10 Abbot's Place, London

Flood Risk Assessment & Drainage Strategy

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QUALITY CONTROL

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CUBE

EXECUTIVE SUMMARY

This report compiles and analyses information from numerous sources including flood risk maps and historical flood records to assess the risk that flooding poses to the proposed development and then suggests methods to mitigate these risks.

As part of the National Planning Policy, it is a requirement that Flood Risk associated with developments is assessed, considering the risk of flooding of development sites themselves and also any changes to the surrounding flood regime as a result of the development. The findings of this assessment are outlined in this site-specific Flood Risk Assessment report (FRA). This FRA is based on the requirements of the National Planning Policy Framework (NPPF) and the associated planning practice guidance, as well as any relevant local flood risk policies.

The site is located within a Critical Drainage Area and some of the surrounding streets have experienced flooding in the past, during extreme rainfall events from surface water/sewer flooding. This site-specific Flood Risk Assessment has found that based on the detailed information available, the risk to the site of flooding from all sources is low. This is due primarily to the topography of the site and surrounding streets which mitigates against surface water and sewer flooding.

The risk of the development flooding from different flood sources is summarised below:

FLOOD SOURCE	RISK CATEGORY			COMMENTS
	HIGH	MEDIUM	LOW	
Tidal/fluvial			X	Site Located wholly in Flood Zone 1
Surface Water Run-off from Heavy Storm Events			X	The site is classified as being at low risk of flooding from surface water from all available data. Due to the presence of flooding nearby the risk of surface water flooding should be considered in the design.
Groundwater			X	The site was found to be at low risk of ground water flooding.
Reservoirs			X	The proposed site does not lie within an area affected by reservoir flooding.
Sewers			X	Records do not show any localised flood incidents on the site, the risk of flooding from sewers is considered to be low. Due to the presence of large offsite combined public sewerage, the potential risk of sewer surcharge should be considered in the design, particularly to basement areas.

Table 1 - Summary of the Flood Risk

Whilst the risk of flooding from all sources was found to be low, due to the presence of flooding nearby and the location within a Critical Drainage Area, it is recommended that flood resilient design is incorporated into the design and construction of the project.

The following flood risk mitigation proposals are recommended for consideration:

- Retaining the existing 2.4m high wall to the rear of the Abbot's Place footpath which acts as a flood barrier to the site. Flood proof gates or demountable barriers are recommended for use in the two access openings.
- All basement foul and surface water flows to be pumped from basement level to ground floor, ensuring no route into the basement from below ground public sewer surcharge. This will ensure it is not possible for bedrooms or bathrooms at basement level to be flooded from surcharging of the public sewer.
- In line non return valves to be provided at the site outfalls to mitigate against surcharge from the offsite public sewers.
- A new below ground surface water drainage network should be provided, designed to accommodate a 1 in 100 year storm without flooding, whilst providing an allowance for 40% climate change. Rainwater harvesting and attenuation tanks provide water storage to allow a flow control device to limit the peak discharge rate from the site to 1 l/s. A significant reduction compared to existing.
- Onsite levels to fall away from the building to mitigate against surface water flooding.

This site specific Flood Risk Assessment has demonstrated that the risk of flooding to the site is low, and the flood risk mitigation measures proposed will provide very robust protection against any potential sources of flooding.

PLANNING POLICY AND RELEVANT GUIDANCE

INTRODUCTION

The purpose of this section is to give an overview of key flood risk and planning policy matters in England. There is a particular emphasis on the flood risk issues given in the National Planning Policy (NPPF) Framework document.

Consequently, this section of the report is not site-specific. Whilst some issues covered may not be directly relevant to the specific development they do provide the overall context for assessing flood risks in England.

NATIONAL PLANNING POLICY FRAMEWORK

At a national level flood risk planning issues are detailed in the National Planning Policy Framework (NPPF), originally produced by the Department for Communities and Local Government in March 2012 and updated in December 2023. This provides a framework within which local communities can produce their own distinctive plans and determine what and how developments should proceed. The planning authorities and the EA take the NPPF into account when making planning decisions.

When determining applications planning authorities should ensure that there are no consequential increases in flood risk elsewhere.

In areas of flood risk, any proposed developments should be appropriate to the level of flood risk at the site and should be supported by a site-specific FRA. Such an FRA is required for proposals in high and medium flood risk areas and for sites of 1 hectare or more, including those in the lowest flood risk zones.

The impacts of climate change should be taken into account as part of the assessment process for developments. Potential climate change impacts on flood risks and drainage matters must be considered and impacts mitigated in the development proposals.

TECHNICAL GUIDANCE TO THE NPPF

Whilst much of the NPPF consists of high-level policies and principles the particular importance of flood risk is recognised and additional guidance is provided. This was originally in the form of "Technical Guidance to the National Planning Policy Framework", published in March 2012 by the Department for Communities and Local Government and has been updated to the latest version published in September 2023.

As part of the guidance a site-specific FRA checklist has been included, stating that the following issues should be covered in a site-specific FRA:

- Development description and location – including flood vulnerability;
- Definition of the flood hazard – identifying the sources of flooding that could affect the site;
- Probability – covering Flood Zones, mapping, etc.;
- Climate change – considering the possible effects on flood risks at the site;
- Detailed development proposals – including land uses and levels of flood risk;
- Flood risk management measures – to consider how the proposals minimise the on-site flood risks;
- Off-site impacts – ensuring that there are no increases in flood risks elsewhere;
- Residual risks – considering any remaining risks and how these might be managed.

These issues have been considered within this FRA.

SEQUENTIAL TEST

Definition

A key component of the NPPF is the Sequential Test. This is a mechanism for directing development vulnerable to the impacts of flooding to areas with a lower flood risk.

In the Planning Policy Guidance developments with residential units at ground floor are considered to be in the "more vulnerable" category with respect to flood risk. Under this vulnerability classification the Sequential Test advises the following:

- Flood Zone 1 (Does not flood in a 1,000 year fluvial event): Developments with any level of vulnerability are appropriate for this Flood Zone
- Flood Zone 2 (floods between a 100 year and a 1,000 year fluvial event): "More vulnerable" development is appropriate for this Flood Zone, with the general provision that it is to be located in the highest land available
- Flood Zone 3a (floods in a 100 year fluvial event or in a 200 year tidal event): The requirements of the Exception Test must be passed to allow any "more vulnerable" developments within Flood Zone 3a
- Flood Zone 3b (functional floodplain – normally considered to flood in a 20 year fluvial event): "more vulnerable" development is not allowed within Flood Zone 3b

EXCEPTION TEST

Definition

The exception test states that:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk; and
- The development will be safe for its lifetime, without increasing flood risk elsewhere and where possible it will reduce flood risk overall. Table 2 of NPPF outlines the flood risk vulnerability and flood zone compatibility, below outlines the contents of Table 2 in NPPF.

Flood risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	×	Exception Test Required	✓
	Zone 3b functional floodplain	Exception Test Required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

Table 2 - NPPF Technical Guidance

STRATEGIC FLOOD RISK ASSESSMENT

NPPF guidance refers to Strategic Flood Risk Assessments (SFRAs), which provide an assessment of all types of flood risk in a defined area, which is then used to inform land use planning decisions. They are the responsibility of the Local Planning Authority (LPA). An SFRA may cover part or all of an LPA's area or even an area that includes several LPAs. It should primarily be used to support the development of Local Plans, prepared in consultation with the EA. The SFRAs must consider the effects of climate change.

A Level 1 Strategic Flood Risk Assessment has been undertaken by AECOM for the London Borough of Camden, with the most recent update being January 2024. The SFRA has been reviewed and considered as part of the development of this Flood Risk Assessment. Mapping and information from the SFRA has been provided in this report where relevant.

CLIMATE CHANGE IMPACTS

In addition to considering the existing flood risk from all sources, an FRA must include an allowance for future climate change, as outlined in section 14 of the NPPF.

Specific details are outlined in Tables 4 and 5 of the document "Technical Guidance to the National Planning Policy Framework", which was prepared by the Department of Communities and Local Government in March 2012 and updated in February 2019.

Recent supplementary guidance was released by the EA in February 2016 updated in May 2022 provides revised predicted impacts to rainfall intensity caused by climate change. If a development is expected to have a lifetime anywhere between 2040 and 2069 an increase in the peak rainfall intensity of 20% should be considered, for developments with a lifetime between 2070 and 2115, an increase in the peak rainfall intensity of 40% should be considered. In addition, this guidance also amends the allowances for a potential change to the peak river flow by location.

SITE DESCRIPTION AND CONTEXT

SITE LOCATION

The proposed site is located in the London Borough of Camden off a residential Street, Abbot's Place.

The site area is approximately 210 sqm and is bounded by highway to the south and other residential buildings boundaries to all other sides. The site is currently occupied by a detached two storey building with two bedrooms.

The existing site is mostly hardstanding, consisting of building roofs and a concrete internal courtyard with some planting.

The site is centred at:

- National Grid Reference: TQ 25582 83966
- Easting, Northing: 525582 , 183966
- Nearest Postcode: NW6 4NP

Figure 1 - Proposed Site

HYDROLOGICAL SETTING

The closest hydrogeological feature is understood to be the Regents Canal, approximately 1.5 miles to the south of the site. According to the Environment Agency (EA) modelling shown on the flood map for planning, the development site lies outside any flooding catchment area for nearby watercourses. As can be seen in the figure below.

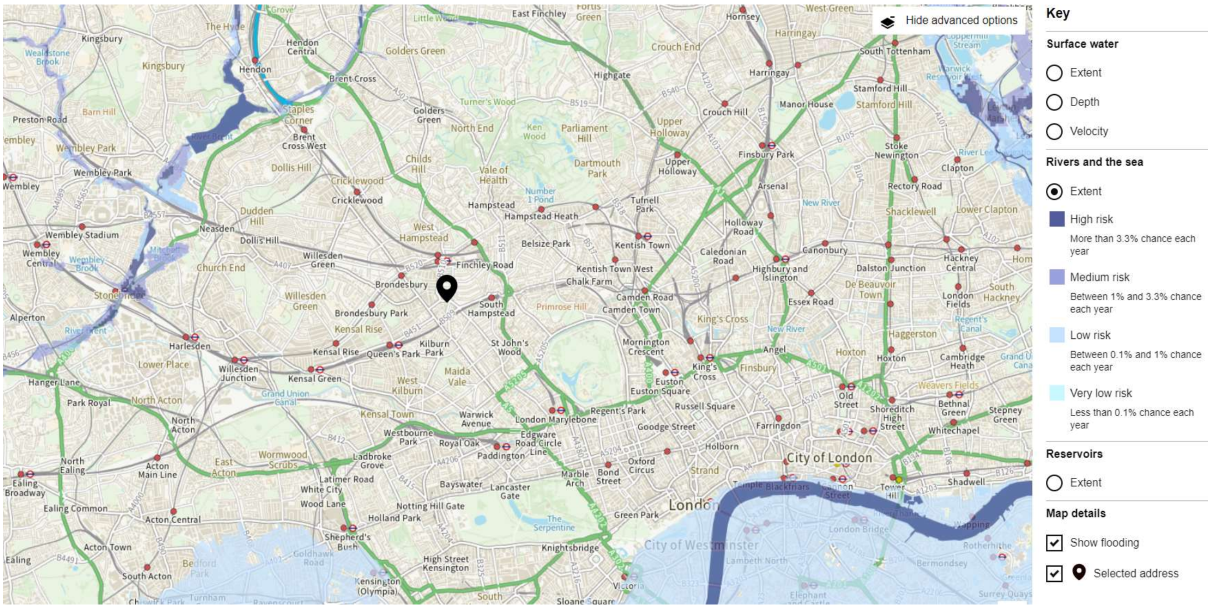


Figure 2 - Environment Agency Flood Mapping

HYDROGEOLOGICAL SETTING

The EA/Defra has developed Groundwater Source Protection Zones (SPZ) to assist in the assessment of risk to groundwater supplies taken from an abstraction point. Details of the zones are as follows:

- Inner zone (Zone 1) - Defined as the 50 day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres;
- Outer zone (Zone 2) - Defined by a 400 day travel time from a point below the water table. The previous methodology gave an option to define SPZ2 as the minimum recharge area required to support 25 percent of the protected yield. This option is no longer available in defining new SPZs and instead, this zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction;
- Total catchment (Zone 3) - Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. There is still the need to define individual source protection areas to assist operators in catchment management;
- Special interest (Zone 4) - A fourth zone SPZ4 or 'Zone of Special Interest' was previously defined for some sources. SPZ4 usually represented a surface water catchment that drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream). In the future, this zone will be incorporated into one of the other zones, SPZ 1, 2 or 3, whichever is appropriate in the particular case or become a safeguard zone.

Figure 3 below shows that the proposed development is outside of all the groundwater source protection zones.

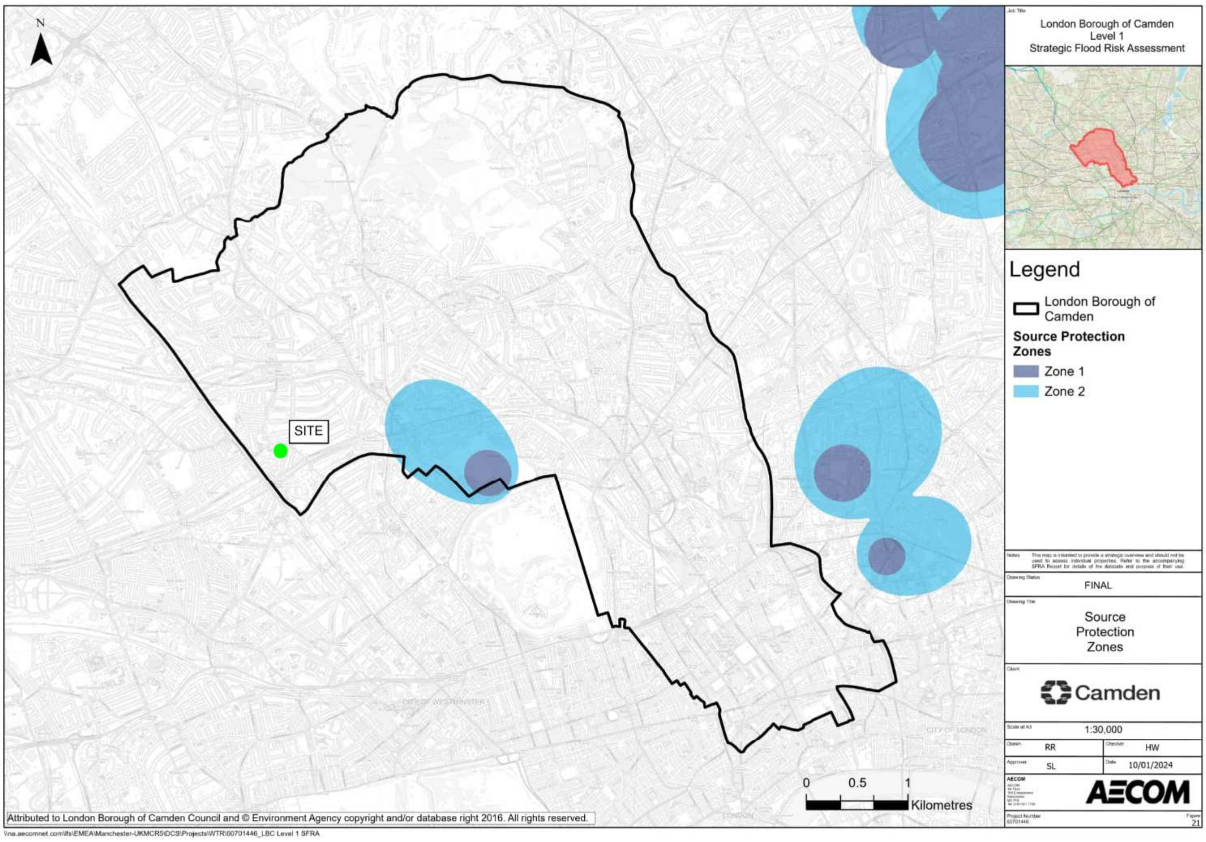


Figure 3 – SFRA Map - Source Protection Zone Map

The EA/Defra has developed aquifer designations which are in line with the Water Framework Directive and are based on maps produced by the British Geological Survey (BGS). Definitions for the aquifer types are provided below based on the EA website:

- Principal Aquifer: "These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as a major aquifer."
- Secondary A aquifer: "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers."
- Secondary B aquifer: "predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons, and weathering. These are generally the water-bearing parts of the former non-aquifers."
- Secondary 'undifferentiated' aquifer: "it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type."

It can be seen from Figure 4 that the site is in unproductive area of groundwater.

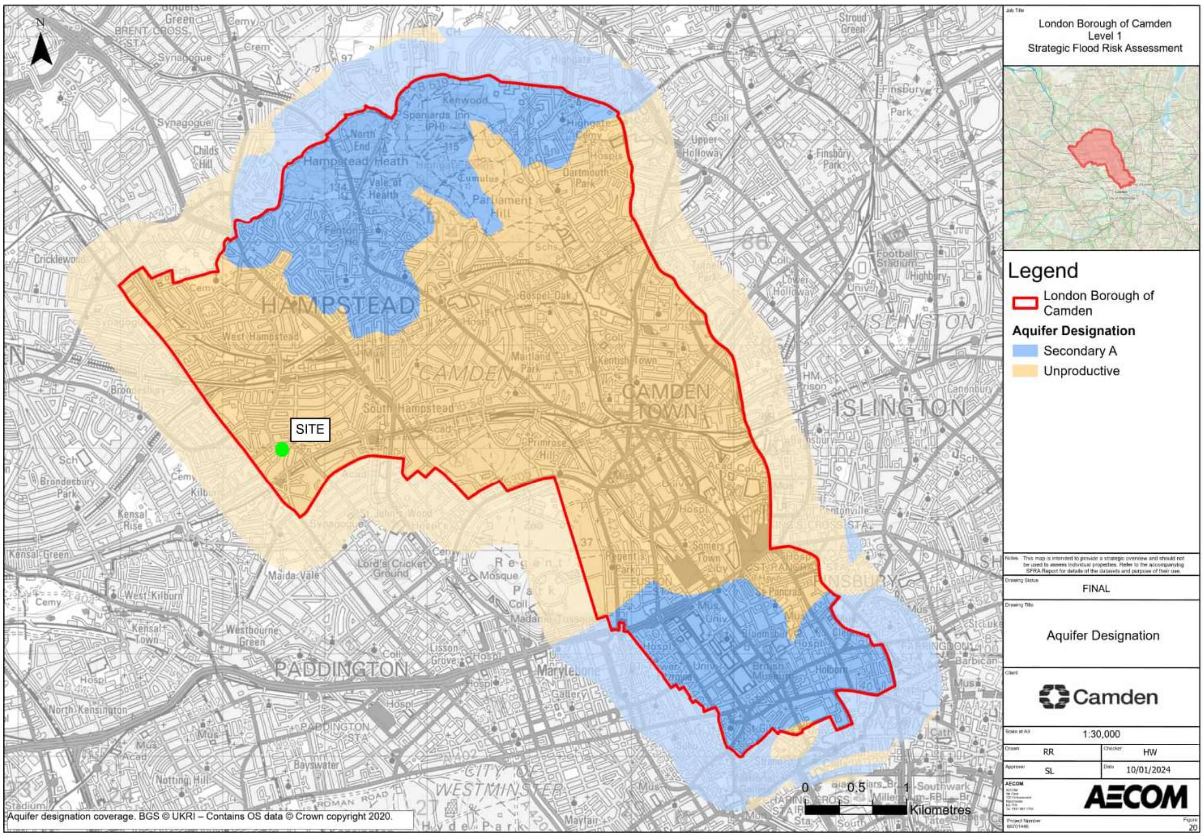


Figure 4 - SFRA Map – Aquifer Designations

FLOOD RISK ANALYSIS

FLOOD RISK SOURCES

The potential sources of flooding that could pose a risk to a site are presented in Table 3 below.

FLOOD SOURCE	MECHANISM	SITE IMPACT
Tidal/fluvial	Extreme flood water levels from the nearby watercourses.	Floodwaters entering buildings via thresholds or other openings. Flooding of external areas etc.
Land and Surface water Flooding	Surcharging/inundating of existing drainage networks with overland flows to the site.	Flood water entering the site from adjacent highways/properties. Affecting external areas and proposed buildings.
Groundwater	Rising groundwater within underlying aquifers.	Rising groundwater levels could affect the site if the pathway is available.
Drainage/infrastructure systems	Blockages/failure of drainage or water distribution systems on or adjacent to the site.	Backing up into the site of surface/foul water flows. The risk is to property and low-lying areas.

Table 3 - Flood Risk Sources

TIDAL AND FLUVIAL

The site is located in Flood Zone 1 based on the Environmental Agency Flood mapping which means that the probability of flooding from tidal and fluvial sources is less than 1 in 1000 years. The risk of tidal/fluvial flooding is deemed to be low.

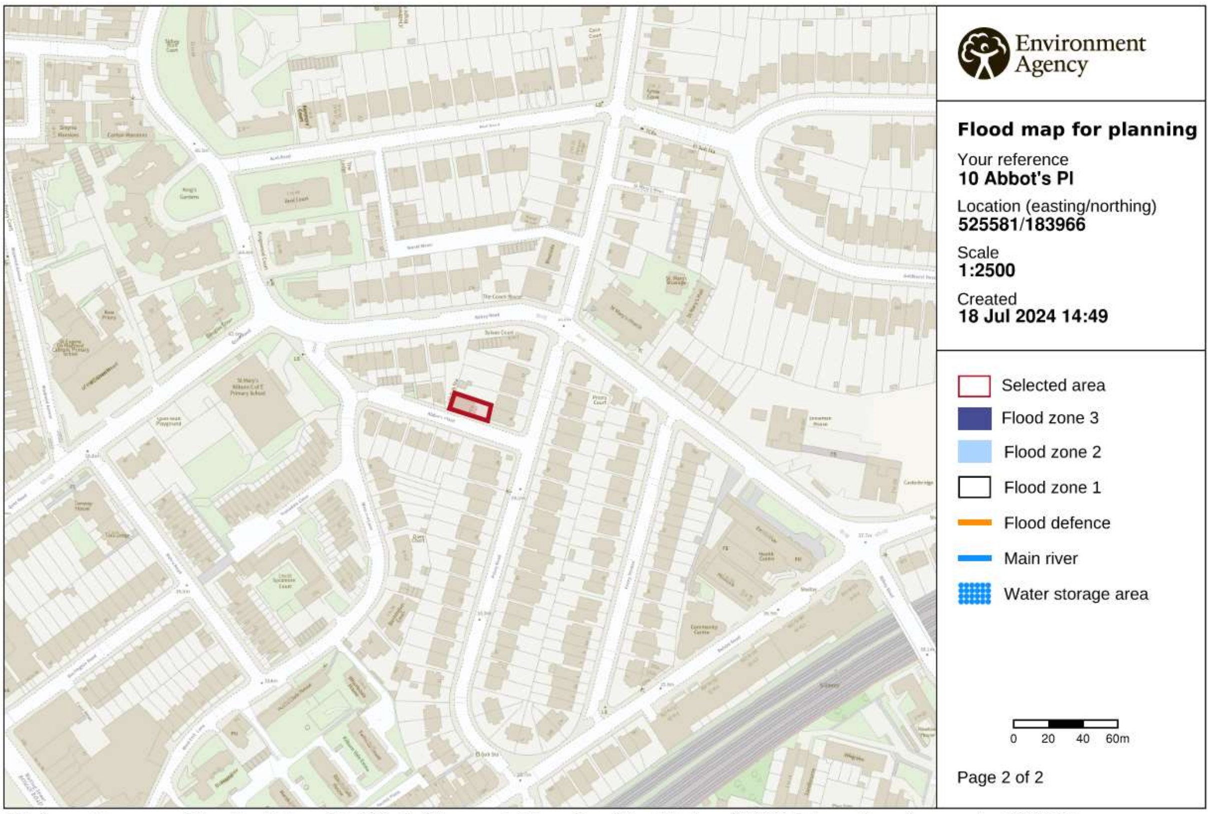


Figure 5 - Extract from EA Flood Maps - Flood Map for Planning (Tidal and Fluvial)

SURFACE WATER AND SEWER FLOOD RISK

Much of the information and mapping provided within this section comes from the London Borough of Camden SFRA 2024, with information about sewers and surface water flooding also provided by the Thames Water report of 16th June 2023, titled Understanding Flood Risk and Long-Term Strategy. Surface water flood risk mapping has also been sourced from the Environment Agency.

Critical Drainage Areas

A Local Critical Drainage Area is defined as a 'discrete geographic area where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones'. A specific area within a Local Critical Drainage Area is not necessarily at higher risk than an area located outside of a Local Critical Drainage Area. However, developments within a Local Critical Drainage Area may contribute to a flooding hotspot. As identified from the outputs of the Drain London Study, the majority of the Borough of Camden is located within a Local Critical Drainage Area.

It is integral that surface water management practices are adopted for new developments, particularly those located within a Local Critical Drainage Area.

A review of Local Flood Risk Zones was undertaken as part of the 2024 SFRA update. Two new Local Flood Risk Zones were identified. These are located to the west of the Borough, 'Priory' and the north of the Borough, 'South End', as presented in Figure 6. These areas have been derived from anecdotal evidence of internal and external flooding during the 12th and 25th July 2021 flood events. For example, within the 'Priory' Local Flood Risk Zone, internal and external flooding was reported at Priory Terrace, Priory Road and Belsize Road.

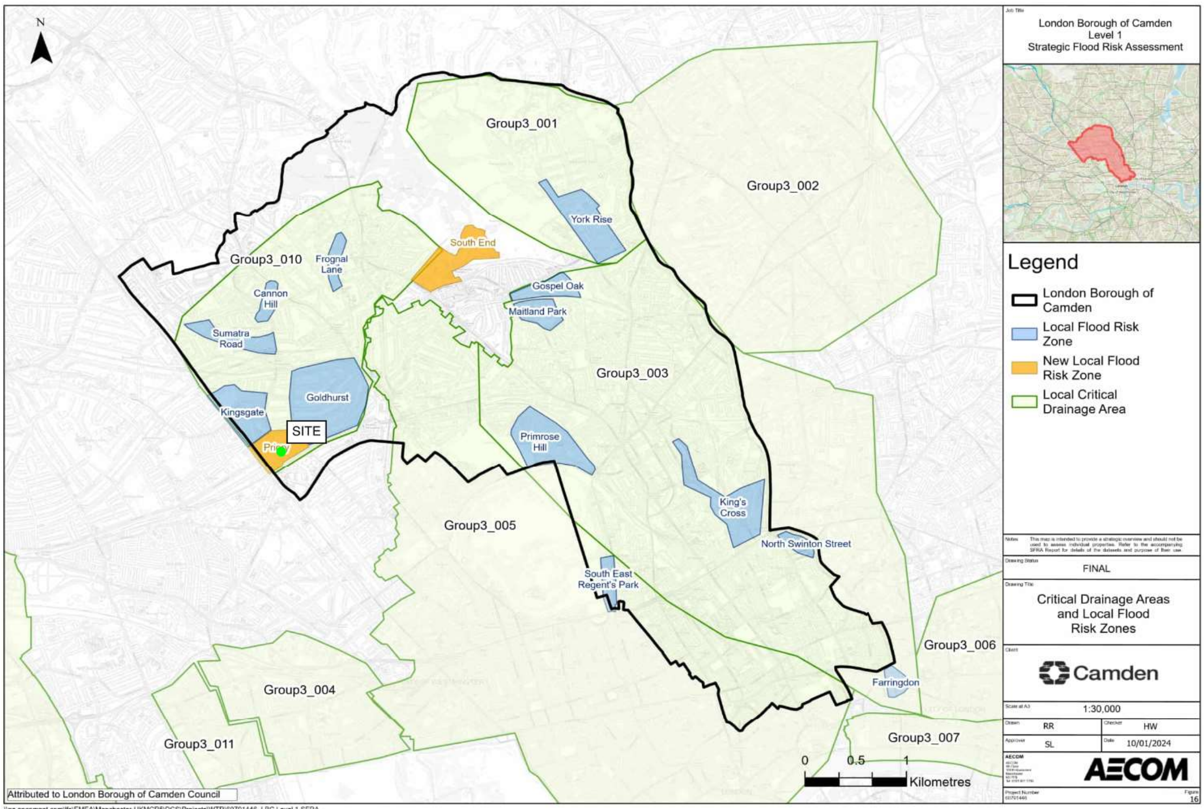


Figure 6 - SFRA Map – Critical Drainage Areas and Local Flood Risk Zones

Counters Creek Catchment

The Counters Creek Catchment extends across several Boroughs north of the River Thames, including the Royal Borough of Kensington and Chelsea and the Boroughs of Hammersmith and Fulham, City of Westminster, Brent and Ealing and the London Borough of Camden. The catchment comprises an area of approximately 85 km^2 of which 18% is within the Borough. The catchment area within the Borough is approximately 12 km^2; this is presented in Figure 7. As outlined in the Local Plan (2017), Thames Water Utilities Limited identified that the southeast of the London Borough of Camden discharges storm flow into the Counters Creek drainage catchment. Thames Water records associated with the Drainage and Wastewater Management Plan 65 indicate there is a risk to property in connection to the Counters Creek Catchment, which extends west of the London Borough of Camden. Relative to the neighbouring Borough of Brent and the City of Westminster, areas in the London Borough of Camden appear to be at lower risk of internal and external flooding (based on predictive datasets); as presented in Figures 7 and 8. The indicative data suggests there is a greater risk of flooding to people and property in the downstream reaches of the Counters Creek Catchment. Therefore, areas in the upstream catchment, such as the London Borough of Camden, should introduce policy to limit discharge rates and minimise impact on the neighbouring Boroughs.

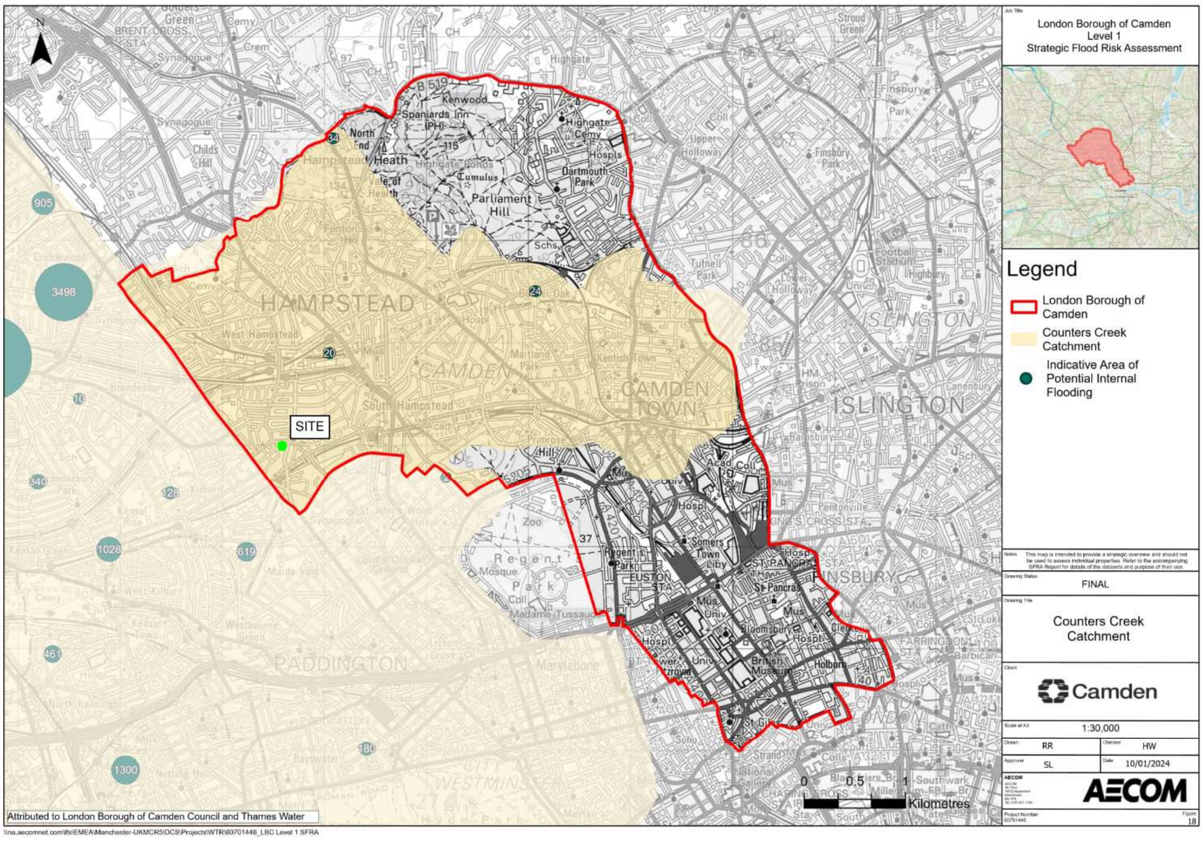


Figure 7 - SFRA Map – Counters Creek Catchment and Indicative Area of Potential Internal Flooding

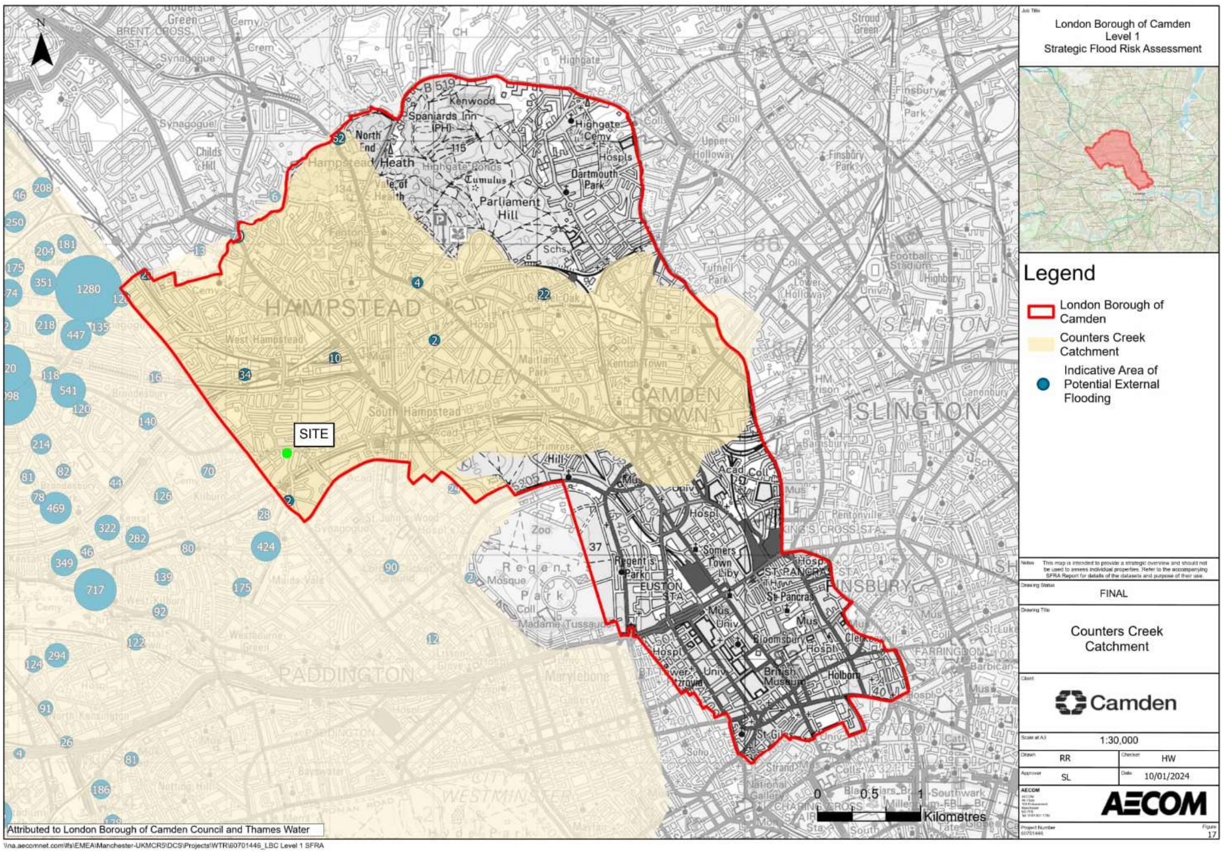


Figure 8 - SFRA Map – Counters Creek Catchment and Indicative Area of Potential External Flooding

As suggested through the low rates of flooding associated with the Counters Creek within Camden, the Counters Creek Catchment has little direct impact on property flooding. However, drainage processes associated with the catchment may contribute to overall flood risk. This is more likely to have an impact on sewer flooding than surface water flooding, due to the extensive combined sewer network which conveys both foul and surface water.

It can be seen that the site sits within the Counters Creek catchment and that no indicative areas of internal or external flooding are shown near to the site.

Historic Incidents of Flooding

There are three main documented significant flooding events that have occurred in the region historically. These were in 1975, 2002 and 2021, the most widespread of which is understood to be the 2021 incident.

On the 12th and 25th July 2021, flood events occurred in London as a result of saturated ground conditions and an intense, highly localised rainfall event. The floods were preceded by the fifth wettest three-month combined May-June-July rainfall total on record, which saturated green spaces such as Hampstead Heath. This limited the capacity for attenuation at the point of peak rainfall, increasing the volume of surface water conveyed overland. The rainfall event had a high spatially variability, which led to a varying scale of impact across the Borough. Areas north and west of the London Borough of Camden, such as Hampstead and South Hampstead, were the worst affected. This corresponds with the areas of greatest rainfall intensity, where the most severe rainfall return period exceeded a 1% AEP event on 12th July. On the 12th and 25th July 2021, the return period rainfall exceeded the design standard of the sewer and drainage network. This led to surcharge of sewer assets and subsequent sewer flooding. On 12th July 2021 over a month's rainfall fell in under an hour, with Kensington, Westminster and Hammersmith being the most affected. Over 80mm of rain fell (170% of July's average rainfall) in a few hours over the course of the storm. The Met Office has confirmed return periods of up to 179 years for the amount of rain that fell in one hour. This coincided with a peak in high tide, which meant that the water in the combined sewer could not escape into the Thames. To put this into context, the joint probability of this magnitude of storm occurring at the same time as a peak high tide is 1 in 716 years.

Over 100 incidents of flooding were reported for the July flood event. An investigation undertaken by Camden Council (including a Section 19 Report) suggest a significant number of properties were subject to internal flooding in July 2021. Most incidents reported by residents were considered a result of surface water. The focus of the Section 19 Flood Investigation report is detailed in Figure 9. It can be seen that the development site sits outside of any area of focus.

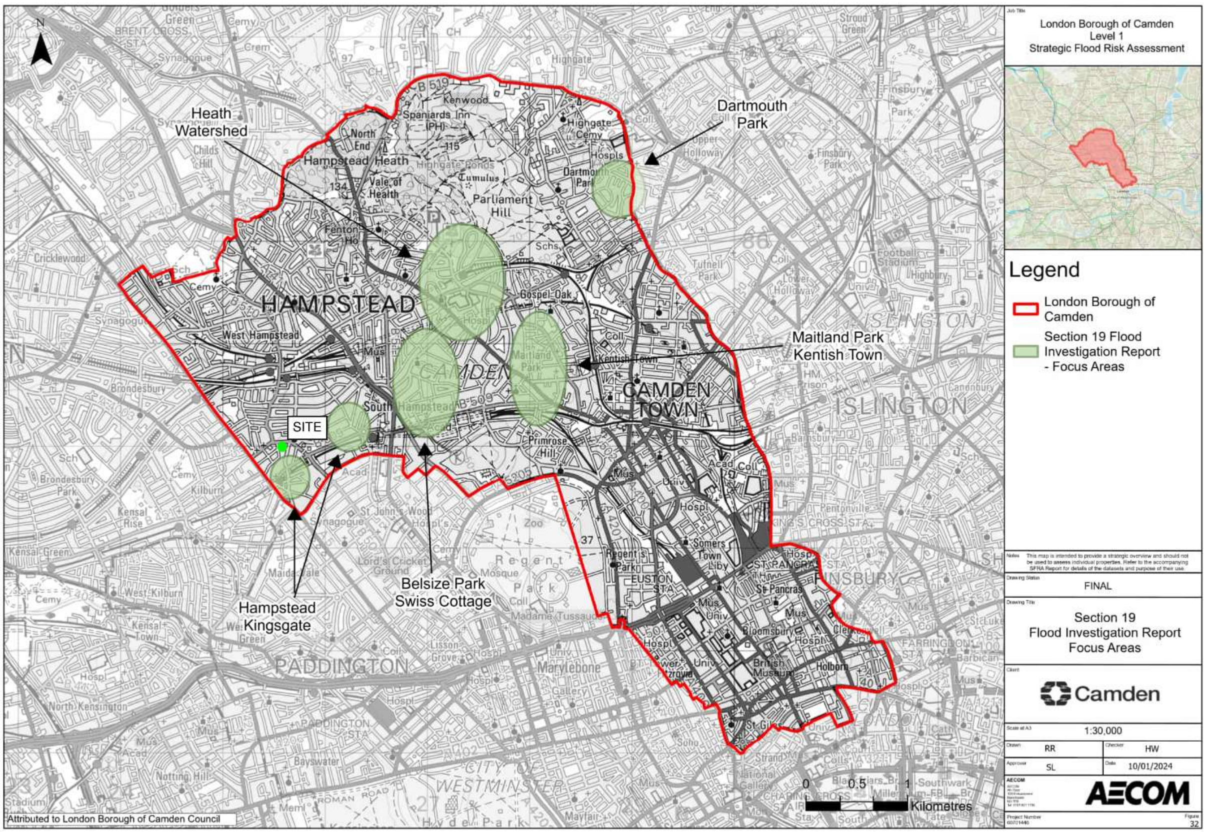


Figure 9 - SFRA Map – Section 19 Flood Investigation Report Focus Areas

The extent of the flooded streets in each of these historic flood events is detailed on the map in Figure 10. While many of the adjacent streets experienced flooding, Abbot's Place and the development site did not.

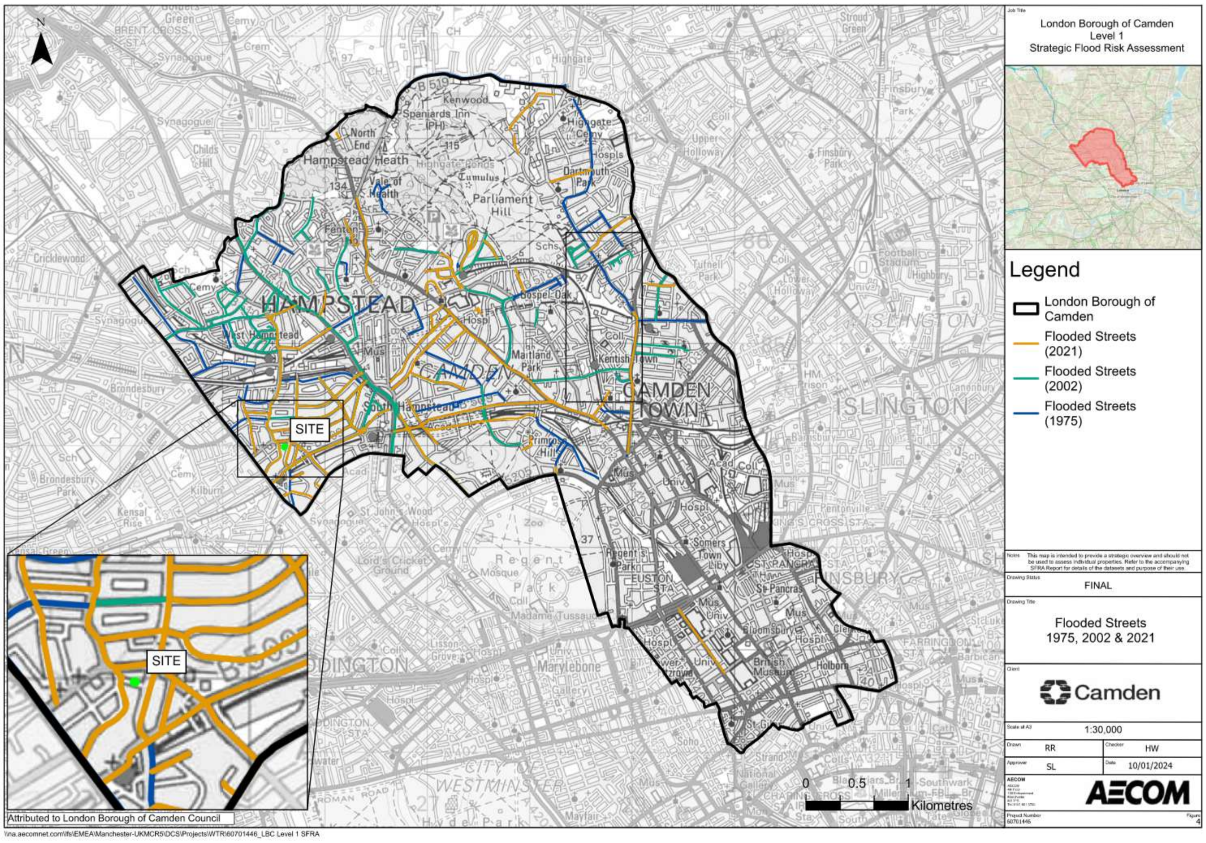


Figure 10 - SFRA Map – Flooded Streets 1975, 2002 & 2021

Thames Water produced a report on 16th June 2023 titled Understanding Flood Risk and Long Term Strategy. The flooding events of July 2021 were the focus of the report and Thames Water outlined their long-term strategy for alleviating flood risk in Counters Creek Catchment with the following key elements:

- Commissioning of the Tideway Tunnel in 2025.
- Provision of protection to basement properties in the Counters Creek area which flooded in the 2021 severe flooding event, where Thames Water are investing over £10m.
- Encouraging more SuDS with over 7,000 hectares of impermeable area drained into SuDS, across London including rainwater harvesting, rain gardens, green roofs and rewilding projects.
- Investing up to £1.7bn in risk zones 2 and 4 (covering Counters Creek) to reduce the risk of flooding of customers to 1.5% (internal) and 3% (external) up to a 1 in 30-year storm event in any given year by 2050, ensuring 95% of properties are not at risk of a 1 in 50-year storm event.
- Updating the asset base so that it is reliable, resilient to climate change and able to support London's growth.
- Digitising the tunnel and the existing trunk sewer system to use real-time data (rainfall, sewer levels, flow, storm discharges etc.) alongside predictive models (rainfall, hydraulic, operational resources etc.) to reduce discharges to the tidal River Thames by up to 95%.

- Reducing the risk of sewer flooding in homes by building resilience in the network, working in partnerships with public, private, non-governmental and community partners, and using the new Thames Tideway Tunnel to its full potential to support the reduction of risk.
- Ongoing operation of the network - using smart controls and sensors to track how the system performs under pressure, enabling improvements and enhancing our response to and recovery from significant weather events.

Site Specific Surface Water Flood Risk

Surface water flooding can occur during intense rainfall events where the rainwater is unable to soak into the ground or enter the drainage system. This type of flooding is usually associated with a short duration storm with heavy downpours or a failure or blockage within the drainage system.

The Environment Agency has produced surface water flood mapping which can be used to gain an understanding of the risk, depth, and velocity of flooding.

The site is classified as having a low chance of surface water flooding in the EA flood maps, as can be seen in the extracts provided in Figures 11 and 12. The site is classified as being outside of the flood extent and therefore having a chance of surface water flooding of less than 0.1% (i.e. an annual probability of flooding occurring of less than 1 in 1000). This is consistent with the information provided in the SFRA and summarised in Figure 10.

As part of the proposed development a new surface water drainage network will collect and manage all surface water runoff that falls on the site. The proposed below ground surface water drainage will be designed to manage a 1 in 100 year storm event + 40% climate change and therefore will protect the proposed development from the risk of surface water flooding.

For further details of the surface water drainage refer to the Drainage Strategy section of this report.

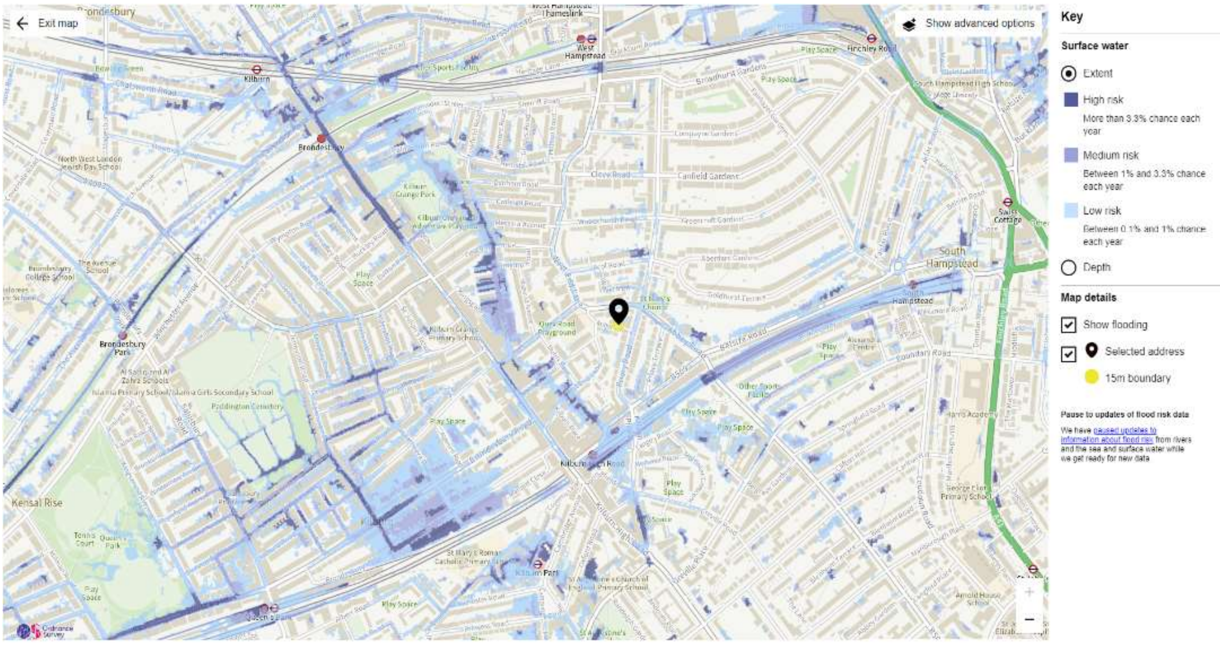


Figure 11 - Extract from EA Flood Maps - Flood Map for Surface Water Extent

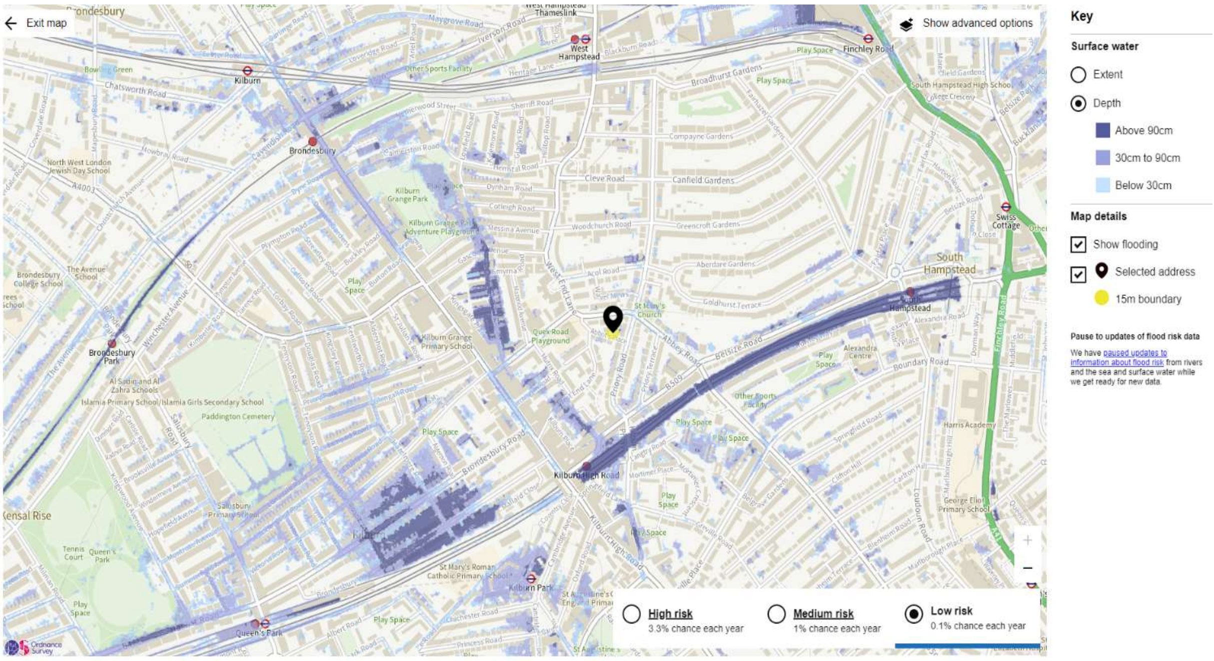


Figure 12 - Extract from EA Flood Maps - Flood Map for Surface Water Flood Depth (low risk)

Site Topography

It can be seen from Figure 13 that there is a significant gradient along the footpath outside the site and along the road Abbot's Place. The road falls 400mm along the fall arrow on Abbot's Place alone. Furthermore, there is a kerb to the footpath which then rises to the site. The site is therefore approximately 200mm above the highway level. To the east Abbot's Place, the road joins Priory Road which continues to fall south away from the site. Refer to Figure 14 for local area Lidar levels data.

Refer to Appendix A for the site topographical survey.

Even in periods of very significant rainfall it is therefore expected that surface water will flow along Abbot's Place without surcharging to a significant enough depth to enter the level of the development site. Furthermore, there is a wall with gate running along the back of footpath, separating the development site from the highway.

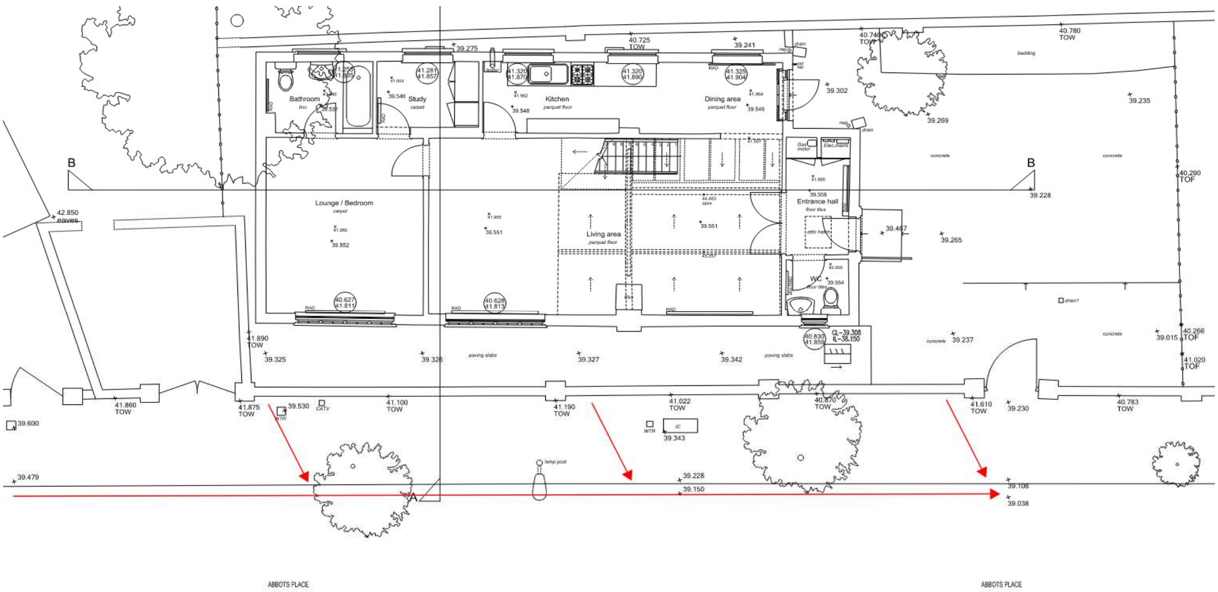


Figure 13 – Site Topographic Survey and Falls

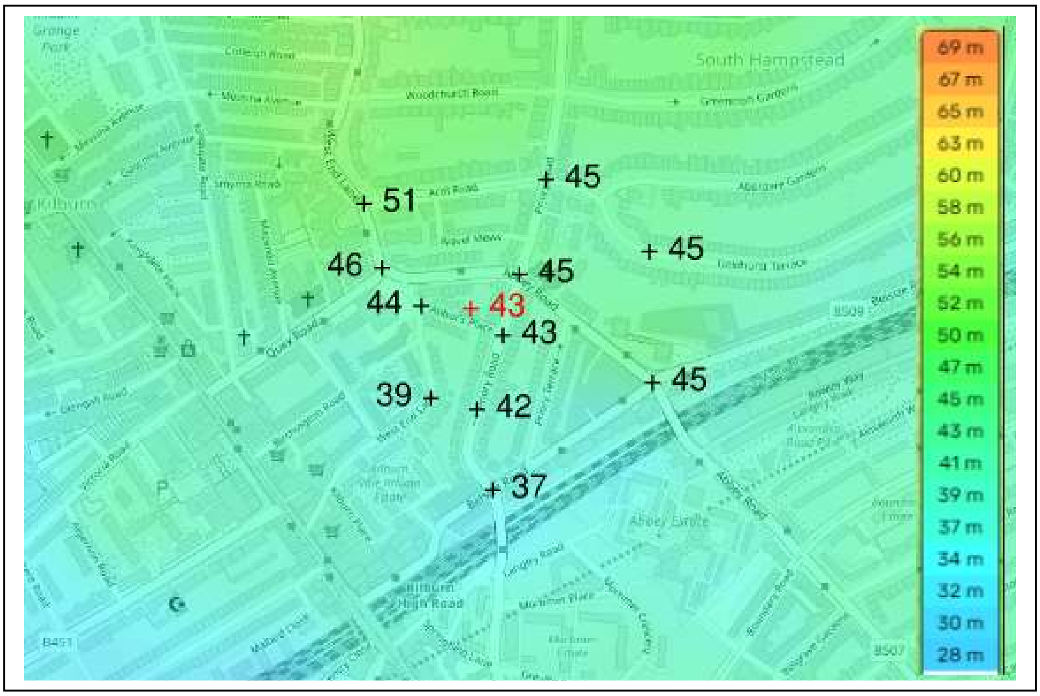


Figure 14 – Regional Topography

Whilst all the available information shows that the site is at low risk of surface water flooding, the risk should still be considered and mitigated against within the building design where appropriate.

Site Specific Foul/Combined Water Flooding

A Sewer Flooding History Enquiry was undertaken with Thames Water dated 6th June 2024 (refer to Appendix B for details). Thames Water confirmed that *"The flooding records held by Thames Water indicate* *that there have been no incidents of flooding in the requested area as a result of surcharging public sewers."*

The extract of the public sewers provided in Figure 15 shows that the site and surrounding area are served by combined public sewers. It can be seen that there is a 229mm diameter combined public sewer in Abbot's Place that outfalls to a 5m deep, large 1016mmx610mm sewer in Priory Road which then heads south following the natural fall of the land. As can be seen from the flooded streets map in Figure 10, Priory Road was subject to flooding in the 2021 floods. Whilst this was reported as surface water, it is certainly possible that some of the houses along this road experienced internal flooding to their basements as a result of surcharging public sewers. This effect is illustrated in Figure 16.

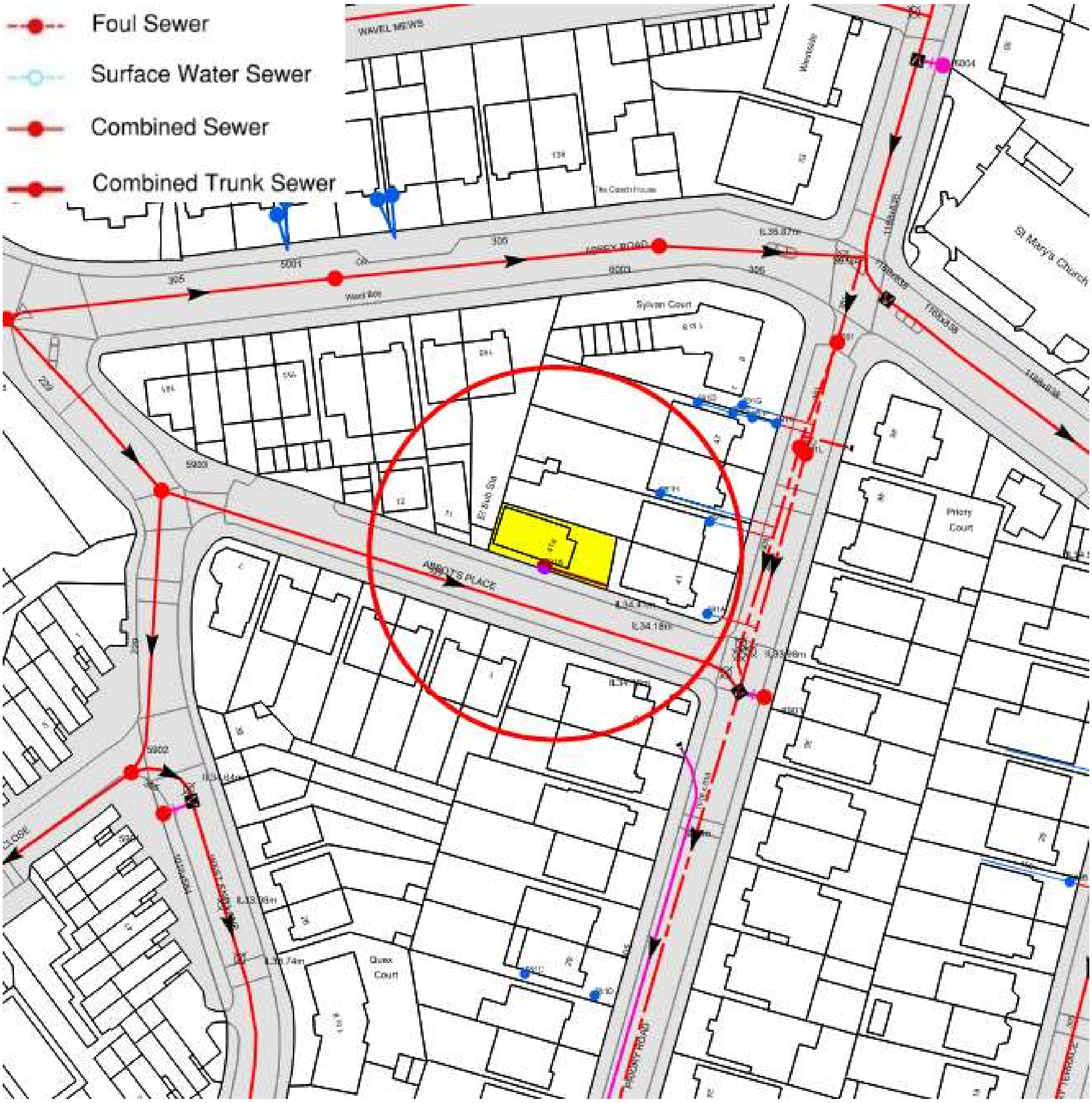


Figure 15 – Extract of Thames Water Public Sewer Records

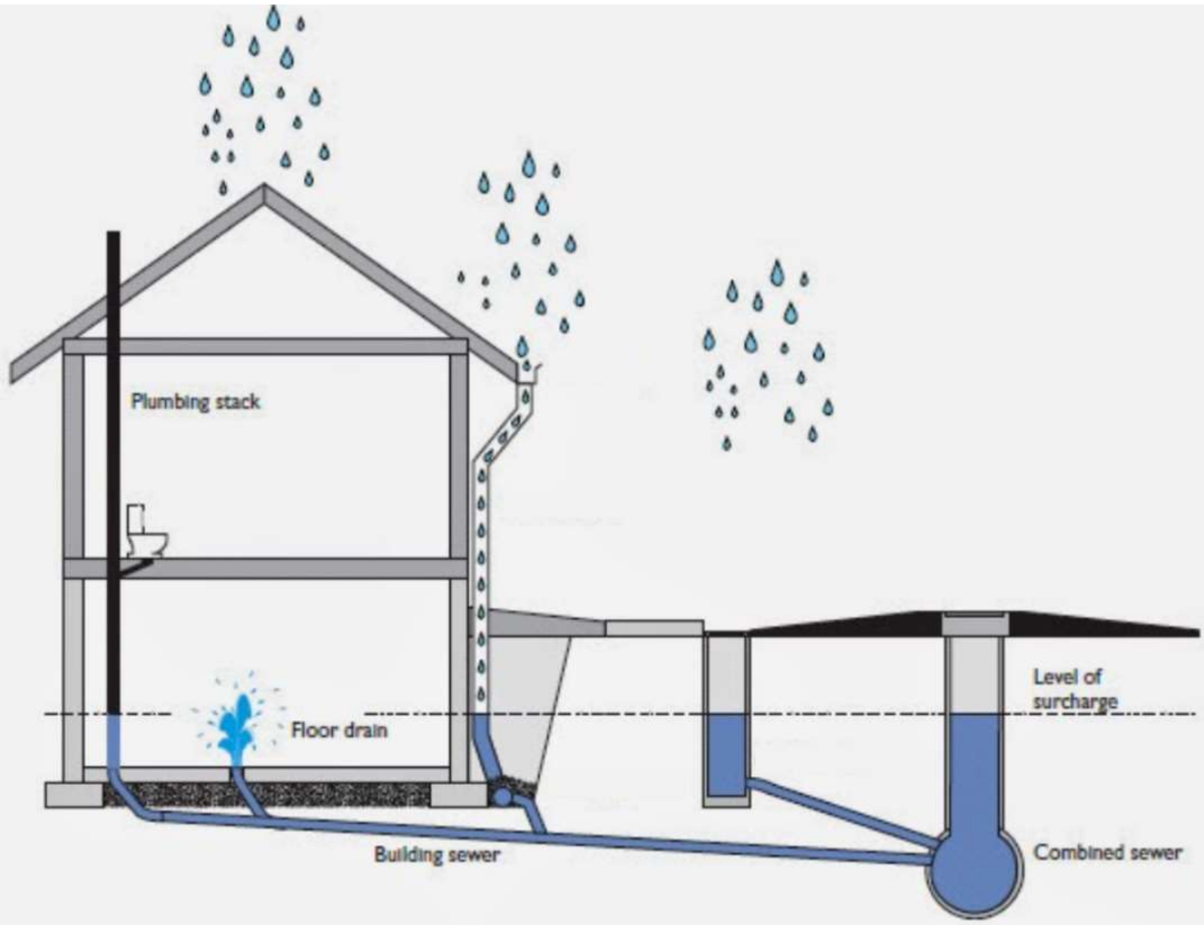


Figure 16 – Basement Flooding Scenario due to Surcharging Sewers

All available information shows that Abbot's Place was not subject to sewer flooding which is to be expected given the levels change and gradients in the area. As can be seen from the site Topographical survey in Appendix A, there is a significant fall along Abbot's Place (400mm outside the site alone) down to Priory Road, which then continues to fall to the south, with the south of Priory Road being approximately 6m below the proposed site. Any surcharging combined public sewers will therefore flood to the road surface via gullies and chamber covers before the level of surcharge reaches the levels on Abbot's Place. Any such floodwater at the surface will then fall south along the surrounding roads such as Priory Road. Any unprotected basements along Priory Road therefore may be at risk of fooding from surcharging public sewers.

The impact of basement flooding should still be considered for the development site, and appropriate design approach utilised to ensure that the proposed basement is protected from flooding due to surcharging public sewers. The Flood risk form surcharging public sewers is therefore considered to be low.

RESERVOIR FLOOD RISK

The Environment Agency mapping in Figure 17 shows that the site does not lie within an area that is susceptible to reservoir flooding. Therefore, flood risk from reservoir failure is considered to be low.

No canals are known to be located near to the site (at least 1.5 miles away to the Regents Canal).

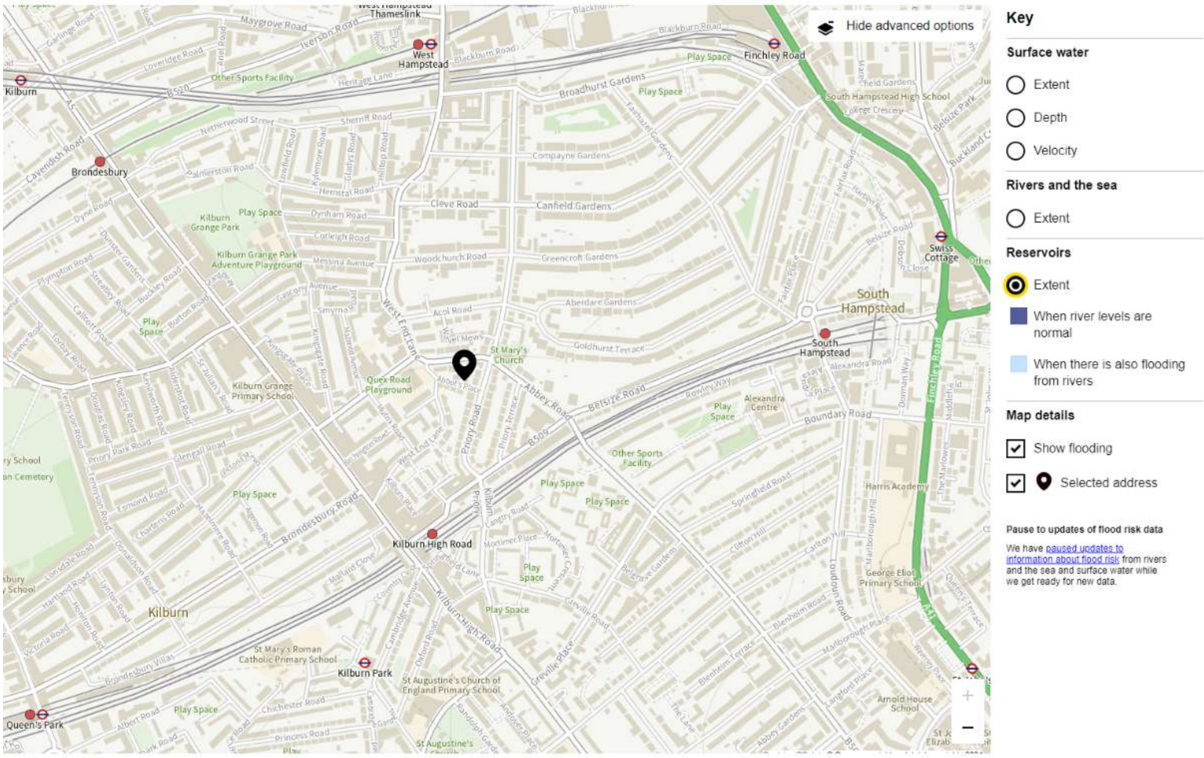


Figure 17 - Extract from EA Flood Maps - Flood Map for Reservoir Flooding

GROUNDWATER FLOOD RISK

Groundwater flooding occurs as a result of water rising up from an underlying aquifer or flowing from abnormal springs. This tends to occur after much longer periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is likely to be at shallow depth. Groundwater flooding tends to occur sporadically in both location and time, and tends to last longer than fluvial, pluvial or sewer flooding.

Groundwater flooding can also interact with other flood sources, exacerbating the risk of pluvial, fluvial or sewer flooding by reducing rainfall permeation or infiltrating to sewers.

The London Borough of Camden is predominantly underlain by the London Clay Formation bedrock, which is predominantly clayey in nature. Although the upper part of London Clay Formation provides permeable horizons, the clayey nature of the bedrock type has low permeability and is of little significance as an aquifer. Although groundwater may flow through fractures of the clay within the bedrock, flows will be significantly slower than other strata underlying the Borough. There is little capacity for groundwater storage or conveyance, which suggests a limited risk of groundwater flooding.

Mapping is provided in the SFRA which details areas susceptible to groundwater flooding. An extract of which is provided in Figure 18. It can be seen that the site is not in an area suspectable to groundwater flooding.

A comprehensive site ground investigation has been carried out, the results of which revealed a ground profile comprising a variable thickness of made ground (up to 0.7m bgl depth), overlying soft to firm becoming stiff consistency dark brown silty clay. Traces of Selenite were noted from 6.0m depth (considered to represent the London Clay Formation), encountered to the base of the boreholes (up to 8.0m bgl). Groundwater was not observed during the investigation. Concentrations of all contaminants within the suite were found to be below the relevant Guideline Limits. No Remediation of the site will be necessary as part of the proposed development.

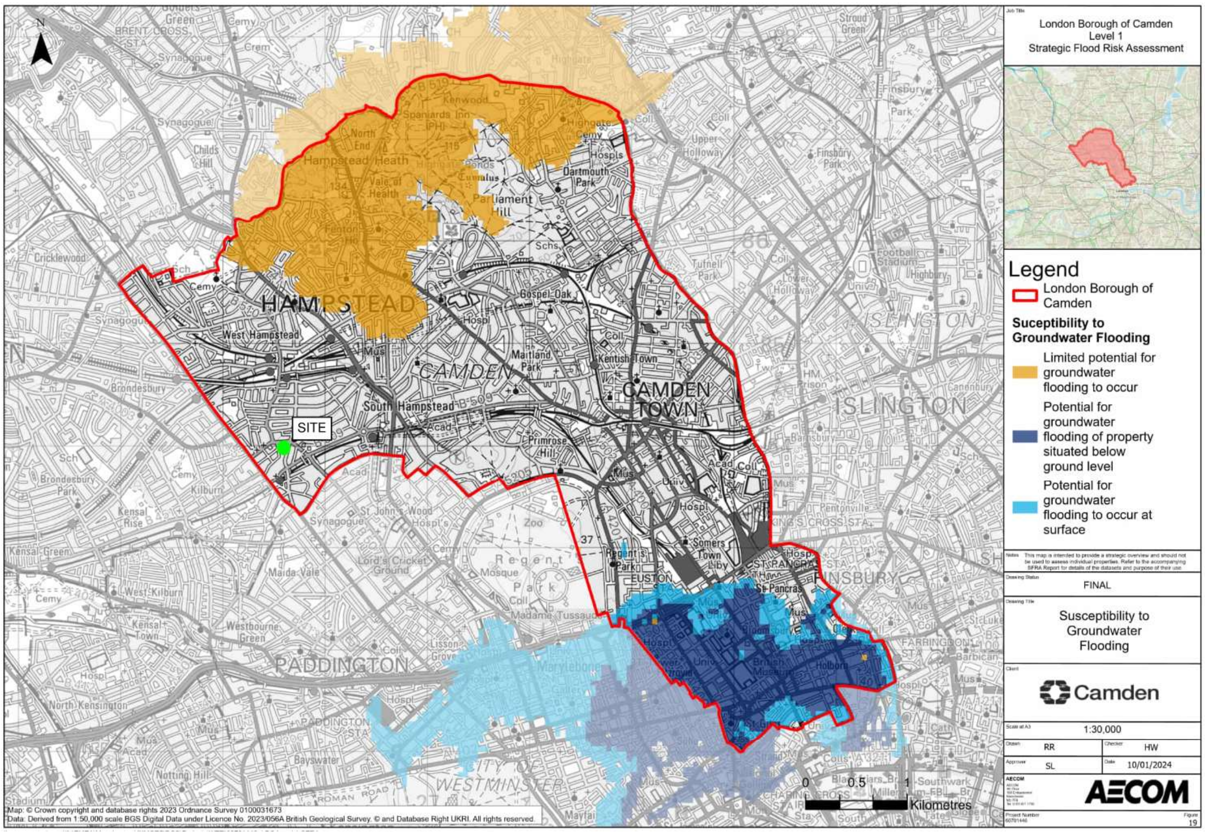


Figure 18 - Extract from SFRA Maps – Susceptibility to Groundwater Flooding

The topography of the site is also such that the ground levels fall to the south, with a significant gradient along the road adjacent to the site. It is also assumed that any groundwater flooding is more likely to occur on the adjacent lower lying land (shown hatched blue indicating potential flooding on the extract provided).

It is therefore considered that the risk of groundwater flooding at the proposed site is low

Flood Risk Summary

FLOOD SOURCE	RISK CATEGORY			COMMENTS
	HIGH	MEDIUM	LOW	
Tidal/fluvial			X	Site Located wholly in Flood Zone 1
Surface Water Run-off from Heavy Storm Events			X	The site is classified as being at low risk of flooding from surface water from all available data. Due to the presence of flooding nearby the risk of surface water flooding should be considered in the design.
Groundwater			X	The site was found to be at low risk of ground water flooding.
Reservoirs			X	The proposed site does not lie within an area affected by reservoir flooding.
Sewers			X	Records do not show any localised flood incidents on the site, the risk of flooding from sewers is considered to be low. Due to the presence of large offsite combined public sewerage, the potential risk of sewer surcharge should be considered in the design, particularly to basement areas.

Table 4 - Flood Risk Summary for Development

PROPOSED DRAINAGE STRATEGY

Existing Drainage

The existing site is served by private dedicated foul and surface water drainage. The foul water from building collects in an external below ground chamber that enters the land of the adjacent property. From here it is assumed to collect foul water from the neighbouring property before discharging to the combined public sewer in Priory Road. Similarly, the onsite surface water drains collect surface water from the existing building and hardstanding, before the drainage enters the neighbouring property boundary. From here it is assumed to discharge to offsite public sewers in Priory Road. Both foul and surface water are assumed to discharge at unrestricted rates. Refer to Figure 19 for existing drainage layout details.

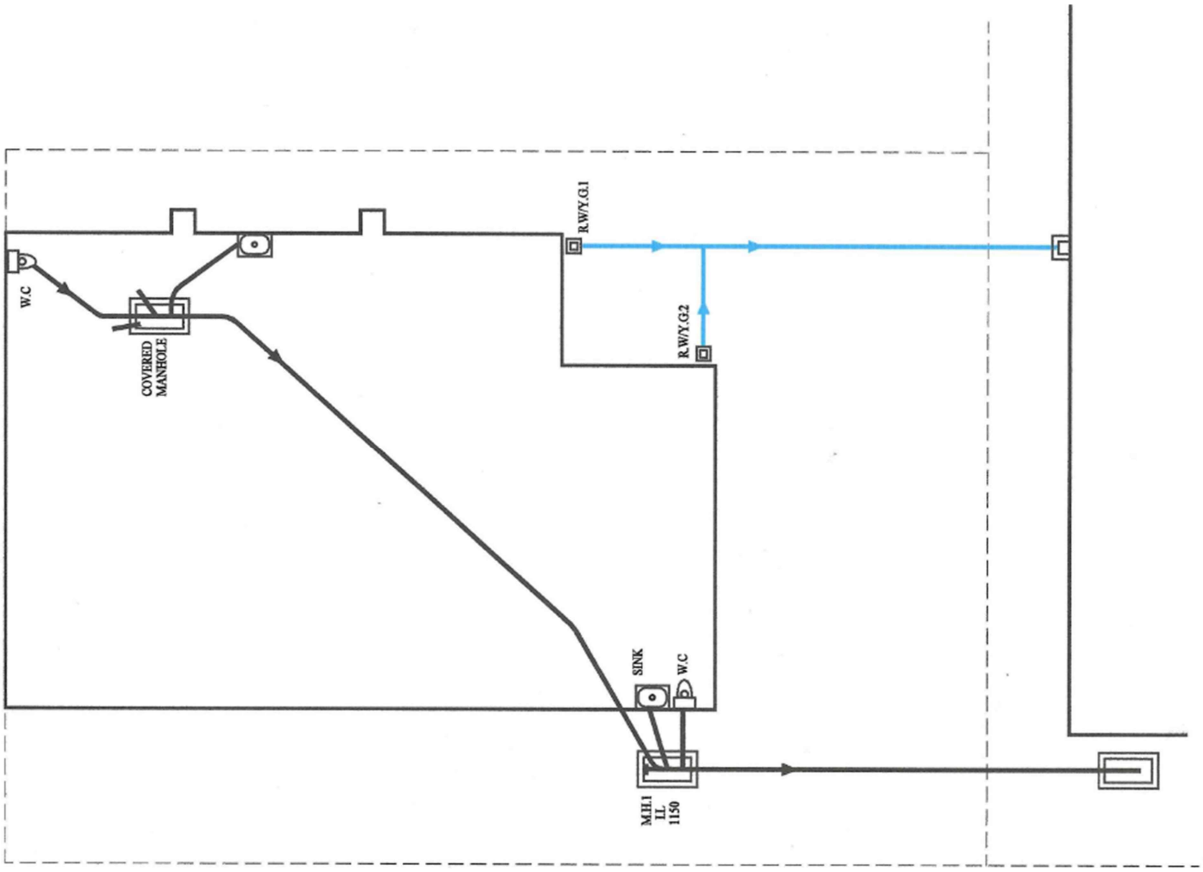


Figure 19 – Existing Site Drainage Layout

Proposed Basement Drainage

As discussed in this report, the risk of surcharging from the public sewer to the development site ground level is considered to be low, due to fact that the combined public sewer the development site connects to is understood to be a 5m deep sewer on Priory Road. The finished ground levels on Priory Road are significantly lower than the ground levels on the development site, so flooding would occur on Priory Road and the surrounding buildings before the surcharge level could reach ground level at Abbot's Place.

As it is lower than the existing ground level, the risk of flooding to the proposed basement should however be considered. It is proposed to collect foul and surface water from the basement toilets and hardstanding areas in dedicated pump stations. From here, flows will be pumped up to dedicated foul and surface water drainage networks at ground level. This will ensure that there is no gravity connection between basement level and the below ground drainage network, so it is not possible for the basement to flood from surcharging of the public sewers.

Proposed Foul Water Drainage

Flows pumped from the basement join a below ground foul water drainage network that will be constructed to serve the site. Foul water discharge from the building ground and upper floors will discharge to the below ground drainage network that will utilise the existing onsite private connection to the offsite public sewers. An inline non return valve will be located in the outfall pipe from the last manhole chamber on the site, to mitigate against public sewer surcharge back into the onsite drainage network.

Foul water flows will be discharged unrestricted, no significant additional flows are expected to be generated as a result of the proposals, as an existing house is present on the site.

Refer to the proposed drainage layout drawing in Appendix C for further details.

Proposed Surface Water Drainage

The existing site is predominantly hardstanding area consisting of the existing building and hardstanding amenity area. The existing flows are understood to discharge unrestricted to the offsite public sewers. The existing flows from the site have been calculated using a Microdrainage hydraulic model for the site. The discharge rates are detailed in Table 5, refer to Appendix D for detailed modelling information.

The existing greenfield runoff rate has been calculated, and the results shown in Table 5, refer to Appendix E for detailed calculations.

The lowest discharge rate that it is recommended to restrict down to is 1 l/s, otherwise an unacceptable risk of blockage is created by using the small opening required in the flow control device. As such it is therefore proposed to restrict the discharge rate from the site to 1 l/s using a hydrobrake flow control device and small underground tank for all storms up to and including the 1 in 100 year storm with a 40% allowance for climate change. Additionally, a rainwater harvesting tank is proposed to collect water from the building roof and store it for later use.

An inline non return valve will be located in the outfall pipe from the last manhole chamber on the site, to mitigate against public sewer surcharge back into the onsite drainage network.

Return Period	Existing Discharge Rate	Greenfield Runoff Rate*	Proposed Discharge Rate
1 in 1 year	2.9 l/s	0.36 l/s	1 l/s
1 in 30 year	7.9 l/s	0.98 l/s	1 l/s
1 in 100 year	10.3 l/s	1.36 l/s	1 l/s

*Rate based on 0.1 Ha site minimum requirement (development site area is 0.021Ha)

Table 5 - Flood Risk Summary for Development

The proposed development will therefore result in a significant decrease in peak discharge rate from the site. Refer to the proposed drainage layout drawing in Appendix C for further details.

The surface water drainage network has been designed in Microdraiange modelling software to accommodate a 1 in 100 year return period storm with a 40% allowance for climate change. Refer to the proposed drainage modelling calculations in Appendix F for details.

FLOOD RISK MANAGEMENT RECOMMENDATIONS

Whilst the risk of flooding from all sources was found to be low, due to the presence of flooding nearby and the location within a Critical Drainage Area, it is recommended that flood resilient design is incorporated into the design and construction of the project:

- Retaining the existing 2.4m high wall to the rear of the Abbot's Place footpath which acts as a flood barrier to the site. Flood proof gates or demountable barriers are recommended for use in the two access openings.
- All basement foul and surface water flows to be pumped from basement level to ground floor, ensuring no route into the basement from below ground public sewer surcharge.
- In line non return valves to be provided at the site outfalls to mitigate against surcharge from the offsite public sewers.
- A new below ground surface water drainage network should be provided, designed to accommodate a 1 in 100 year storm without flooding, whilst providing an allowance for 40% climate change. Rainwater harvesting and attenuation tanks provide water storage to allow a flow control device to limit the peak discharge rate from the site to 1 l/s. A significant reduction compared to existing.
- Onsite levels to fall away from the building to mitigate against surface water flooding.

IMPACT ON LOCAL FLOODING REGIME

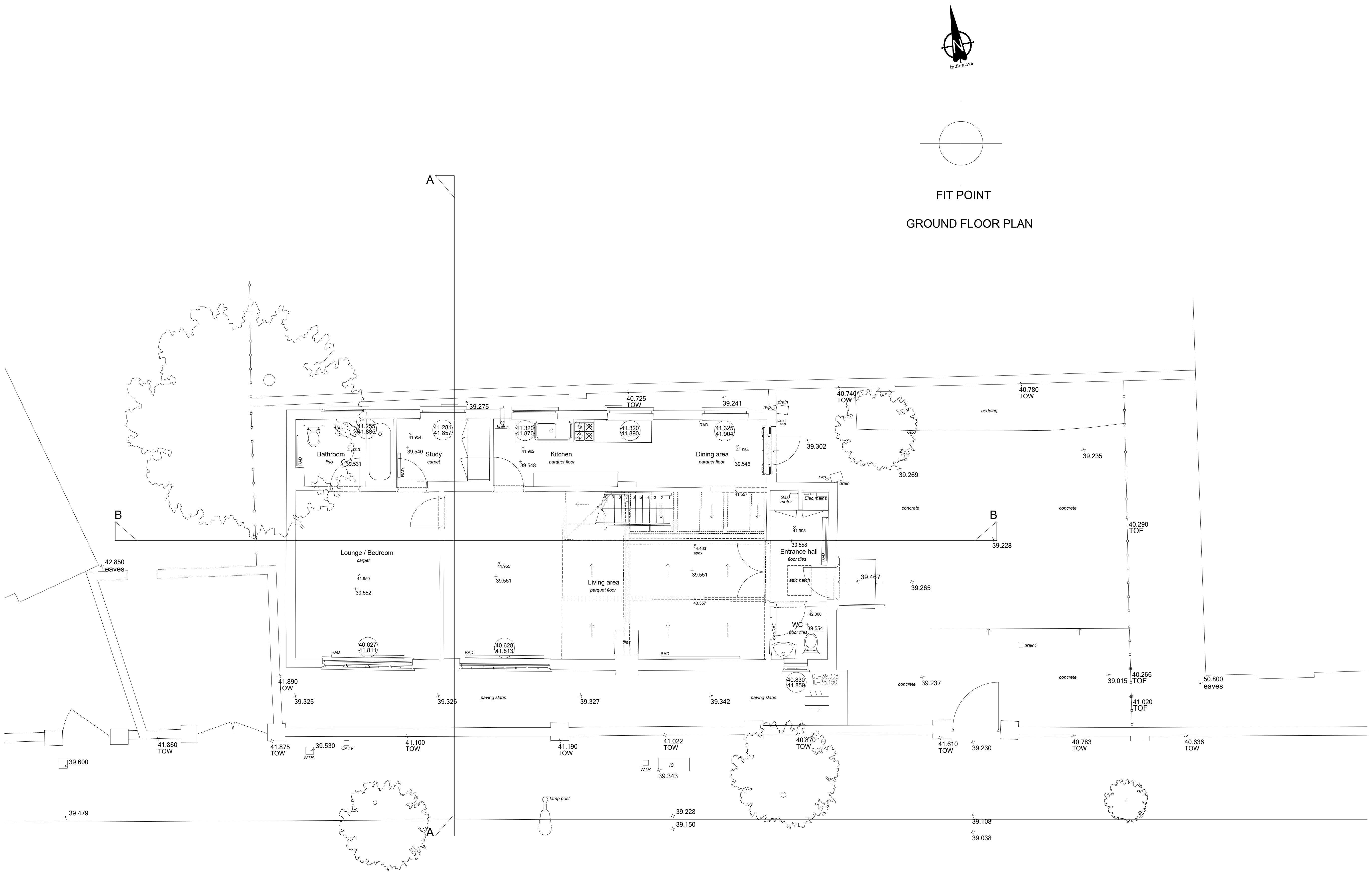
In addition to assessing the sources of flooding to the development, the NPPF requires that an FRA also considers the potential for a development to increase flood risk to the surrounding area.

As detailed above, the site of the proposed development is located within Flood Zone 1 and therefore is outside of the designated flood plain. Therefore, it is considered that the development will not have any impact on the surrounding areas so there is no requirement to provide floodplain compensation storage.

Additionally, it is proposed to reduce the surface water peak discharge rate from the site by approximately 90% for the 1 in 100 year storm, while also making an allowance of 40% for climate change. The development will therefore result in decreased loading on the offsite combined sewers and therefore decrease flood risk to downstream properties.

Appendix A
Topographical Survey

GROUND FLOOR PLAN



LEGEND

STREET FURNITURE	
BB	BELISHA BEACON
Bin	LITTER BIN
BO	BOLLARD
BS	BUS STOP
CPO	CONCRETE POST
EP	ELECTRIC POLE
FHM	FIRE HYDRANT MARKER
FL	FLOOD LIGHT
FP	FLAG POLE
JB	JUNCTION BOX
GB	GRIT BOX
GPO	GATE POST
IBO	ILLUMINATED BOLLARD
LP	LAMP POST
LW	LIGHTWELL
MPO	METAL POST
PB	POST BOX
PM	PARKING METER
RS	ROAD SIGN
SI	SIGN
SL	SUNKEN LIGHT
STN	SURVEY STATION
Tap	ATTACHED TO WALL ETC
TP	TELEGRAPH POLE
TPO	TIMBER POST

PIPES	
DP	DOWN PIPE
GP	GAS PIPE
RWP	RAIN WATER PIPE
SP	STAND PIPE
SVP	SOIL VENT PIPE
VP	VENT PIPE
WP	WASTE PIPE

LEVELS	
A	APPROXIMATE
CL	COVER LEVEL
EL	EAVES LEVEL
FFL	FINISHED FLOOR LEVEL
FRL	FLAT ROOF LEVEL
ID	INVERT DEPTH
IL	INVERT LEVEL
PAL	PARAPET WALL LEVEL
RL	RIDGE LEVEL
TFL	TOP OF FENCE LEVEL
TWL	TOP OF WALL LEVEL

VEGETATION	
BSH	BUSH
FB	FLOWER/SHRUB BORDER
HDG	HEDGE
OVG	OVERGROWTH

TREE	
	TYPE
	GIRTH / SPREAD (R)

WALLS & FENCES	
BW	BLOCK WALL
BRTW	BRICK RETAINING WALL
BRW	BRICK WALL
CBF	CLOSE BOARD FENCE
CCF	CHESTNUT CLEFT FENCE
CIF	CORRUGATED IRON FENCE
CLF	CHAIN LINK FENCE
CRW	CONCRETE RETAINING WALL
CW	CONCRETE WALL
DIL	DILAPIDATED
FPO	FENCE POST
HR	HAND RAIL
MF	MISCELLANEOUS FENCE
MRF	METAL RAILING FENCE
OBF	OPEN BOARD FENCE
PRF	POST & RAIL FENCE
RTW	RETAINING WALL
STW	STONE WALL
STRW	STONE RETAINING WALL
WMF	WIRE MESH FENCE

INSPECTION CHAMBERS	
AC	ACCESS COVER
EIC	ELECTRIC INSPECTION COVER
FH	FIRE HYDRANT
GIG	GAS INSPECTION COVER
GM	GAS METER
GY	GULLY
IC	INSPECTION COVER
SV	STOP VALVE
TIC	TELECOM COVER
UTL	UNABLE TO LIFT
WIC	WATER INSPECTION COVER

SURFACES	
ASPT	ASPHALT
BCP	BARK CHIPS
BPAV	BRICK PAVING
CONC	CONCRETE
CPAV	CONCRETE PAVING SLABS
CPS	CRAZY PAVING
FB	FLOWER/SHRUB BORDER
GRS	GRASS
GVL	GRAVEL
MPAV	MIXED PAVING
MRB	MARBLE STONES
SHG	SHINGLE
TLE	TILE
TMAC	TARMAC
TPAV	TACTILE PAVING
WDK	WOODEN DECKING

	SINGLE GATE
	DOUBLE GATE
	BANKING
+0.00	LEVEL
	SURVEY STATION

TREE LEGEND

ALD	ALDER	LAR	LARCH
ASH	ASH	LBM	LABURNUM
ASP	ASPEN	LCS	LOCUST
BCH	BEECH	LIM	LIME
BRC	BIRCH	LPN	LONDON PLANE
CED	CEDAR	MAG	MAGNOLIA
CHY	CHERRY	MPL	MAPLE
CON	CONIFEROUS	OAK	OAK
CYP	CYPRESS	PNE	PINE
DEC	DECIDUOUS	POP	POPLAR
DED	DEAD	RDN	RHODODENRONS
ELD	ELDERBERRY	RWN	ROWAN
ELM	ELM	SLW	SALLOW
EUC	EUCALYPTUS	SAP	SAPLING
FIR	FIR	SCH	SWEET CHESTNUT
FRT	FRUIT	SPR	SPRUCE
HAW	HAWTHORN	SYC	SYCAMORE
HZL	HAZEL	UNK	UNKNOWN SPECIES
HBM	HORNBEAM	WBM	WHITEBEAM
HCH	HORSE CHESTNUT	WLW	WILLOW
HLY	HOLLY	WNT	WALNUT
IBT	INDIAN BEAN TREE	YEW	YEW

NOTES

This survey has been carried out to an accuracy consistent with a presentation scale of
1:100; therefore interrogated dimensions will be within the tolerance associated with this scale. The same accuracies implied by the plotting scale are equally applicable to digital data supplied for CAD. The scale of this drawing should not be changed without permission.

Boundaries shown are not necessarily legal boundaries.

Building footprints edged with a solid line have been surveyed. Where the outline is merely hatched the footprint is indicative only.

All levels, heights, measurements and dimensions are in metres unless otherwise stated.

Eaves levels are generally surveyed as the end of the roof slate/tile/thatch. In cases where this is not possible the top of gutter is surveyed instead. Where underside of fascia or other features are surveyed these are recorded as such.

All below–ground features (including drainage, voids and services) have been identified from above ground and therefore all details relating to these (such as sizes, depth, pipe positions and alignments, description etc.) will be approximate only. Underground services have not been traced, but any visible surface features have been located. No allowance has been made for any sub–surface manholes or other chambers or voids below ground level. While every effort is made to identify all visible above–ground features, it should be noted that there may be features obscured at the time of survey.

Spot heights at edges of roads are road/gutter levels, not top of kerb unless otherwise stated.

Trees have been drawn diagrammatically (i.e. circular) showing average canopy spread.

Measurements to internal walls have been taken to the wall finishes at approximately 1m above floor level and assumed to be vertical.

0 1 2 3 4 5
Scale (m)

cad surveys
CAD Surveys Ltd.
Suite 2 KPC House
Canterbury Road
Willesborough
Ashford
TN24 0BP
www.cadsurveys.co.uk
01233 635089

Project : 10 Abbot's Pl
North Maida Vale
London
NW6 4NP

Drawing title : Ground Floor Plan

Scale: 1:100 @ A2
Date : 19/04/2023
Drawn by : SE

Appendix B

Sewer Flooding Enquiry

Sewer Flooding
History Enquiry

Thames Water Property Searches

Qaim Structures

Bath Road

Search address supplied	41 Priory Road London NW6 4NP

Your reference	0675
Our reference	SFH/SFH Standard/2024_5001234
Received date	**6 June 2024**
Search date	**6 June 2024**

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Sewer Flooding

History Enquiry

Thames Water Property Searches

Search address supplied: 41,Priory Road,London,NW6 4NP

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is "overloaded" when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- "Internal flooding" from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- "At Risk" properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company's reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk

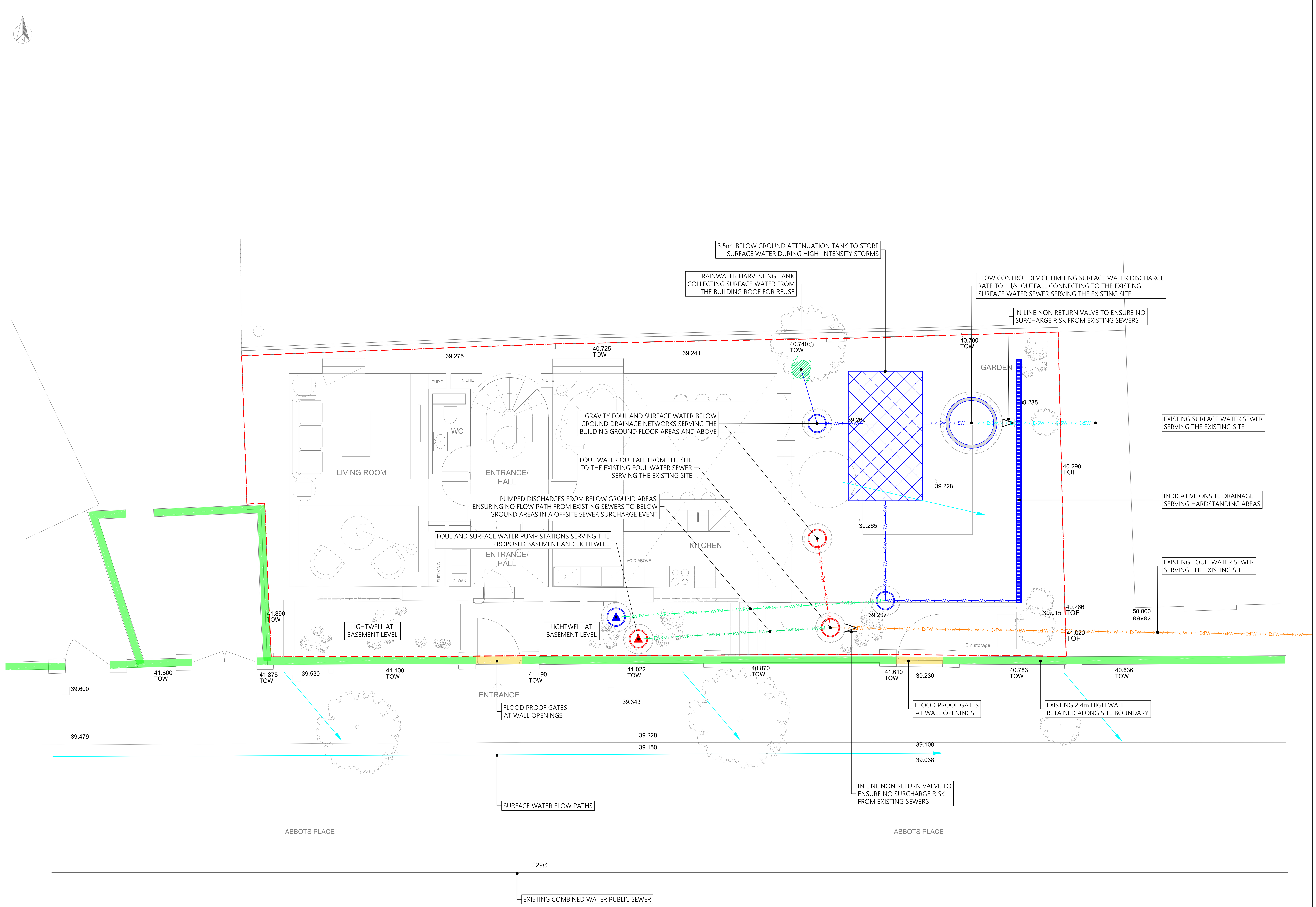
Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Appendix C

Proposed Drainage Layout



NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS ARE IN METRES ABOVE ORDINANCE DATUM AND ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. ALL WORKS TO EXISTING PUBLIC SEWERS TO BE SUBJECT TO THAMES WATER APPROVAL.
4. GREENROOF AND BLUEROOF DESIGN AND SPECIFICATION BY OTHERS.
5. ALL SEWERS TO BE ABANDONED ARE TO BE CHECKED TO ENSURE ALL LIVE CONNECTIONS ARE IDENTIFIED AND CATERED FOR.
6. PERMISSION TO BE OBTAINED BY CLIENT/CONTRACTOR FOR ANY CONSTRUCTION/LOCATION OF DRAINAGE INFRASTRUCTURE IN THE PUBLIC HIGHWAY/FOOTPATH
7. ATTENUATION VOLUMES ARE APPROXIMATE AT THIS STAGE, SUBJECT TO DETAILED HYDRAULIC MODELING
8. DRAINAGE LAYOUTS ARE INDICATIVE ONLY, FOR COORDINATION.
9. ARBORICULTURIST TO ADVISE ON FEASIBILITY OF ROUTING DRAINAGE THROUGH TREE ROOT PROTECTION AREAS.

KEY

- SITE BOUNDARY
- EXISTING FOUL WATER SEWER
- EXISTING SURFACE WATER SEWER
- EXISTING COMBINED WATER PUBLIC SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED SURFACE WATER ACCESS CHAMBER
- PROPOSED SURFACE WATER PUMPING STATION
- PROPOSED FOUL WATER SEWER
- PROPOSED FOUL WATER ACCESS CHAMBER
- PROPOSED FOUL WATER PUMPING STATION
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED SURFACE WATER RISING MAIN
- PROPOSED ATTENUATION TANK
- BRICK WALL ACTING AS FLOOD BARRIER
- FLOOD PROOF GATE/DEMOUNTABLE FLOOD BARRIER
- IN LINE NON RETURN VALVE
- SURFACE WATER FLOW PATH
- INDICATIVE SURFACE WATER DRAINAGE CHANNEL
- WATER HARVESTING TANK

REV	DATE	DESCRIPTION	DRN	APP
P01	24/07/2024	PRELIMINARY ISSUE	AP	CR

STATUS
PRELIMINARY ISSUE

PREPARED BY
CUBE CONSULTING ENGINEERS
WWW.CONSULTTHECUBE.CO.UK

CLIENT
-

PROJECT
10 ABBOT'S PLACE

DRAWING TITLE
BELOW GROUND DRAINAGE LAYOUT AND FLOOD MITIGATION

JOB NO.	DATE	SCALE
1197	24/07/24	1:50

DRN	DES	CHK	APP
AP	AP	CR	CR

DRAWING NUMBER	REV
1197-C-DR-0100	P01

Appendix D

Existing Site Hydraulic Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.600	Add Flow / Climate Change (%)	0
Ratio R	0.437	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.017	4-8	0.004

Total Area Contributing (ha) = 0.021

Total Pipe Volume (m³) = 0.353

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.011	0.011	0.011
1.001	-	-	100	0.010	0.010	0.010
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.021	0.021	0.021

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	30
Ratio R	0.437		

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.439
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%					9.034
1.001	2	15 Winter	1	+0%					8.997
1.002	3	15 Winter	1	+0%					8.946
1.003	4	15 Winter	1	+0%					8.896

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.116	0.000	0.12			1.6	OK	
1.001	2	-0.103	0.000	0.21			2.9	OK	
1.002	3	-0.104	0.000	0.21			2.9	OK	
1.003	4	-0.104	0.000	0.21			2.9	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.439
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%					9.055
1.001	2	15 Winter	30	+0%					9.032
1.002	3	15 Winter	30	+0%					8.981
1.003	4	15 Winter	30	+0%					8.931

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.095	0.000	0.29			4.0	OK	
1.001	2	-0.068	0.000	0.56			7.9	OK	
1.002	3	-0.069	0.000	0.56			7.8	OK	
1.003	4	-0.069	0.000	0.56			7.9	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.439
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+0%					9.064
1.001	2	15 Winter	100	+0%					9.047
1.002	3	15 Winter	100	+0%					8.997
1.003	4	15 Winter	100	+0%					8.946

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.086	0.000	0.37			5.2	OK	
1.001	2	-0.053	0.000	0.73			10.3	OK	
1.002	3	-0.053	0.000	0.73			10.2	OK	
1.003	4	-0.054	0.000	0.73			10.3	OK	

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Appendix E
Greenfield Runoff Rate Calculations

hr wallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	andrew prior
Site name:	10 Abbot's Place
Site location:	London

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.54060° N
Longitude:	0.19059° W
Reference:	3589004244
Date:	Jul 23 2024 11:14

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	630	630
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default Edited

Q_{BAR} (l/s):	0.43	0.43
1 in 1 year (l/s):	0.36	0.36
1 in 30 years (l/s):	0.98	0.98
1 in 100 year (l/s):	1.36	1.36
1 in 200 years (l/s):	1.6	1.6

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Appendix F
Proposed Site Hydraulic Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.600	Add Flow / Climate Change (%)	0
Ratio R	0.437	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.011	0.011	0.011
1.001	-	-	100	0.010	0.010	0.010
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.021	0.021	0.021

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003		10.000	8.800	8.800	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	30
Ratio R	0.437		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 4, DS/PN: 1.003, Volume (m³): 1.1

Unit Reference	MD-SHE-0065-2000-1150-2000
Design Head (m)	1.150
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	65
Invert Level (m)	8.850
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.150	2.0
Flush-Flo™	0.284	1.8
Kick-Flo®	0.579	1.5
Mean Flow over Head Range	-	1.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	1.200	2.0	3.000	3.1	7.000	4.6
0.200	1.8	1.400	2.2	3.500	3.3	7.500	4.8
0.300	1.8	1.600	2.3	4.000	3.5	8.000	4.9
0.400	1.8	1.800	2.4	4.500	3.7	8.500	5.0
0.500	1.7	2.000	2.6	5.000	3.9	9.000	5.2
0.600	1.5	2.200	2.7	5.500	4.1	9.500	5.3
0.800	1.7	2.400	2.8	6.000	4.3		
1.000	1.9	2.600	2.9	6.500	4.4		

Storage Structures for Storm

Cellular Storage Manhole: 3, DS/PN: 1.002

Invert Level (m) 8.900 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	6.0	6.0	0.501	0.0	10.9
0.500	6.0	10.9	2.000	0.0	10.9

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.439
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%	30/15 Winter				9.034
1.001	2	15 Winter	1	+0%	30/15 Summer				8.997
1.002	3	15 Winter	1	+0%	30/15 Summer				8.972
1.003	4	15 Winter	1	+0%	30/15 Summer				8.969

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.116	0.000	0.12			1.6	OK	
1.001	2	-0.103	0.000	0.21			2.9	OK	
1.002	3	-0.078	0.000	0.13		7	1.8	OK	
1.003	4	-0.031	0.000	0.11			1.6	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.439
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Winter	30	+0%	30/15 Winter				9.156
1.001	2	30 Winter	30	+0%	30/15 Summer				9.153
1.002	3	30 Winter	30	+0%	30/15 Summer				9.149
1.003	4	30 Winter	30	+0%	30/15 Summer				9.146

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.006	0.000	0.20			2.8	SURCHARGED	
1.001	2	0.053	0.000	0.37			5.1	SURCHARGED	
1.002	3	0.099	0.000	0.16		19	2.2	SURCHARGED	
1.003	4	0.146	0.000	0.13			1.8	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.439
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Winter	100	+40%	30/15 Winter				9.663
1.001	2	30 Winter	100	+40%	30/15 Summer				9.661
1.002	3	30 Winter	100	+40%	30/15 Summer				9.658
1.003	4	30 Winter	100	+40%	30/15 Summer				9.654

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.513	0.000	0.33			4.6	SURCHARGED	
1.001	2	0.561	0.000	0.63			8.8	SURCHARGED	
1.002	3	0.608	0.000	0.19			2.6	SURCHARGED	
1.003	4	0.654	0.000	0.13			1.8	SURCHARGED	

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