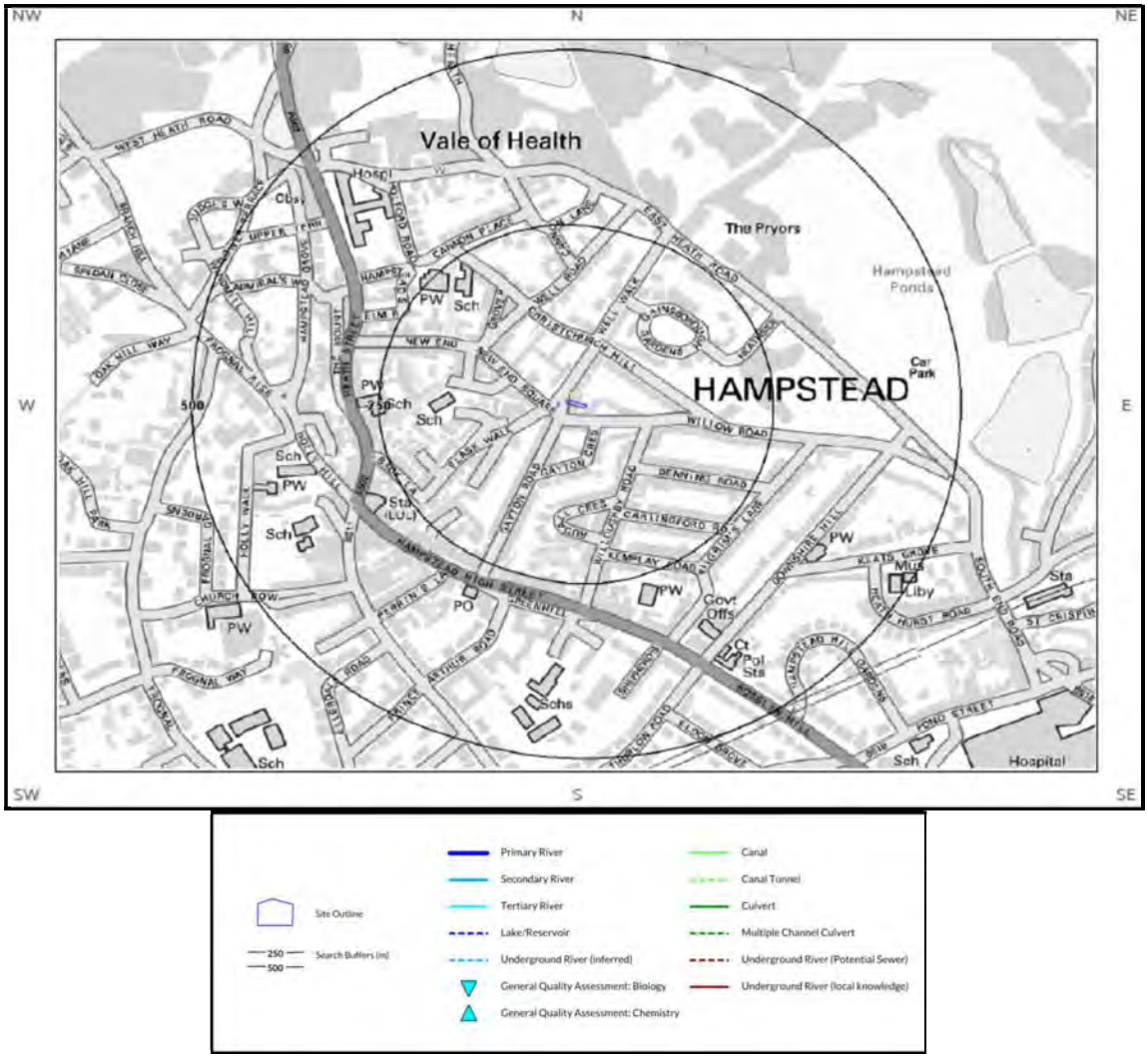


Figure 18 Detailed River Network

10.4 Surface Water Abstractions

There are no surface water abstraction licenses within 2000m of the site.

10.5 Summary of Hydrology

On completion of development the rainfall will drain in the same manner to public drains with no increased surface water runoff. A small lawn will replace hard cover decreasing surface water run off slightly. There are no rivers, canals, ponds, surface water abstractions or lost rivers that could be detrimentally affected or detrimentally affect the basement development.

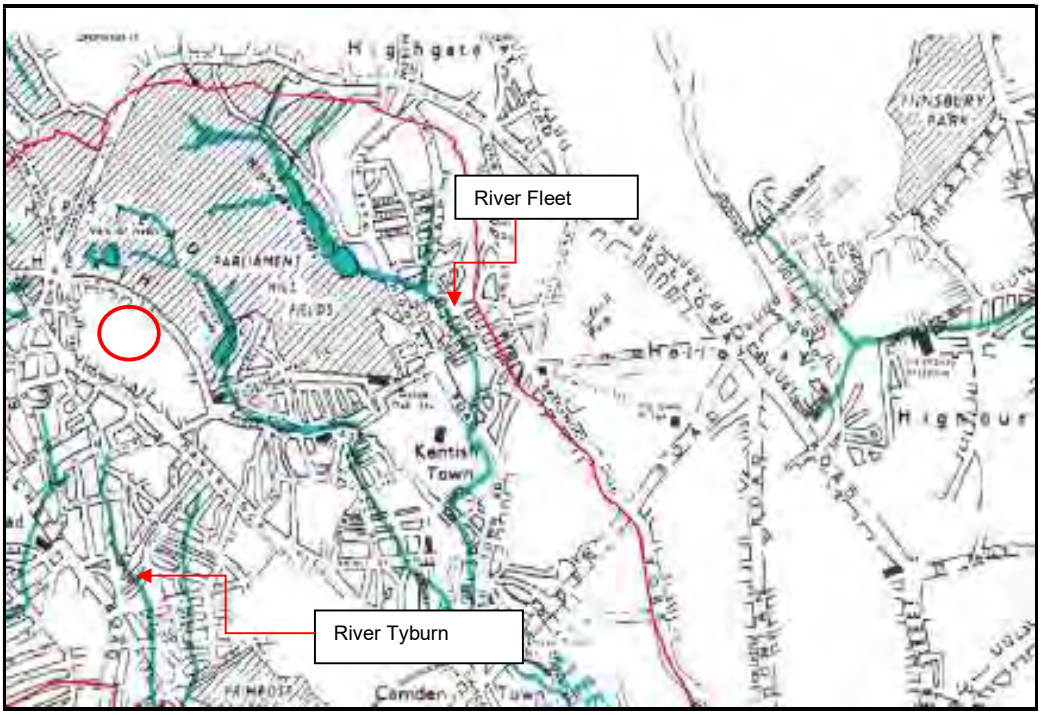


Figure 19 Lost Rivers in Camden

11. FLOOD RISK

11.1 Flood Risk from Surface Water

Camden is at risk from surface water runoff (i.e. rainwater that is on the surface of the ground and has not entered a watercourse, drainage system or public sewer), because pipes have burst or gone beyond capacity due to heavy rainfall. These situations are only likely to occur in extreme rainfall events such as in 2002 when floods occurred in Camden, during which time Willow Road to the south of site was recorded as flooded.

The site does lie in a Critical Drainage Area 3_010, but does not lie within a Local Flood Risk Zone.

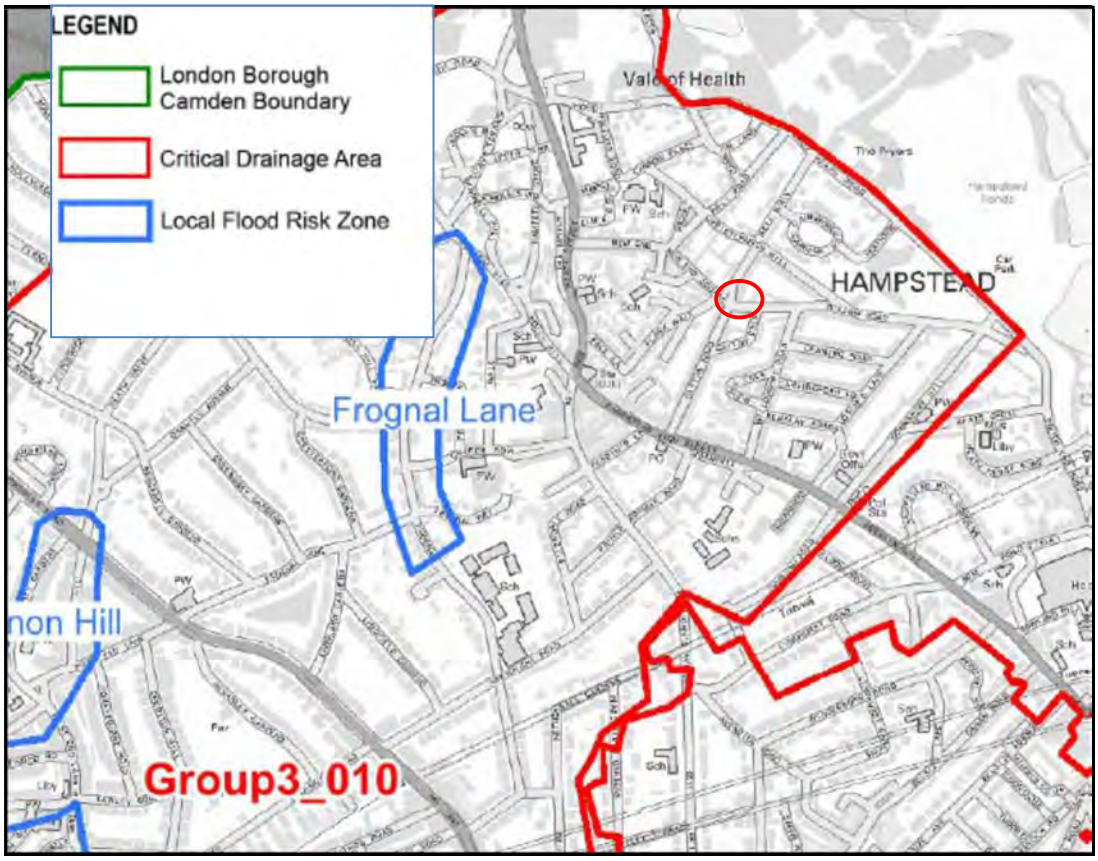


Figure 20 Critical Drainage Areas and Local Flood Risk Zones

Camden are, since publishing the Scrutiny Task Group Report on surface water flooding, aiming to increase clearage of gullies and drains to enable better discharge of water in times of heavy rain fall.

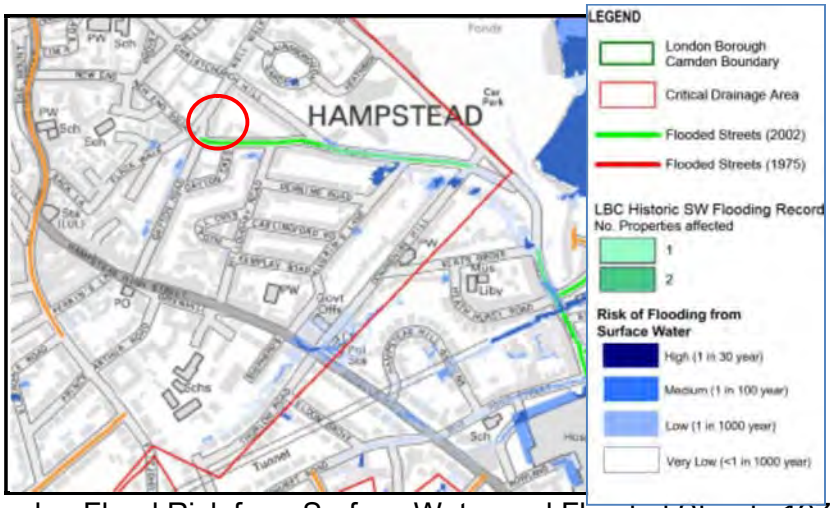


Figure 21 Camden Flood Risk from Surface Water and Flooded Streets 1975 and 2002

The site is recorded as at very low risk of flooding from surface water. Willow Road was flooded in 2002 but not flooded in 1975 and is at low risk of flooding in a 1 in 1000 year event as shown on Figures 21 and 22.

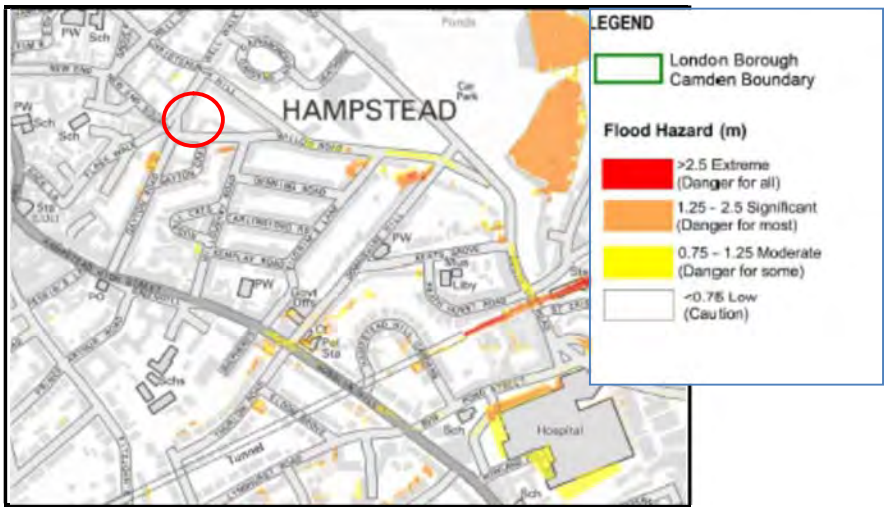


Figure 22 1 in 1000 Year Flood Event

11.2 Flood Risk From Rivers and Seas

The site is shown by the Environment Agency (EA) to not lie within/on the boundary of an area at risk of flooding. The EA indicate a very low risk of flooding from rivers and the sea.

The Flood Zone maps produced by the Environment Agency provide an initial assessment of flood risk. The Flood Zones are divided into four categories of flood probability and do not take into account any flood defences. PPS25 defines the flood zones as:

Zone 1: Low Probability-This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Zone 2: Medium Probability-This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% to 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% to 0.1%) in any year.

Zone 3: High Probability- This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Zone 3B 'The Functional Floodplain' – This zone comprises land where water has to flow or be stored in times of flood.

The site lies within a Flood Zone 1.

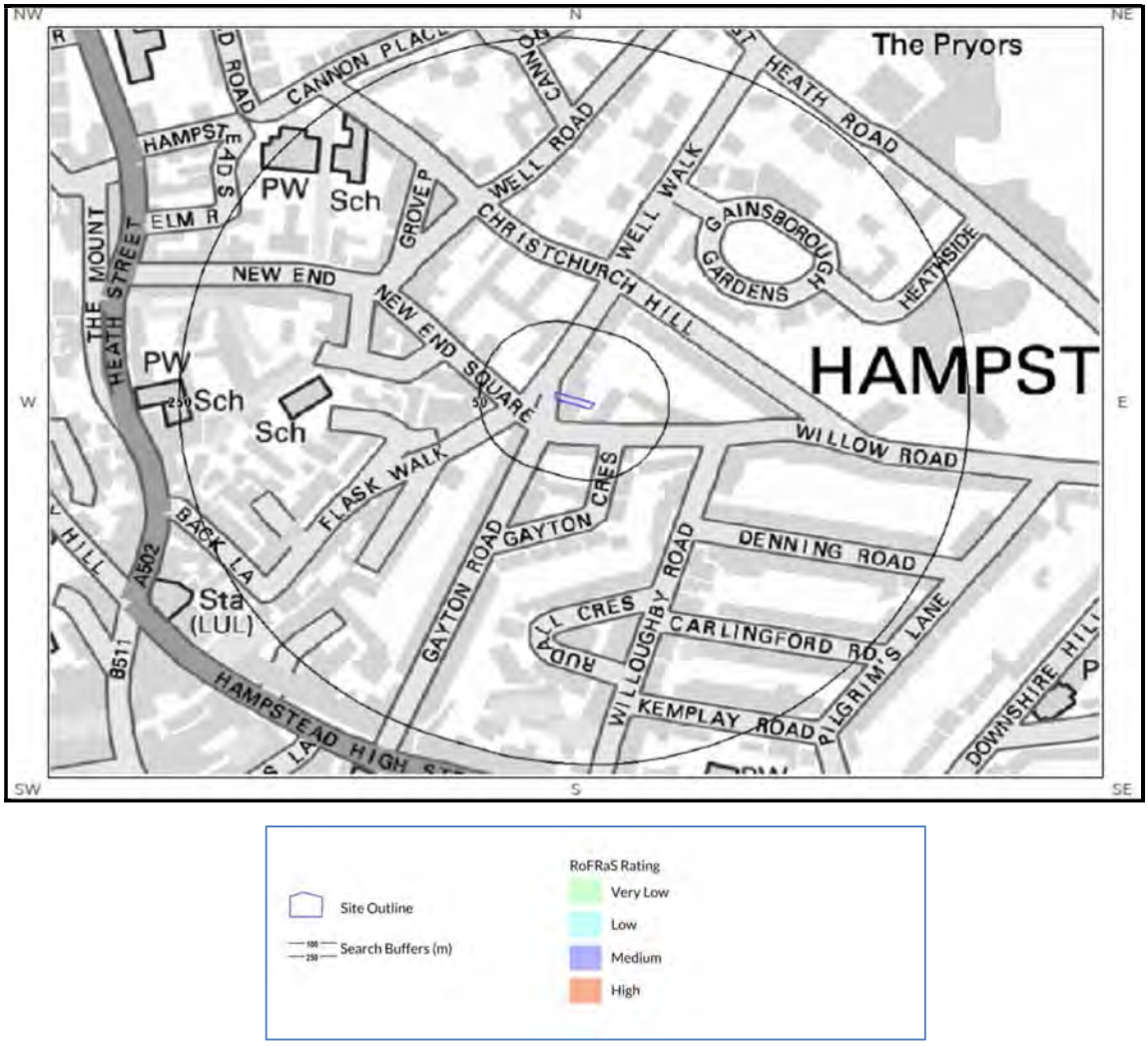


Figure 23 Risk of Flooding from Rivers and Seas

The risk of flooding from rivers and seas (RoFRaS) rating for the site is not a risk as detailed in Figure 23.

11.3 Flood Risk From Reservoirs

The Environment Agency are the enforcement authority for the Reservoirs Act (1975) and all large reservoirs are inspected and monitored by reservoir panel engineers. The risk of flooding from reservoirs is therefore very low. The Environment Agency Reservoir Flood Risk Maps for large reservoirs (>25,000m3) for this area indicate the site is at very low risk of flooding from reservoirs.

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency ensure that reservoirs are inspected regularly, and essential safety work is carried out.

Figure 24 indicates the site is not at risk of flooding from reservoirs, any water flowing within the lower ground of the railway cutting.

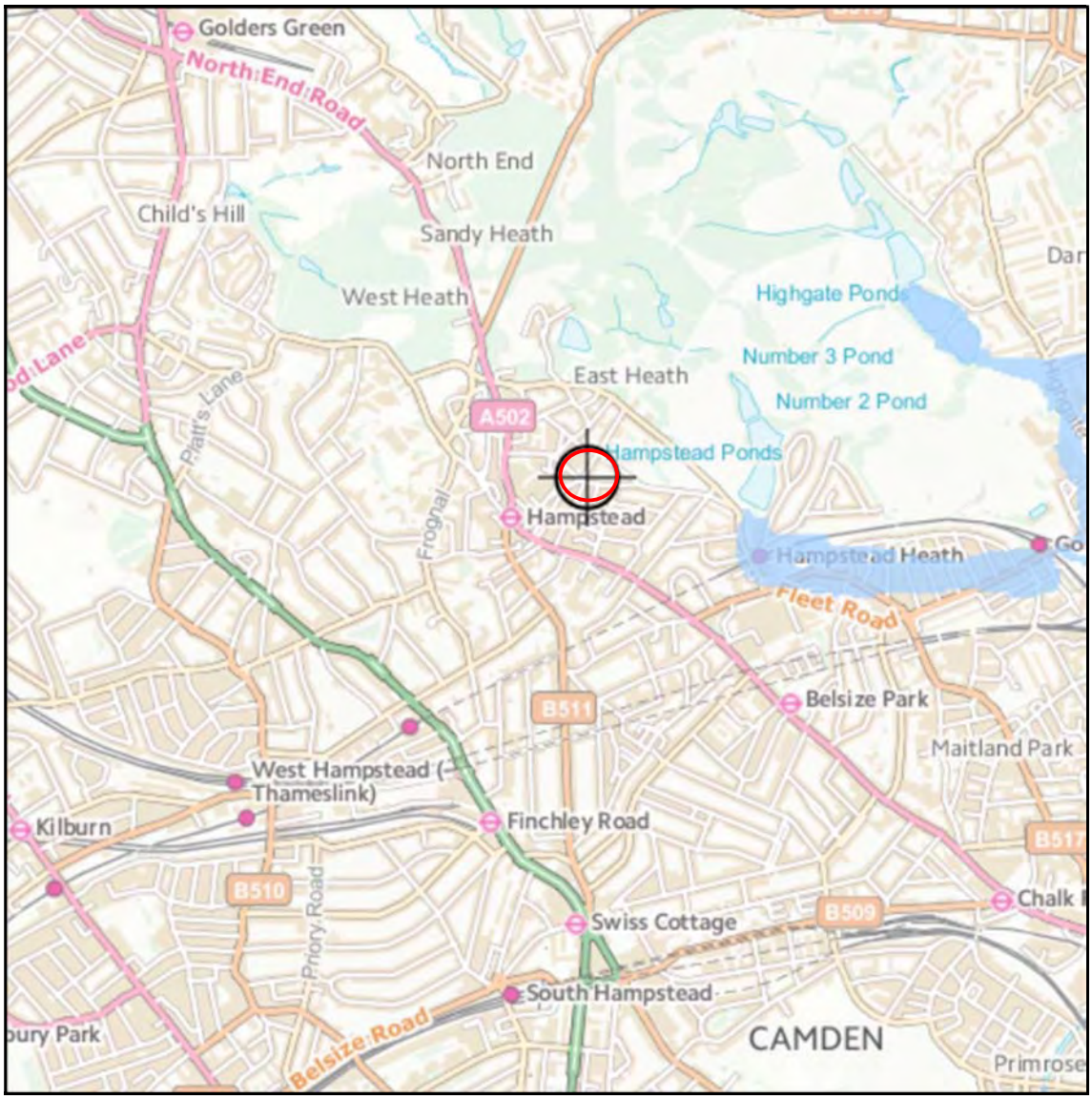


Figure 24 Flood Risk From Reservoirs

11.4 Flood Risk From Groundwater

According to the BGS there are possible Clearwater flooding(unconfirmed aquifers) groundwater flood susceptibility areas within 50m of the site. It is noted that there is a limited potential for this to occur and therefore no action is required.

11.5 Flooding from Sewers

Figure 25 shows an area where 4 properties have been affected by internal sewer flooding and Figure 26 indicates area where 1 property has been affected by external sewer flooding. The site is unlikely to be detrimentally affected by flooding sewers.

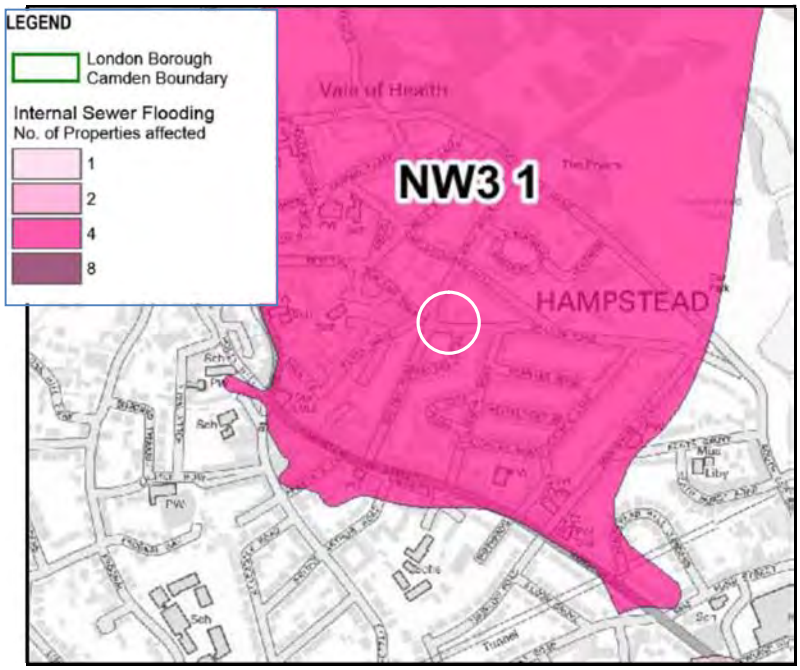


Figure 25 Internal Flooding from Sewers

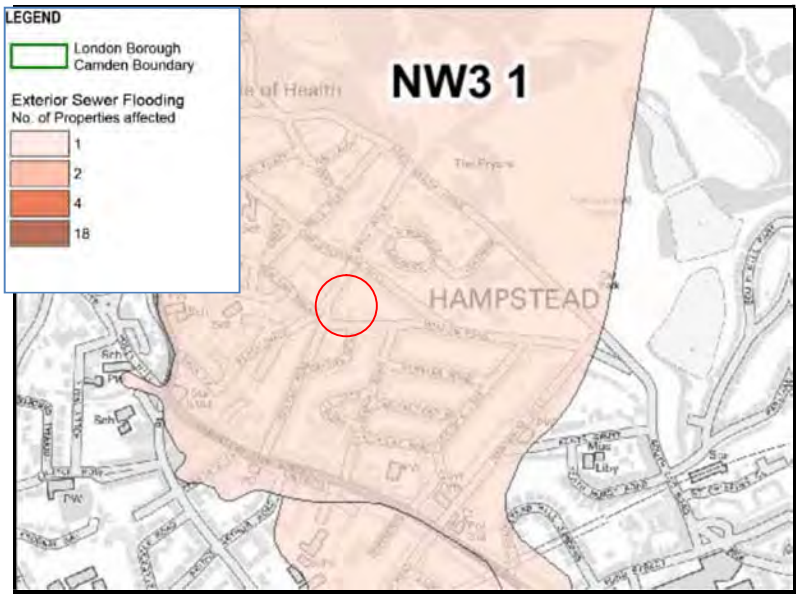


Figure 26 External Flooding from Sewers

11.6 Summary of Flood Risk

According to the historical evidence, Well Walk has not flooded in the past, this site does lie within a Critical Drainage Area but not within a Local Flood Risk Zone. Due to this, it is considered that a site specific flood risk assessment is not required for this site. This is based on the evidence of the lack of a risk of the site flooding from rivers and seas, and lack of risk of flooding from surface water, groundwater, reservoirs and sewers. Mitigation measures against flooding as recommended in Section 13 should be incorporated into the construction as a precaution.

12. SCREENING AND SCOPING

12.1 Screening

Screening is the process of determining whether or not there are areas of concern which require further consideration and / or investigation for a particular project. In order to undertake screening a site characterisation was undertaken in the previous sections. Scoping is the process of producing a statement which defines further matters of concern identified in the screening stage. This defining is in terms of ground processes in order that a site specific BIA can be designed and executed by deciding what aspects identified in the screening stage require further investigation by desk research or intrusive drilling and monitoring or other work.

The scoping stage highlights areas of concern where further investigation, intrusive soil and water testing and groundwater or gas monitoring may be required.

A series of flowcharts have been used in the screening process to identify what issues are relevant to the site. Each question posed in the flowcharts is completed by answering “Yes”, “No” or “Unknown”. Any question answered with “Yes” or “Unknown” is then subsequently carried forward to the scoping phase of the assessment.

The results of the screening process for the site are provided in Table 4 below. Where further discussion is required the items have been carried forward to scoping.

Scoping often indicates that a ground investigation is required to establish more fully the base conditions. The Basement Impact Assessment determines the potential impacts of the proposed basement on the baseline conditions, taking into account any mitigating measures proposed.

Table 4
Screening For Basement Impact Assessment

Ref	Question	Response	Details
	Surface Flow and Flooding		
1	Is the site within the catchment of the pond chains of Hampstead Heath?	No	Refer to Maps in Appendix B and section 10.1.
2	As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	Both front and rear gardens are hard covered, Drainage routes will not alter.
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	Refer to Appendix A drawings. There will be no increase in hard covered areas.
4	Will the proposed basement result in changes to the	No	Surface water originating from

Table 4
Screening For Basement Impact Assessment

Ref	Question	Response	Details
	profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?		the site is not received by adjacent properties or downstream watercourses (other than run-off to sewers).
5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	Surface water originating from the site is not received by adjacent properties or downstream watercourses (other than run-off to sewers).
6a	Is the site in an area identified to have surface water flood risk, according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk assessment, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	No	The site does not lie below the water level of any surface water feature. The road was not flooded in 1975 or in 2002.
6b	Does site lie within a Critical Drainage Area?	Yes	The site does lie within a CDA, 3-010. Carried forward to scoping
6c	Does the site lie within to a Local Flood Risk Zone	No	The site does not lie within a Local Flood Risk Zone
	Subterranean (groundwater) Flow		
1a	Is the site located directly above an aquifer?	Yes	The site lies on the Secondary (A) Aquifer Claygate Beds Carried forward to scoping
1b	Will the proposed basement extend below the surface of the water table?	No	The water table lies within permeable strata beneath the London Clay at >80m bgl
2	Is the site within 100m of a watercourse, well (disused / used) or a potential spring line?	No	The site lies >100m from lost rivers and existing rivers/canals
3	Is the site within the catchment of the pond chains of Hampstead Heath	No	Refer to Appendix B maps and section 10.1.
4	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	There will be no increase in hard covered areas
5	As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	Not to soakaways, but there will be extra landscaped ground for rain water drainage.
6	Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond or spring line?	No	No surface water feature or springs within 250m of the site.
	Ground Stability		
1	Does the existing site include slopes, natural or manmade, greater than 7°?	No	Refer to site description. Slope is < 3 degrees to horizontal. See Figure 13
2	Will the proposed re-profiling of landscaping at site change slopes at the property to more than 7°? (1 in 8)	No	Refer to Appendix A.
3	Does the development neighbour land, including railway cuttings and the like, with a slope greater	No	Refer to site description Section 2. The local area has a

Table 4
Screening For Basement Impact Assessment

Ref	Question	Response	Details
	than 7°? (Approx 1 in 8)		gradient of less than 3 degrees to the horizontal. See Figure 13
4	Is the site within a wider hillside setting in which the general slope is greater than 7 degrees? (Approx 1 in 8)	No	Slope is less than 7 degrees.
5	Is the London Clay the shallowest strata at the site?	No	Refer to Geology, Section 5. Claygate Beds overlie the London Clay
6	Will any trees be felled as part of the proposed development and / or are any works proposed within any tree protection zones where trees are to be retained?	No	No trees to be felled as part of proposed development.
7	Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No	No effects evident on site. Testing for soil plasticity is recommended Carried forward to scoping
8	Is the site within 100m of a watercourse of potential spring line?	No	Not within 500m of any surface water.
9	Is the site within an area of previously worked ground?	Yes	Unlikely on site. House constructed before 1894 on site previously occupied by militia barracks yard. Infilled ground within 250m. Methane monitoring recommended. Carried forward to scoping
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?	Yes No	Site underlain by Secondary (A) Aquifer in Claygate Beds. Carried forward to Scoping
11	Is the site within 50m of the Hampstead Heath Ponds?	No	See maps in Appendix B. It lies 250m distance from catchment area.
12	Is the site within 5m of a pedestrian right of way?	Yes	Well Walk pavement lies <5m from the basement extension. Carried forward to scoping
13	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	No	Neighbouring property has a basement.
14	Is the site over (or within the exclusion of) any tunnels, e.g. railway lines?	No	Site is not located over any railway tunnels.

In summary the issues carried forward to scoping include those associated with the plasticity of the strata, CDA, groundwater levels, the impact of the basement on the pavement, ground and on the ground supporting adjacent properties.

12.2 Scoping

Scoping is the activity of defining in further detail the matters to be investigated as part of the BIA process. Scoping comprises of the definition of the required investigation needed in order to determine in detail the nature and significance of the potential impacts identified during screening.

The potential impacts for each of the matters highlighted in Table 4 above are discussed in further detail below in Table 5 together with the requirements for further research and / or investigations. Detailed assessment of the potential impacts and recommendations are provided where possible.

Table 5
Scoping for Basement Impact Assessment

Reference	Issue	Potential Impact and Action
	Surface Water and Flooding	
6b	The site lies within a CDA but not within a Flood Risk Zone. There is not a risk from flooding from rivers and seas, groundwater, sewers or reservoirs or surface water.	**Impact:** Low Risk of Flooding **Action:** Waterproofing Basement extension and lightwell. Non return valves on drains and emergency pump.
	Subterranean (groundwater) Flow	
1a	Basement and extension increasing the amount of landscaped ground.	**Impact:** Reduced flooding **Action:** None
	Ground Stability	
7	Shrink and swelling of clay	**Impact:** Ground Movement **Action:** Undertake Plasticity Tests to design foundations and floor slab for basement construction
9	Site is within 250m of potentially infilled ground.	**Impact:** Methane Gas **Action:** Test for toxic gases. Mitigating measures may include installation of methane membrane
10	Site within a Secondary (A) Aquifer	**Impact:** Water ingress during construction. **Action:** Water Pump on site
12	Site within 5m of pedestrian right of way	**Impact:** Damage to services in pavement. **Action:** Obtain service drawings. Assess ground movement potential in pavement.

The screening and scoping indicates a requirement for dealing with mitigating measures against flooding in the basement, investigation of ground conditions, geotechnical testing for clay shrinkability and obtaining service drawings for the pavement.

12.3 Summary of Screening and Scoping

The screening has revealed that the site lies within a CDA, however the risk of flooding from various sources is low and providing mitigating measures are included in design, there is no requirement for a site specific Flood Risk Assessment (FRA). As the site lies over the Claygate Beds aquifer, groundwater monitoring was undertaken to enable any necessary design for mitigation measures during construction.

Testing for plasticity was udertaken to assess shrinkability of the soil and monitoring was undertaken of toxic gas due to the presence of potentially infilled ground in the locality of the site. As the basement will lie within 5m of the pavement, a services search was requested

to enable design of any necessary prevention measures in place to ensure no disturbance to services during construction.

13. GROUND INVESTIGATION

13.1 Fieldwork

In order to confirm ground conditions beneath the site and to collect soil samples for testing for contamination and engineering properties of the strata a ground investigation was undertaken on 1st May 2019. Two boreholes were sunk in the rear garden of 8 Well Walk, close to the existing building and towards the rear boundary wall. The rear garden was the only area accessible with a drilling rig.

The ground investigation comprised the drilling of two 80mm diameter window sampler borehole (WS1 & WS2) which included insitu soil tests for strength and sampling of the soil for geotechnical and environmental testing. All the site work was supervised by an Engineer. There was no evidence of ground instability or subsidence to the building.

All soil samples were sent to a UKAS accredited laboratory for testing of heavy metals, redox value, sulphate and moisture content, the presence of hydrocarbons and Waste Acceptance Criteria Tests (WACS) to assess contamination and waste disposal. Both window sampler boreholes (WS1 and WS2) were installed with standpipes to facilitate groundwater monitoring.

Borehole results are presented in Tables 6, 7, 8 and 9 and in Appendix D. Geotechnical and Environmental Test Results are presented in Tables 7 to 10 inclusive and full results are presented in Appendix D.

All exploratory points were marked out on site by reference to existing physical features on the site.

Figure 27 Borehole Location Plan

13.2 Ground Conditions

The ground conditions encountered in the window sampler boreholes comprised of a layer of paving slabs overlying fine sand with gravel of red brick and stone and occasional brown silty clay and roots to 1.45 bgl in WS1 and 1.50m bgl in WS2, while red shale was also discovered in WS2. The made ground continued in WS1 to 2.15m bgl comprising of brown black gravel of stones, clay and red brick with flint, glass, chalk and occasional coal specks. In WS2 damp silty brown clay with coal, flint, stones and occasional roots comprised the made ground to 2.40m bgl. The made ground in both boreholes was underlain by damp brown, orange and/or grey silty slightly sandy clay with occasional flint pebbles to proven depths of 6.00m bgl in WS1 and 4.45m bgl in WS2.

The ground conditions encountered are summarised in Table 6 below. WS1 was sunk in the rear courtyard nearest to existing building and WS2 closer to the eastern boundary wall.

The boreholes determined the ground conditions anticipated and are suitable to allow the design of the foundations for the proposed development.

TABLE 6
Ground Conditions Encountered in WS Borehole

Hole Ref.	MADE GROUND Depth in mbgl	CLAY (Low to Medium Strength) Depth in mbgl
WS1	GL – 2.15	2.15 – 6.00+
WS2	GL – 2.40	2.40 – 4.45+

13.3 Geotechnical Test Results
13.3.1 Standard Penetration Test Results

The Standard Penetration Test (SPT) was undertaken in boreholes by means of a standard 50.80mm outside diameter split spoon sampler to determine the approximate in situ density of soils and when modified by a cone end (CPT) the relative strength or deformity of rock.

The results for the Standard Penetration Test are shown in Table 7 and on the borehole logs in Appendix D. The Standard Penetration Test results indicate an initially low strength clay at 2.00m bgl and medium strength clay at 3.00m bgl. The results at 4.00m and 5.00m bgl indicate a medium strength clay.

TABLE 7
Standard Penetration N Values Recorded

Depth	Made Ground/Topsoil	Silty Clay In mbgl
0.00-1.00m	-	-
1.00-2.00m	4, 5	
2.00-3.00m	8	8
3.00-4.00m		18, 12
4.00-5.00m		14, 13
5.00-6.00m		12
EC7		Low –Medium strength

13.3.2 pH and Sulphate Test Results

Two soil samples were tested for redox value and for sulphate content to assess the design of underground concrete.

TABLE 8
pH and Sulphate Test Results

Sample	Depth in mbgl	pH	Sulphate mg/l
WS1	1.60	8.07	11
WS2	0.70-1.10	8.09	

The results indicate that considerations are not required for design of underground concrete for foundations. According to BRE Special Digest 1:2005, the Class for design of underground concrete is DS-1, however due to the selenite crystals in the London Clay we recommend design to DS-2 ACEC Class AC-1s.

13.3.3 Plasticity Test Results

TABLE 9
Plasticity Test Results

Sample	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
WS1 2.90m	27	51	23	28
WS2 3.50m	24	49	24	25

The results for plasticity tests indicate the soils at the depths tested have borderline intermediate to high plasticity and may shrink and swell under varying moisture conditions. This needs to be taken into account in design of construction.

13.4 Engineering Properties of Strata Tested

13.4.1 Topsoil and Made Ground

Topsoil and Made Ground are very variable both laterally and vertically and no test results should be assumed to represent the entire sequence. The made ground is likely to be in a loose state of compaction and highly compressible.

Topsoil and Made Ground are unsuitable material on which to place foundations without ground treatment.

13.4.2 Clay

Standard Penetration Test results in the clay indicate it to be low to medium strength as described in Section 13.3.1, however generally the clay is indicated to be medium strength at foundation level. The clay was tested for plasticity. Tests in WS1 at 2.90m and WS2 at 3.50m bgl gave moisture contents of 27% and 24% respectively. Liquid Limits results were 51% and 49% with Plastic Limits of 23% and 24% and Plasticity Index of 28% and 25%. The results indicate the clays to have a lower end high plasticity to an upper end intermediate plasticity. It is likely that the clays therefore may shrink and swell under varying moisture conditions.

The Claygate Beds generally have a bulk density of 1900kg/m3, cohesion of circa 50kPa based on SPT results and an angle of friction of 15 to 22 degrees based on the high plasticity of the clay.

13.5 Groundwater Conditions and Flow

Groundwater was not encountered during drilling. Groundwater was encountered during monitoring at depths varying from dry to 5.05m bgl. These levels considered to be perched water.

It is possible that sump pumping may be required for deepening of the existing basement if undertaken during or after heavy rainfall.

13.6 Gas Conditions

There are no recorded landfill sites within 250m of the site, however there is historic infilled land 111m to the north west of site, therefore monitoring for landfill gas was undertaken. Monitoring undertaken for toxic gases gave results of nil methane, 1.4-3.8% carbon dioxide and 18.3-19.5% oxygen when undertaken alongside groundwater testing. Recorded flow rates were 0.0-0.1l/h and atmospheric pressures were 1008-1011Pa. Methane protection is not required in construction.

There is a very low risk that the site is affected by radon gas and as such, radon protection measures will not be required in the basement as part of the proposed development.

13.7 Environmental Conditions

13.7.1 Standards

There are no definitive legal standards for contaminated land in the United Kingdom. The UK Risk Assessment Framework is based on a tiered approach, Tier 1 being a risk screening or qualitative risk assessment, Tier 2 is a generic quantitative risk assessment and Tier 3 is a detailed quantitative risk assessment. Where the Tier 2 identifies a potentially unacceptable risk to human health either a Tier 3 Detailed Quantitative Risk Assessment (DQRA) is undertaken or risk management action recommended to remove the pathway and the risk.

For this site both a Tier 1 and Tier 2 assessment have been undertaken using generic assessment criteria and site specific assessment criteria based on ATRISK soil SSVs 2017 and LQM/CIEH S4ULs which are based on the new CLEA Software version 1.071 (2016) incorporating changes to exposure, assessment parameters, methodology and land uses as set out in the Department for Environment, Food and Rural Affairs (Defra) Category 4 Screening Level (C4SL) Project Methodology Report. Where there are no figures for compounds in 2016 guidelines, then 2009 guidelines have been used for assessment.

With the exception to contaminants with published C4SLs (arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead), the toxicological assessment for contaminants Is based on minimal toxicological risk in accordance with the Environment Agency guidance (SR2). Toxicological data for some contaminants has been sourced from the CLAIRE-EIC Report.

The basement will be used for the residential purposes. The risk assessment has used a scenario of residential use with consumption of home grown vegetables as the model for assessment. In deriving the SSVs a child has been chosen as the critical receptor with exposure over a lifetime being the most appropriate and conservative scenario.

The assessment of the risks to users on the site has been undertaken within the framework set out in guidance published by DEFRA and the Environment Agency for the assessment of risks to human health associated with chronic long term exposure to contaminated soils. The guidance set out in this documentation has been used to establish a conceptual model of the risks on the site following redevelopment.

The Contaminated Land Exposure Assessment (CLEA) model provides a means of establishing concentrations of contamination in soils at a site. If results exceed these concentrations, then further assessment or intervention by mitigation or remediation may be required to reduce risks to human health.

13.7.2 Environmental Tests on Soils

Of the soil samples collected, 5 samples were selected from WS1 and WS2 for various environmental testing. The samples were tested for speciated PAH, speciated TPH, heavy metals, PCBs, sulphate, pH, soil organic matter and fraction of organic matter and asbestos. One sample from WS2 at 0.70m to 1.10m bgl was tested for Waste Acceptance Criteria to enable disposal of excess soil during construction. Results are presented in Appendix D.

TABLE 10
Results of Environmental Tests on Soils

Compound	No of samples tested	Minimum Value mg/kg	Maximum Value mg/kg	SSV guideline Residential Use In mg/kg	Samples exceeding SSV guidelines
Phytotoxic					
Copper	1	13.4	13.4	4790	None
Nickel	1	13.8	13.8	136	None
Zinc	1	46.6	46.6	20300	None
Selenium	1	<1	<1	375	None
Metals					
Arsenic	1	14.1	14.1	37(C4SL)	None
Cadmium	1	0.2	0.2	22.1(C4SL)	None
Chromium VI	1	<0.6	<0.6	20.5(C4SL)	None
Lead	1	41.8	41.8	200(C4SL)	None
Mercury	1	<0.14	<0.14	1.44	None
Organics					
Benzene	1	<0.009	<0.009	0.871(C4SL)	None
Toulene	1	<0.007	<0.007	780	None
Ethylbenzene	1	<0.004	<0.004	453	None
o-Xylene	1	<0.01	<0.01	336	None
mp-Xylene	1	<0.01	<0.01	312	None
TPH total	1	75.2	75.2	500	None
PAH USEPA 16	1	2.09	2.09	40	None
MTBE	1	<0.01	<0.01	220	None
PCB	1	<0.021	<0.021		None
Others					
Asbestos	1	Amosite(brown) & Chrysotile(white)		NAD	WS1@0.4m

NAD=No Asbestos Detected
Red = above guideline
C4SL= DETR SP1010 guideline for C4SLs(2014)

The area of the site was found where tested to be uncontaminated by heavy metals and hydrocarbons. All other test results lay within guideline limitations. During drilling and sampling none of the samples exhibited hydrocarbon free product.

Asbestos fibres were detected in WS1 @ 0.40m bgl.

TABLE 11
Results of Tests for Polyaromatic Hydrocarbons

Polyaromatic Hydrocarbons	Units	WS2 @ 0.15 Value mg/kg	ATRISK and LQM/CIEH S4Uls Contaminated Land Screening Values (SSV)
			Residential with plant uptake mg/kg
Naphthalene	mg/kg	0.0312	12.2
Acenaphthylene	mg/kg	0.0225	920
Acenaphthene	mg/kg	<0.008	2760
Fluorene	mg/kg	<0.01	2610
Phenanthrene	mg/kg	0.101	440
Anthracene	mg/kg	0.0246	26,200
Fluoranthene	mg/kg	0.221	2980
Pyrene	mg/kg	0.195	2120
Benzo(a)anthracene	mg/kg	0.154	13
Chrysene	mg/kg	0.176	27
Benzo(b)fluoranthene	mg/kg	0.348	3.7
Benzo(k)fluoranthene	mg/kg	0.115	100
Benzo(a)pyrene	mg/kg	0.225	4.95 **(C4SL)
Indeno(1,2,3-cd)pyrene	mg/kg	0.256	41
Dibenz(a,h)anthracene	mg/kg	0.0327	0.30
Benzo(ghi)perylene	mg/kg	0.183	350
TOTAL PAH	**mg/kg**	**2.09**	

LQM/CIEH S4Uls 2015
** DETR SP1010 guideline for C4SLS(2014)
Red indicates the result exceeds guidelines

Tests for PAHs showed none of the results exceeded the guidelines for individual compounds and as none exhibited free product of hydrocarbon, therefore all samples are considered uncontaminated in line with guidelines. Tests on soil samples for Benzene, Ethylbenzene, Toluene and Xylene (BTEX) and Methyl tertiary-butyl ether (MTBE) all fell within guidelines. Tests on soil samples for TPH all fell within guidelines for residential use. The results indicate the soils tested are not contaminated by hydrocarbons.

Redox values were 8.07 to 8.09 being slightly alkaline. Soluble sulphate test results were 11mg/l which lie within 500mg/l where no special consideration is required for underground concrete. Sulphate is not a health hazard.

Asbestos (Brown Amosite & White Chrysotile) was detected in WS1 at 0.40m.

The soil samples tested gave a TPH speciated result of 75.2mg/kg being within the 500mg/kg generally recognized figure for residential use guidelines. The PAH levels were well within the generally accepted level of 40mg/kg, and all 16 individual results fell within guidelines.

Waste Acceptance Criteria Tests (WACS) indicated the soil excavated is likely to go to landfill as inert waste.

13.7.3 Environmental Risk

13.7.3.1 Sources of Contamination

Sources of contamination were investigated through archival maps and the Desk Study and the ground investigation.

A search of environmental databases via an EnviroInsight report (provided by Centremaps) did not reveal any offsite sources of contamination that are considered likely to pose a risk to the site and the proposed development. Tests for contamination on site indicate no contamination by heavy metals or hydrocarbons in the samples tested, however asbestos was located in WS1 at 0.40m. In the unlikely event of undetected contaminated, risks are assessed.

13.7.3.2 Pathways for Migration

The potential pathways for carrying any undetected contamination present on the site to reach sensitive receptors may include:

a) *Ingestion of and/or skin contact with contamination in the soil*
Low Likelihood to Unlikely – Due to the hard cover on the site, very small garden area and lack of contamination there is a restricted potential for ingestion/skin contact with contamination in the soil. The soil was tested as uncontaminated by the compounds tested with the exception of asbestos in WS2. There may be a low risk to workmen which may be mitigated by appropriate use of Personal Protective Equipment.

b) *Ingestion of contamination and uptake of contamination in plants/vegetables/animals/pets*
Low Likelihood to Unlikely – Vegetables are unlikely to be grown on the site and ingestion of contamination through uptake in plants/vegetables is unlikely to occur. It is considered that animals in the food chain and pets will not be present on site. Hard cover on the site will prevent any uptake.

c) *Ingestion of contaminated drinking water through leaching of contamination into groundwater flowing to underlying aquifers/water abstractions*
Unlikely – No contamination was detected on the site and leaching of undetected contamination is unlikely to occur due to hard cover and very small garden area. There are no potable boreholes within 2000m of the site. The site is not within a Source Protection Zone and there are no groundwater abstractions within 2000m.

d) *Inhalation of vapours produced by landfill/radon/hydrocarbons/old mines*
Low Likelihood to Unlikely – There are no historic or current recorded landfill sites within 250m of the site. Hydrocarbons were not present in the ground from previous land use. The site does not lie within a radon protection area. There are no recorded old mines beneath the site. Toxic gases were not detected during monitoring.

e) *Inhalation of contaminated airborne dust*
Low Likelihood – The appropriate safety measures must be exercised to protect both the workers and the local residents from dust during any demolition and construction. Provided this work is carried out diligently, the ongoing risk is low. Asbestos fibres were detected in the soil in WS2 and these should be removed according to government regulations.

f) *Contamination of controlled waters*
Unlikely – Leaching of contamination from the site into surface water is unlikely due to lack of contamination and distance to surface water.

13.7.3.3 Sensitive Receptors

Sensitive receptors to the contamination on the site could include workmen and future occupants. However, based on the history of the site and its surrounds, and lack of contamination detected in the soil tests, no sensitive receptors are likely to be detrimentally affected by the site.

13.7.3.4 Environmental Risk Assessment

The environmental liabilities of the site and risk assessments have been undertaken for the continued residential use. If the site use changes then a further risk assessment may be required.

Environmental risk considerations on the site have been assessed by adopting a site specific qualitative approach to identify the risk, if any, of environmental harm. In accordance with the DETR Draft Statutory Guidance on Contaminated Land the approach is by identifying a hazardous source and establishing possible links between the source via exposure pathways to a potential receptor.

The hazard is a contaminant or potentially polluting substance that is in, on or under the land and which has the potential to cause harm or to cause pollution to controlled waters. The receptor is a living organism or organisms, an ecological system or piece of property, which is being harmed, interfered with or polluted by the contaminant. The pollutant linkage is by means of the pathway which is one or more routes by or through which that receptor is being, or could be, exposed to, or affected by, that contaminant. Thus, the presence of a hazard on a site does not necessarily mean that there are risks unless pathways and receptors are present and are receptive to being affected by that specific hazard or contaminant.

- SOURCE - release of pollutant - eg. oil spills
- PATHWAY - route to receptor - eg. permeable strata
- RECEPTOR eg. - river

The likelihood of contamination affecting the environment depends on the migration and persistence of contaminants which varies with the nature of the contaminant and the ground and groundwater conditions, and the presence of sensitive receptors.

The following tables (Tables 12, 13, 14 and 15) which are extracted from CIRIA C552 'Contaminated Land Risk Assessment – A Guide to Good Practice' have been used to assess the risk to sensitive receptors from site contamination.

Any category which shows as medium risk or above may require investigation and if high risk is proven, remediation may be required following investigation.

TABLE 12
Risk Matrix – Comparison of Consequence and Probability

Risk = Probability x Consequences		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

TABLE 13
Classification of Probability

Probability Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

TABLE 14
Classification of Consequence

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem or organisation forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. **Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).**
Medium	Chronic damage to Human Health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem or organism forming part of such ecosystem, (note: the definitions of ecological systems within Draft Circular on Contaminated Land, DETR, 2000).	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve. **Lesser toxic and asphyxiate effects of carbon dioxide**
Mild	P3ollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the Draft Circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

TABLE 15
Classification of Risks and Likely Action Required

Risk Classification	Definition
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe. If any harm were to occur, it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Any category which shows as moderate risk or above may require investigation and possibly subsequent remediation.

As the risks from contamination are low to very low, no further assessment is required.

13.7.3.5 Summary of Ground Investigation

The ground investigation encountered between 2.15m and 2.40m of made ground overlying brown orange grey silty slightly sandy clay with occasional flint pebbles of generally medium strength with intermediate to high potential to shrink and swell under varying moisture conditions in the ground. Perched groundwater was recorded in the made ground at circa 5.00m bgl and slightly elevated levels of carbon dioxide (1.4-3.8%) were recorded during monitoring.

The risk assessment has been based on the future use of the basement for residential purposes. If the site is to be used for any other purpose a reassessment of the risk may be necessary.

The environmental test results have shown that soils are generally uncontaminated by the compounds tested for at the sampling location. In line with CIRIA Risk Assessment recommendations, the levels of potential contamination detected are unlikely to cause harm to humans, animals, plants and controlled waters. Workmen should take the usual precaution of wearing gloves when handling soil.

14. IMPACT ASSESSMENT AND CONCEPTUAL MODEL

14.1 Introduction

The BIA has been undertaken for the proposed deepening to 2.60m height and extending of an existing basement. The anticipated bearing pressure of the structure has not been provided.

The comprehensive desk based assessment together with the site inspection and walkover and site investigation have been sufficient to allow the potential impacts of the issues identified during the screening and scoping stage and site investigation to be assessed and a Conceptual Model drawn.

This section of the report provides an interpretation of the findings of the Desk Study and Ground Investigation, in the form of a ground model, and provides advice and recommendations with respect to temporary and permanent works and foundation options. A Conceptual Model is presented in Appendix D.

The detailed Structural Engineers Report is reported by Pole Structural Engineers in Appendix E and the Construction Transport Management Plan is presented in Appendix F.

14.2 Geological and Hydrogeological Setting

The site is underlain by the sandy clay of the Claygate Beds underlain by the clay horizon of the London Clay, and has an adequate safe bearing capacity for low rise developments. The clays within the strata were has intermediate to high plasticity.

The ground conditions encountered in the window sampler boreholes comprised of a layer of paving slabs overlying fine sand with gravel of red brick and stone and occasional brown silty clay and roots to 1.45 bgl in WS1 and 1.50m bgl in WS2, while red shale was also discovered in WS2. The made ground continued in WS1 to 2.15m bgl comprising of brown black gravel of stones, clay and red brick with flint, glass, chalk and occasional coal specks. In WS2 damp silty brown clay with coal, flint, stones and occasional roots comprised the made ground to 2.40m bgl. The made ground in both boreholes was underlain by damp brown, orange and or grey silty slightly sandy clay with occasional flint pebbles to proven depths of 6.00m bgl in WS1 and 4.45m bgl in WS2.

Groundwater levels in the area lie >50m bgl in the Thanet Sand or underlying Chalk. Monitoring indicated the level of any perched water to be circa 5.00m+ bgl. therefore the construction of the basement extension is unlikely to have any detrimental effect on groundwater levels or flow as the basement will not extend into the groundwater. There is a low risk of flooding from groundwater

14.3 Hydrology and Flood Risk

The screening indicated that the site does not lie within a Flood Zone, Local Flood Zone or a Critical Drainage Area. Recommendations are that the basement should be waterproofed and tanked, with non return valves on the drains and an emergency pump incorporated, in case of an unexpected flood. There are no local rivers or local lost rivers in the vicinity of the site. There is a low risk of flooding from reservoirs, groundwater, surface water and sewers. It is concluded that a site specific Flood Risk Assessment is not required provided that the mitigating measures described above are incorporated in construction.

14.4 Contamination

Ordnance Survey maps inspected indicated the site lay as open ground with the house and gardens constructed by 1894. There is a low risk of contamination being present on the site, any undetected contamination is unlikely to detrimentally affect groundwater or other controlled waters. As a precaution, all builders should wear PPE and also use gloves when handling soil for Health and Safety at Work in accordance with HSE and CIRIA guidelines.

Screen tests undertaken for a suite of contamination for Health and Safety of workmen indicated no contamination by the compounds tested at the borehole location. Based on the site history there is a low risk of undetected contamination. A risk assessment to CIRIA C552 indicated a low risk of any harm from contamination to sensitive receptors.

14.5 Basement and Lightwell Excavations

The excavation for the basement extension beneath the house will be circa 2.60m below existing ground floor level. The floor formation level will be within the Claygate Beds. Excavation in any made ground and Claygate Beds could be achieved by mechanical excavator. All excavations will require a stiff temporary support mechanism for construction.

14.6 Foundation Design

Topsoil and made ground are unsuitable founding strata and all foundations should be constructed on the Clay horizon. The clay, below 3.0m bgl is anticipated to be of medium strength with N values of 12 to 18. Based on plasticity index and N values these indicate an

allowable bearing capacity, with a Factor of Safety of 3, of 87kN/m2 to 130kN/m2. An allowable bearing capacity of 100kN/m2 should be taken for design. Bulk Density for the clay should be taken as 1900kg/m3.

Groundwater may be encountered especially during and after heavy rainfall. Temporary works may require sump pumping. If rainwater falls into the excavation it can easily be dealt with by sump pumping. If this occurs the softened surface of any clay strata should be removed prior to any pouring of concrete for the foundations or floors.

In accordance with Eurocode 7 (BSEN 1997-1) groundwater should be taken at ground level for short and long term design. Such design must resist the buoyant uplift pressures generated by groundwater at ground level.

Excavations for the proposed structure will require stiff temporary support in all strata to maintain stability of the surrounding structures and to prevent any excessive horizontal ground movements. A Structural Method Statement (SMS) for Method of Construction is presented as Appendix E.

Excavation should be undertaken in an underpinning sequence with a temporary propping system to support the underpinning sections during the excavation works, until the basement extension is completed. The reinforced concrete underpin wall should support the party walls and be designed to resist lateral soil and water pressures. The underpinning should be constructed in a hit and miss sequence with a maximum width of 1.20m excavated at any time.

Construction of the proposed basement lightwell will need to be supported by new retaining walls. Design of retaining walls is provided in a Structural Method Statement.

The proposed basement slab must be designed to accommodate heave from long term swelling on removal of overburden and the high volume change of the Clays.

The support for the temporary and permanent conditions must take account of maintaining the stability of the excavation and the stability of the adjacent properties and surrounding structures. Design of the walls may be decided as to whether the temporary support is also incorporated into the permanent solution.

14.7 Adjacent Structures, Potential Ground Movement and Monitoring

The development of the basement extension is unlikely to impact on adjacent properties provided mitigating measures and appropriate temporary and permanent design are undertaken.

It would be prudent to undertake a structural condition survey of adjacent properties which can be undertaken by a Party Wall Surveyor.

Ground movement calculations undertaken in accordance with CIRIA C760 indicate very slight Damage Category according to Burland and Boscardin Scale of Damage. Calculation Methodology is presented in Appendix C.

By compiling the curves on C760 Figures 6.8, 6.9 and 6.15 onto the computer, it is then possible to insert the excavation and wall depths into the appropriate figures and calculate the horizontal and vertical movements due to the excavation and wall depth on the site. By

placing these into an Excel spreadsheet and adding the appropriate equations, the horizontal strain, house slope, delta and the length from the property wall to maximum deflection can be determined to calculate delta/length.

Once these are determined, the horizontal strain and delta/length are divided by Elim in order to plot the results on C760 Figure 6.27 to check they fall below the required L/H for the Category of Damage to be determined.

The worst case scenario is damage to No 10 Well Walk as No 6 party wall is already underpinned a they have a basement. The results, presented in Appendix C, gave a very slight or Category 1 results according to Burland Categories of Damage.

Potential ground movement calculations were undertaken to determine the category of damage that may occur to adjacent properties during construction of the basement extension. The methodology follows CIRIA C760 and is presented in detail in Appendix C. The results of calculations, taking into account the length of the existing terrace distance from the proposed house, indicate Damage Category 0 or negligible movements will occur to adjacent properties in line with Burlands, 'Classification of visible damage to walls' (Burland et al ,1977 and Boscardin and Cording, 1989, and Burland, 2001), reproduced in Appendix C.

Recommendations for monitoring movement during construction are given in Appendix C.

The proposed basement extension will lie within 5m of the pavement of Well Walk. Horizontal and vertical movements associated with the construction of the basement are recorded in Appendix C. These indicate 1.5mm horizontal and 0.5mm vertical movement in the pavement area. Lateral and vertical movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of any adjacent structures or services within the pavement/roadway. Service drawings are presented separately. The calculations indicate that horizontal and vertical movements in the pavement are unlikely to damage clay, cast iron or plastic pipes.

14.8 Underground Concrete

Testing for the presence of pH and sulphates in the clay were undertaken to allow for recommendations for design of underground concrete according to Table C2 of BRE Special Digest 1 Part C (2005). Due to the selenite (CaSO4.2H2O) content in London Clay, it is recommended that underground concrete is designed to DS-2 Ac-1s.

14.9 Service Excavations

Shallow excavations for services and the like are unlikely to be stable in the made ground or clay in the short or long term and will require substantial support. Some sump pumping may be required to keep the trenches dry.

14.10 Waste Disposal

Any spoil arising from excavations or landscaping works will need to be disposed of to a licensed tip. Under the European Waste Directive landfills are classified as accepting inert non-hazardous or hazardous wastes in accordance with the EU Waste Directive. Based on

the technical guidance provided by the Environment Agency it is considered likely that the soil from this site would be classified as inert waste, based on the Waste Acceptance Criteria Tests on the soil.

15. RECOMMENDATIONS

The comprehensive desk based assessment together with the site inspection and ground investigation has been sufficient to allow the potential impacts of the issues identified during the scoping stage of the project to be assessed. This section of the report provides recommendations for development.

It will be necessary to ensure that the basements are designed in accordance with the NHBC Standards and take due cognisance of the potential impacts highlighted above. This may be achieved by ensuring best practice engineering and design of the proposed scheme by competent persons and in full accordance with the Construction (Design and Management) Regulations.

With regard to the geology, hydrogeology and hydrology of the site, the report concludes that the site is immediately underlain by the Claygate Beds underlain by the relatively impermeable London Clay which is classified as a non productive aquifer by the Environment Agency. There is no recorded groundwater during the ground investigation and no abstraction licences which could be detrimentally affected by the basement development. There is no surface water which could be affected by the development.

The BIA has been undertaken for the proposed construction of a new extension to the existing ground floor and basement. The depth of the basement is anticipated to be 2.60m bgl. The anticipated bearing pressure of the new structure has not been provided.

The desk study has revealed that the site has not had a potentially contaminative history having been occupied by a garden for a residential property and on the basis of the fieldwork, the ground conditions at this site can be characterised as follows.

- the topsoil and made ground extend to depths of between 2.15m to 2.40m bgl and comprised loose soil with brick, gravel and soil.
- The underlying strata of the Claygate Formation was a brown grey medium strength clay to a maximum proven depth of 6.00m.
- Groundwater was not encountered in the boreholes during drilling, and during monitoring perched water was encountered at circa 5.05m bgl.
- Geotechnical tests on the clay indicated a high to high potential for swelling and shrinkage of the clay under varying moisture conditions.
- Based on the shear strength, an allowable bearing capacity for the medium strength clay at 3m depth is 100kN/m^2.
- Environmental tests on the topsoil and shallow clay indicated the soils to be uncontaminated according to guidelines for residential use of the site, with the exception of asbestos in one soil sample which should be removed to appropriate licensed landfill by a carrier licensed to carry asbestos.
- Due to the low permeability of the clay, the site is not suitable for the use of soakaways to infiltrate excess surface water into the ground.

Excavations for the proposed basement structure will require temporary support to maintain stability of the surrounding structures and to prevent any excessive horizontal ground movements. Groundwater is unlikely to be encountered and if rainwater falls into the excavation it can easily be dealt with by sump pumping. If this occurs the softened surface of the clay should be removed prior to any pouring of concrete for the basement floor.

Construction of the proposed basement will need to be supported by new retaining walls. Formation level for the proposed development will be the clay beneath any topsoil and made ground which are unsuitable bearing strata. The clay should provide a suitable bearing stratum for spread foundations, a raft, box construction or piles whichever is required based on the bearing pressure or ground loading of the structure.

The basement support for the temporary and permanent conditions must take account of maintaining the stability of the excavation and the stability of the attached structures. The retaining solution should ensure maintenance of lateral support to existing foundations.

The potential for ground movement during the excavation and construction of the basement has been considered as outlined in Appendix D1 of the Camden Geological, Hydrogeological and Hydrological Study. Any significant ground movements could cause structural damage to adjacent properties. Ground movement could occur from heave of the ground following removal of overburden. Following the excavation of the basement, it is likely that the floor slab for the proposed basement will need to be suspended over a void to accommodate the anticipated heave, unless the slab can be suitably reinforced to cope with these movements.

Damage to existing foundations could occur if removal of lateral support occurs. However as illustrated in the Appendix D1study, for clay subsoils this effect is not usually significant and results in circa 10% reduction in the soil capacity locally. Since there are no current signs of distress in the existing wall foundations it is considered that very short term reductions in soil stiffness are unlikely to cause any significant settlements, and hence any damage to adjacent properties. Ground movement calculations to CIRIA C760 indicate very slight movements, which should be checked by the monitoring during construction. It would be prudent to undertake a structural condition survey of adjacent properties before work commences.

Any spoil arising from excavations or landscaping works will need to be disposed of to a licensed tip. Under the European Waste Directive landfills are classified as accepting inert non-hazardous or hazardous wastes in accordance with the EU Waste Directive. Based on the technical guidance provided by the Environment Agency it is considered likely that the soil from this site, as represented by the chemical tests carried out, would be classified as INERT waste. It is likely that only a small proportion of excess material will be made ground and most of the waste will be natural clay. Asbestos should be removed according to government regulations.

The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material based on the environmental test results and Waste Acceptance Criteria Test (WACS) results.

The development of the basement may impact on adjacent properties if mitigating measures and appropriate temporary and permanent design are not undertaken. The development of

the basement if unlikely to impact on groundwater, surface water or flooding, unlikely to impact on drainage or ground infiltration of rainwater.

Recommendations include:

- The building should be constructed on reinforced concrete pins with a raft slab foundation.
- Underpinning to party walls at the lower ground level.
- Temporary propping of excavations.
- Monitoring of adjacent buildings during construction.
- Party Wall Surveyor to be employed.
- Service Drawings to be obtained.
- Compressible material beneath basement slab to accommodate heave.
- Foundation stratum to be clay.
- Proposed basement should be tanked and waterproofed to the height of the finished ground floor levels.
- The basement must provide internal access to higher ground.
- The basement must include a positive pumped device such as a sump pump, in line with the 2017 London Borough of Camden Basement Planning Guidance.
- A non-return valve should be installed at the foul water sewer manhole serving the property.
- Surface water should be managed by the use of SuDS where practicable.
- Construction Transport Management Plan should be followed to reduce inconvenience to neighbours.
- A Chartered Engineer should be employed to manage the Works.

16. GENERAL REMARKS

This report truly reflects the conditions found during the screening and scoping. Whilst the screening and scoping was undertaken in a professional manner taking due regard of additional information which became available as a result of ongoing research, the results portrayed only pertain to the information attained, and it is possible that other undetected information and undetected ground and gas conditions, undetected mining conditions and undetected contamination may exist. The screening and scoping was only undertaken within the site boundaries and should not be used for interpretation purposes elsewhere. These conclusions are only a brief summary of the report, and it is recommended that the report is read in full to ensure that all recommendations have been understood.

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