QUALITY MANAGEMENT FOR REPORT

Project	219A Goldhurst Terrace, Swiss Cottage, London, NW6 3EP		
Client	Mr M Zaman		
Date	April 2021		
Version	Issue 1		
Prepared by	Frances A Bennett	BSc (Hons), CGeol, FGS, FIMMM, C.WEM, MCIWEM, CEnv, AIEMA, MIEnvSci	Director Ashton Bennett Ltd
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NON TECHNICAL SUMMARY OF REPORT

The site has always been occupied by open ground and a residential house and based on local historic and current industrial sites uses, contamination is not expected to be present in the ground. The site is underlain by the London Clay which does not generally hold groundwater except in thin lenses of limited extent. Sump pumping may be required for construction during and after heavy rainfall.

The basement construction is unlikely to detrimentally affect the depth or flow of groundwater beneath the site, and is unlikely to affect any water abstraction wells, surface water, ponds or underground rivers.

There will be a minor reduction in lawned area increasing rainfall run off slightly which can be mitigated by the use of rainwater harvesting.

The London Clay may shrink and swell or heave on varying moisture conditions and this needs to be taken into account by the use of a void or compressible material beneath the floor slab.

There are no trees to be felled for the development. The basement will increase the depth of foundations compared to neighbouring properties. The site does not lie over any railway tunnels.

The site lies within Flood Risk Zone 1 with a low flood risk. The site has a low risk of fluvial flooding and a very low risk of surface water and groundwater flooding. The site lies within a Critical Drainage Area of Goldhurst which has a pluvial/sewer capacity issue, although there is no record of No 219A being flooded.

Mitigation measures include tanking the basement, non return valves on drains and use of rainwater harvesting with grey water recycling to cope with additional rainfall run off from new hard cover area.

The development of the basement, provided it is constructed competently, is unlikely to harm neighbouring properties or have any significant effects on the stability or bearing capacity of adjacent land generally.

The development of the basement is unlikely to 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, is unlikely to impact above 'very slight' on the Burland Scale 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 which should be dealt with by sump pumping.

There are no concerns to the construction of the proposed basement that cannot be easily mitigated by appropriate design and monitoring.

Recommendations before development include:

- Ground Investigation
- Soil Tests and Groundwater Monitoring
- UXO Desk Study
- Structural Method Statement
- Construction Management Plan
- Investigation of exact location of NW Storm Relief Sewer
- 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.

- Sulphate resisting cement for underground concrete.
- 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.
- 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.
- Soakaways will not work due to the impermeable strata encountered.
- High stiffness temporary and permanent ground support
- A Chartered Engineer should be employed to manage the Works.
- PPE for workmen.

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

EXECUTIVE SUMMARY

Site Location	219A Goldhurst Terrace, London NW6 3EP
Site Description	Terraced 3 storey house
Historical Land Use	Open land and House constructed by 1935.
Current Land Use	Residential house
Potential Contamination	Low Risk
Archaeological Potential	Low Risk
Hydrogeology	Non productive Aquifer
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 of West Hampstead LFRA of Goldhurst. Flood Risk Assessment undertaken, Low risk of Flooding identified, mitigating measures of rainwater harvesting.
Flooding from Surface Water	Low Risk
Flooding Incidents	Recorded in east end of Goldhurst Terrace only
Flooding from Sewers	Low Risk
Flooding from Reservoirs	Low Risk
Flooding from Groundwater	Low Risk
SUDS	Ground not suitable for soakaways, rainwater harvesting recommended
Geology	London Clay, highly plastic use of material to accommodate heave required
Landfill gas potential	No landfill within 250m, no methane or radon gas protection required
Contamination	Low risk
Geotechnical Properties	Clay strata is highly plastic
Extra hard cover	None
Groundwater	No dewatering required, sump pump may be necessary during and after heavy rainfall
Concrete	Underground concrete to be designed as Design Class is DS3 ACEC Class AC-2s.
Ground Movement	Category 1 according to Burland and Boscardin and Cording
Waste Disposal	Waste disposal is responsibility of owner to ensure it is disposed appropriately to landfill. Likely to go as inert waste.

1. INTRODUCTION
1.1 Project

This report describes the results of a Basement Impact Assessment undertaken for the development of a basement at 219A Goldhurst Terrace, Swiss Cottage, London, NW6 3EP. The work was undertaken on behalf of Mr Marcus Zaman and was carried out by the Ashton Bennett Consultancy. Plans of the proposed development are provided in Appendix A.

The purpose of this Report is to ascertain the potential impacts that the proposed basement may have on the ground stability, the hydrogeology and the hydrology in the vicinity of the site. The site lies within the Administrative Boundary of Swiss Cottage 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 the London Plan D10.

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 together with a site visit. The results of the screening enabled scoping which determined whether a ground investigation is required to establish ground conditions. The Basement Impact Assessment (BIA) is provided in full and is undertaken in general accordance with the recommended methodologies highlighted in Arup document "Guidance for Subterranean Development", prepared for the London Borough of Camden Planning Guidance CPG4 and in URS document "London Borough of Camden SFRA" July 2014 and the London Plan D10 Basements.

The four stage approach taken comprises of:

- Screening – Identification of matters of concern using checklists.
- Scoping – Definition of the matters of concern identified in the screening.
- Impact Assessment – Determination of the impact of the proposed basement on the baseline conditions.
- Review and decision making – Undertaken by London Borough of Camden and independent reviewer.

1.2 Authors

The assessment was prepared by Frances A Bennett an engineering geologist who is a Chartered Geologist CGeol, Chartered Environmentalist CEnv and Chartered Water and Environmental Manager C.WEM at Ashton Bennett Consultancy. Land stability will be assessed by an engineer qualified with CEng, MICE in the Structural Method Statement to be presented before development.

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 April 23rd 2021.
- Historical and Current mapping from Ordnance Survey 1850 to date.
- Geological mapping from British Geological Survey Sheet 256, North London.
- BGS archival borehole logs
- Hydrogeological data from Environment Agency
- Hydrological data from Environment Agency.
- Flood Risk mapping from Environment Agency and Ambiental Risk Analytics
- London Borough of Camden Strategic Flood Risk Assessment. URS
- Guidance for Subterranean Development, (CPG4),
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study-Guidance for Subterranean Development, (ARUP, 2010).
- London Plan D10, 2021

- Foundation Design and Construction, MJ Tomlinson, 2001.
- Conservation Areas in Camden.
- Map of Archaeological Priority Areas in Camden.
- World War II Bomb Locations. The National Image Library.
- EnviroInsight Report on 219A Goldhurst Terrace Centremaps, 2021.

2. THE SITE
2.1 Site Description

The site is located at number 219A Goldhurst Terrace which lies between the A41 Finchley Road and the A5 Kilburn High Street to the north of the B509 Belsize Road. A site walkover was undertaken on Friday April 23rd 2021 in order assess the property.

The site area comprises the house and garden of 219A Goldhurst Terrace which is a private middle terrace residence on a plot of 400m2. The house is attached on the west side by house No 217 and on the east by No 221. The Basement Impact Assessment refers to the ground floor flat of the house which is divided into three flats, one on each floor.

The site fronts onto Goldhurst Terrace to the north, with a hard covered front garden and a lawned rear garden.

It is proposed to extend the house to the rear and construct a basement beneath the house and part of the rear garden.

The site is bounded to the north by Goldhurst Terrace, to the south by the gardens of houses fronting onto Belsize Road.

All land on the site was relatively flat with a slope of <7 degrees to the horizontal.

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 west to east collecting drainage from the adjoining properties.

There are existing lawn areas to the rear of the house which allow infiltration of rainwater into the ground.

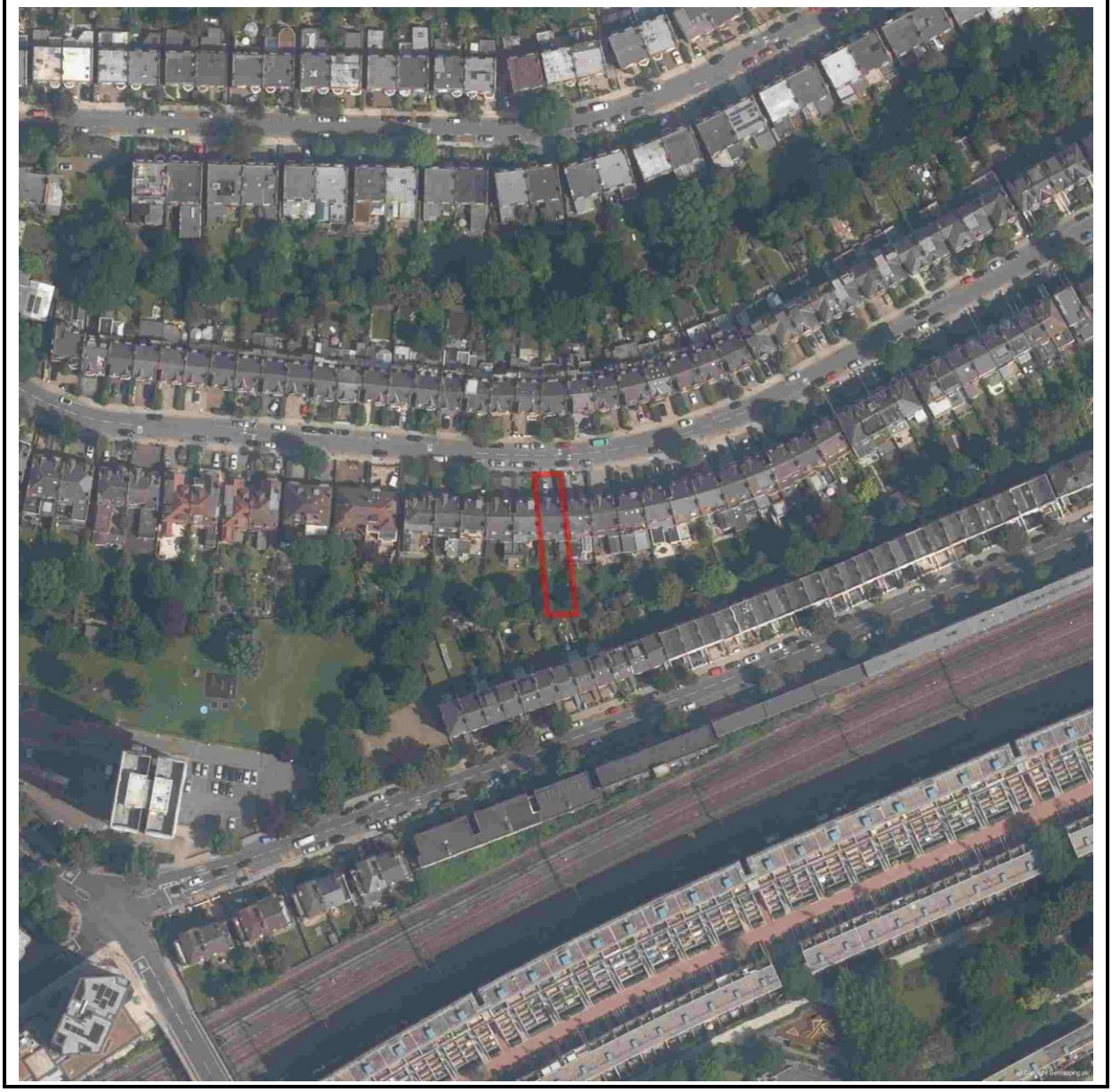


Figure 1 Site Location Plan

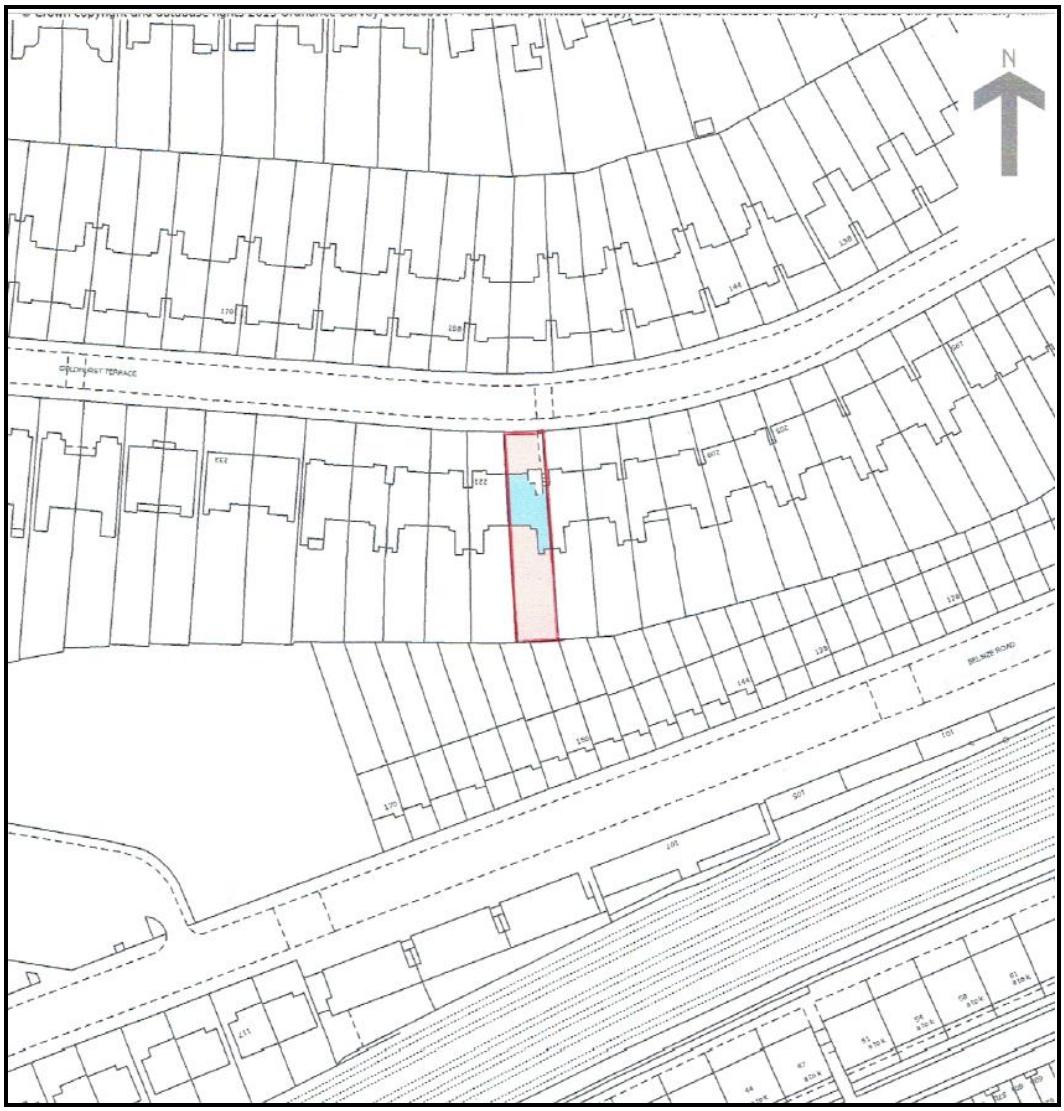


Figure 2 Site Plan

Figure 3 Existing Rear Elevation

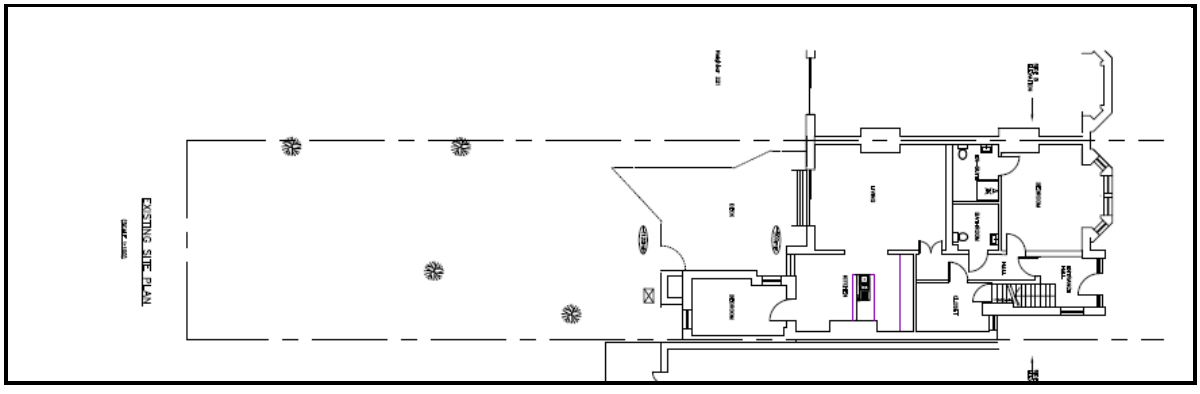


Figure 4 Existing Ground Floor

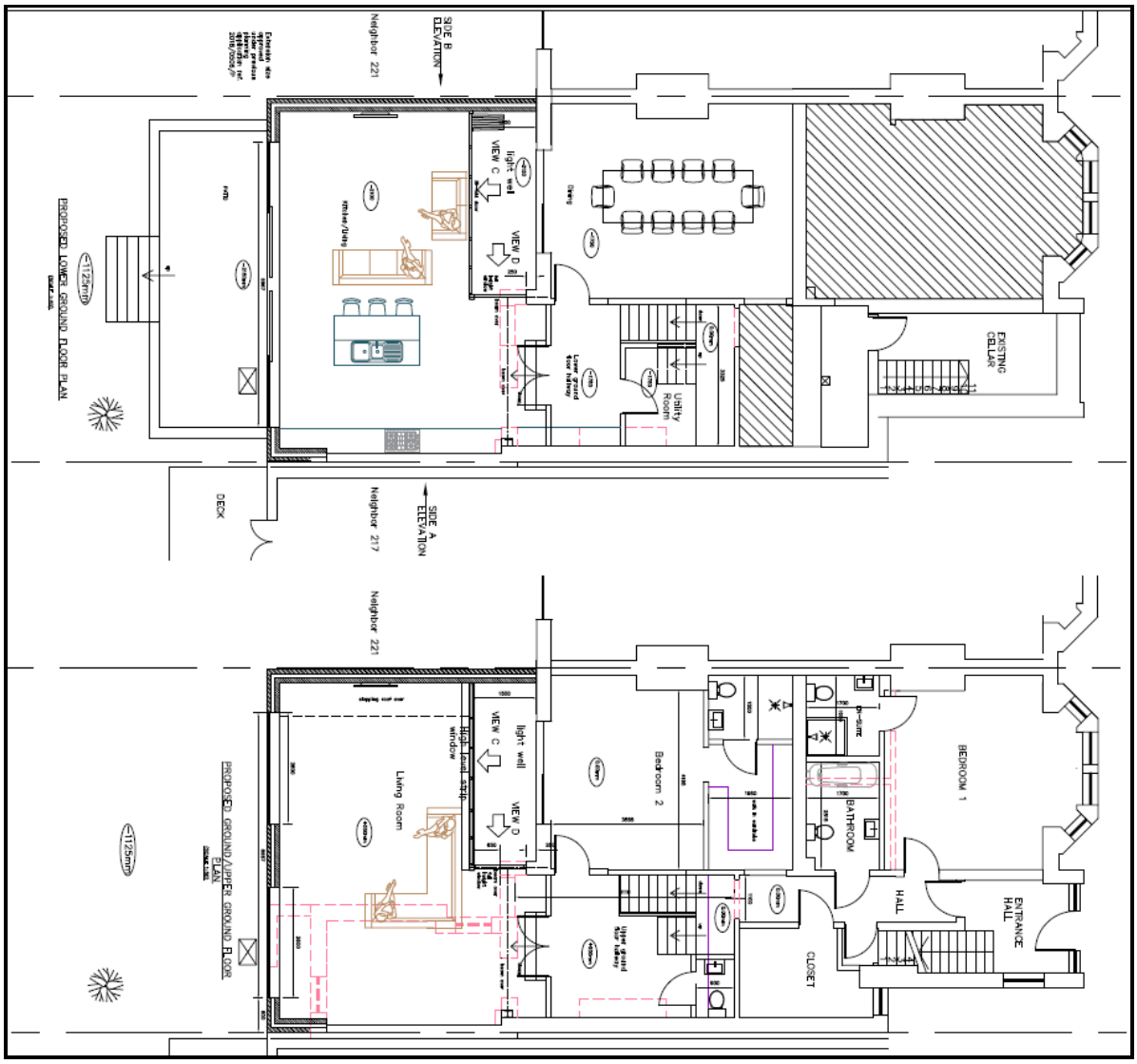


Figure 5 Proposed Ground Floor and Basement Plans

The site lies around National Grid Reference 525962^{E} 184008^{N} at a height of around 30m above Ordnance Datum. A Site Location Plan is presented as Figure 1 and a Site Plan is presented as Figure 2 and an Existing Rear Elevation Photo as Figure 3. The Existing Ground Floor is presented as Figure 4 and Proposed Ground Floor and Basement Plans are presented in Figure 5. Approximate Location of Bombs, Second World War is presented as Figure 6. Historic Industrial Land Use is presented as Figure 7 and Current Industrial Land Use as Figure 8.

Waste Exemptions are presented as Figure 9 and EA recorded Landfill Sites as Figure 10. The Conservation Area of South Hampstead is presented as Figure 11.

A Geology Plan is presented as Figure 12, and a Landslip Plan as Figure 13. A Local Borehole Plan is presented as Figure 14. A Hydrogeology Plan is presented as Figure 15, and Abstractions and Source Protection Zones as Figure 16. Risk of Flooding from Surface Water is presented as Figures 17a (EA) and 17b (URS) and Figures 18 (ARA)and 19(URS).

Flooded Roads 1975 and 2002 are presented as Figure 20. The 1 in 1000 Year Flood Event as Figure 21. The NW Storm Relief Sewer Location is presented as Figure 22 and the EA Flood Risk from Reservoirs as Figure 23. The Risk of Flooding from Groundwater is presented as Figures 24 and 25 (URS) and Figure 26 (ARA). The Risk of Sewer Flooding (URS2014) as Figure 27. Critical Drainage Areas and Local Flood Risk Zones are presented on Figure 28 and Transport Infrastructure is presented as Figure 29 with Detailed Local Infrastructure as Figure 30.

Drawings of site proposals are presented in Appendix A and archival maps are presented in Appendix B. A Conceptual Model is presented in Appendix C, Ground Movement Calculations and Monitoring Strategy in Appendix D.

3. SITE HISTORY

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
1871 1872	1:10,560 & 1:2500	The site is undeveloped open fields with a pond to the west	Belsize Road to the south is constructed with houses and the London and North Western Railway lies to the south
1873-74	1:10,560	No significant change.	No change to the surrounding area.
1894 1896	1:10,560	The road outline for Goldhurst Terrace is marked out, but the site is undeveloped	No change to the surrounding area.
1894	1:10,560	No significant change.	Houses to the east of the site Goldhurst Terrace have been built. Housing developed to the north of Goldhurst Terrace. .
1896	1:2,500	No significant change.	No change to the surrounding area.
1915	1:2,500	Goldhurst Terrace and the houses thereon have been built including the site	The surrounding area has been developed.
1920	1:10,560	No significant change.	No change to the surrounding area.

DATE	SCALE	DESCRIPTION	
		SITE	SURROUNDING AREA
1935	1:2,500	No significant change	The three properties to the west have been built
1948-51	1:10,560	No significant change.	No change to the surrounding area.
1957-8	1:10,560	No significant change.	No change to the surrounding area.
1965-8	1:10,560	No significant change.	The houses to the south fronting onto Belsize and Abbey Road have been demolished
1969	1:2,500	No significant change.	The two tower blocks to the south of the property have been built
1973-6	1:10,000	No significant change.	No significant change.
1989-93	1:10,000	No significant change.	No significant change.
2002	1:10,000	No significant change.	No significant change
2012	1:10,000 & 1:1,250	No significant change.	No significant change to the surrounding area.

In summary, the site was open fields until 1893, when Goldhurst Terrace road was formed, most of the houses in Goldhurst Terrace were built between 1893 and 1920.

3.2 World War II Bomb Locations

A check was made of the bomb locations in the site vicinity and the nearest to the site area was at a close proximity and it is recommended that an Unexploded Ordnance Desk Study is undertaken before development to determine the exact details of the bombs.

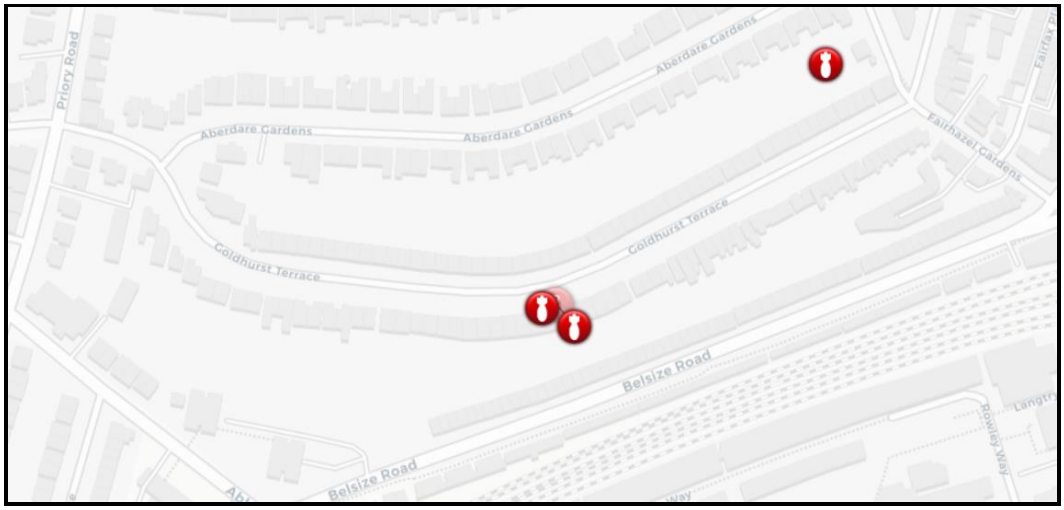


Figure 6 Approximate Location of Bombs, Second World War

3.3 Historic Industrial Land Use

Historic Land Use indicates the presence of railway land, sidings and a railway station all located within 100m of the site area to the south and south east.

The closest unspecified tank to site is located 220m to the south, last present in 1871. The closest historical energy feature, an electricity substation, existed 72m to the south east of site circa 1970-91.

No historical petrol stations have existed within 300m of the site area. An historical garage existed to the north west of site 312m distant circa 1953-1955.

No historical Military Land has occupied land within 300m of the site in the past.

The site lies within a residential area with historic industrial land use to the south. Past railway land to the south east of the site. It is considered unlikely that any of these historical land uses have detrimentally affected the site.

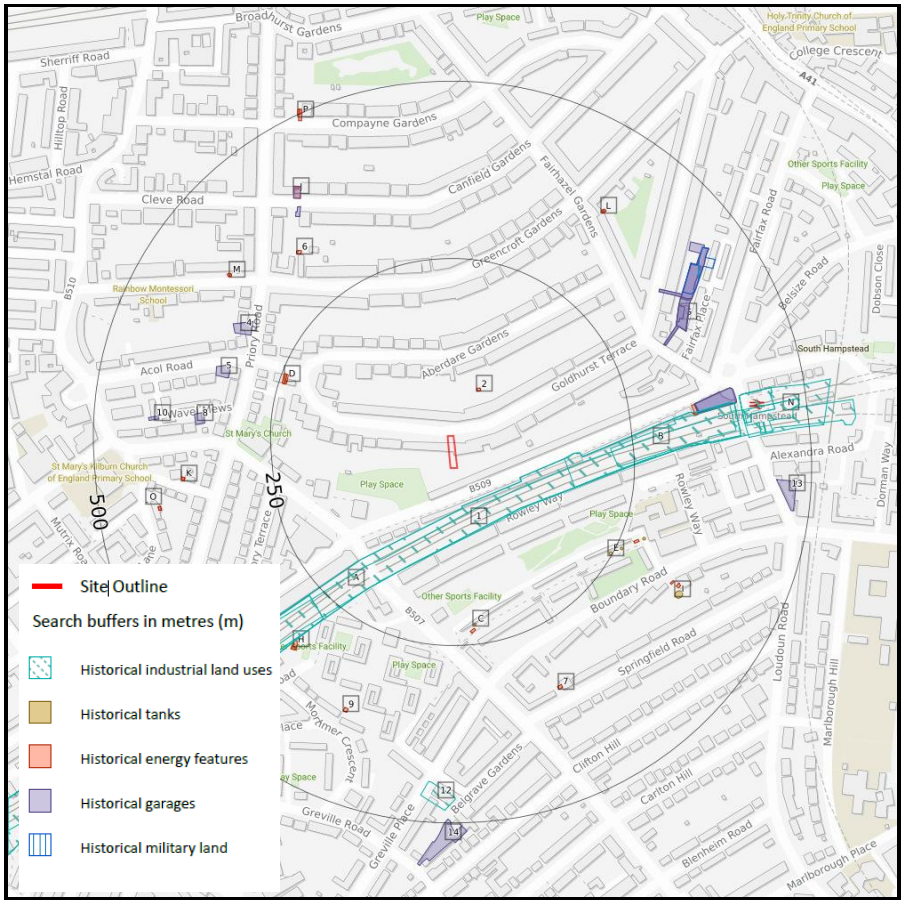


Figure 7 Historic Industrial Land Use

3.4 Current Industrial Land Use

The site is currently occupied by a residential dwelling. An electricity sub station exists to the north east, 75m distant. Three further electricity sub stations exist within 250m of the site.

There are no current petrol stations within 500m of the site. There are no high voltage electricity cables or high pressure underground gas transmission pipelines.

Table 2
Incidents, Regulations and Authorisations

Regulated Industry	On SITE	Within 250m	DETAILS
Records of COMAH and NIHHS sites	None	None	
Regulated Explosives Sites	None	None	
Records of Hazardous Substance Consents and Enforcements	None	None	
Historic IPC Authorisations	None	None	
Part A(1) and IPPC Authorised Activities	None	None	
Records of Part A(2) and Part B activities and enforcements	None	None	
Radioactive Substance Authorisations	None	None	-
Licensed Discharge Consents	None	None	-
Red List Discharge Consents	None	None	
Pollutant Release to public sewer	None	None	
List 1 Dangerous Substances Inventory Sites	None	None	
Records of List 2 Dangerous Substances Inventory Sites	None	None	
Pollution Incidents EA/NRW	None	1	One at 191m south construction waste no impact to water land or air
Pollution Inventory Substances	None	None	
Pollution Inventory Waste Transfers	None	None	-
Pollution Inventory Radioactive waste	None	None	-
Sites determined as contaminated land under Section 78R of EPA 1990	None	None	-
Records of Made Ground	None	None	-
Active or recent landfill	None	None	
Historical Landfill BGS records	None	None	
Historical Landfill LA and OS records	None	None	
Historical Waste Sites	None	None	
Licensed Waste Sites	None	None	
Waste Exemptions	None	None	9 within 250 to 500m
High voltage electricity cables	None	None	
Petrol and Fuel Sites	None	None	-
Underground High Pressure Oil and Gas Pipelines	None	None	-
Residential Property (within 250m)	Yes	Yes	Residential and commercial

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 construction of a basement.

With the exception of made ground that may have been associated with the residential development on the site and in the surrounding area, the historical map and uses of site searches have not identified any potential sources of contamination or archaeological features that could be present on 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 not considered necessary to undertake tests for contamination.

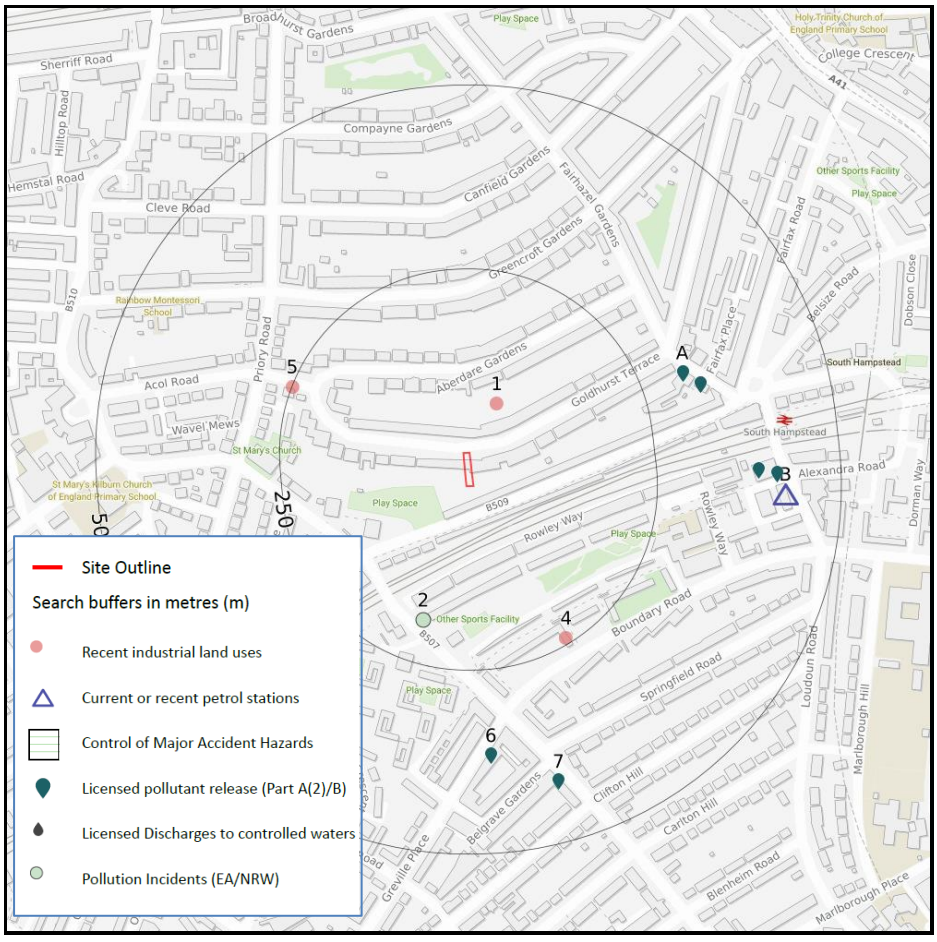


Figure 8 Current Industrial Land Use

3.5. Landfill

According to the Environment Agency there are no landfill sites within 250m of the site and therefore the site does not require monitoring for landfill gas and does not require landfill gas protection in construction of the basement.

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.

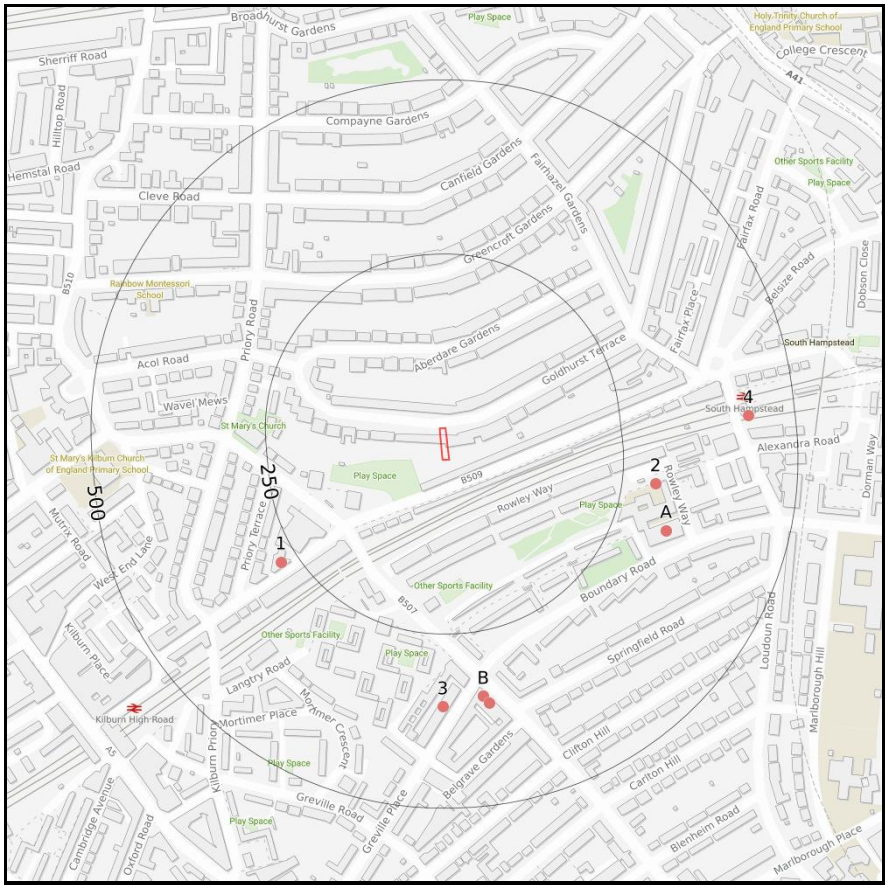


Figure 9 Waste Exemptions

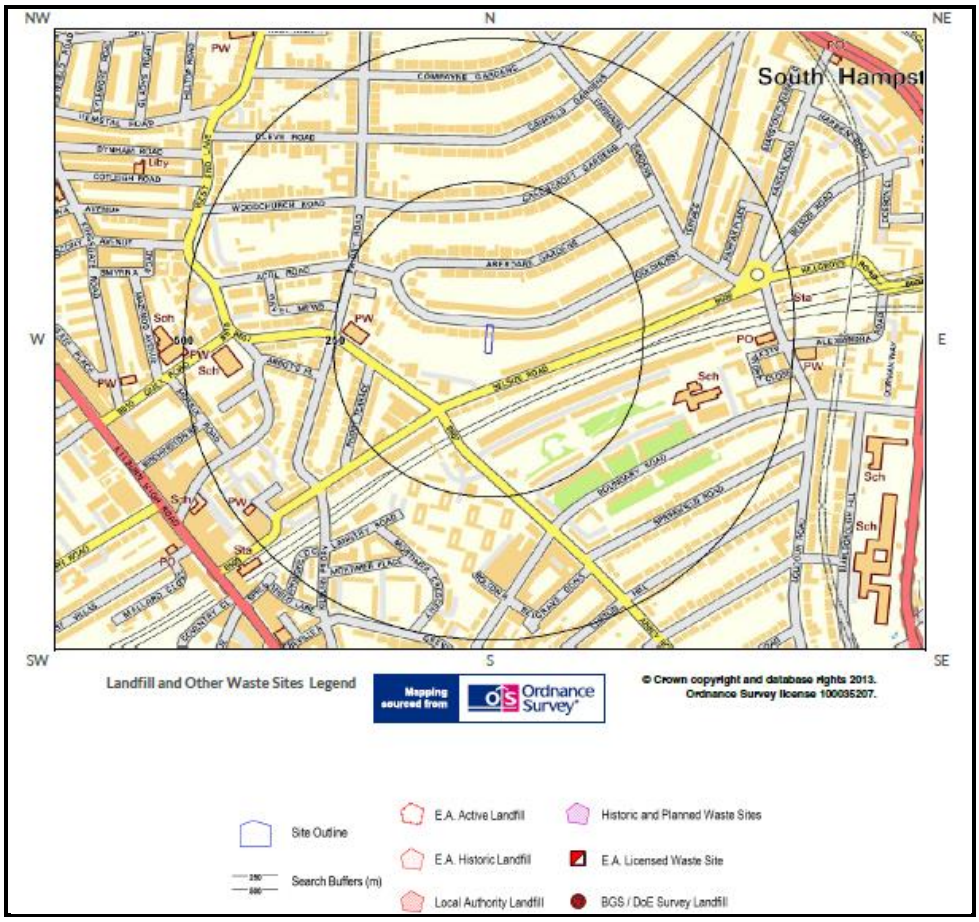


Figure 10 EA Recorded landfill sites

4. VISUAL, CULTURAL AND ENVIRONMENTAL DESIGNATIONS

The site does not lie within 250 of a World Heritage Site, Area of Outstanding Natural Beauty, National Park, Scheduled Ancient Monument, Registered park and Garden.

There are 2 listed buildings within 250m of the site and the site lies within the conservation area of South Hampstead designated in 1988.

The site does not lie within an Archaeological Priority Area according to English Heritage.

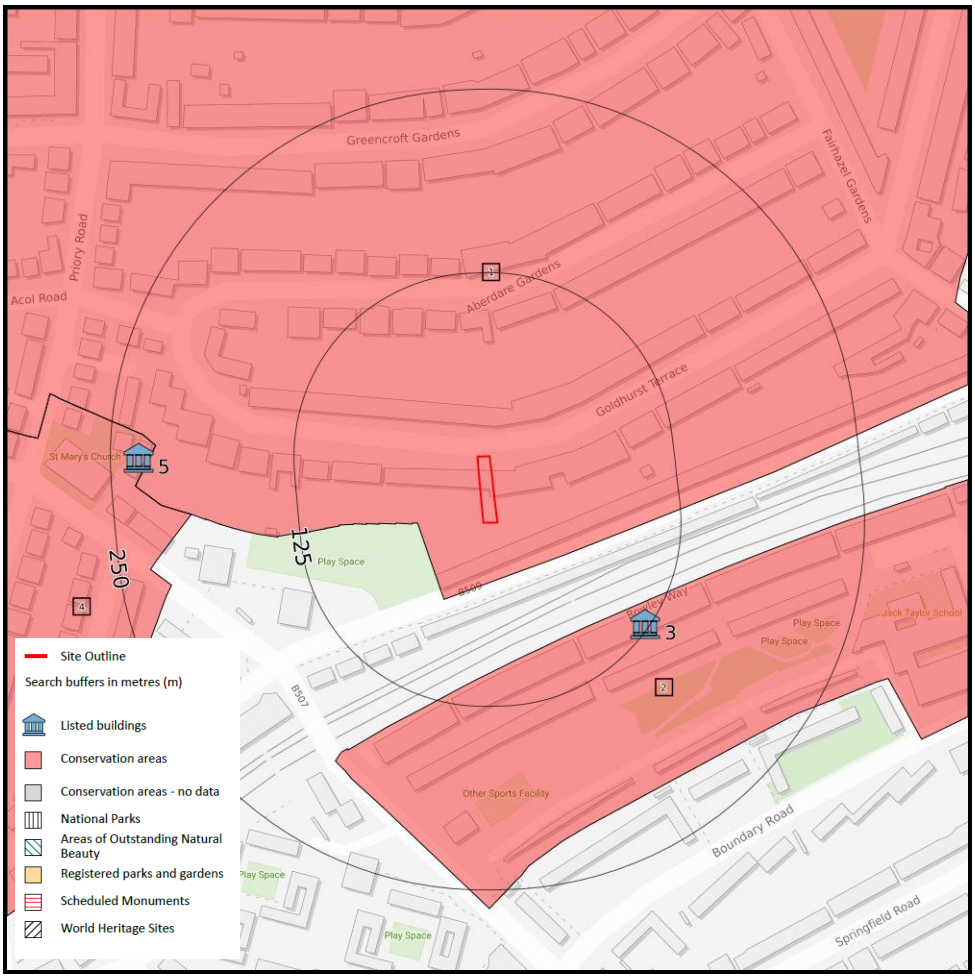


Figure 11 Conservation Area of South Hampstead

There are no recorded Sites of Special Scientific Interest (SSSI), Conserved wetland sites (Ramsar), Special Areas of Conservation (SAC), Special Protection Areas (SPA), National Nature reserves (NNR), Local Nature reserves (LNR), Designated Ancient Woodlands, Biospere Reserves, Forest Parks, marine Conservation Zones, Green Belt, Proposed Ramsar sites, Possible Special areas of Conservation (pSAC), Potential Special Protection Areas (pSPA), Nitrate Sensitive Areas, Nitrite vulnerable Zones within 2000m of the site.

5. SITE GEOLOGY

5.1 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 the London Clay Formation (up to 85m thick) of the Eocene geological epoch. The London Clay is underlain by further clays, sands and chalk. An extract of the BGS Geological Map is provided in Figure 12 below.

The London Clay is shown not to be overlain by any superficial deposits. Given the historical development of the site and surrounding areas, there may be made ground present on the site.

The London Clay exhibits a moderate hazard rating for shrinking and swelling on varying moisture content during seasonal changes. The geology indicates a very low risk of running sands, landslips or collapsible deposits, a negligible risk of compressible deposits and ground dissolution of soluble rocks.

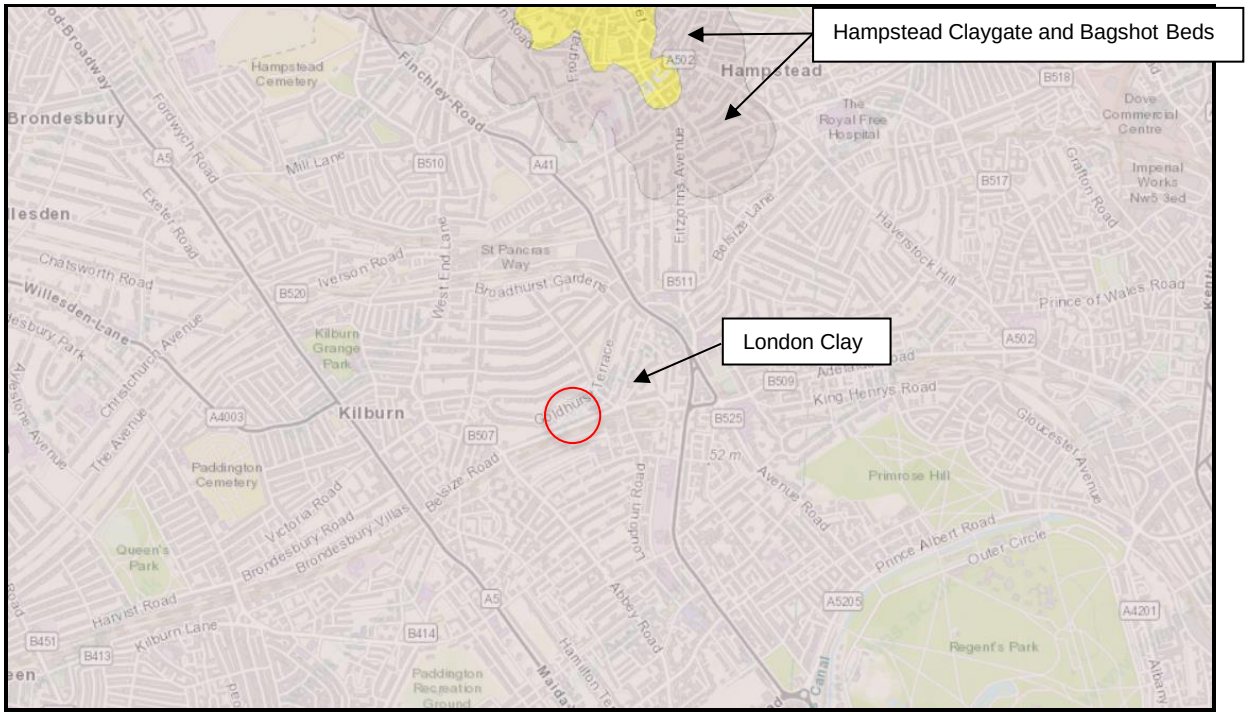


Figure 12 Geological Plan

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

5.2 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, stone or other recorded mineral works.

Underground working associated with the underground railway lie >500m to the east.

5.3 Landslips

The site is shown not to be within an area of significant landslide potential as shown in Figure 13 Landslip Plan. (reference Figure 17 of Arup Report for London Borough of Camden "Guidance for Subterranean Development", 2010). This is reinforced by the low slope angles recorded during the site walk over and the geology of the London Clay with no overlying deposits.

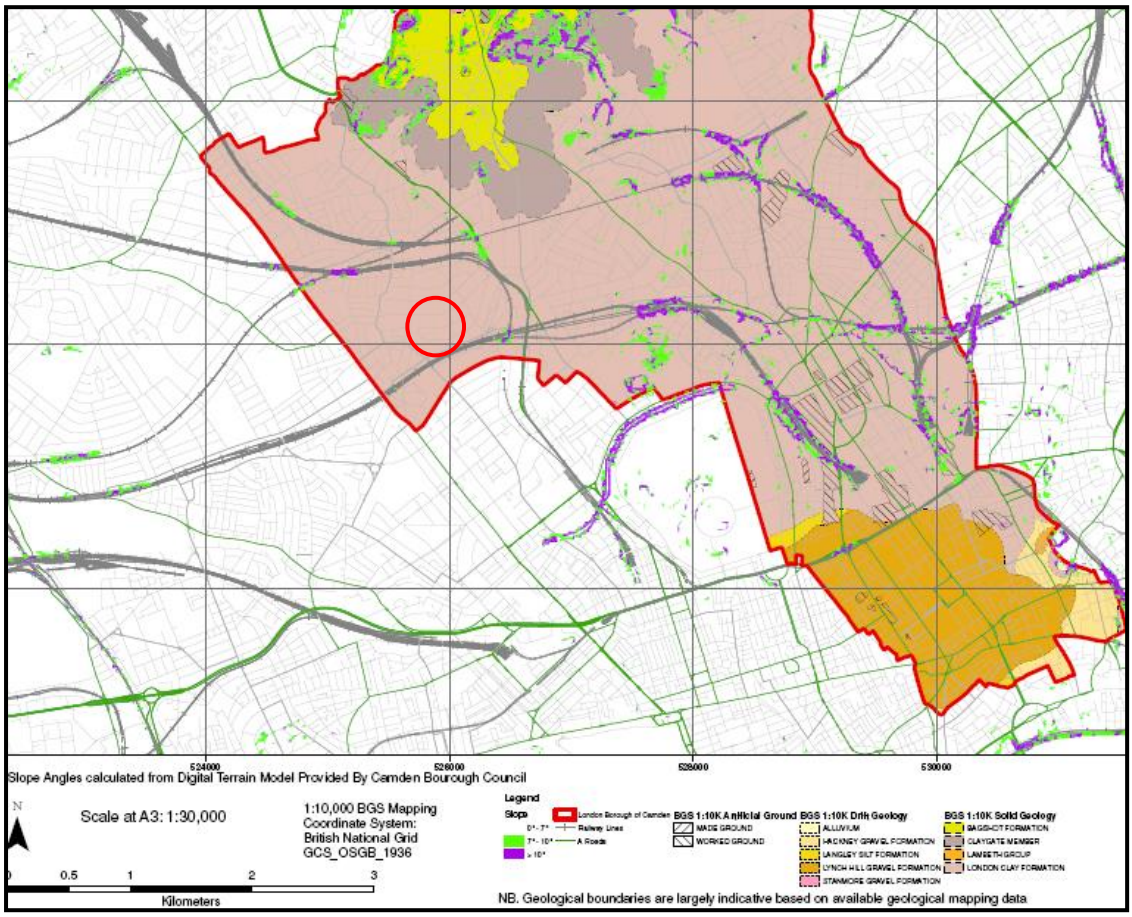


Figure 13 Landslip Plan

5.4 Local Boreholes

A number of relevant available historic borehole logs have been obtained from the BGS website 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
TQ28SW11	85	London Clay to 85m sand thereafter	RWL 40m
TQ28SE360	45.72	London Clay	
TQ28SE46	177	London Clay to 81m, sand to 96m and Chalk thereafter	Water details not recorded
TQ28SE276	7.62	Topsoil to 0.46m underlain by loamy clay and brown clay	Dry

These boreholes confirm the geology of the area surrounding the site and confirm that any local water abstraction wells are from generally >100m depth into the Chalk aquifer.

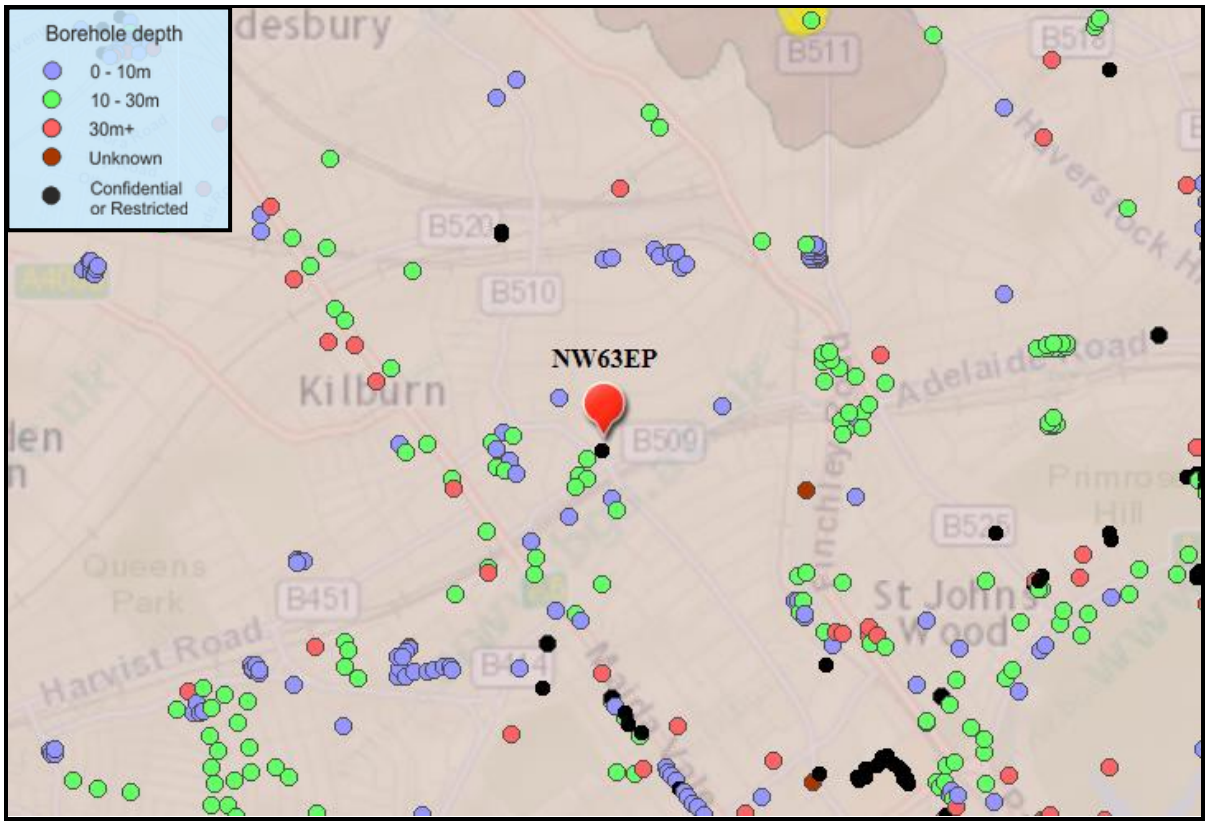


Figure 14 Local Borehole Plan

5.5 Engineering Geology

The London Clay usually provides good bearing strength for low rise housing. For the 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 London Clay may shrink and swell under varying moisture contents. The BGS classify the potential for clays to shrink and swell as moderate. Plasticity tests should be undertaken to assess this potential on the site.

6. HYDROGEOLOGY

6.1 Aquifers

The above referenced geological map indicates the site to be underlain by the London Clay Formation, which is relatively impermeable. The Environment Agency have designated the London Clay Formation beneath the site as an "Unproductive Aquifer" which means the strata has 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.

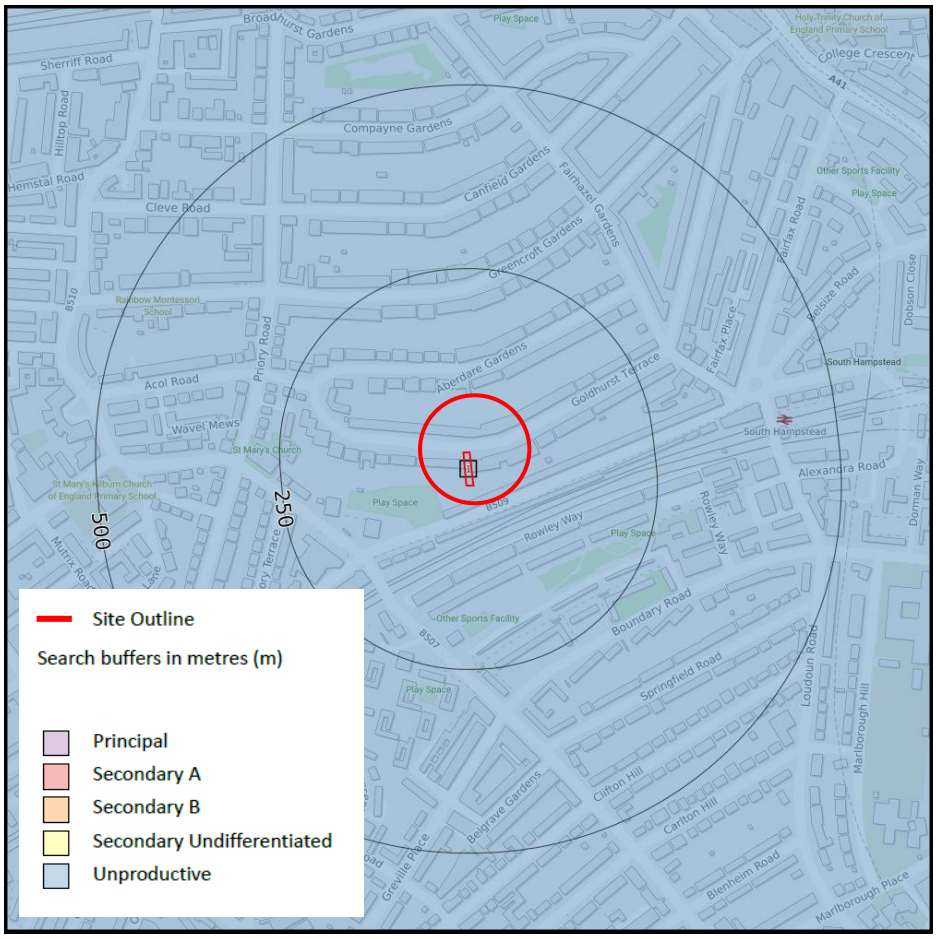


Figure 15 Hydrogeology Plan

The natural soils underlying the site are likely to comprise a superficial covering of made ground (potentially absent) overlying weathered London Clay (clay soils). The London Clay

soils have very low permeability and do not readily permit the downwards transfer of surface water or percolating groundwater.

6.2 Groundwater Depth and Flow

The development of a basement is unlikely to detrimentally affect any groundwater which lies circa 100m bgl in the Chalk Aquifer. There are no Superficial Deposits overlying the London Clay which could hold perched water.

It is unlikely that the basement will realign or detrimentally affect any flow of groundwater such that groundwater could detrimentally affect neighbouring properties, springs or watercourses.

It would be prudent to waterproof the basement and take into consideration potential uplift pressures and a groundwater level at least 1m above formation level in case of water rising during and after heavy rainfall.

6.3 Wells and Springs

There are no groundwater or potable water abstraction licences within 500m of the site. There are water abstractions at 883m and 886m E for spray irrigation and at 1762m E for potable water from Barrow Hill Pumping Station. The site does not lie within a Source Protection Zone for a potable water supply.

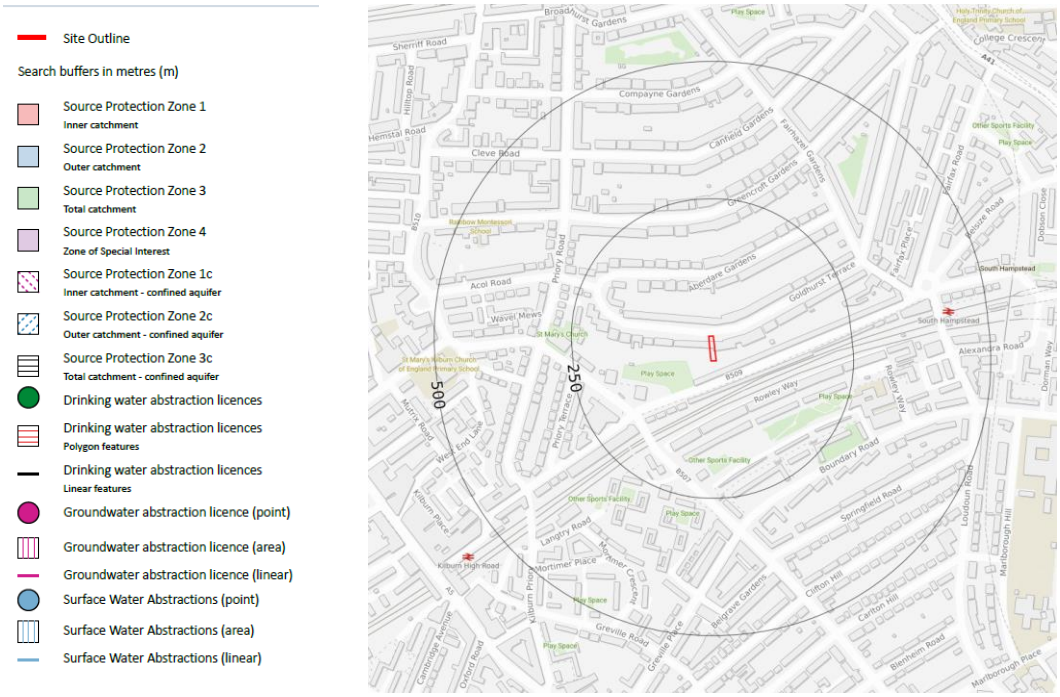


Figure 16 Abstractions and Source Protection Zones

Other unrecorded or unlicensed wells may be present close to the site, however abstractions are unlikely to be from the London Clay Formation and likely to be from the underlying Chalk Formation at circa >100m bgl. The development is unlikely to detrimentally affect any water abstractions.

6.4 Flood Risk from Groundwater

According to the BGS there are no groundwater flood susceptibility flood areas within 50m of the site. According to the BGS there is a negligible risk of groundwater flooding based on the underlying geology. This is confirmed in Figures 24 and 25 and 26 in Section 7.5.

6.5 Summary of Geology and Hydrogeology

Based on the ground and groundwater conditions encountered it is considered that the development proposals are unlikely to pose a risk to groundwater levels or groundwater flow or to wells or springs. It is unlikely that the basement will be detrimentally affected by the local hydrogeology provided sump pumping is available during construction, the basement is waterproofed (Grade 3 BS 8102) and uplift pressures from rising groundwater of at least 1m are taken into consideration.

7. HYDROLOGY AND FLOOD RISK

7.1 Hydrology

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 north east of the site.
- Surface water from the front yard drains into surface drains.
- Surface water in the rear garden will be infiltrated into the topsoil.

On completion of redevelopment the rainfall will drain in the same manner to public sewers.

There are no surface water features within 250m of the site.

There are no biological river quality assessments within 1.5km of the site. There are no surface water abstraction licences within 1.5km of the site. The closest is 1875m E from Regents Canal for non evaporative cooling.

7.2. Flood Risk From Surface Water

The site is shown by the Environment Agency to lie within a low risk for flooding from rivers and very low from the sea.

Camden is primarily 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), groundwater or flooding from sewers which have either burst or gone beyond capacity due to heavy rainfall. All of these situations are only likely to occur in extreme rainfall events such as in 1975 and 2002.

The site lies within the Critical Drainage Area of West Hampstead and the Local Flood Risk Zone of Goldhurst.

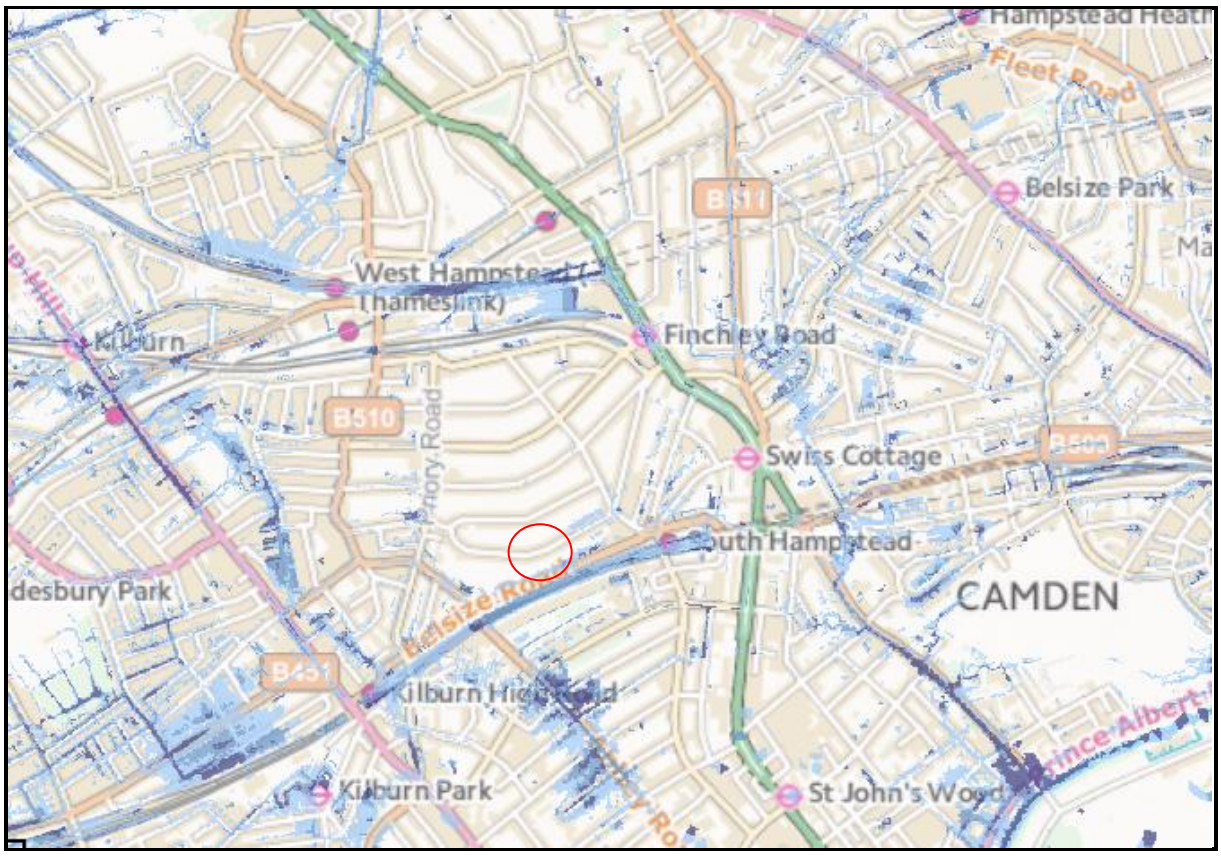


Figure 17a Risk of Flooding from Surface Water (EA 2014)

The history of flooding in this area is that Goldhurst Terrace was affected by flooding in both 1975 and 2002. However, after the 2002 floods, Thames Water invested in significant new flood risk infrastructure as part of the West Hampstead Flood Relief Scheme. The project involved larger diameter sewers and a holding tank both of which have substantially reduced flood risk in the area.

The recent Environment Agency map reproduced in Figure 17a indicates a very low risk from flooding from surface water.

The map reproduced from URS 2014 Report indicates 2 properties in Goldhurst Terrace have flooded from surface water. Section 3.2.11 in URS 2014 Report states, " Where streets are

shown (on Fig 17b) to have experienced flooding during the 1975 and 2002 flood events, the mapping is relatively coarse in scale and does not allow a distinction between, for example, an entire street flooding, or an isolated section of road flooding as a result of a blocked gulley."

It appears therefore that the EA 2014 map in Fig 17a is more accurate and shows the flooding in the east end of Goldhurst Terrace and away from No 219A.

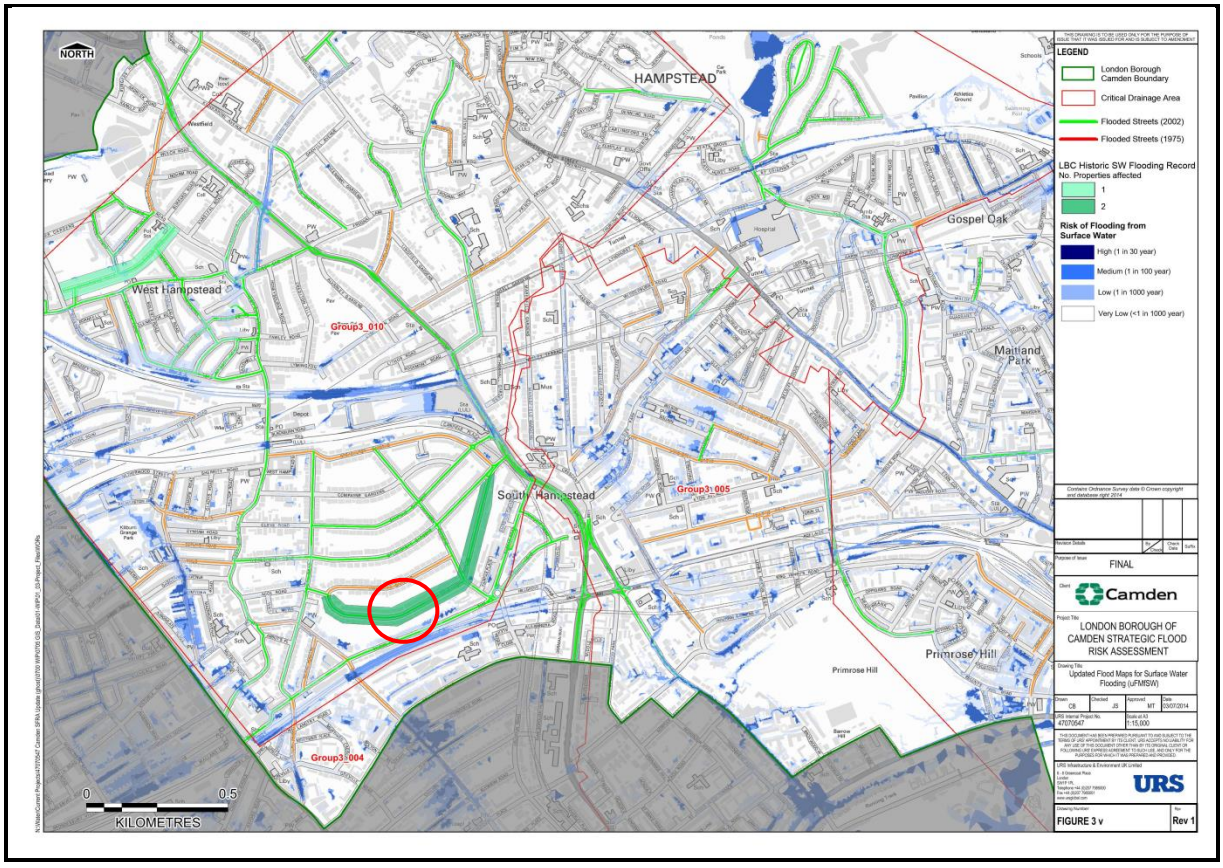


Figure 17b Risk of Flooding from Surface Water (URS 2014)

Figure 17b indicates that two properties only in Goldhurst Terrace have been affected by surface water flooding and the risk of number 219A being flooded is very low according to the EA ans according to Ambiental Risk Analytics.

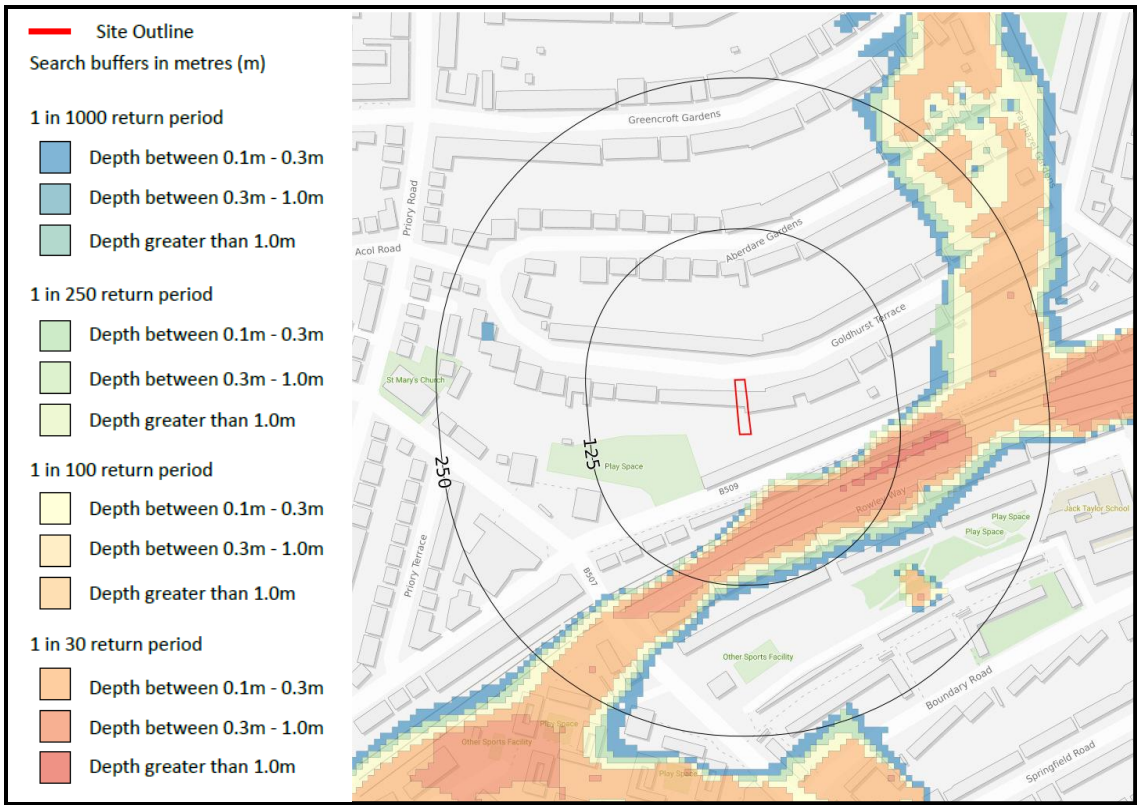


Figure 18 Surface Water Flooding (Ambiental Risk Analytics)

Figure 19 Detailed Surface Water Flood Risk

The Detailed Surface Water Flood Risk shown in Figure 19 also shows flooding at the east rather than west end of Goldhurst Terrace.

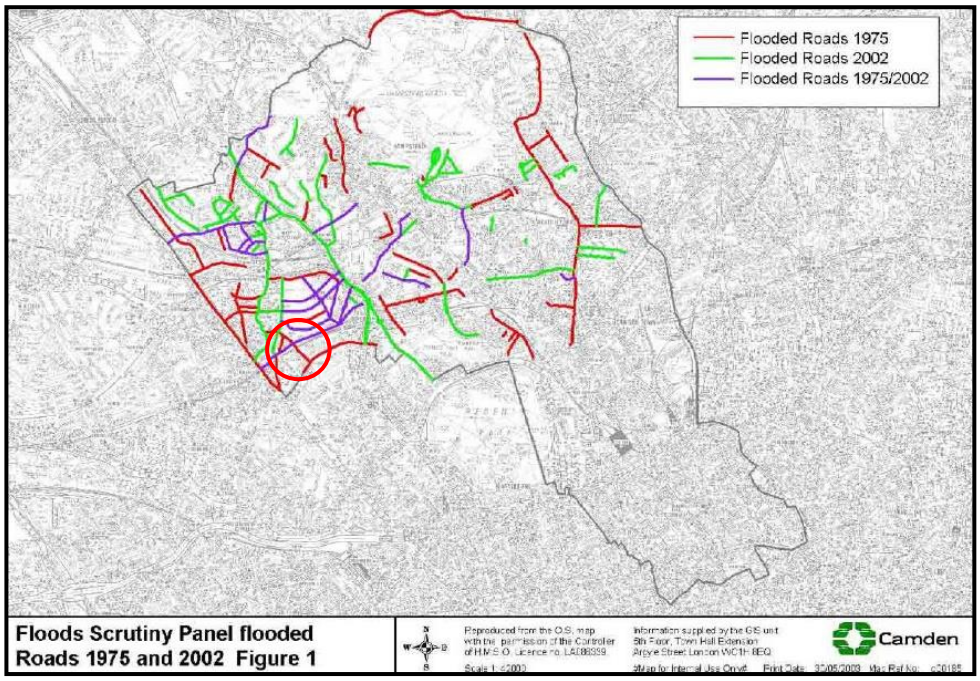


Figure 20 Flooded Roads 1975 and 2002

7.3 Flood Risk From Rivers

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.

Camden lies entirely within Flood Zone 1 with a low probability of flooding from rivers or the sea.

Camden is not at risk from flooding from rivers. The closest surface water is the Regents Canal almost 1000m to the south.

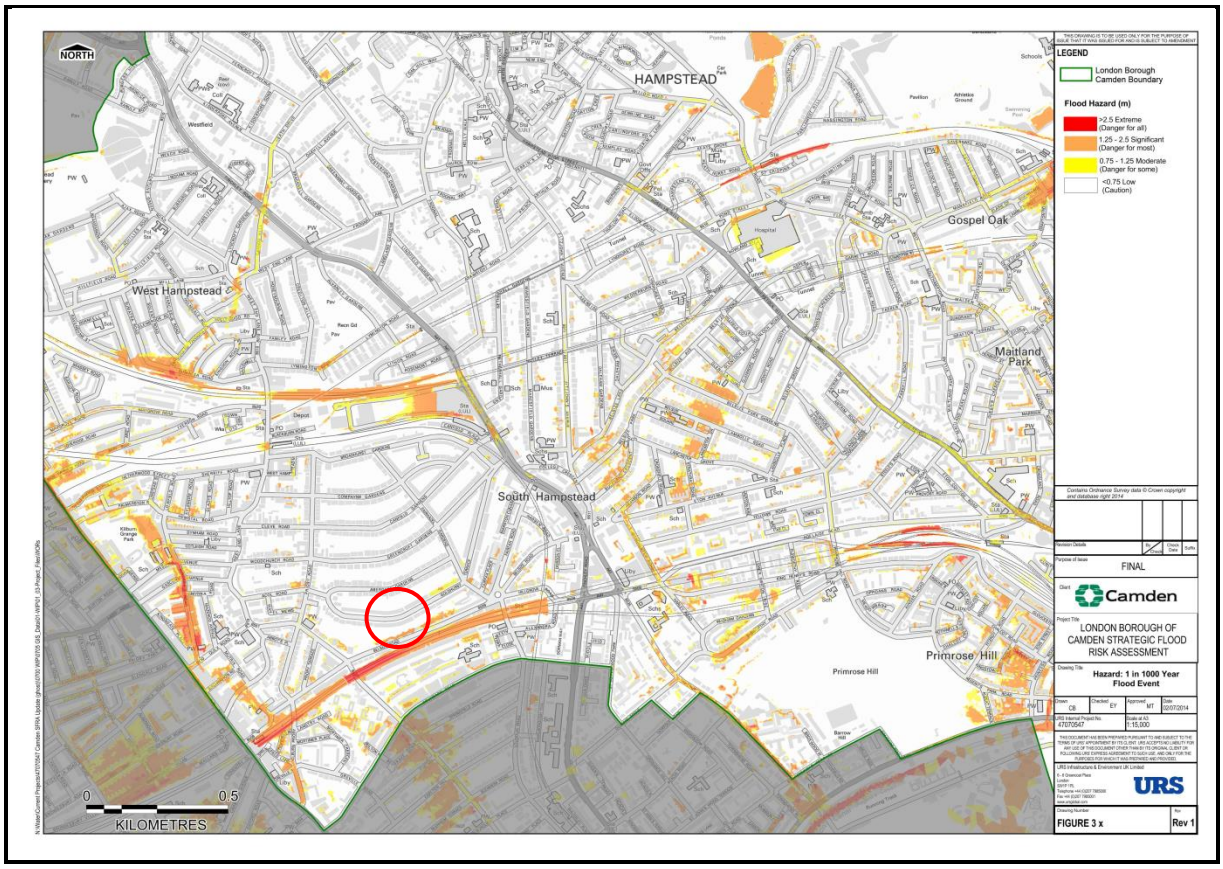


Figure 21 1 in 1000 year Flood Event

The URS (2014) map above indicates a <0.75m flood hazard or low risk at 219A Goldhurst Terrace.

The site lies within close proximity to the former surface water of the River Westbourne, which flowed from West Hampstead to the north, through Goldhurst Terrace and Kilburn to supply water to the Serpentine before flowing into the River Thames at Pimlico.

The River was culverted by the North West Storm Relief Sewer and no longer flows on the surface. The exact location of the sewer should be established prior to excavation of the basement.

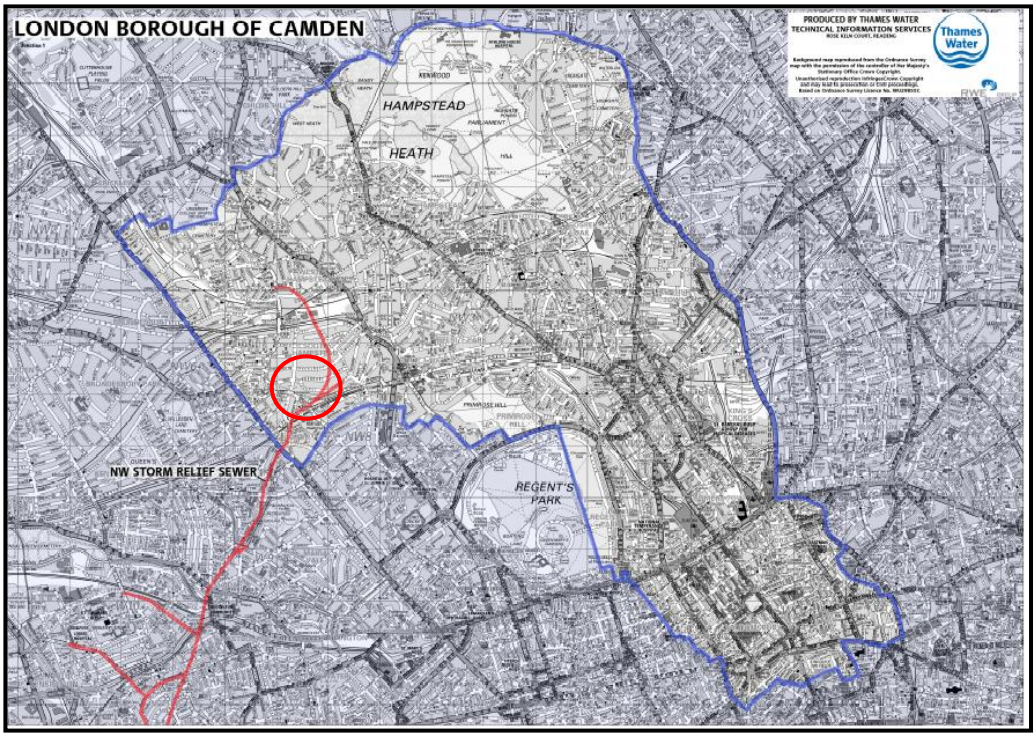


Figure 22 NW Storm Relief Sewer (shown in red)

7.4 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. There is a very low risk from the Hampstead Heath Reservoir 760m to the north west of the site as detailed in Figure 23.

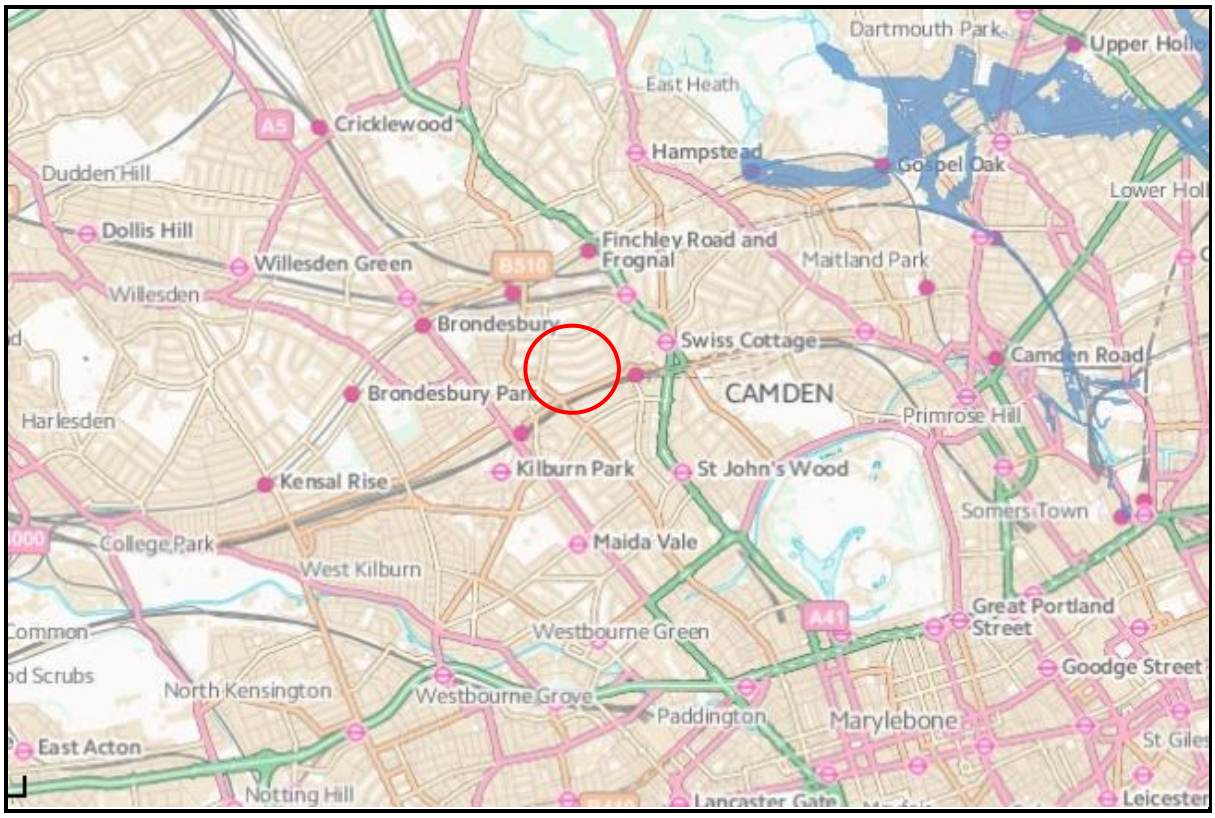


Figure 23 EA Flood Risk From Reservoirs

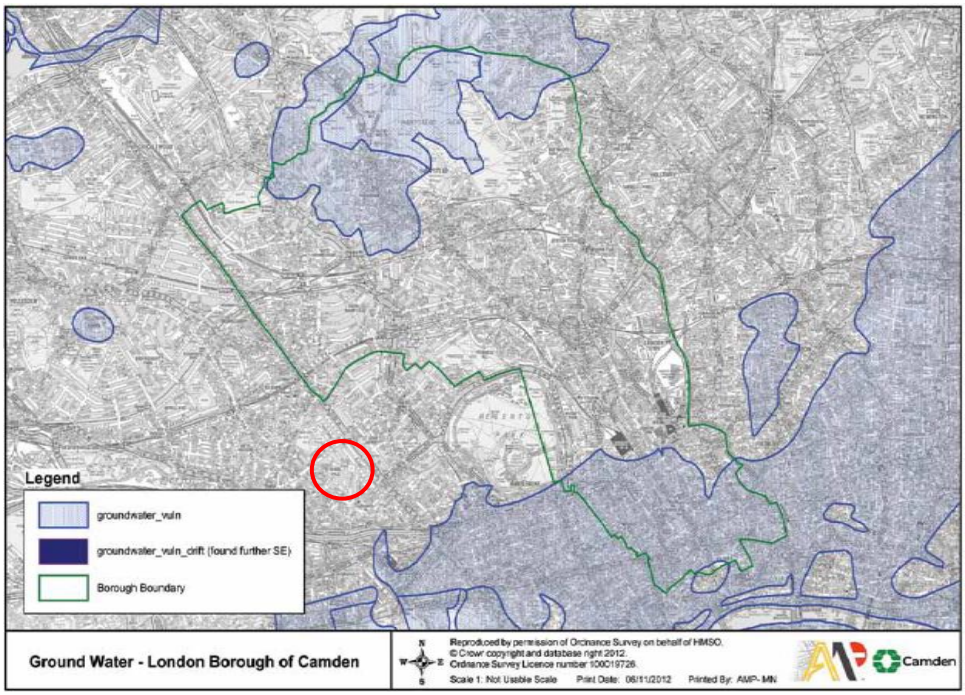
Below are the reservoirs that could affect this area.

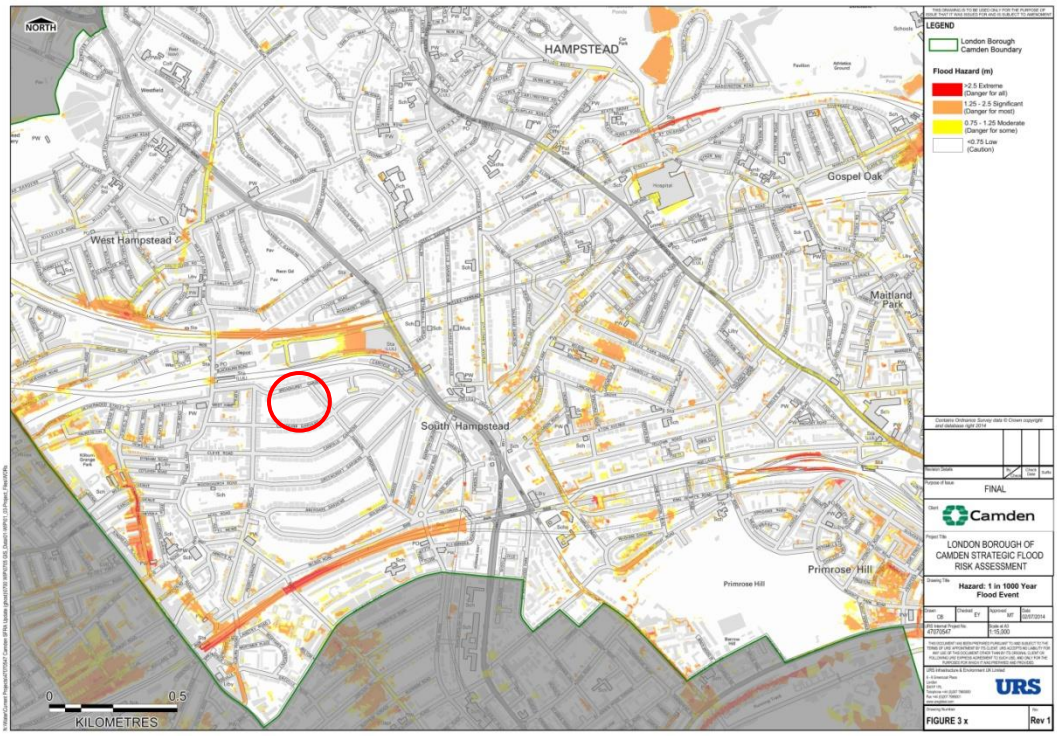
Hampstead Pond No.1		
Reservoir Owner: Corporation of London		
Reservoir location (grid reference):527210, 185750	**Environment Agency Area:** North East Thames Area in South East Region	**Local Authority:**Camden

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.

7.5 Flood Risk From Groundwater

According to the BGS there are no groundwater flood susceptibility flood areas within 50m of the site. There is according to the BGS a negligible risk of groundwater flooding based on the underlying geology.





Figures 24 and 25 Groundwater Flooding

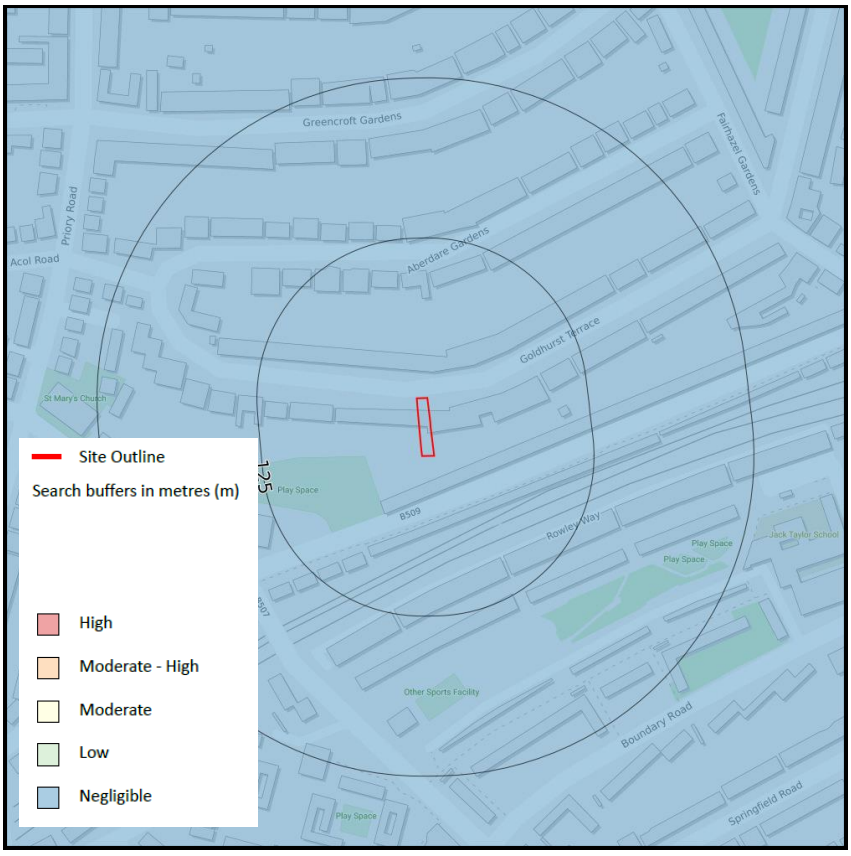


Figure 26 Groundwater Flooding (Ambiental Risk Analytics)

Figure 24 (EA) and Fig 25 (URS) and 26 (ARA) above indicate no concern with flooding from groundwater on the site.

7.6 Flooding from Sewers

The URS (2104) Report states that 8 properties in the area of NW6 3 have been affected by internal sewer flooding and 18 have been affected by external sewer flooding as detailed on Figure 27. It is unlikely that the site will be detrimentally affected by sewer flooding.

7.7 Critical Drainage Area/Local Flood Risk Zone

The site lies within the Critical Drainage Area of Group 3_010 and in the Local Flood Risk Zone of Goldhurst as shown on Figure 28.

Based on the evidence provided it is unlikely that the site will be detrimentally affected by flooding.

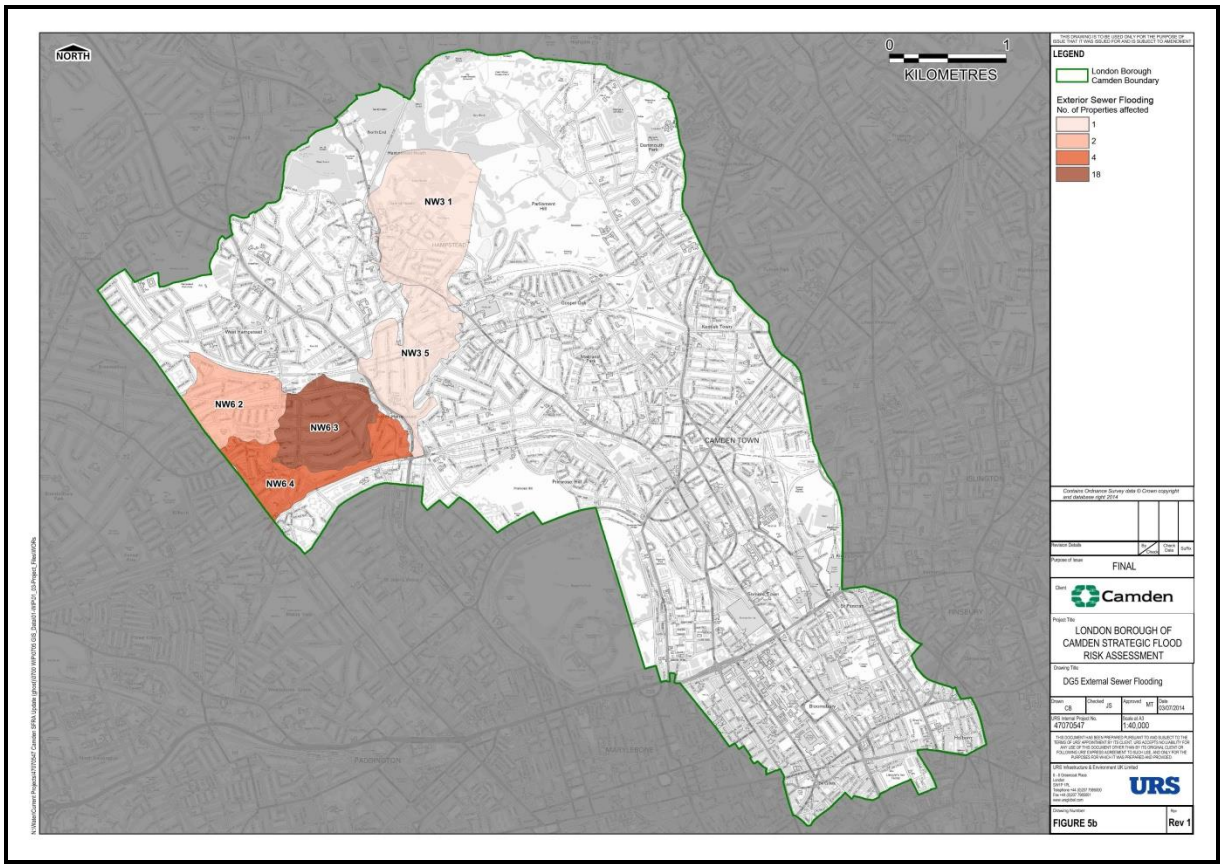


Figure 27 Sewer Flooding (URS 2014)

7.8 Summary of Hydrology and Flood Risk

Goldhurst Terrace was partly flooded during 1975 and 2002, and maps indicate that it is the east end of the terrace, east of the site which was affected. Since the construction of the NW Storm Relief Sewer which carries additional floodwater as well as the River Westbourne, the site is not expected to flood in the future. Mitigating measures should be installed to cater for any unexpected future flooding.

The site is at low risk of flooding from rivers and seas, groundwater, reservoirs and sewers.

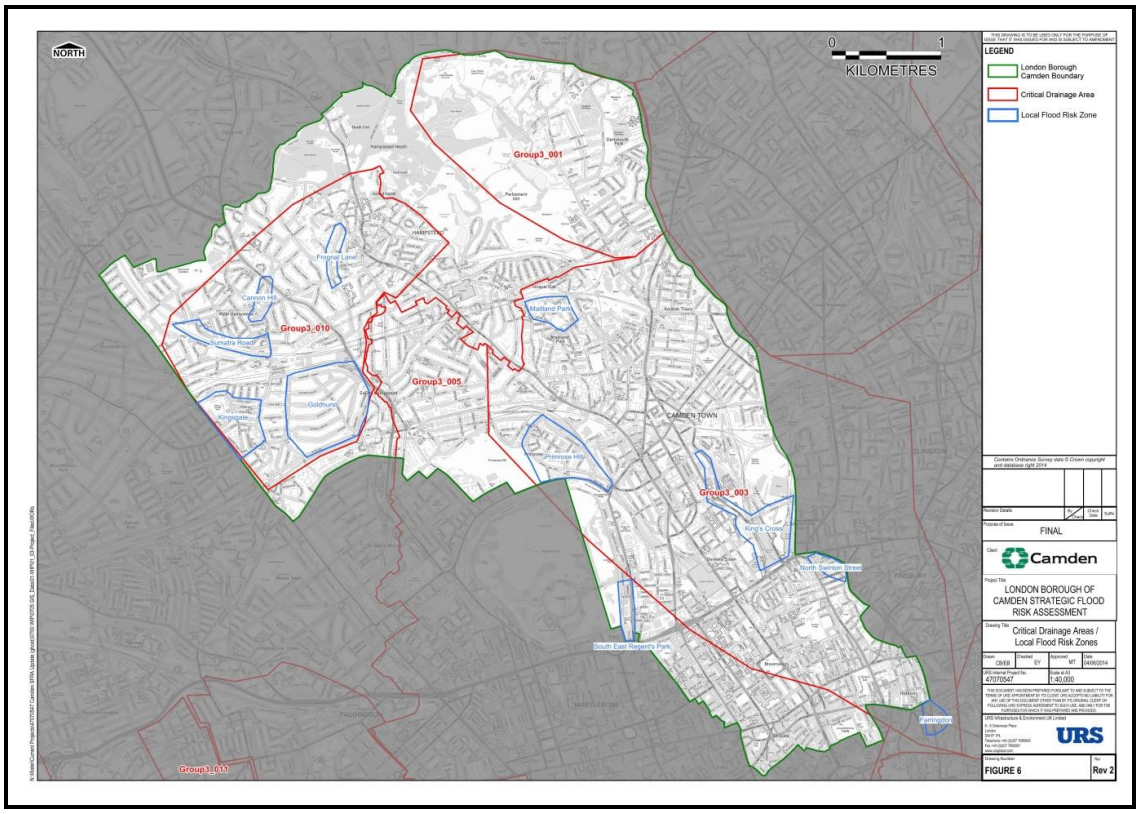


Figure 28 Critical Drainage Areas and Local Flood Risk Zones

8. INFRASTRUCTURE

HS2 is a proposed high speed rail network running from London to Manchester and leeds. Civils on Phase I began in 2019 and this is expected to be operational by 2026. An area to the south of the site and south of the existing railway at 125m to 250m distance from 219A is safeguarded for a preferred route of a subsurface/tunnel for HS2.

The map in Figure 29 reproduced from the Camden Geological, Hydrogeological and Hydrological Study (Figure 18) indicates there is no transport infrastructure beneath the site.

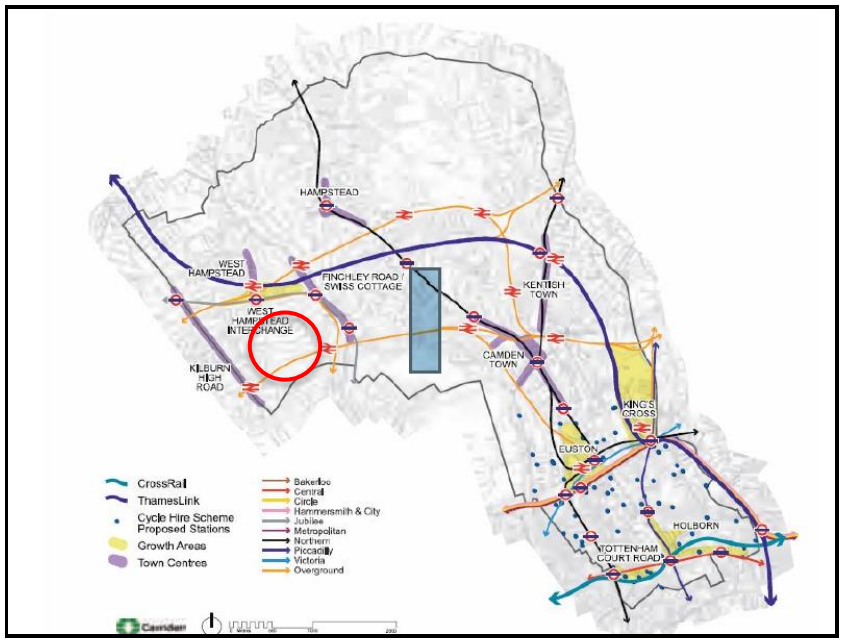


Figure 29 Transport Infrastructure

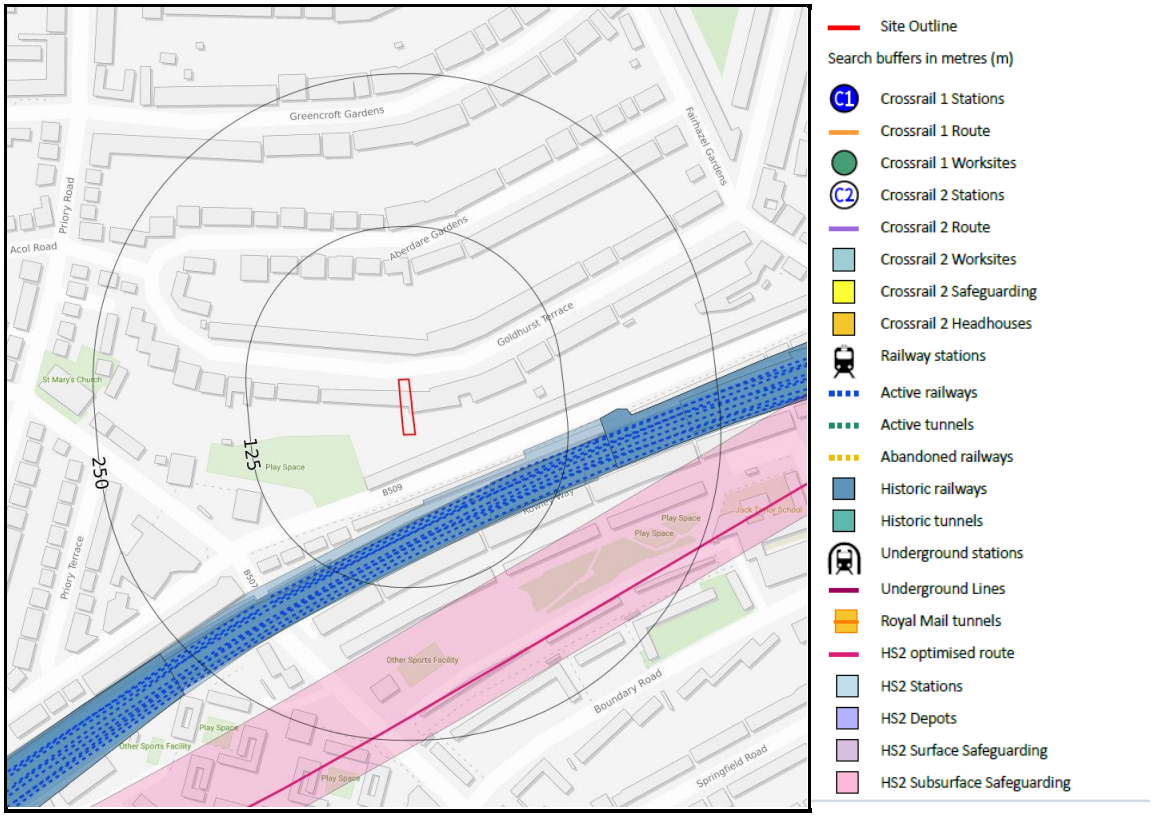


Figure 30 Detailed Local Infrastructure

10. SCREENING AND SCOPING

10.1 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 ponds chain on Hampstead Heath?	No	Refer to Maps in Appendix B
2	As part of the site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	Developer to provide proposed drainage details
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.
4	Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	Surface water originating from 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).
6	Is the site in an area identified to have surface water flood risk according to either the Flood Risk Management Strategy or the Strategic Flood Risk	Yes	Goldhurst Terrace was affected by surface flooding in

Table 4
Screening For Basement Impact Assessment

Ref	Question	Response	Details
	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?		1975 and in 2002 east of No 219A. NW Storm Relief Sewer constructed to alleviate surface water floods. The site does not lie below the water level of any surface water feature. Carried forward to Scoping
	Subterranean (groundwater) Flow		
7	Is the site located directly above an aquifer?	No	Site underlain by London Clay with Chalk Aquifer >100m bgl.
8	Will the proposed basement extend below the surface of the water table?	No	Site underlain by London Clay. Water table >100m bgl.
9	Is the site within 100m of a watercourse, well (disused / used) or a potential spring line?	Yes within 100m of former watercourse	Historic watercourse of River Westbourne identified from "Lost Rivers of London" Now culverted in NW Relief Sewer. Carried forward to Scoping.
10	Is the site within the catchment of the pond chains on Hampstead Heath?	No	Refer to Appendix A
11	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	Refer to Appendix A drawings.
12	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	Refer to Appendix A. Soakaways unsuitable in London Clay discharge will be to public sewer.
13	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 (not just the pond chains on Hampstead Heath) or spring line?	No	No surface water feature within 1000m of the site.
	Ground Stability		
14	Does the existing site include slopes, natural or manmade, greater than 7°?	No	Refer to site description.
15	Will the proposed re-profiling of landscaping at site change slopes at the property to more than 7°?	No	Developer to provide details. Refer to Appendix A.
16	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	No	Refer to site description.
17	Is the London Clay the shallowest strata at the site?	Yes	London Clay has the potential to shrink and swell under varying moisture conditions Carried forward to Scoping
18	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.
19	Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	Yes	London Clay has potential Carried forward to scoping.
20	Is the site within an area of previously worked ground?	No	Unlikely
21	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	Site underlain by impermeable London Clay a non productive aquifer
22	Is the site within 50m of the Hampstead Heath ponds?	No	No it is 1000m distant

Table 4
Screening For Basement Impact Assessment

Ref	Question	Response	Details
23	Is the site within 5m of a pedestrian right of way?	No	Goldhurst Terrace lies >5m from the basement.
24	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Possibly	Adjacent properties are unlikely to have basements. Depth of foundations to be confirmed. Carried forward to scoping
25	Is the site over (or within the exclusion of) any tunnels, e.g. railway lines?	Unlikely	Site is not located over any recorded railway tunnels. Developer to confirm site does not overlie other tunnels such as water / Royal Mail / NW Sewer Carried forward to scoping.

In summary the issues carried forward to scoping include those associated with surface water flooding, historic underground watercourse, increased hard cover and increased depth of basement compared to neighbours.

10.2 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 Flow and Flooding	
6	The road was affected by surface flooding in 1975 and in 2002. NW Relief Sewer constructed to alleviate surface water floods. The site does not lie below the water level of any surface water feature. Site Lies within CDA of West Hampstead.	**Impact:** Potential for future surface flooding. **Action:** Design basement as waterproof building with emergency pumps
	Subterranean (groundwater) Flow	
9	Historic watercourse of River Westbourne identified from "Lost Rivers of London" Now culverted in NW Relief Sewer	**Impact:** Flooding of basement. **Action:** Design basement as waterproof building with emergency pumps
	Ground Stability	
17	London Clay is the shallowest strata	**Impact**: Shrinkage and swelling **Action:** Soil Tests

19	London Clay has ability to shrink and swell under varying ground conditions. No evidence of damage to existing house.	**Impact:** Disturbance to foundations. Heave on excavation of basement. **Action:** Basement foundations will be below vulnerable zone. Suitable compressible material to be used in basement floor to accommodate heave.
24	Adjacent properties are unlikely to have basements. Depth of foundations to be confirmed.	**Impact:** Differential settlement to attached house. **Action:** Check depth of foundations to 217 and 221.
25	Site is not located over any railway tunnels. Developer to confirm site does not overlie other tunnels such as water / Royal Mail / NW Sewer	**Impact:** Stress changes in ground, damage to tunnels **Action:** Check to be made on location of Royal Mail/NW relief Sewer and other potential tunnels.

The scoping stage highlighted the need for the following before development of the basement:

- a ground investigation including soil testing
- groundwater monitoring
- Geotechnical design
- Underground concrete design
- Search for underground tunnels
- Design of temporary and permanent works
- Check of foundation depths of attached property
- Rainwater Harvesting or other rainwater disposal
- Structural Engineering Report

It is recommended that an intrusive investigation should be undertaken to confirm ground conditions, test the London Clay for plasticity and sulphate content and monitor for groundwater levels before development of the basement.

11. IMPACT ASSESSMENT

11.1 Introduction

The BIA has been undertaken for the proposed construction of a new basement. The depth of the basement is anticipated to be 1.7m to 2.1m bgl as the existing ground floor will be raised by 900mm. The anticipated bearing pressure of the new structure has not been provided.

The comprehensive desk based assessment together with the site inspection and ground investigation and flood risk assessment have been sufficient to allow the potential impacts of the issues identified during the screening and scoping stage of the project to be assessed.

This section of the report provides an interpretation of the findings of the Desk Study 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 C.

11.2 Geological and Hydrogeological Setting

With regard to the geology and hydrogeology of the site, the report concludes that the site is immediately underlain by topsoil and clay of the London Clay geological group. The London Clay is highly plastic in nature and has a high sulphate content due to included selenite.

The London Clay is relatively impermeable and is classified by the Environment Agency as a non productive aquifer. There are no recorded abstraction licences which could be detrimentally affected by the basement development.

Groundwater is not expected at shallow depths due to the impermeable nature of the London Clay, although thin bands of siltstone may produce water seepage into excavations which could easily be dealt with by sump pumping.

11.3 Hydrology and Flood Risk

There are no surface water features within 100m of the site which could affect the development. The River Westbourne used to flow to the east and is now culverted in the NW Storm Relief Sewer and unlikely to detrimentally affect the site or be affected by the site. Its exact location should be confirmed before excavation for the basement.

There is a small proposed change of hard cover which could slightly increase run off. The site is not suitable for soakaways due to the underlying impermeable London Clay.

Part of Goldhurst Terrace was affected by the 1975 and 2002 floods and a NW Storm Relief Sewer has since been constructed to alleviate the flooding. It not expected therefore that the site will be detrimentally affected by surface water flooding in the future.

There is a low risk of the site being flooded from groundwater, rivers and seas, reservoirs and sewers. It is recommended that mitigating measures for unexpected flooding should be incorporated in design.

11.4 Contamination

Ordnance Survey maps inspected indicated the site was an open field before construction of No 219 house around 1912. As such there is a low risk of contamination being present on the site. As a precaution all builders should also use gloves when handling soil for Health and Safety and work in accordance with HSE and CIRIA guidelines.

There is no risk of methane or radon detrimentally affecting the site.

11.5 Basement Excavations

The excavation for the basement will be between 1.70m and 2.10m below existing ground floor level, as the existing ground floor will be raised by up to 900mm to reduce excavation depth.

The basement floor formation level will be on the London Clay. In order to form the floor beyond the influence of the zone of shrinking and swelling in the London Clay it is advisable to form the floor at least 0.90m below ground level.

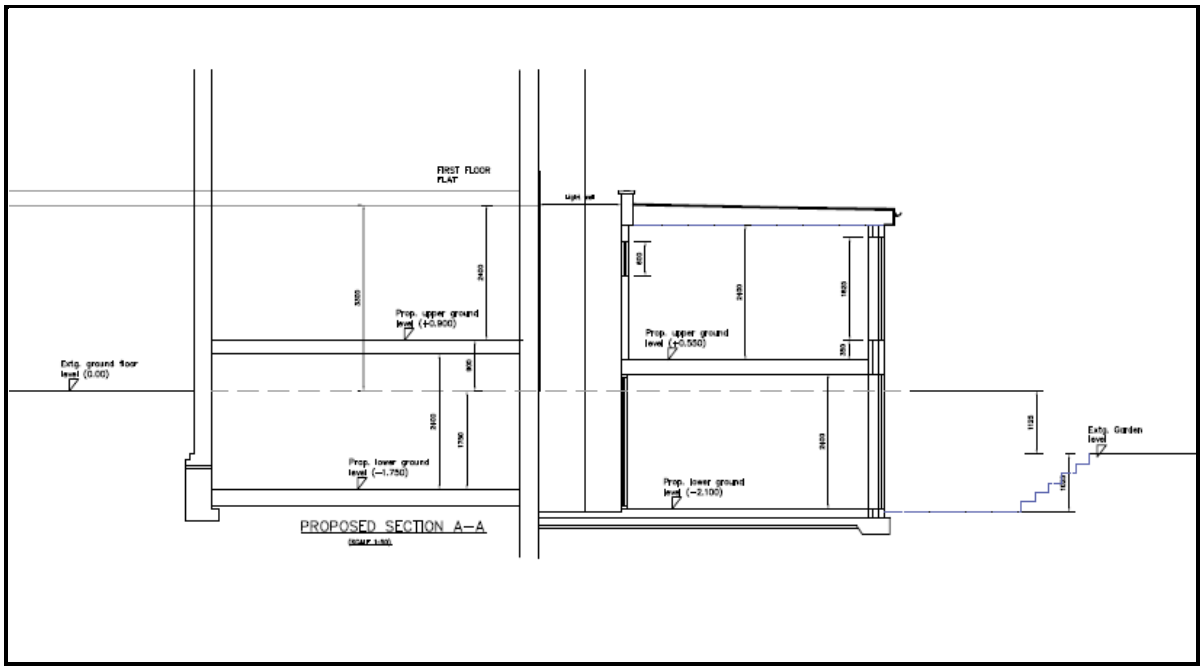


Figure 31 Section through Ground Floor and Basement

Excavation in the made ground and clay could be achieved by mechanical excavator.

Groundwater is unlikely to be encountered except during and after heavy rainfall when a sump pump is expected to deal with the water ingress. If rainwater falls into the excavation it can easily be dealt with by sump pumping. If this occurs the softened surface of the clay strata should be removed prior to any pouring of concrete for the basement floor.

Excavations for the proposed basement structure will require temporary support in all strata to maintain stability of the surrounding structures and to prevent any excessive horizontal ground movements.

Construction of the proposed basement will need to be supported by new retaining walls. Formation level for the proposed development will be the London Clay beneath any topsoil or made ground which are unsuitable bearing strata. The London Clay should provide a suitable bearing stratum for underpinned foundations, a 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 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.

The potential for ground movement during the excavation and construction of the basement has to be considered. Any significant ground movements could cause structural damage to adjacent properties. Ground movement could occur from heave of the ground following removal of overburden. For clay subsoils this effect is not usually significant.

Following the excavation of the basement, it is possible 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 or a layer of compressible material added to accommodate the heave. 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. For this basement the uplift pressure used for design should be 25kN/m2.

11.6 Basement Retaining Walls

The following parameters are recommended for design of retaining walls:
Made Ground: 1600kN/m2 Bulk Density, Effective Cohesion of 0kN/m2, 20 degrees Effective Angle of Friction.
London Clay: 2000kN/m2 Bulk Density, Effective Cohesion of 0kN/m2, 26 degrees Effective Angle of Friction.

Groundwater should be taken as ground level. The basement should be designed as water proofed and to accommodate groundwater pressures in line with BS 8102:2009.

11.7 Foundation Design

Foundations should be placed below the shrink and swell zone of the London Clay and in unweathered strata where a net allowable bearing pressure of 115kN/m^2 can be used for design.

Topsoil and made ground are unsuitable founding strata and all foundations should be constructed on the London Clay horizon. The clay is anticipated to be of medium strength.

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.

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 1.00m excavated at any time.

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

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.

11.8 Adjacent Structures, Potential Ground Movement and Monitoring

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

Care should be taken to design a retention system that maintains stability to all adjacent structures at all times during the works. It would be prudent to investigate the depth of foundations of the adjacent property before construction.

It would be prudent to undertake a structural condition survey of adjacent properties on both sides of No 219 before work commences.

The proposed basement will not lie within 5m of the pavement of Goldhurst Terrace. Lateral 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 footpath or services.

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 CIRIA 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, in order 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 adjacent houses. The results, presented in Appendix C, gave a very slight or Category 1 damage to houses 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 1 or very slight 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 not lie within 5m of the pavement of Goldhurst Terrace. Horizontal and vertical movements associated with the construction of the basement are recorded in Appendix C. 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.

11.9 Underground Concrete

The London Clay contains selenite crystals which elevate the presence of sulphate in the clay. The recommendations for design of underground concrete is ACEC class DS3-Ac-2s from Table C2 of BRE Special Digest 1 Part C (2005). This assumes a static water condition on natural strata.

11.10 Service Excavations

Shallow excavations for services and the like are unlikely to be stable in the made ground in the short or long term and may require battering. Excavations within the clay may be stable in the short term but not the long term. Some sump pumping may be required to keep the trenches dry.

11.11 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

The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The

tips will be able to provide costs for disposing of this material but will require Waste Acceptance Criteria Tests (WACS) to be presented.

11.12 Existing Tunnels

The proposed basement excavation will not be within the zone of influence of any of the London Underground (rail) tunnels shown in Arup Report for London Borough of Camden "Guidance for Subterranean Development", 2010).

It is possible that other tunnels owned and maintained by other service providers may exist beneath the site that could be affected by the proposed excavation and construction works.

It will be necessary to undertake a full search of potential tunnels that may underlie the site. On the assumption that it is confirmed that the site is not within the "zone of influence" of any underlying tunnels then no further activities in this regard will be required (the zone of influence is normally defined as the strip of land present above a tunnel with boundaries defined from a line drawn at 45° from the invert level of the tunnel to the ground surface). Alternatively, it will be necessary to liaise with the tunnel owner and undertake further engineering analysis to determine the potential impacts that the proposed basements could have on the tunnel.

11.13 Recommendations

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.

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. This will include:

- Establishment of the likely ground movements arising from the temporary and permanent works and the mitigation of excessive movements;
- Assessment of the impact on any adjacent structures
- Determination of the most appropriate methods of construction of the proposed basements;
- Undertake pre-condition surveys of adjacent structures;
- Monitor any movements and pre-existing cracks during construction;
- Establishment of contingencies to deal with adverse performance;
- Ensuring quality of workmanship by competent persons.

The desk study and site investigation have revealed that the site has not had a contaminative history, having been occupied by a garden for a residential property.

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. 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 and superficial deposits which are unsuitable bearing strata. The clay, where unweathered, 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 adjacent 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, and WACS test results it is considered 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.

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:

- Ground Investigation before development.
- Soil testing and groundwater monitoring before development.
- A Structural Method Statement
- A Construction Management Plan
- Investigation of exact location of NW Storm Relief Sewer
- The building should be constructed on reinforced concrete pins with a raft slab foundation.
- Underpinning to party walls at the lower ground level.
- Stiff 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 at 3.0m bgl.
- Proposed basement should be tanked and waterproofed to the height of the finished ground floor levels.
- High stiffness ground support should be provided for temporary and permanent design.
- The basement must provide internal access to higher ground.
- The basement must include a positive pumped device such as a sump pump.
- 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.
- Soakaways will not work within the impermeable clays.
- Use of sulphate resisting cement for underground concrete.
- A Chartered Engineer should be employed to manage the Works.
- PPE for workmen.

12. GENERAL REMARKS

This report truly reflects the conditions found during the desk study. Whilst the desk study 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 investigation 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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