73 Redington Road

Project No. 24-09

Flood Risk Assessment
DMAG-2409-FRA
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Produced for Mr Danny Shaw

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1 Introduction

2 Policy and Planning Context

This section provides an overview of the flood risk and sustainable drainage policies and requirements on national, regional, and sub-regional levels.

2.1 Environment Agency

According to the Environment Agency (EA), a Flood Risk Assessment is necessary if the development is within any of the following flood zones:

- In flood zones 2 or 3 including minor development and change of use.
- More than 1 hectare (ha) in flood zone 1.
- Less than 1ha in flood zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs).
- In an area within flood zone 1 which has critical drainage problems as notified by the EA, or within a surface water hotspot.

2.2 National Planning Policy Framework

The National Planning Policy (NPPF) was updated on 20th December 2023 is the current overarching policy document setting out the Government's policies for England and their application, including flood risk planning, surface water drainage and SuDS. The Environment Agency (EA), Lead Local Flood Authorities (LLFA) and other flood risk management authorities must be the ley advisers on the relevant policies that are applicable to the given site.

The NPPF Table 2 categorises different types of uses and development according to their vulnerability to flood risk. Table 3 maps these vulnerability classes against the flood zones set out in Table 1 to indicate where development is 'appropriate' and where it should not be permitted.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding.
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding, or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding, or Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplains and their boundaries accordingly, in agreement with the Environment Agency.

Table 2.1 Flood Zones

The development's flood risk has been confirmed using the Environment Agency's flood risk map. Further clarification of the flood risk can be found in section 4.0.

Essential infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.

	• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More Vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works if adequate measures to control pollution and manage sewage during flooding events are in place.
Water-Compatible Development	• Flood control infrastructure. • Water / Sewage transmission infrastructure and pumping stations. • Sand and gravel working. Docks, marinas and wharves. Navigation facilities. • Ministry of Defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.

	• Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 2.2 Flood Risk Vulnerability Classification

The proposals involve a new extension to the existing lower ground floor beneath the existing building above. The development is within Zone 1 and is deemed less vulnerable therefore development is appropriate in line with the Table below:

	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	X	Exception Test required	✓	✓
Zone 3b	Exception Test required	X	X	X	✓

Table 2.3 Flood Risk Vulnerability and flood zone 'compatibility'

Key:
✓ Development is appropriate
X Development should not be permitted

2.3 London Plan

Policy SI 12 Flood Risk Management

In London, the boroughs are Lead Local Flood Authorities (LLFAs) and are responsible, in particular, for local surface water flood risk management and for maintaining a flood risk management assets register. They produce Local Flood Risk Management Strategies and cooperate on strategic and cross-boundary issues.

Policy SI 12 discusses the flood risk management objectives that boroughs in London must achieve. They are:

- Current and expected flood risk from all sources (as defined in paragraph 9.12.2) across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.
- Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London.
- Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.
- Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.
- Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

- Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.
- Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat.

2.4 London Borough of Camden Strategic Flood Risk Assessment

The London Borough of Camden Strategic Flood Risk Assessment evaluates flood risk in the borough from all possible sources of flooding, which is summarised below:

- Fluvial flood risk is low across the Borough. All main rivers historically located within LBC are now culverted and incorporated into the TWUL sewer network therefore there is no fluvial risk within LBC.
- The LBC Surface Water Management Plan (SWMP) identified a number of Critical Drainage Areas (CDA) within LBC, which are areas where multiple and interlinked sources of flood risk cause flooding in one or more Local Flood Risk Zones. The majority of the Borough is located within a CDA identified in the SWMP. Historic flood records indicate that LBC, particularly to the north of Euston Road, is prone surface water flooding.
- Flooding from sewers, usually occurs due to blockages or material failure of the sewer network. TWUL flood records show that internal sewer flooding of properties is concentrated in the north of the Borough, while external flooding is further concentrated in the west of the Borough.
- Areas underlain by bedrock within the borough are expected to have depths to the water table of either >5m throughout the year or <3m for part of the year. In areas with superficial deposits, the expected depths to the water table is either between 3 and 5m for throughout the year or <3m for part of the year. LBC SWMP provides a dataset of areas described as having an “Increased Potential for Elevated Groundwater”; however, some groundwater flooding incidents have been identified outside of these areas.

2.5 Camden Local Plan

The Council will require a site-specific FRA for:

1. All sites of 1ha or greater
2. All major planning applications in areas at high risk to flooding; and
3. All basement developments on streets identified as being at flood risk, or in an areas where historic underground watercourses are known to have been present, or in areas where there is an elevated risk of groundwater flooding.

Policy CC3 Water and Flooding

The Council will seek to ensure that the development does not increase flood risk and reduces the risk of flooding where possible, and will require the development to:

a. Incorporate water efficiency measures
b. Avoid harm to the water environment and improve water quality
c. Consider the impact of the development in areas at risk of flooding (including drainage)
d. Incorporate flood resilient measures in areas prone to flooding
e. Utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible

f. Not locate vulnerable development in flood-prone areas

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

2.6 Camden's Flood Risk Management Strategy

The Camden's Local Flood Risk Management Strategy (LFRMS) discusses the different sources of flooding in the Borough, and outlines actions to increase Building community resilience to flooding to be implemented by the following stakeholders:

- Thames Water and Camden Council to pilot a Community Flood Plan to identify practical actions to take before and during a flood
- GLA to deliver the Climate Resilient Schools Programme, seeking to install measures in schools to manage surface water flood risk
- Camden Council, GLA, London Councils & Thames Water to continue to highlight the issue of flood insurance in Camden.

Similarly, it outlines measures to improve flood risk management through development; developments which have been identified as being at risk of surface water flooding must be designed to cope with storm events with a 1% chance of happening in any one year (including an appropriate allowance for climate change). All new basement developments whether domestic or non-domestic to conduct Basement Impact Assessments which consider both groundwater and surface water flooding.

3 Development Description

3.1 Existing site

The site is located at 73 Redington Road, London, NW3 7RP (Grid Reference: TQ 25590 86091) and occupies a footprint of around 652 square meters. The site comprises a 4-storey detached house in a residential area in Camden split into several apartments, with the flat being extended comprising the lower ground and ground floor.

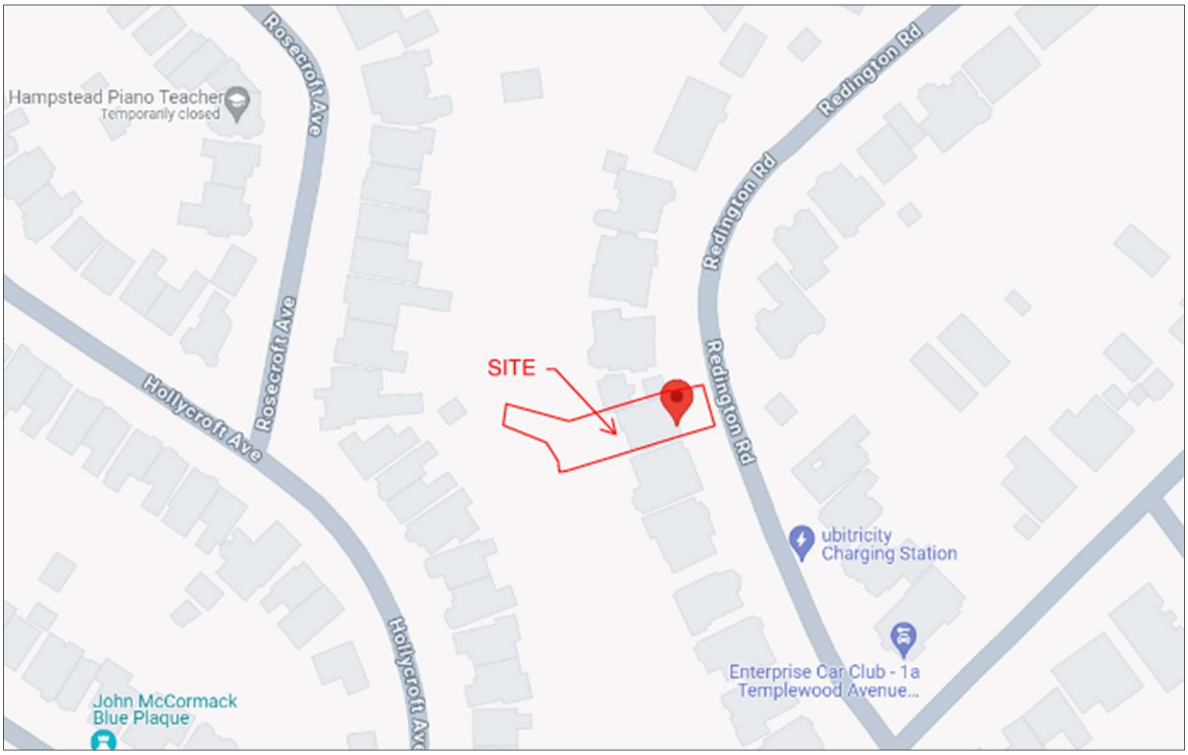

Figure1 Location Plan

3.2 Development Proposals

The proposed development seeks to extend the lower ground floor level by excavating further under the ground floor, whilst also lowering the existing floor level of the existing lower ground floor area to improve the floor to ceiling height throughout.

3.3 Topography

A topographical survey is not available for the site. The existing sections show that the site slopes from the front of the property to the rear, where access to the lower ground floor is gained. The level difference between the front and rear garden is approximately 2.5m. From visual inspection onsite, the main road levels are slightly lower than the front of the property.

Figure 2 Sections through property

3.4 Geology and Hydrology

The British Geological Survey (BGS) website shows that the site is in an area primarily composed of two significant geological formations:

Claygate Member (Bedrock Geology).

- The Claygate Member - Clay, silt and sand. Sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period. The Claygate Member is classified as a secondary aquifer.

Superficial Deposits:

- No information available

Historical borehole records situated approximately 400m to the southwest (borehole 1 and 2) and 450m to the northeast (borehole 3 and 4) of the site are available in the BGS website:

Borehole 1. Reference TQ28NE119. Total depth of 15.42m comprising made ground down to 0.58m, over sandy clayey silt to 5.8m, underlain by London Clay. Groundwater was recorded at a depth of 6.3m.
Borehole 2. Reference TQ28NE119. Total depth of 1.7m comprising topsoil to 0.18m, over Claygate Beds to 4.3m, underlain by London Clay. Groundwater was recorded at a depth of 9.0m.
Borehole 2. Reference TQ28NE102. Total depth of 11.27m comprising soil and stones down to 1.8m over sandy clay to 6.6 m, loamy sand to 9.1m, sandy clay to 11.27m, underlain by loamy sand. No groundwater was recorded.
Borehole 3. Reference TQ28NE104. Total depth of 21.33m comprising sand to 1.2m, silty clayey sand to 12.8m, silty clay to 13.4m, silty sand to 15.2m, grey silt (liquid) to 18.3m, underlain by grey clay. No groundwater was recorded.

Five trial pits were excavated at the development site to depths up to 1.25m. These indicate the soil to be comprised by made ground (varying from 0.55m to 1.15m) underlain by the Claygate Member. No groundwater was encountered to a maximum depth 1.25m bgl. The rear boundary which is considerably deeper that the existing lower ground (approximately 2.5m) and no sign of spring line or water flow.

3.5 Existing Drainage

Thames Water records show the presence of a 940x610mm combined water public sewer in Redington Road running in a north to south direction approximately 5m below the road level. It is reasonably assumed that private drainage from the property discharges into the public sewer by gravity.

Figure 3 Thames Water Asset Map

4 Flood Risk

4.1 Flood Risk from Rivers and Seas

Flooding from river and/or sea is caused by storm surges and high tied. Where tidal defences exist, they can be overtopped or breached during severe storms, which may become more likely with climate change. The EA´s ´Statuary Main River Map´ shows that the nearest watercourse to the development is River Brent which is approximately 2.8km to the north of the Site. The LBC SFRA confirms that all main rivers historically located within LBC are now culverted and incorporated into the TWUL sewer network. Historic watercourses can be seen in Figure 4.

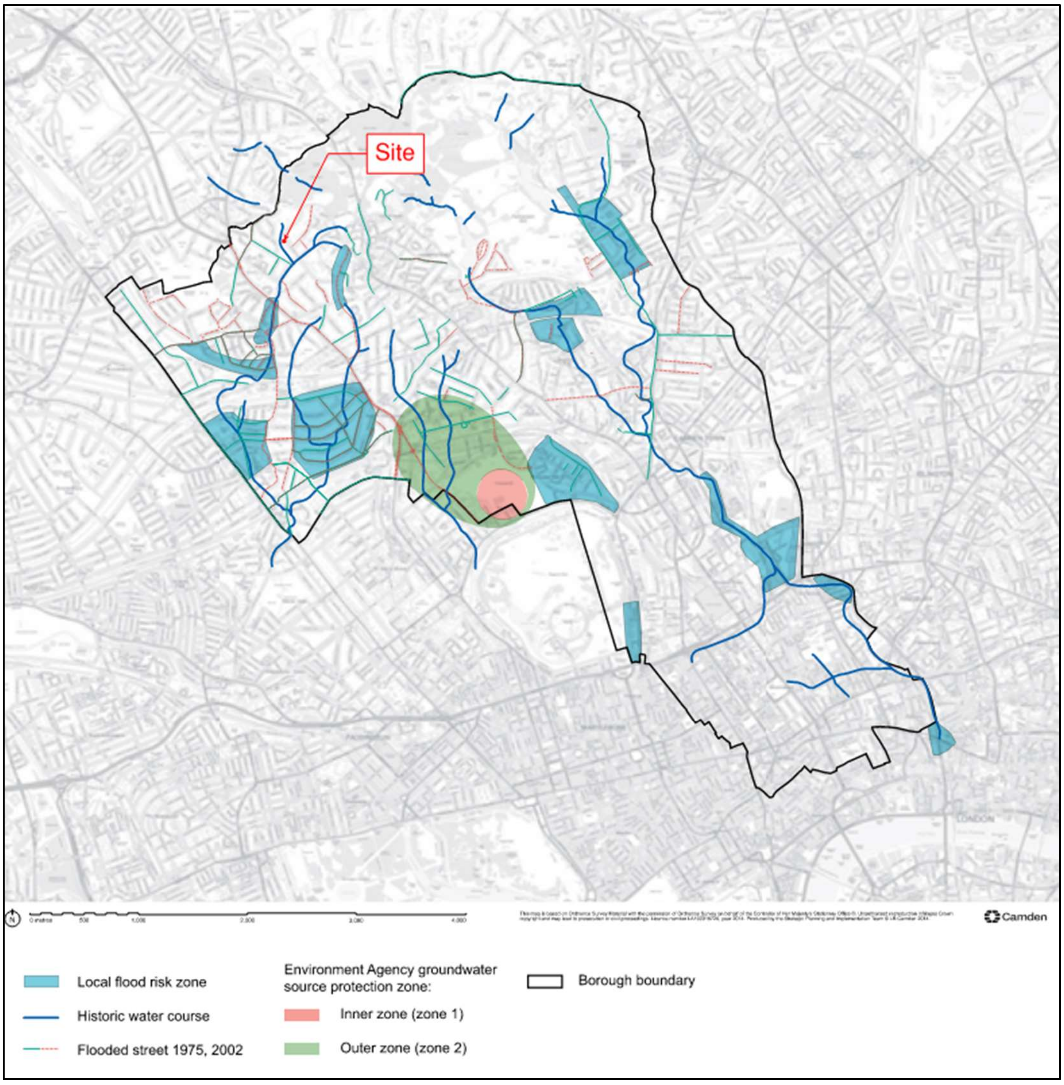

Figure 4 LBC Historic Water Course Map

The EA was consulted using their online mapping tools. EA flood map for planning shows that the site is located within flood zone 1 (Figure 5). This zone comprises land assessed as having a less than 1 in 1000 annual probability of flooding from fluvial or tidal sources.

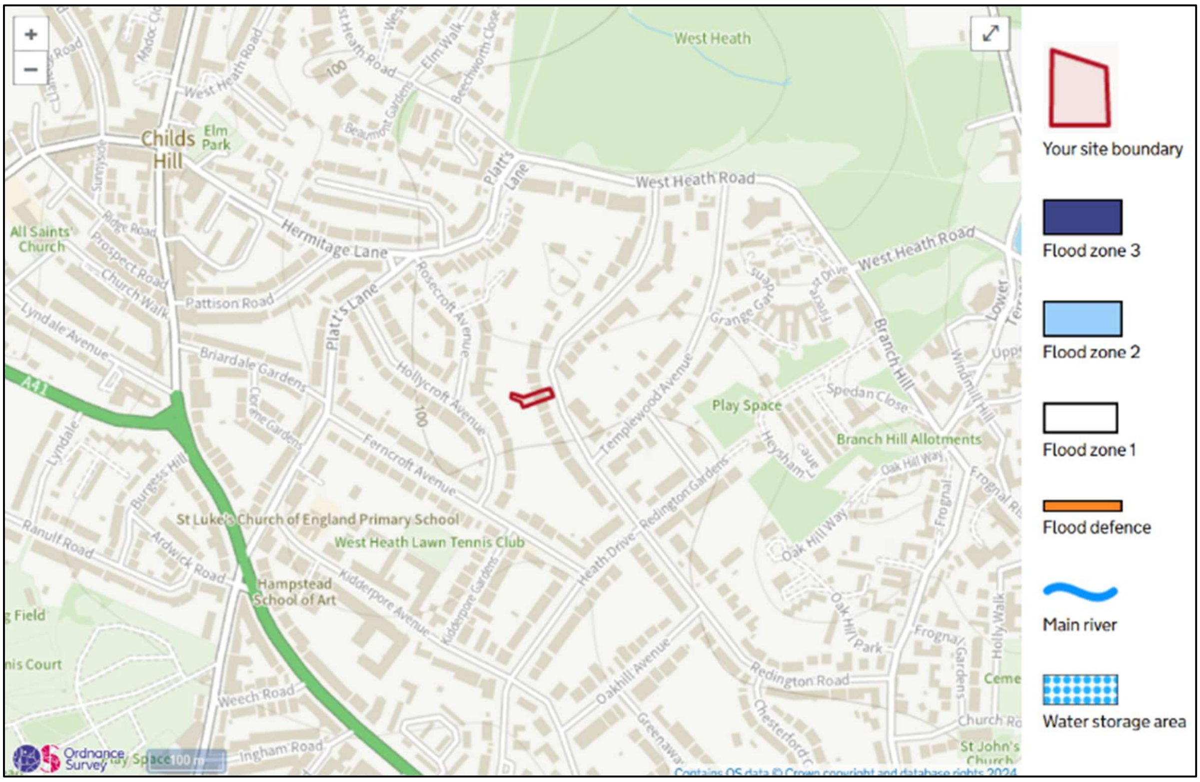

Figure 5 EA Flood map for planning

The development Site is considered at low risk of flooding form fluvial and tidal sources and the risk will remain unchanged post-development.

4.2 Flood Risk from Surface Water

Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. This occurs most commonly in urban areas where water is unable to enter the ground due to the presence of impermeable surfaces.

The surface water flooding extent map from the EA shows the site to be within an area that has a very low chance of being affected by surface water flooding.

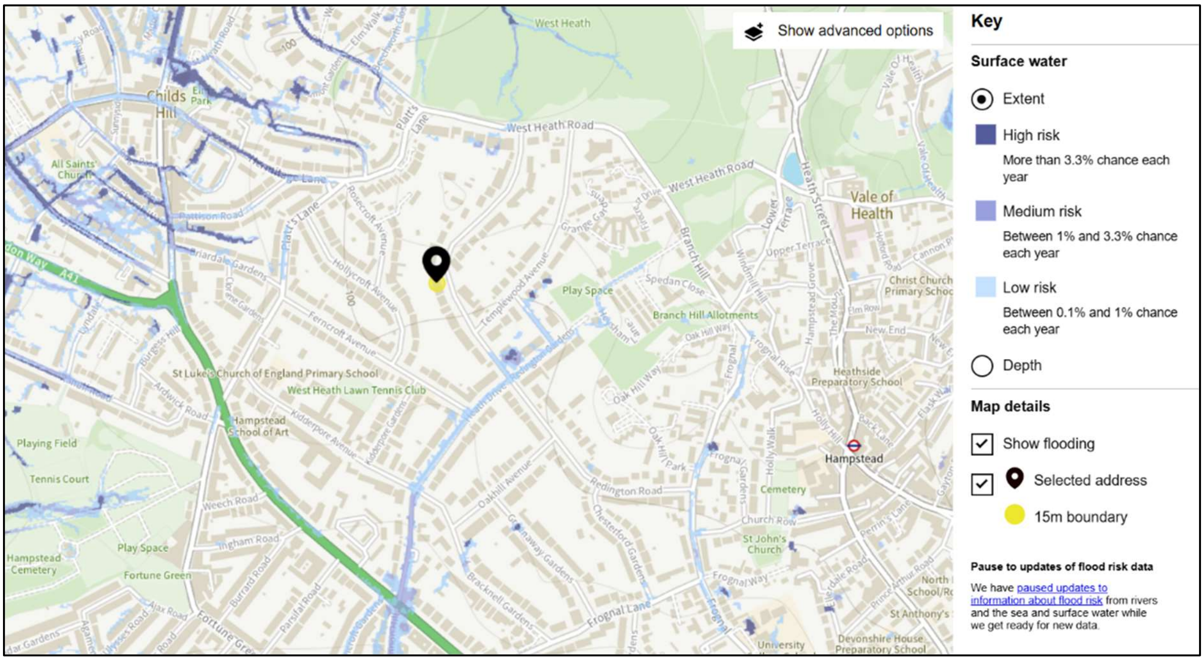

Figure 6 EA Map Surface Water Flooding

The LBC SFRA provides a map showing surface water flooding and critical drainage areas. As it can be seen, the Site is shown to be within a very low risk of flooding from surface water and not within a critical drainage area.

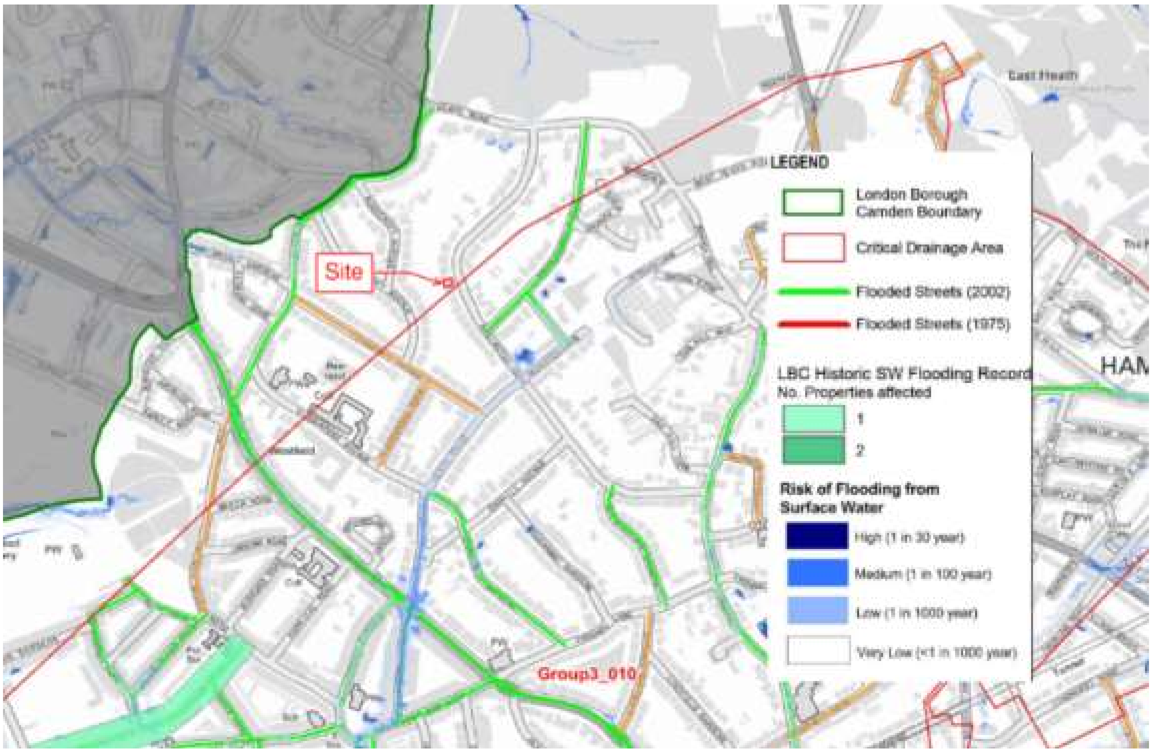

Figure 7 SFRA Surface Water Flooding Map

In addition, Figure 8 shows the LBCC Flood Hotspots in relation to the site from the Flood Investigation Report developed by ARUP in 2019. It can be seen the site does not lie within a flood hotspot.

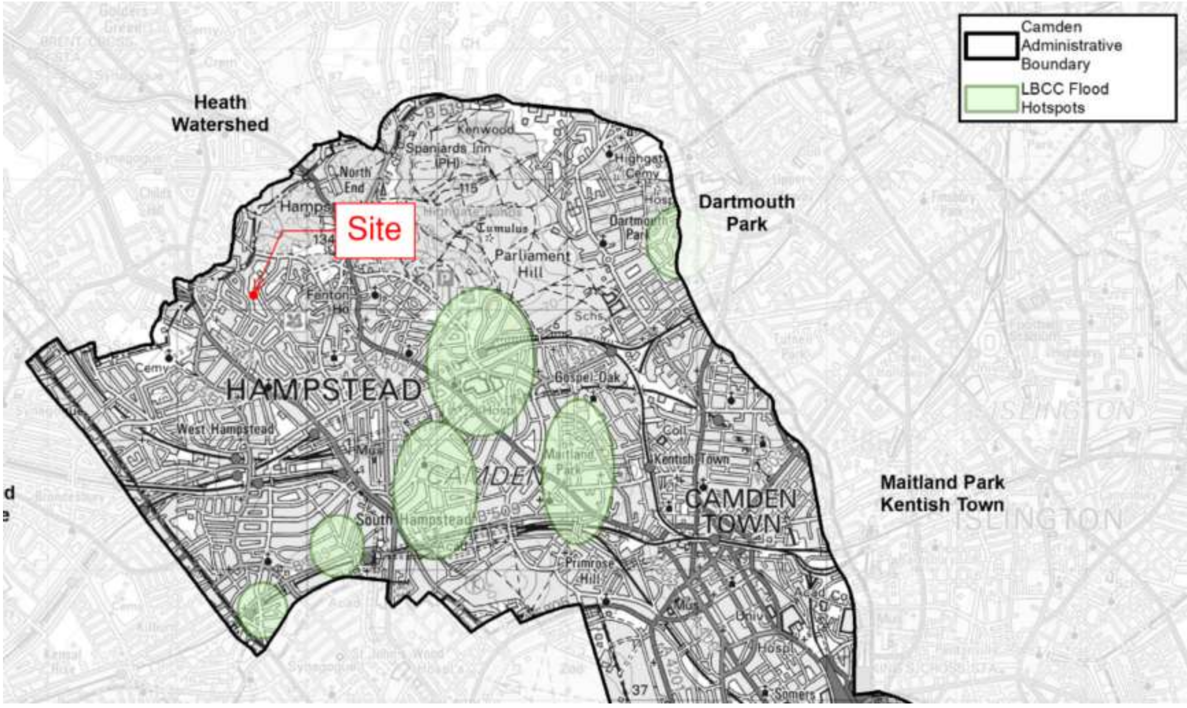

Figure 8 LBCC Flood Hotspots

Considering the above, the risk of the development flooding due to surface water is very low. The proposals do not involve changes to the footprint of the building or increase to the existing impermeable areas, therefore the risk will remain unchanged post development.

4.3 Flood Risk from Groundwater

Groundwater flooding usually occurs in low-lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low-lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground.

Rising groundwater levels resulting from heavier rainfall and reduced abstractions can present problems. Groundwater flooding generally occurs during long and intense rainfall when infiltration into the ground raises the level of the water table until it exceeds ground levels. It is most common in low-lying areas overlain by porous soils and rocks, or in areas with a naturally high-water table.

Irrespective of whether water shows at the surface, rising groundwater levels are posing an increased threat to buildings with basements. Such flooding may occur separately or in conjunction with flooding from other sources such as surface water flooding.

An assessment for groundwater flood risk was carried out using LBC SFRA ´Increased Susceptibility to Elevated Groundwater´ map (Figure 9) and Defra´s ´Groundwater Vulnerability map (Figure 10).

Figure 9 identifies areas within the Borough with an increase susceptibility to elevated groundwater and locations where groundwater flooding incidents have occurred (red squares). This map was derived from four individual data sources (BGS Groundwater Flood Susceptibility maps; EA Thames Estuary 2100 groundwater hazard maps; Defra Groundwater emergence maps; and JBA Consulting Groundwater flood maps) and identifies areas where there is increased potential for groundwater levels to rise within 2m of the ground surface following periods of higher-than-average recharge. The map shows the Site to be outside an area with increase susceptibility for elevated groundwater and no incidents have been recorded.

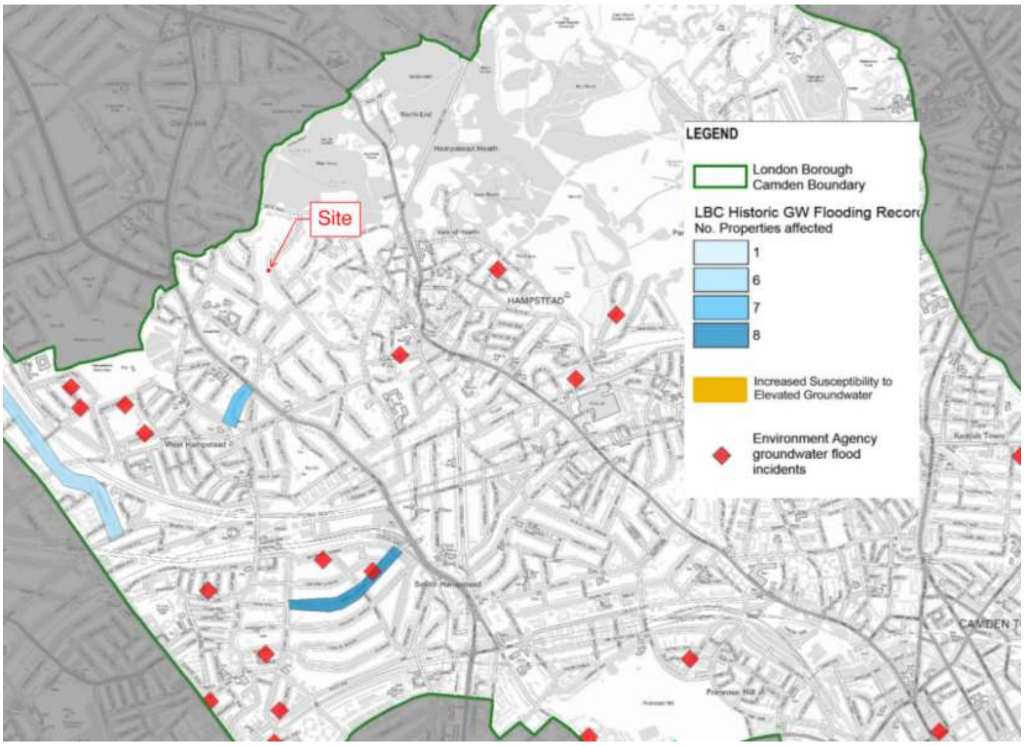

Figure 9 SFRA Increased Susceptibility to Elevated Groundwater Map

However, Defra´s ´Groundwater Vulnerability´ map shows the Site to be within a ´High´ groundwater vulnerability area.

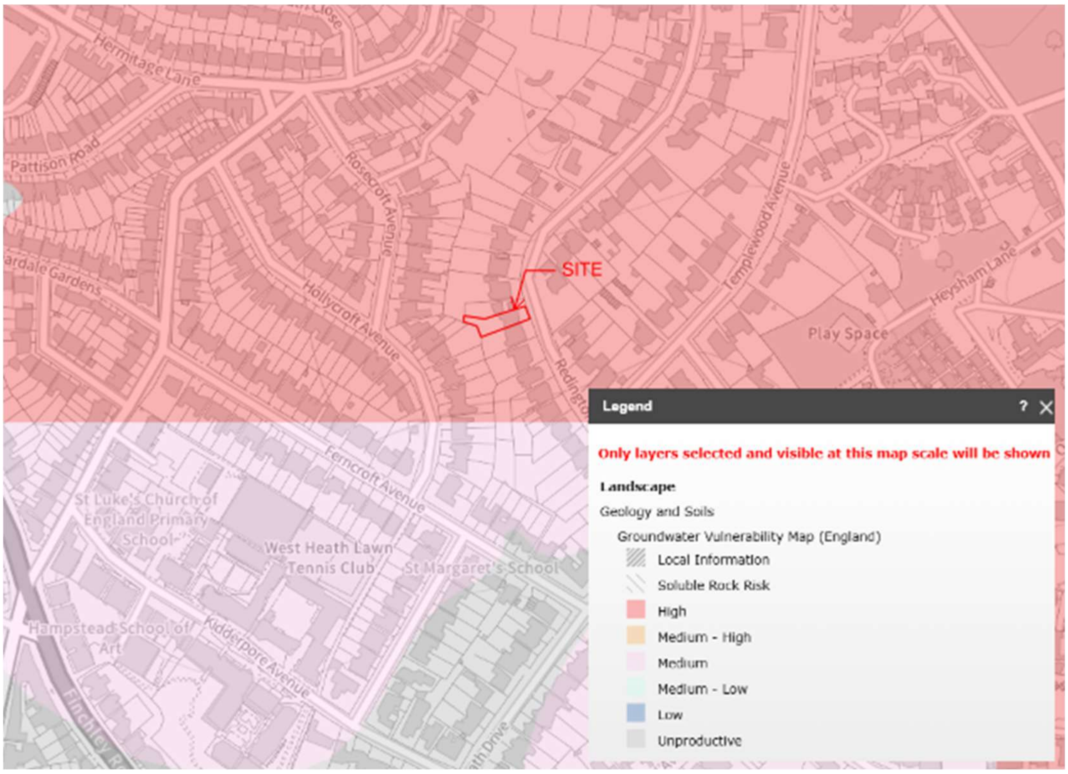

Figure 10 Defra´s Groundwater Vulnerability Map

As such, waterproofing of the lower ground structure is recommended in line with BS 8102:2022 – Code of Practice for Protection of Below Ground Structures Against Water Ingress´. A Basement Impact Assessment has been carried out and considers the use of waterproofing of the structure. This report should also assess the likely damming effect of the development and assess the likely rise in groundwater levels.

A site-specific investigation has been undertaken by Milvum, including 5 trial pits across the site (Figure 11), which covered most of the site including the lower part at the rear.

TPs 1, 3, 4 and 5 were all undertaken at lower ground floor level (TP1, TP3 and TP4 externally, TP5 internally) down to a maximum depth of 1.25m below ground level, and TP2 was undertaken in the middle terrace of the garden, which is approximately 1.0m below lower ground floor level, and no groundwater was observed in any of them.

Figure 11 Trial Pits

The lowest terrace of the garden (along the rear boundary fence) is approximately 2m lower than lower ground level. No evidence of groundwater / springlike was observed in the slope down to the lowest terrace, positioned approximately 6m to the southeast of the swimming pool. The Claygate member was encountered in all trial pits as a slightly sandy clay of likely very low permeability. This unit of the Claygate Member is unlikely to transmit any significant volumes of groundwater.

The Redington Frognal Neighbourhood Forum states that the geological complexity of the Redington Frognal area is such that springs may occur at the boundary between:

- Bagshot Formation and Claygate Member
- Claygate Member and London Clay
- and potentially anywhere in between, depending on the local hydrogeological conditions.

The Redington Frognal Neighbourhood Forum commissioned Arup to map underground rivers for the neighbourhood. Figure 12 below shows the springline interpretation based on Professor’s MH De Freitas’s sketch for 28 Redington Road Planning Appeal APP/X5210/W/3164577 indicating the mapped Bagshot Formation / Claygate Member boundary by the BGS.

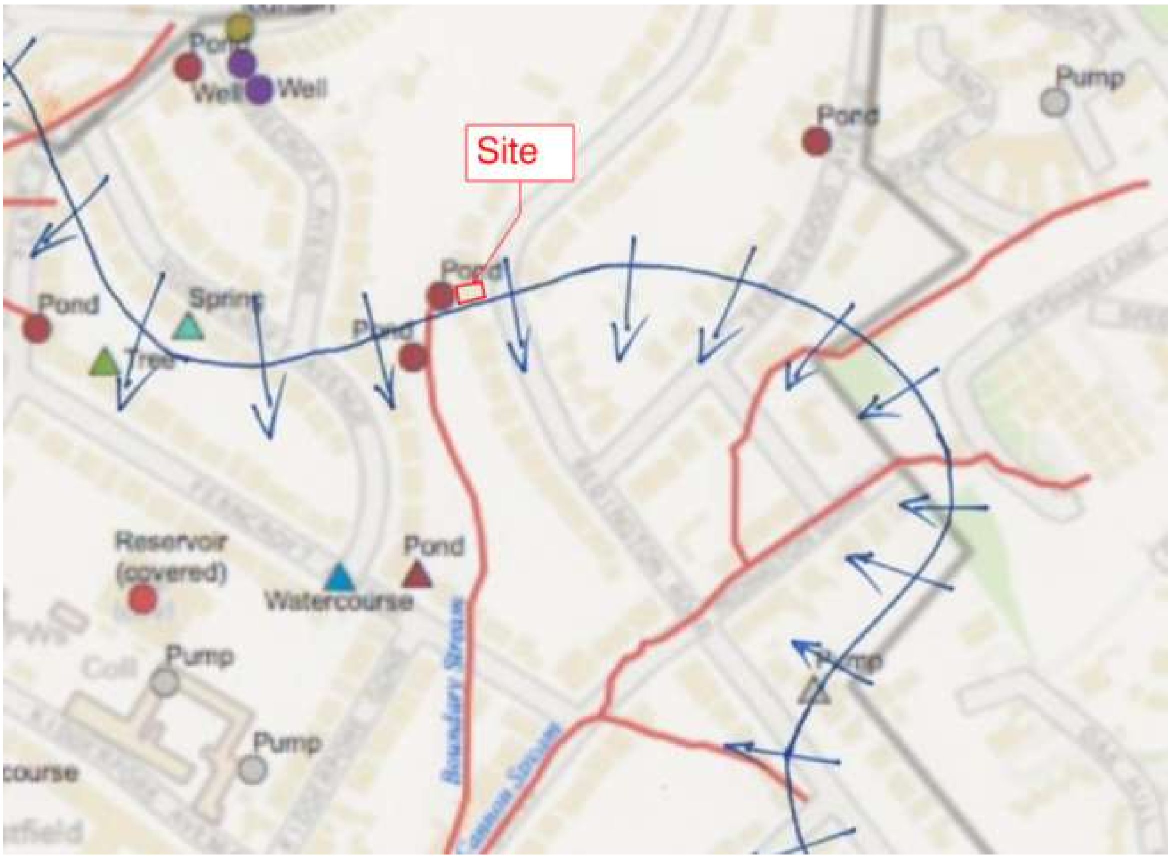

Figure 12 Arup base mapping with Professor’s MH De Freitas’s springline interpretation

Bagshot Formation was not observed on site and, based on the trial pits undertaken, is considered likely that the springline does not fall within the site boundary nor would be impacted by the proposed basement. Based on these findings, groundwater, if present, is suspected to be deeper than the lower ground and the springline to be located further downstream the property given the expected direction of flow. As such, the proposals are not considered to have an impact on the current risk of groundwater flooding.

Based on no records of groundwater flooding to the Site (Figure 9), the site investigation findings and the inclusion of waterproofing to the basement, it is considered that the risk of groundwater flooding is low and will not change post-development.

4.4 Flood Risk from Sewers

Flooding from sewers can occur when the sewer is overwhelmed by heavy rainfall, becomes blocked, or is of inadequate capacity. The cause of the problem may be some distance away from where the flooding is happening. During a heavy storm, the flow in combined sewers (which are designed to manage both surface water and wastewater) is much greater and can reach maximum capacity. In the event of a fully surcharge sewer, the continued failure mechanism will generally be outflow via road gullies and the pressure lifting covers and, as such, is likely to behave in the same way as overland flows from surface water flooding.

According to TWUL DG5 sewer records (Figure 13 and 14), there have been no internal or external sewer flooding incidents at the development Site. Therefore, the flood risk from sewers is considered to be low.

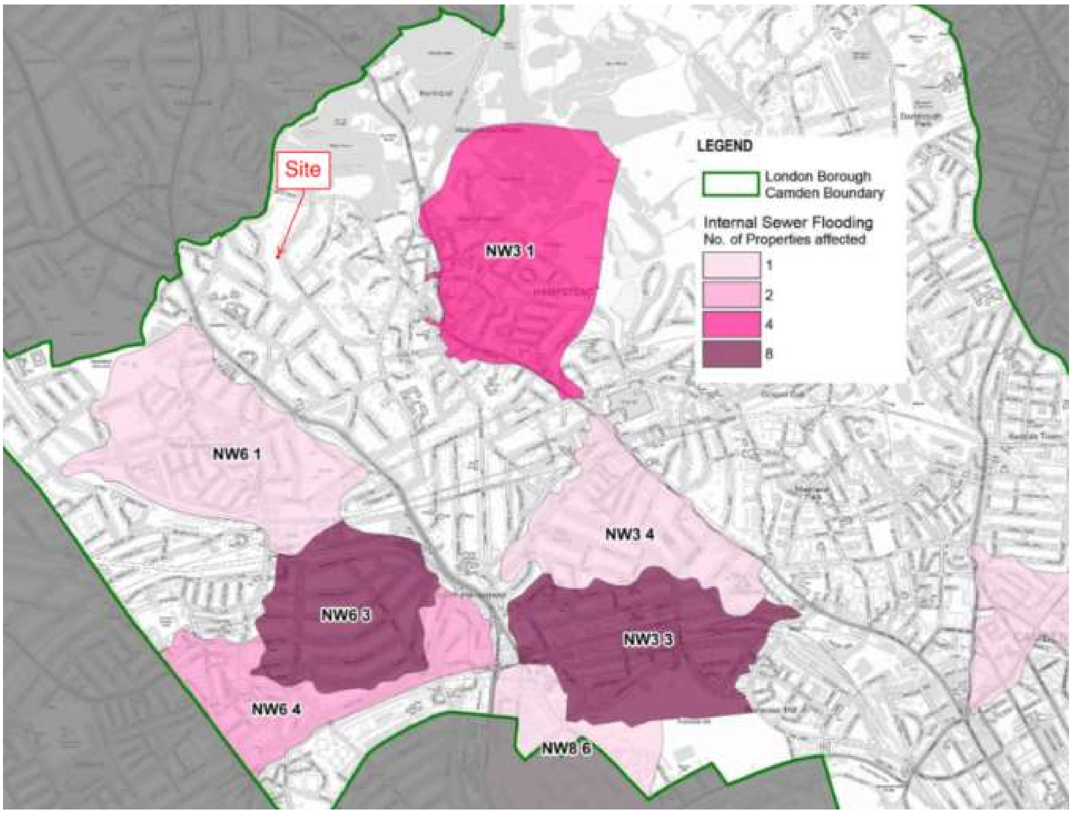

Figure 13 SFRA DG5 Internal Sewer Flooding

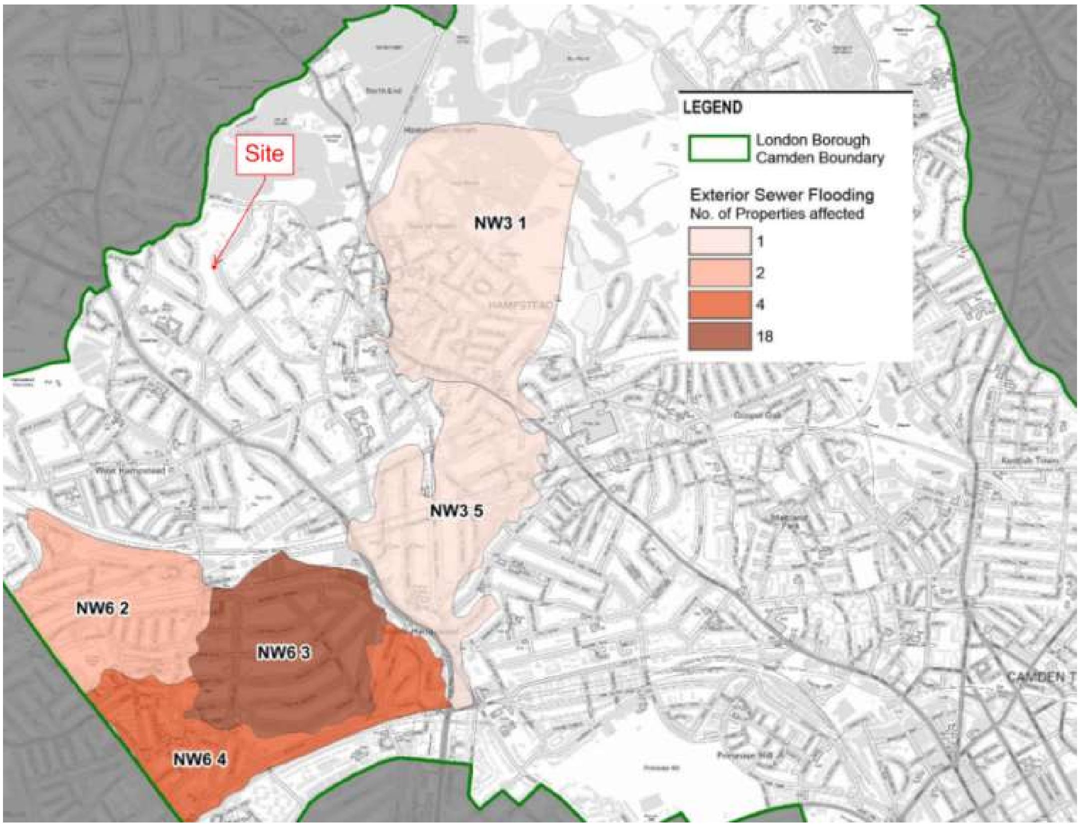

Figure 14 SFRA DG5 External Sewer Flooding

4.5 Flood Risk from Reservoirs and Other Artificial Sources

Non-natural or artificial sources of flooding can include reservoirs, canals and lakes where water is retained above natural ground level. The potential effects of flood risk management infrastructure and other structures also need to be considered. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of a dam or bank failure.

The failure of a reservoir or artificial source has the potential to cause catastrophic damage due to the sudden release of large volumes of water. However, the probability of flooding from these sources is minimal.

SFRA Camden Surface Waterbodies map (Figure 15) shows the waterbodies within the Borough.

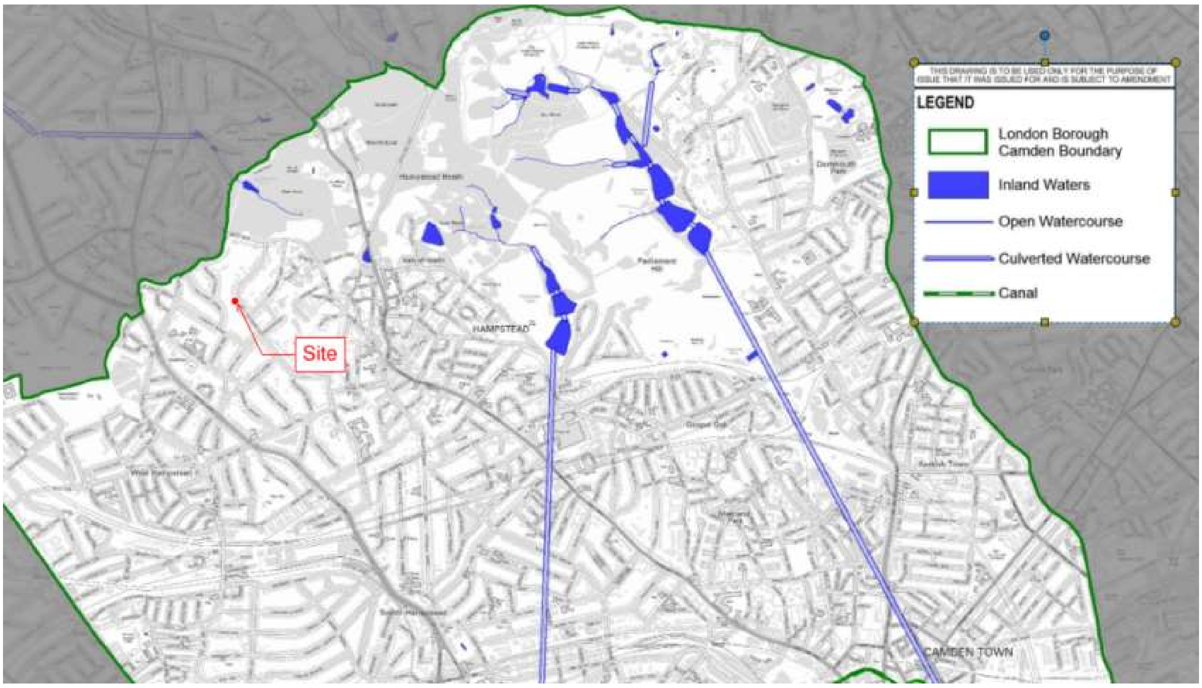

Figure 15 LB Camden Surface Waterbodies

The EA´s flood map from reservoirs (Figure 16) shows the Site to be outside the maximum extent of flooding from reservoirs.

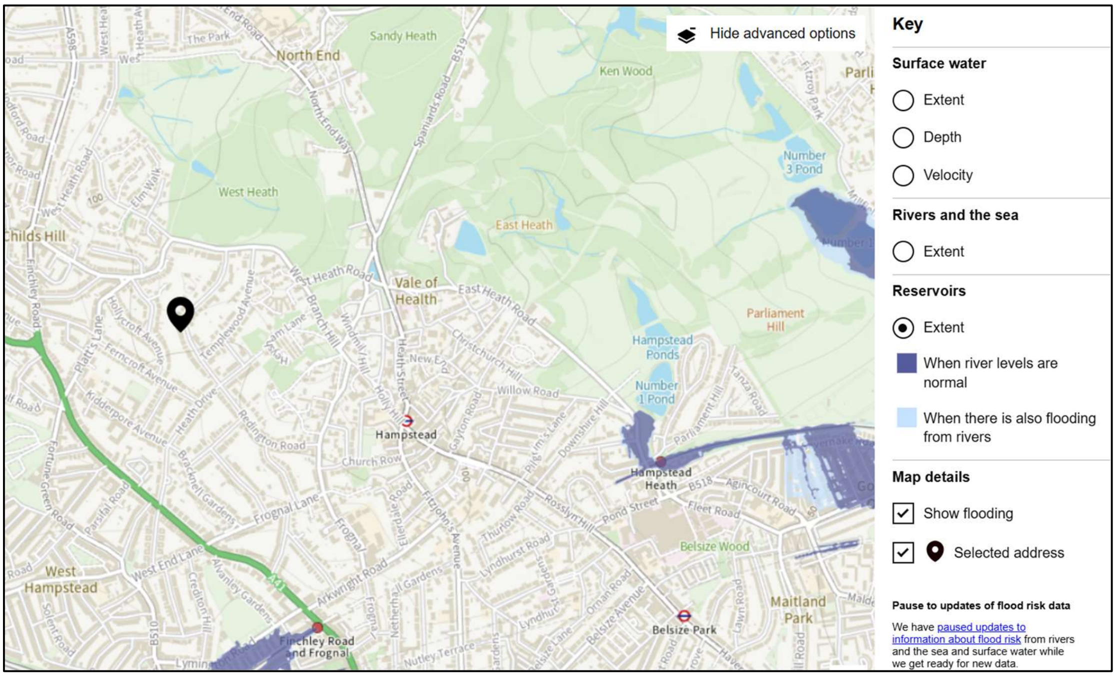

Figure 16 EA Reservoir Flood Risk Extent

Based on the above, it can be considered that the risk of flooding from reservoirs is low and will remain unchanged in the post developed site.

5 Conclusions and Recommendations

A Site-specific flood risk assessment has been undertaken following and has identified the development to be in Flood Zone 1, which means there is less than 0.1% annual probability of river and sea flooding from fluvial and tidal sources.

A review of flood data published by the Environment Agency and London Borough of Camden found that development is at a low risk of flooding from all sources.

If the principles set out within the previous sections of this report are implemented, the post developed site can be considered:

- To have a suitably managed risk of flooding from any source.
- To be proved as not increasing the probability of flood risk elsewhere.