4599 Pope’s Road

Flood Risk Assessment

March 2020

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C	27/03/2020	Issued for Planning
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1 Introduction

AKT II have been commissioned to undertake a Flood Risk Assessment (FRA) in support of the proposed development of Pope's Road located in London Borough of Lambeth in the postcode area of SW9 8JB. This report is intended to cover only flood risk and to provide guidelines and parameters for the detailed drainage design.

This study has been prepared in accordance with the guidance contained in the National Planning Policy Framework (NPPF) and the accompanying planning practice guidance.

2 Existing Site

The site is located in the London Borough of Lambeth (LBL) at the postcode area of SW9 8JB and at the National Grid Reference 531720,175470.

The site is located approximately 60 metres (m) to the east of Brixton railway station and is also situated to the north-east of Brixton London Underground Station. The site is located within a predominantly commercial and retail setting, including the Brixton Recreation Centre, Brixton Village Market, restaurants and bars; residential properties are also located within the surrounding context, towards the northern, north-eastern and southern areas of the site.

To the immediate north and south, the site is bound by elevated railway tracks and viaducts (which are currently boarded up) upon which the tracks were built, with only a single pedestrian street separating the site from the railway tracks and viaducts. To the east, the site is bound by an area which is currently used as a servicing yard by the existing occupiers of the site, and Valentia Place further beyond; to the west, the site is bound by Pope's Road, which separates the site from Brixton railway station.

The site can loosely be described as 130m x 30m rectangular shape which narrows from West to East. The approximate area of the site is 0.26 ha. The site level is approximately 15.00 AOD and is effectively constant across the site.

The majority of the site is occupied on ground level by market shops and stalls with the roof of the building used as a storage area combined with parking for commercial vehicles.

3 Proposed Development

The current proposal is to demolish existing building and to erect a two-part building at Pope's Road comprising of a part ground floor +19 storeys, part ground + 8 storeys. The development will provide flexible A1/A3/B1/D1/D2 uses at ground and first floor with B1 accommodation on floors 2 to 19, with plant enclosure at roof level, and associated cycle parking.

The proposal for the development are shown in figures 3.1 and 3.2.

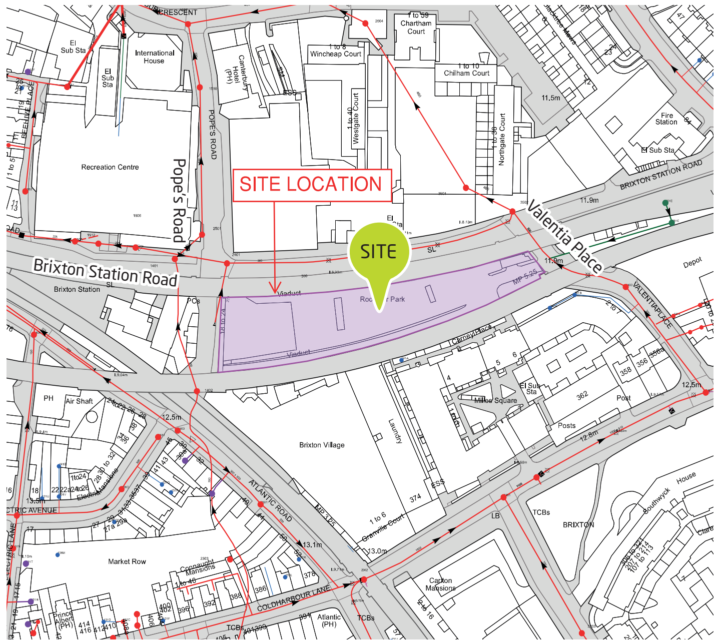

Figure 2.1 Map of site

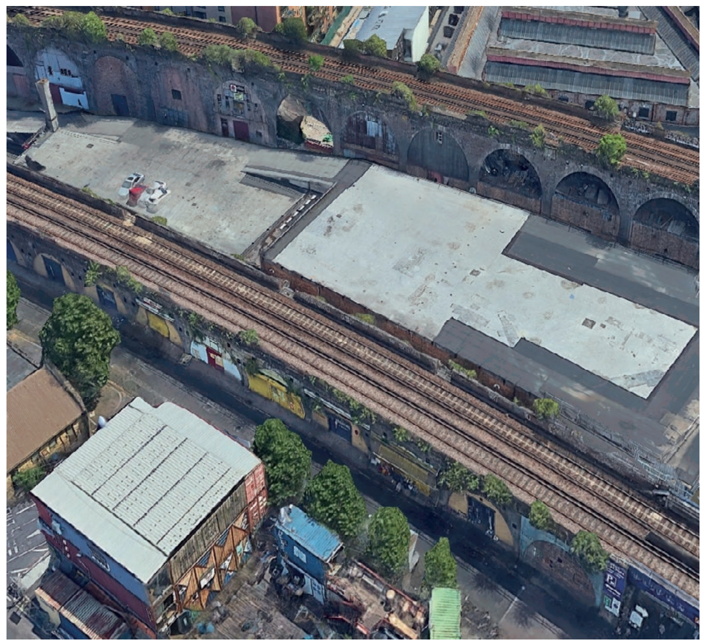
Figure 2.2 Existing site - aerial view

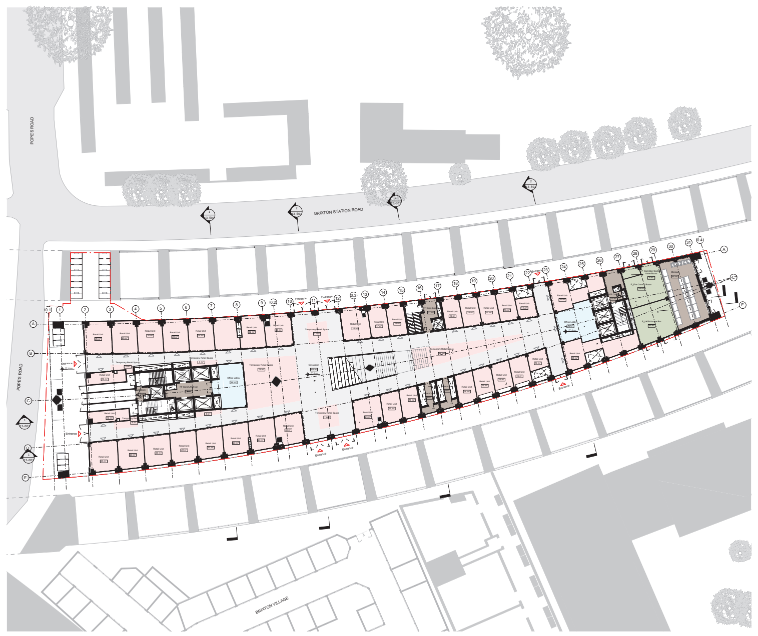
Figure 3.1 Proposed scheme ground floor plan

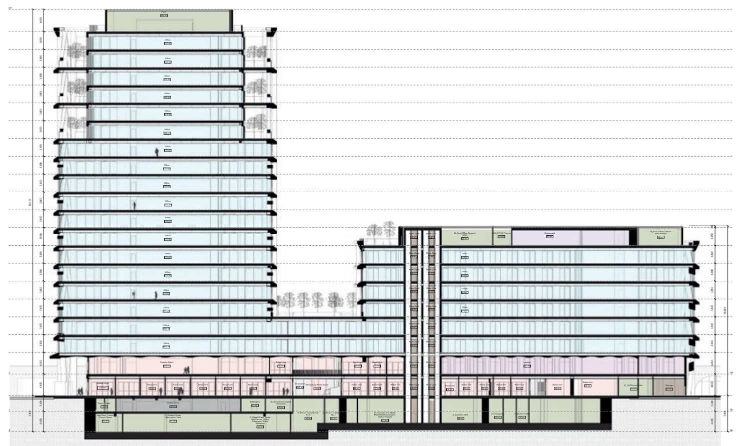
Figure 3.2 Proposed scheme long section

4 Requirements of National Planning Policy Framework (NPPF)

4.1 Summary

The National Planning Policy Framework (NPPF) has recently superseded Planning Policy Statement 25 "Development and Flood Risk" (PPS 25) although the requirements and goals remain essentially the same:

- The susceptibility of land to flooding is a material planning consideration;
- The Environment Agency has the lead role in providing advice on flood issues, at a strategic level and in relation to planning applications;
- Planning decisions should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid inappropriate development on undeveloped and undefended flood plains etc;
- Developers should fund flood defences and warning measures required because of the development;
- Planning policies and decisions should recognise that the consideration of flood risk and its management needs to be applied on a whole-catchment basis and not only be restricted to flood plains.

With regard to the NPPF, those proposing particular developments are responsible for:

- Providing an assessment of whether any proposed development is likely to be affected by flooding and whether it will increase flood risk elsewhere and the measures proposed to deal with these effects and risks and;
- Satisfying the local planning authority that any flood risk to the development or additional risk arising from the proposal will be successfully managed with the minimum environmental effect thus ensuring the safe development and secure future occupancy of the site.

After this has been addressed, it is then the local planning authority's responsibility (advised as necessary by the Environment Agency) to determine an application for planning permission after taking into account all material considerations, including the issue of flood risk and how it might be managed or mitigated. Local planning authorities are required to adopt a risk-based approach to proposals for development in flood risk areas. The assessment of risk should take into account:

- The area liable to flooding;
- The probability of it occurring, both now and over time;
- The extent and standard of existing flood defences and their effectiveness over time;
- The likely depth of flooding;
- The rates of flow likely to be involved; and
- The nature of the development proposed and the extent to which it is designed to deal with flood risk.

Local planning authorities in conjunction with the Environment Agency are responsible for determining that the threat of flooding should be managed. This is to ensure that the development is and remains safe throughout its lifetime (i.e. it has an appropriate degree of protection) and does not increase flood risk elsewhere.

Following flooding in December 2000 the Environment Agency (EA) provided indicative flood plain maps to all authorities and published them on the EA website. In addition to these indicative maps (following a national programme adopted by the Agency in 1996), detailed data and maps for priority areas at risk are available, to provide precise information for building developments.

The Government looks to local planning authorities under the NPPF to apply the risk-based approach to their decisions on development control through a sequential test. Under the test, sites are to be categorised under the following zones.

1 Areas with little or no potential risk of flooding (annual probability less than 0.1% for rivers, tidal & coastal). These areas would have no constraints on development other than the need to ensure that the development does not increase run-off from the site to greater than that from the site in its undeveloped or presently developed state. For development proposals on sites located within Flood Zone 1 comprising one hectare or above the vulnerability to flooding from other sources as well as from river and the sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA.

2 Areas with low potential risk of flooding (annual probability between 1.0% - 0.1% for rivers and between 0.5% - 0.1% for tidal & coastal). These areas would be suitable for most developments.

3a Areas with high potential risk of flooding (annual probability greater than 1.0% for rivers and greater than 0.5% for tidal & coastal). These areas will generally be suitable for "Less Vulnerable" uses such as commercial, retail and industrial uses, provided there are adequate flood defences in place, that ensure buildings are designed to resist flooding, there are suitable warning and evacuation procedures in place and the new development does not add to flood risk downstream. "More Vulnerable" uses such as residential, health and education will require the Exception Test to be passed.

3b Areas at highest risk from flooding (including those areas behind defences that offer a standard of defence less than 1% for rivers and less than 0.5% for tidal & coastal or where there is a significant risk that failure could lead to rapid inundation by fast flowing water). These areas may be suitable for recreation, sport and conservation use.

5 Strategic Flood Risk Assessments

Strategic Flood Risk Assessments (SFRA) are produced by Local Authorities in order to form the basis for preparing appropriate policies for flood risk management. The Environment Agency advise that Developers "should consult the Strategic Flood Risk Assessment prepared by the local planning authority" when preparing the design.

The site is subject of London Borough of Lambeth Strategic Flood Risk Assessment (SFRA) dated March 2013. The key findings and recommendations from this report relating to the development site are summarised in the following section and have been used to inform the preparation of this site-specific flood risk assessment.

5.1 London Borough of Lambeth SFRA

London Borough of Lambeth commissioned URS to undertake a Strategic Flood Risk Assessment (SFRA) in March 2013.

The report provides a series of Policy Recommendations to be followed by sites across the Borough and the main points impacting this development site as are follows;

- The central part of the borough where the site is located is within Flood Zone 1. The sequential test is still required to consider flood risk from other sources.
- The Surface Water Management Plan identifies a number of Critical Drainage Areas (CDAs). The site is located within a Critical Drainage Area "Group7_033".
- Any proposed development within the catchment should consider the implementation of SuDS even if it is not at direct risk of flooding.
- Lambeth Borough has a relatively low risk of flooding from ground water due to the underlying London Clay formation, however there have been historical localised flooding incidences.

Extracts from the report and the relevant Figures are enclosed in Appendix B.

Figure 5.1 Lambeth Strategic Flood Risk Assessment

6 Sources of Flooding

In accordance with the NPPF, it is a requirement to assess the flood risk to the site from all potential sources. For the purposes of this assessment this has been broken down into five potential sources:

- Flooding from rivers and sea
- Flooding from sewers
- Flooding from groundwater
- Flooding from artificial sources (e.g. reservoirs and canals)
- Flooding from surface water

These sources are discussed and assessed in more detail in Sections 6.2 to 6.6 below.

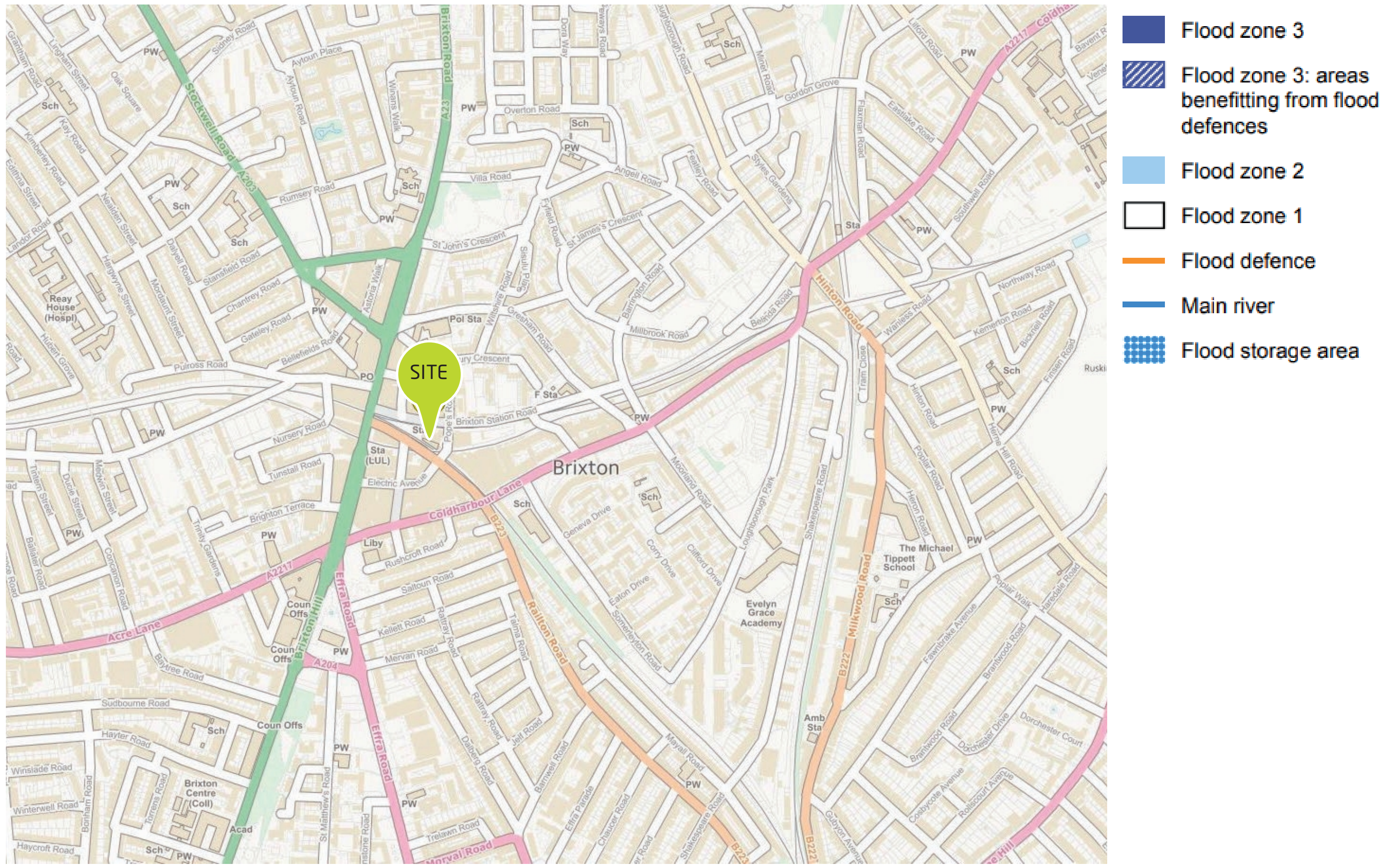

Figure 6.1 Environment Agency Flood Map for Planning (Rivers and Sea)

6.1 Sequential Test

A risk-based Sequential test should be applied at all stages of the planning process. Its aim is to steer developments to areas at the lowest probability of flooding (i.e. Flood Zone 1).

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Based on the Environment Agency's "Flood Map for Planning (Rivers and Sea)" (refer to Figure 6.1), the site is located within Flood Zone 1 - an area assessed as having a low probability of flooding (less than 1 in 1,000 annual) from rivers and sea.

The proposed development comprises of retail, food and drink, office and non-residential institution class D1/D2. In accordance with NPPF Table 2 (reproduced below in Table 6.2), buildings used for retail, office & food and drink are classified as "less vulnerable". It has been assumed that class D1/D2 land uses fall under 'more vulnerable' category.

Referring to NPPF Table 3 (reproduced below in Table 6.3) "less vulnerable" and "more vulnerable" land uses are suitable in Flood Zone 1 and there is no requirement for the Exception Test to be applied. Therefore, the proposed land uses are appropriate for the site and the sequential test is passed.

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 stations, ambulance stations and fire stations and command centres and 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").

[redacted]
- 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.
- [redacted] 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*.

[redacted]
- Police, ambulance and fire stations which are not required to be operational during flooding.
- [redacted]
- 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 transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence 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*.

Figure 6.2 National Planning Policy Framework: Flood Risk Vulnerability Classification

Flood Risk vulnerability classification (see Table 2)		**Essential Infrastructure**	**Water Compatible**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**
Flood Zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Figure 6.3 National Planning Policy Framework: Flood Risk Vulnerability and Flood Zone 'Compatibly'

6.2 Rivers and Sea

Fluvial flooding is caused by rivers, watercourses or ditches overflowing. Tidal flooding is caused by elevated sea levels or overtopping by wave action.

Based on the Environment Agency's "Flood Map for Planning (River and Sea)" (refer to Figure 6.4), the site is located entirely within Flood Zone 1 - an area assessed as having a 1 in 1000 or less annual probability of river or sea flooding (<0.1%). Figure 6.2 Environment Agency's "Risk of Flooding from River and Sea" indicates that the site is outside the low risk area of flooding with the same annual probability.

The SFRA states all man risks located within London Borough of Lambeth have been culverted (lost river of Effra) and incorporated into the Thames Water network and there is no risk of fluvial flooding within the Borough.

Using all the available evidence it is therefore considered that the site has a very low probability of flooding from fluvial and tidal sources.

6.3 Sewers and Local Drainage

Sewer and highway drainage flooding occurs when the capacity of systems are exceeded, or the function of the system is impeded (e.g. tide locking), which results in surcharging of the system and water being forced to the surface via gullies, manholes, foul water appliances such as toilets or other dedicated overflows.

Thames Water hold records of sewer flooding incidents for individual properties within the SW9 8 shown in Appendix B. The map indicates there has been a few properties (11-20) affected by flooding in the last ten years in the site's postcode area.

The existing Thames Water Asset map (Figure 6.5) indicates that there are combined sewers in close proximity of the site;

- A 300mm combined sewer running under Brixton Station Road to the north of the site.
- A 230 mm combined sewer in Pope's Road to the north-west of the site.
- A 300mm dia. combined sewer in Valentia Place to the east of the site.

The SFRA map for recorded incidents of sewer flooding (appendix B) indicates that the site is in an area where the are

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

Based upon the local authority SFRA, it is therefore considered that the site has a low probability of flooding from sewers or the local drainage network, as long as they are adequately maintained.

6.4 Flooding from Groundwater

Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata and is often highly localised and complex. After a prolonged period of rainfall, a considerable rise in the water table can result in inundation for extended periods of time.

Geological maps from the BGS indicate the superficial strata to be made up of Taplow Gravel Formation (TPGR) which is likely made up of a combination of sand and gravel. The superficial strata is underlain by a layer of London Clay which forms the bedrock geology (see Appendix C).

The presence of London Clay throughout the study area suggests that the risk of groundwater flooding should typically be relatively low. However groundwater flooding risks are often highly localised, and dependent upon geological interfaces between permeable and impermeable subsoils. It is therefore essential that an understanding of site specific ground conditions is achieved through site survey and/or review of detailed borehole data.

Figure 6.6 indicates that the site is in an area of increased potential for elevated groundwater, as well as close to a flood incident area.

It is highly likely that perched or elevated ground water will be encountered in the basement of the building. Thus, protection should be offered via an appropriate waterproofing strategy which may include an external tanking membrane, reinforced concrete liner wall or a cavity drainage system.

Using all the available evidence it is therefore considered that if suitable waterproofing strategy is implemented as part of the development, there is a low probability of flooding from groundwater.

6.5 Flooding from Artificial Sources

Where infrastructure retains, transmits or controls the flow of water; flooding may result if there is a structural, hydraulic, geotechnical or mechanical failure of the infrastructure.

The Thames Water Asset Map contained in Appendix E indicates that the followings water mains are located adjacent to the site:

- 3" Distribution main under Brixton Station Road
- 4" and 10" Distribution main under Valentia Place

A water main can burst at anytime, which can result in flooding of adjacent properties. However, it is expected that the flooding would follow the road channels.

To further reduce flood risk from water mains, any initial sign of a burst main should be reported as soon as possible and the local highway drainage system should be adequately maintained.

There have been a number of reported and recorded burst pipe incidents in the Brixton Area in the recent past, but these incidents have affected the high street and the water generated follows the topography to the east and west of the site.

The nearest water reservoirs are the 2 ponds within Brockwell Park, approximately 1.5 km south of the site. If the pond is to overrun, the flow path would follow the topography of the area and it is considered to flow towards the site.

The Environment Agency's Flood Risk from Reservoirs Map, shown in Figure 6.7, indicates that the streets surrounding the site like Pope's road and Valentia Place, are located in areas of potential risk of flooding associated with the reservoirs.

Based on all the information available and provided the proposed levels are similar to existing, it is therefore considered that the site is at a low risk of flooding from artificial sources.

Legend - Flood Risk
- High
- Medium
- Low
- Very Low

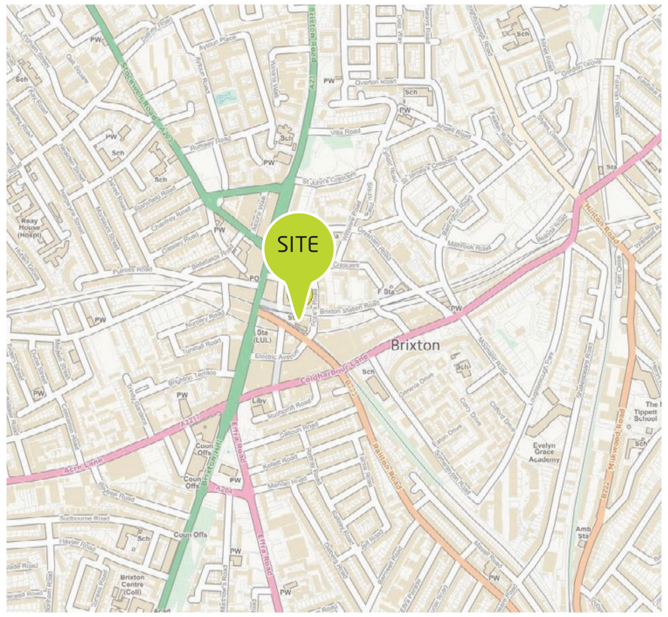


Figure 6.4 Environment Agency Flood Risk Map (Rivers and Sea)

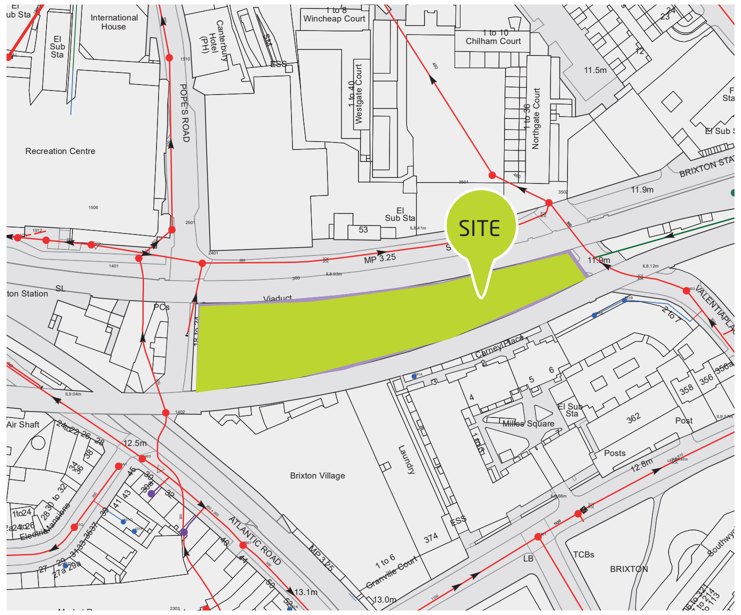


Figure 6.5 Thames Water Asset Map

Legend
- Increased Susceptibility to Elevated Groundwater
- Lost Rivers (Lambeth BC 2011)
- Groundwater Flood Incident (EA Records)

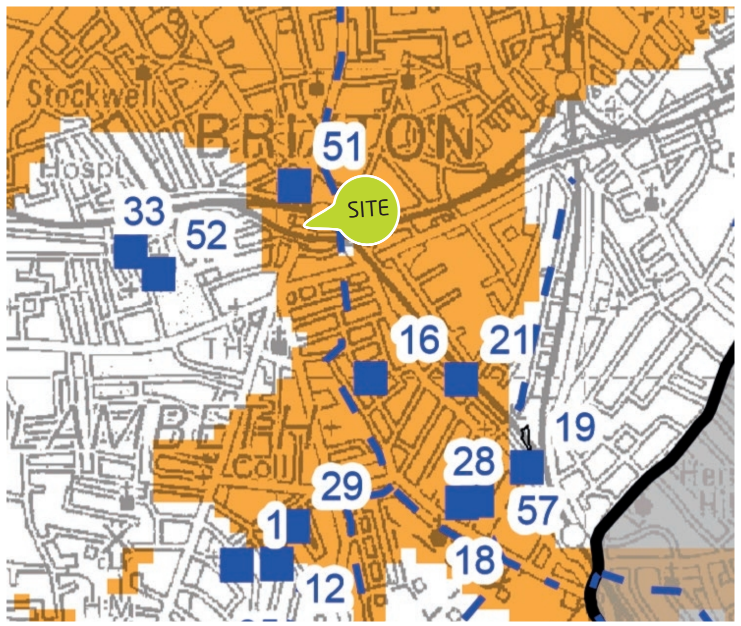


Figure 6.6 SFRA - Increased Susceptibility to Elevated Groundwater

Legend - Flood risk
- Maximum extent of flood

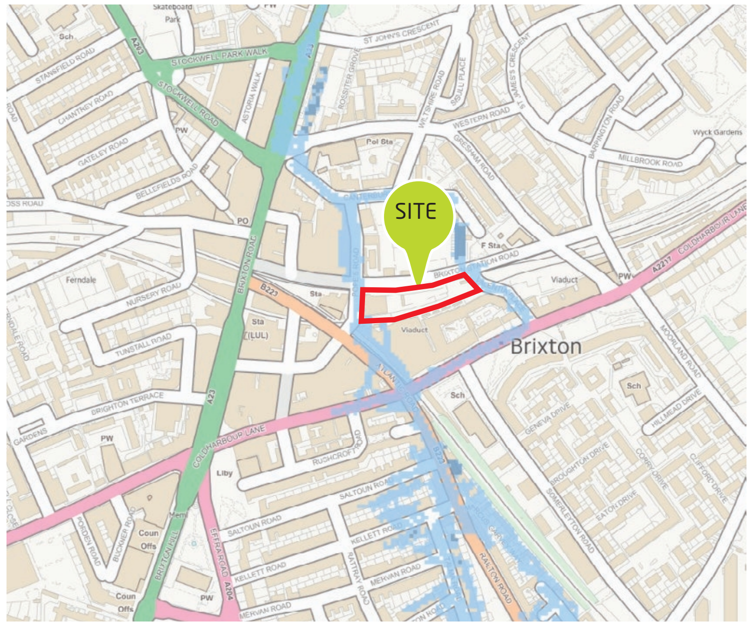


Figure 6.7 Environment Agency Flood Map - Reservoirs

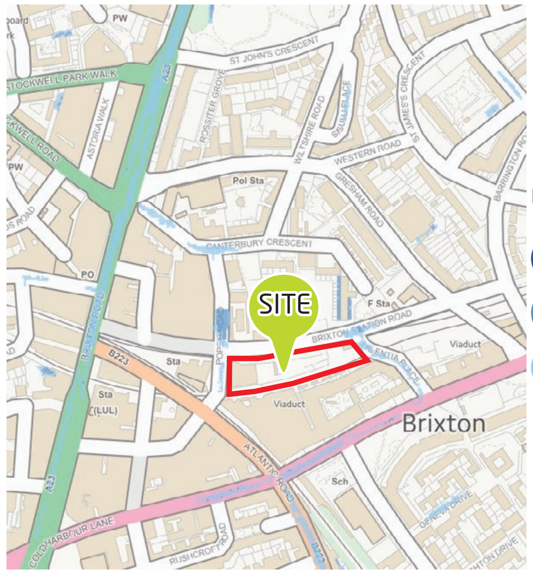
6.6 Flooding from Surface Water

Surface water flooding can occur as a result of either overland flow or ponding. Overland flow occurs following heavy or prolonged rainfall, snow melt, or where intense rainfall is unable to soak into the ground or enter drainage systems due to blockages or capacity issues. Unless channelled elsewhere, the run-off travels overland, following the gradient of the land. Ponding occurs as the overland flow reaches low lying areas in the local topography. These flood events tend to have a short duration and depend on factors such as geology, topography, rainfall, saturation, extent of urbanisation and vegetation.

The Environment Agency's Risk of Flooding from Surface Water map indicates that the majority of the site varies between very low and low risk of flooding. However, medium to high risks of flooding can be identified in the east and west of the site (Valentia Place and Pope's Road) and, low to medium risk of flooding to the north of the site on Brixton Station Road (figure 6.8).

The Environment Agency provide further maps which break down this flooding into probabilities ranging from "High" to "Low" risk of occurring where "High" is a greater than 1 in 30 (3.3%) chance of occurring, "Medium" is a between 1 in 30 (3.3%) and 1 in 100 (1%) chance of occurring, "Low" is a between 1 in 100 (1%) and 1 in 1000 (0.1%) chance of occurring and "Very Low" is a less than 1 in 1000 (0.1%) chance of occurring.

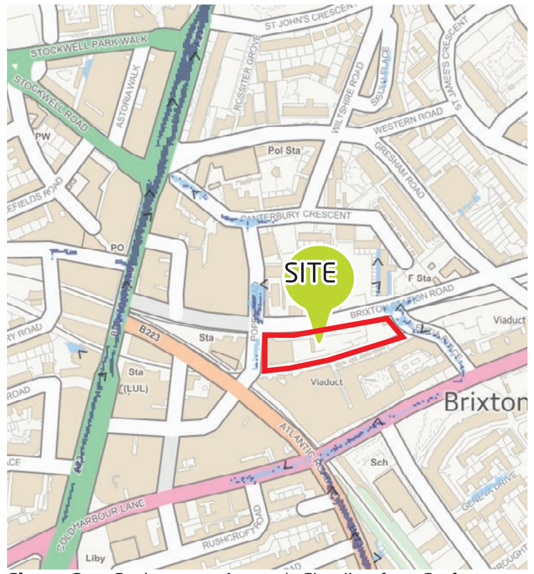
- The "High" probability maps shown in Figs. 6.9 and 6.10 indicate there is no surface water flooding on the site but it shows localised flood depth below 300mm on either side of the site on Pope's Road and Valentia Place. Where the flood depth is below 300mm, the flow would have a velocity of below 0.25m/s.
- The "Medium" probability maps in Figs. 6.11 and 6.12 indicate the site has a localised flood depth between 300 mm and 900mm with a velocity less than 0.25m/s. The map also shows flooding of below 300mm on both sides of the site on Pope's Road and Valentia Place. Both areas have a velocity of over 0.25m/s
- The "Low" probability maps shown in Figs. 6.13 and 6.14 indicates the site has localised flooding with a depth of below 300mm to the left and over 900mm to the right of the site. It has a velocity of over 0.25m/s for flooding depth below 300mm, and a velocity of under 0.25m/s with a flood depth of over 900mm. The map also shows flooding of a depth of over 900mm on Pope's Road and Valentia Place, with a velocity of over 0.25m/s.



Legend - Flood Depth

- Over 900mm
- 300 to 900mm
- Below 300mm

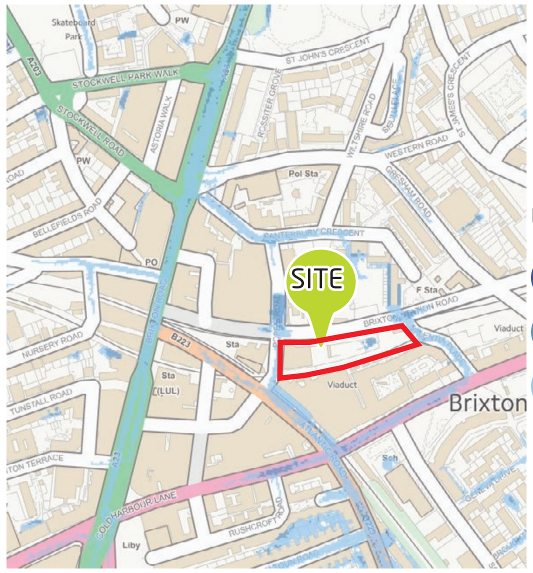
Figure 6.9 Environment Agency's Flooding from Surface Water Map (High Probability - Depth)



Legend - Flood Velocity

- Over 0.25m/s
- Less than 0.25m/s

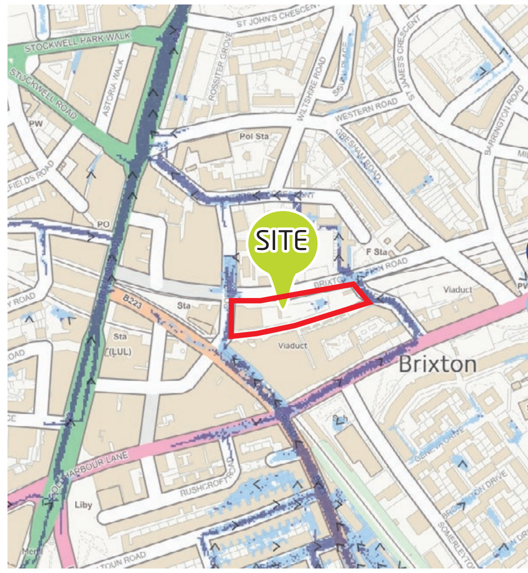
Figure 6.10 Environment Agency's Flooding from Surface Water Map (High Probability - Velocity)



Legend - Flood Depth

- Over 900mm
- 300 to 900mm
- Below 300mm

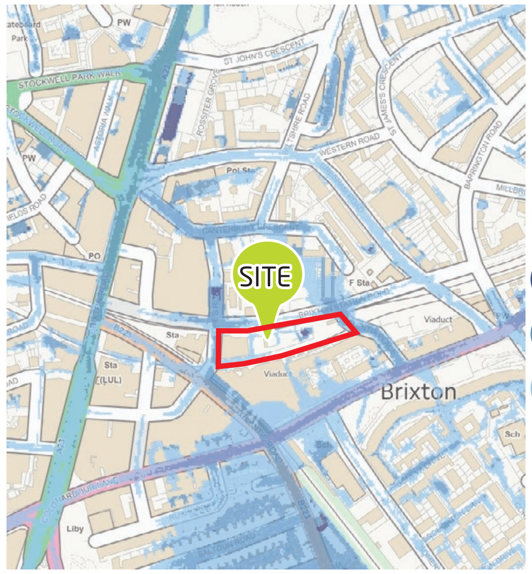
Figure 6.11 Environment Agency's Flooding from Surface Water Map (Medium Probability - Depth)



Legend - Flood Velocity

- Over 0.25m/s
- Less than 0.25m/s

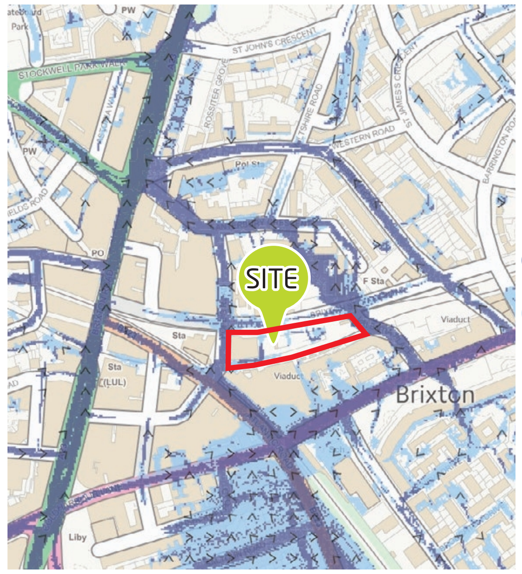
Figure 6.12 Environment Agency's Flooding from Surface Water Map (Medium Probability - Velocity)



Legend - Flood Depth

- Over 900mm
- 300 to 900mm
- Below 300mm

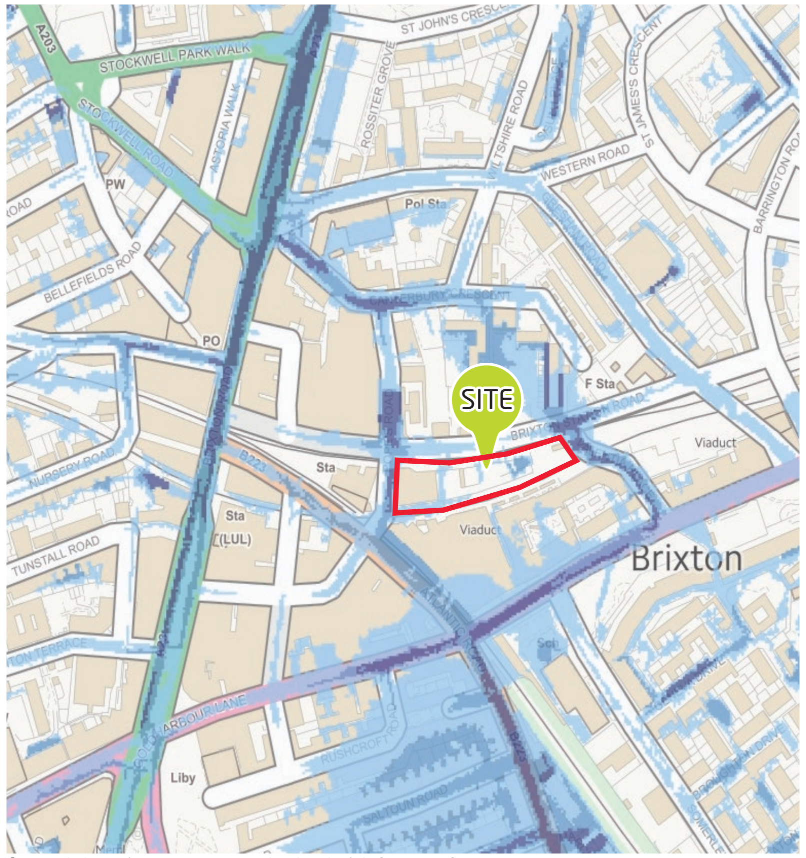
Figure 6.13 Environment Agency's Flooding from Surface Water Map (Low Probability - Depth)



Legend - Flood Velocity

- Over 0.25m/s
- Less than 0.25m/s

Figure 6.14 Environment Agency's Flooding from Surface Water Map (Low Probability - Velocity)



Flood risk

- High
- Medium
- Low
- Very low

Figure 6.8 Environment Agency's Flood Risk from Surface Water map

6.6.1 Safe Access

The EA and Defra published FD2321/TR2 "Flood Risks to People" in March 2006. Guidance Note 2, Figure 2.1 provides details on combinations of flood depth and velocities that cause danger to people. This table shows that people can become endangered in shallow but fast moving water through to still but deep water (refer to Fig. 6.15 opposite).

From the Environment Agency Surface Water Flooding Maps discussed above, the development is at a low to medium risk of a surface water flooding as shown in Figure 6.16. Provided the proposed levels remain similar to the existing at ground floor level, it is therefore believed that, even during an extreme flooding, the combination of depth of flood water and flow would result in an overall low hazard to people as defined in Figure 6.15. In addition, people on ground floor have access to upper floor retail, which will provide safe access.

The area on the Brixton Station Road to the north of the site is subject to a flood depth of less than 300mm deep and velocity below 0.25m/s. Per Figure 6.15 this situation presents a very low hazard to people.

Areas adjacent to the site are subject to surface water flooding between 300mm and 900mm with a velocity over 0.25m/s. Figure 6.15 shows that this represents a danger for some - including children, the elderly and the infirm. Flood depth between 0.75m and 1m can be classified as very low hazard, if the velocity for both is 0.5m/s, and very low hazard for flood depth at 0.5m with a velocity at 0.5m/s.

Therefore, access to these areas should be restricted to Pope's Road and Valentia Place in the 1 in 100 year surface water flooding event as presented in figure 6.16.

An emergency flood risk management and rescue plan (FRMRP) should be prepared and circulated to all occupiers on site. The FRMRP should explain:

- The actual flood risk on a site and the areas most at risk.

- Communication plan where and how are warnings raised to site users and occcupiers

- Expected depth of flooding on site

- Health and safety consideration

- Details of the safe evacuation risk route or "safe zones" for occupiers

- Key contacts, roles, responsibilities and contact details

Velocity (m/s)	Depth (m) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
0.00	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.50	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.00	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.50	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.00	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.50	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.00	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.50	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.00	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.50	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.00	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

Flood Hazard Rating (HR)	Colour Code	Hazard to People Classification
< 0.75		Very low hazard - Caution
0.75 to 1.25		Danger for some – includes children, the elderly and the infirm
1.25 to 2.00		Danger for most – includes the general public
> 2.00		Danger for all – includes the emergency services

Figure 6.15 FD2321/TR2 "Flood Risk to People" Extract

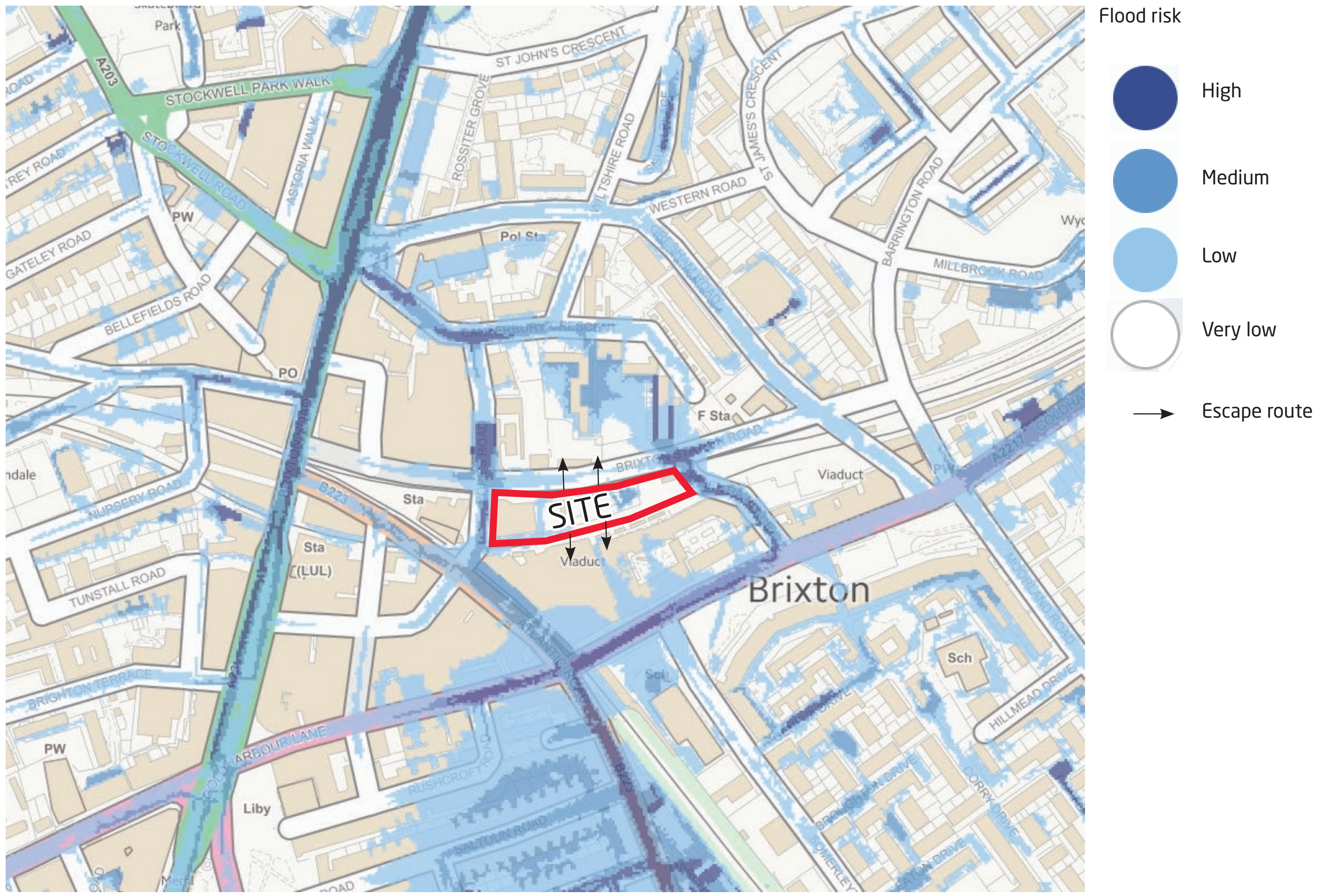


Figure 6.16 Environment Agency's Extent of Surface Water Flooding map

7 Run-off Assessment

7.1 Existing Site Run-off

The available Thames Water record plans indicate that the closest surface water or combined public sewers to the site are:

- A 300mm combined sewer running under Brixton Station Road to the north of the site.
- A 230 mm combined sewer in Pope's Road to the west of the site.
- A 300 mm dia. combined sewer in Valentia Place to the east of the site.

An extract from the record plans is shown in Figure 7.1 for reference.

It is believed that all surface water from the building currently discharges directly to one of these public sewers without any form of attenuation but it is not clear which one and it is therefore recommended that a CCTV survey of the existing site drainage network is to be undertaken to confirm the location and size of all existing connections from the site.

The total run-off catchment area is approximately 2,470 m² and is currently 100% hardstanding. In accordance with the Modified Rational Method, the peak existing run-off from the site is calculated from the formula:

$Q = 3.61 \times C_v \times A \times i$

where C_v is the volumetric runoff coefficient, A is the catchment area in hectares and i is the peak rainfall intensity in mm/hr.

For the peak 1-in-1-year return period storm event this gives an existing discharge rate from the site of:

$Q_1 = 3.61 \times 0.75 \times 0.2470 \times 32.3 =$ **21.6 litres/sec**

and for the peak 1-in-100-year return period storm event this gives an existing discharge rate from the site of:

$Q_{100} = 3.61 \times 0.75 \times 0.2470 \times 102.5 =$ **68.5 litres/sec**

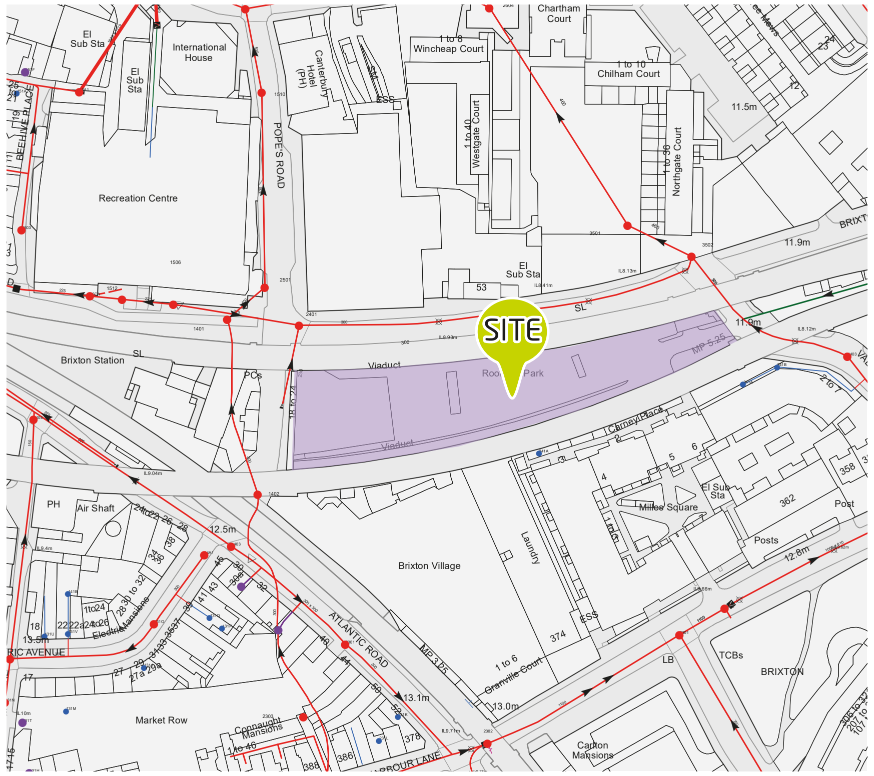


Figure 7.1 Thames Water Sewer Record

7.2 Proposed Site Run-off

The total run-off catchment area is also 2,470 m². Again using the Modified Rational Method, the proposed (unattenuated) peak run-off from the site for the 1-in-1-year return period storm would be:

$Q_1 = 3.61 \times 0.75 \times 0.247 \times 32.3 =$ **21.6 litres/sec**

and for the peak 1-in-100-year return period storm event:

$Q_{100} = 3.61 \times 0.75 \times 0.247 \times 102.5 =$ **68.5 litres/sec**

The Environment Agency updated their guidance on climate change allowance in February 2016 to include an upper and lower allowance to be considered depending on the specific site characteristics. Figure 7.2 shows the revised figures based on various building life spans. Therefore, making an allowance for climate change of 40% this would give an unattenuated design discharge of:

$Q_{1\,(+40\%)}$ **=30.2 litres/sec** and $Q_{100\,(+40\%)}$ **= 96.0 litres/sec**

In accordance with the Environment Agency's guidelines, the Building Regulations and the Water Authority's advice, the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Sustainable Urban Drainage Systems (SuDS) can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharging of groundwater in a manner which mimics nature.

In addition to this, the National Planning Policy Framework requires that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic surface water flows arising from the site prior to the proposed development, whilst reducing flood risk to the site itself and elsewhere, taking climate change into account.

Therefore, as an absolute minimum, the proposed site discharge under the 1-in-100-year storm plus climate change should be no greater than the existing 1-in-100-year storm discharge (i.e. mitigate the impact of climate change and any increase in the area of hardstanding). In this case, this would mean that, rather than discharging 96.0 litres/sec, the maximum permissible discharge from the site would be **68.5** litres/sec.

Further to the above, the London Plan's Policy 5.13 states that "Development proposals should aim to get as close to greenfield run-off rates". The Environment Agency (EA) also suggests that Developers should aim to achieve greenfield run off from their site. In accordance with the method outlined in the Institute of Hydrology Report 124, the Greenfield runoff for the site is calculated from the formula:

$Q_{BAR} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

where AREA is the site area in km² (pro rata of 50 ha if the site is less than 50 ha), SAAR is the Standard Average Annual Rainfall in mm and SOIL is the Soil Index both read from The Wallingford Procedure maps. This gives a greenfield runoff for the site of:

$Q_{BAR} = 0.00108 \times 0.50^{0.89} \times 600^{1.17} \times 0.45^{2.17} =$ **183.4 litres/sec (for 50 ha)**

Scaling this for the actual site area gives:

$Q_{BAR} = (183.4 \times 0.247) \div 50 =$ **0.91 litres/sec**

Using the Hydrological Growth Curve for south east England, the growth factor from Q_{BAR} to Q_{100} is 3.146 which gives a value for Q_{100} = **2.85 litres/sec.**

However, Clause 17 of the DEFRA/EA publication 'Rainfall runoff management for developments' states that "A practicable minimum limit on the discharge rate from a flow attenuation device is often a compromise between attenuating to a satisfactorily low flow rate while keeping the risk of blockage to an acceptable level. This limit is set at 5 litres per second, using an appropriate vortex or other flow control device. Where sedimentation could be an issue, the minimum size of orifice for controlling flow from an attenuation device should normally be 150 mm laid at a gradient not flatter than 1 in 150, which meets the requirements of Sewers for Adoption 7th Edition".

Further Consultation with Local Authority, Thames Water and the EA would be required and the permissible discharge rate agreed at the next design stages.

Manhole reference	Manhole cover level	Manhole invert level
2401	12.14 m	9.63 m
3502	11.71 m	7.94 m
3501	11.62m	7.82 m
1402	n/a	n/a
1401	11.91 m	7.24 m
4403	12.13 m	n/a
2501	11.82 m	7.15 m

Figure 7.2 Thames Water Manhole Reference and Levels

Range	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	10%	20%	40%
Central	5%	10%	20%

Figure 7.3 Peak rainfall intensity climate change allowance

7.3 Disposal methods

SuDS management train

A useful concept used in the development of sustainable drainage systems is the SuDS management train (sometimes referred to as the treatment train). Just as in a natural catchment, drainage techniques can be used in series to change flow and quality characteristics of the runoff in stages. There are a variety of measures that can be implemented to achieve these goals:

Site management / Prevention

Site management procedures are used to limit or prevent runoff and pollution and include:

- Minimising the hardened areas within the site
- Frequent maintenance of impermeable surfaces
- Minimising the use of de-icing products

Source control

Source control techniques will be used where possible as they control runoff at source in smaller catchments. They can also provide effective pollution control and treatment, thereby improving the quality of the effluent discharged to the receiving waters.

Site control

Where source control techniques do not provide adequate protection to the receiving watercourses in terms of flood protection and pollution control, site control may be required.

Regional control

Where large areas of public space are available regional control can be incorporated to provide additional 'communal' storage and treatment to runoff from a number of sites. However, in this case, all storage and treatment will be implemented on site.

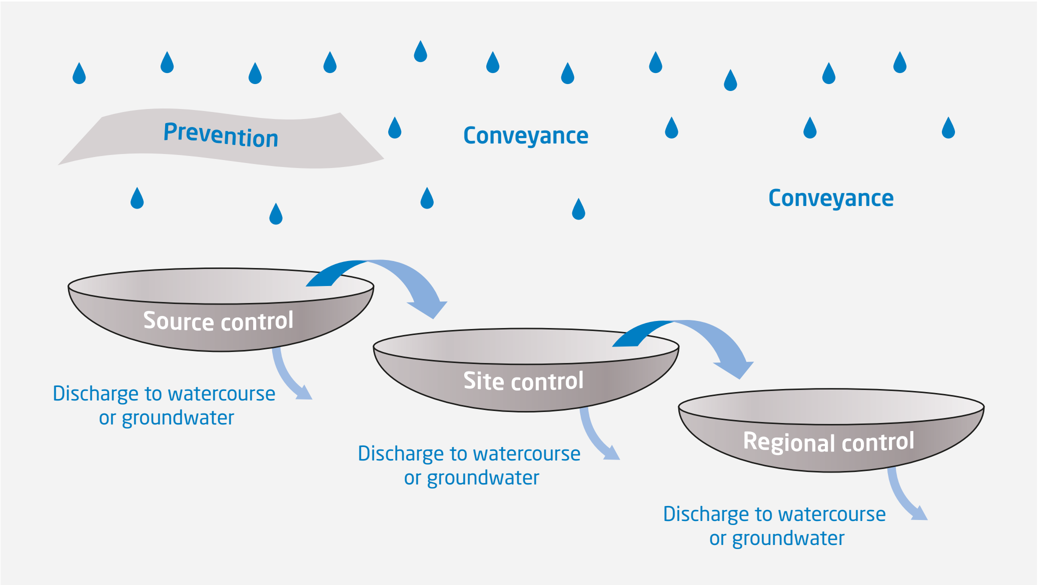


Figure 7.4 SUDS management train

Drainage hierarchy

Based on the above and in line with the London Plan and the Sustainable Drainage Manual published by CIRIA, the following drainage hierarchy will therefore need to be considered when preparing the surface water disposal strategy:

1. Store water for later use
2. Use infiltration techniques such as porous surfaces in non-clay area
3. Attenuate rainwater in ponds or open water features for gradual release to a watercourse
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water drain
7. Discharge rainwater to a combined sewer

Assessment of SuDS techniques

Rainwater harvesting

This involves the capture of rainwater into a tank for re-use (usually non-potable) such as irrigation, toilet flushing or vehicle cleaning. Systems are now available which combine rain water harvesting with tanked attenuation. This means that water is stored during dry periods for re-use but released ahead of predicted storms in order to ensure that the full attenuation capacity remains available when it is needed.

As the project involves the construction of a new building with additional levels, the feasibility of incorporating a rainwater harvesting system into the scheme can be considered. Although there are areas of new roof available to collect water from the development, it is likely the required demand significantly exceeds the yield and would make it inefficient to implement the system. Implementation would need to be confirmed by MEP.

Green / brown / blue roofs

These are used on flat or shallow pitched roofs to provide a durable roof covering which also provides thermal insulation, amenity space, biodiversity habitat as well as attenuation of rainwater. Depending on the design, these roofs can attenuate differing volumes of rainwater. The term 'blue roof' is reserved for those roofs designed to maximise water retention. This is a relatively recent area of increased focus and can involve effectively an attenuation tank at roof level which reduces (or avoids) the need for pumping of basement tanks.

Based on the layout, blue/green and brown roof could be accommodated on the roof at levels 21, 9 and 4. Refer to appendix F. The architect and MEP engineer will need to confirm at the next design stage how the green/brown or blue roof will be incorporated into the development.

Raingardens

Raingardens are planted areas (usually close to buildings but not immediately adjacent) that allow the diversion of a portion of rainwater from either downpipes or the surrounding paved surfaces. These techniques can be incorporated into the landscaping plans for a site and are most effective where the landscaping regime is designed with the aim of capturing as much rainfall as possible. They can either allow infiltration into the ground or have tanked systems for water retention, depending on the site and soil conditions. There are also a number of vertical raingardens attached to building walls with rainwater downpipes diverted through a stacked series of planters.

As the development involves the construction of a new building which consists of a basement up to the site boundary and has no external areas, there is no space to incorporate raingardens.

Bio-retention

This refers to a chain of landscaped features, potentially including reed beds, filter drains, etc. designed to hold and treat surface water. They are often used where there is a high risk of low-level pollution, for example from road run-off. However, it does require areas of open space. The design of a bio-retention system can vary widely depending on site conditions and available space. At a small scale this could include flow through planters or tree pits.

As the development involves construction of a new building which consists of a proposed basement up to the site boundary, there are no external areas to incorporate bio-retention into the scheme.

Permeable surfacing

Permeable hard surfaces which work in much the same way as traditional impermeable surfaces apart from the ability to allow rainwater to pass through. Permeable blocks are traditionally used but there are now a range of permeable asphalt and resin bound gravel pavings being used increasingly commonly. Permeable surfaces can either allow infiltration into the ground or have tanked systems for water retention, depending on the site and soil conditions. They are suitable in even the most densely built-up development. However, they're not well suited to roads carrying heavy or fast motor traffic.

As there are no external areas within the site boundary, it is therefore not feasible to incorporate permeable paving for the development.

Swales

These are dry ditches used as landscape features to allow the storage, carriage and infiltration of rainwater and are often used as linear features alongside roads, footpaths or rail lines. They can also be integrated into the design of many open spaces.

As the development consists of a basement up to the site boundary, it is therefore not possible to incorporate swales into the scheme.

Detention basin / ponds

Landscape features designed to store and in some cases infiltrate rainwater. Detentions basins are usually dry, whereas a pond should retain water. These features need areas of open space but can often be combined with other sustainable drainage techniques.

As the site is heavily developed with limited external areas there is insufficient space to provide a basin or bond.

Discharge to tidal river / dock / canals

Discharging clean rainwater directly to tidal rivers, canals or docks isn't normally a sustainable drainage technique. Other more productive techniques should be used first. However, it is generally more sustainable than discharging to the combined or surface drainage systems. Residual surface water can be discharged to tidal / large waterbodies, in some cases with no limitation on volumes. Some storage may be required to allow for outfalls becoming tide locked. Care is needed to prevent scour in the receiving waterbody and potentially to prevent pollution. Consent from the Environment Agency, the asset owner and where applicable the Canal and River Trust is required.

There are no adjacent rivers or ponds and therefore discharge to a watercourse will not be a viable disposal method.

Infiltration

Geological maps from the BGS, Figure 2.5 and 2.6, indicate the geology beneath the application site comprises of Taplow Gravel Formation (TPGR) superficial deposits, underlain by London Clay Formation. It is therefore believed that it would not be possible to achieve infiltration although this would need to be confirmed by a detailed site investigation.

Additionally, the existing basement footprint is up to the site boundary, therefore no infiltration would be possible.

Storage tanks / geocellular storage

Storage tanks are single GRP units usually located (but not necessarily) below ground level which attenuate rainwater for later slow release back into the drainage system but do not provide the wider benefits of green infrastructure sustainable drainage. They can also have the disadvantage that pumping may be required to empty the tank into the drainage system – especially if the tank is located at or below basement level. Where tanks are designed for large storm events, care is needed to ensure that they still perform a useful sustainable drainage function for low order storms.

Geocellular storage tanks are similar to storage tanks except that the volume is made up from multiple units rather than a single tank meaning they can be more flexible in terms of shape to suit constrained sites.

It is believed that this is the most feasible disposal option for the site and the table below presents the approximate tank volumes required for a range of discharge rates under the 1-in-100-year (plus 40 % climate change) storm event:

Discharge condition	Discharge rate	Storage volume required
Mitigate climate change only (Absolute minimum)	68.6 litres/sec	40 m³
50 % reduction on existing	34.3 litres/sec	60 m³
Pre-development 1-year peak flow rate	21.6 litres/sec	80 m³
"Rainfall runoff management for development's" clause in DEFRA/EA publication	**5.0 litres/sec**	**140 m³**
Greenfield (Environment Agency's preferred rate)	2.9 litres/sec	160 m³

It is recommended that at this stage that a cost and space allowance is made for a storage volume of 140 m³ (5.0 litres/sec) as our recent experience Thames Water and the London Borough of Lambeth suggests this will be the required discharge rate for Planning.

The attenuation tank should be located at a high enough level so as to allow a connection to be made to the public sewer by gravity – in this case, it is assumed that this would be at relatively high level within the basement but we are still awaiting confirmation of the invert level of the existing sewer. Locating the tank below this level would result in a pumped surface water system which is both unsustainable and uneconomic.

Oversized piping

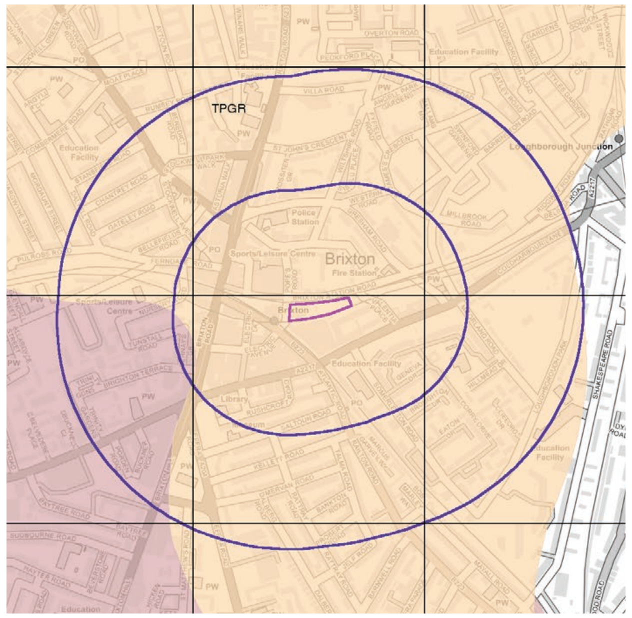
Using larger than necessary pipework creates more room to store rainwater. Potentially more sustainable than storage tanks / geocellular storage if the pipes drain by gravity and do not require pumping. However, lacks the wider benefits of the green infrastructure based techniques.

Due to the restricted nature of the site the pipework would become impractically large to provide the volume of storage required to achieve the required run-off rate.

Design for exceedance

This involves designing areas within a site such that they will flood and hold water during rare storm events (typically a frequency of once in ten years or longer).

As the attenuation tank has been sized to accommodate the 1-in-100-year plus climate change event exceedance should not be a design requirement

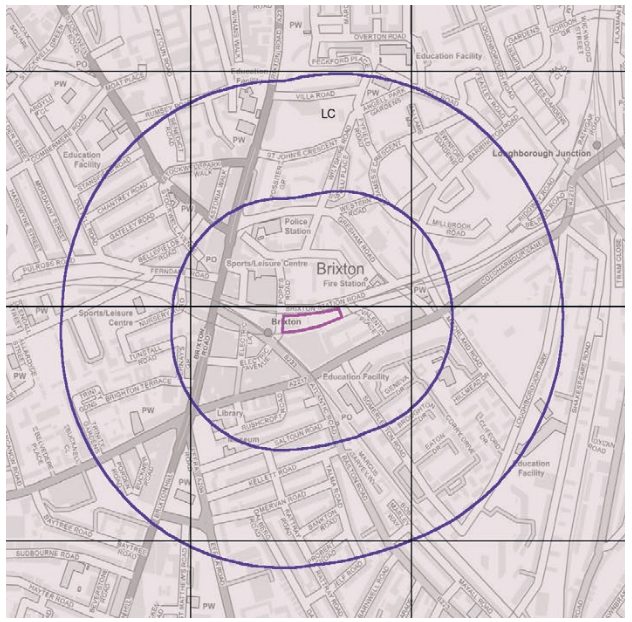


Legend

Taplow Gravel Formation

HEAD Formation

Figure 9.1 BGS map showing superficial geology



Legend

London Clay Formation

Figure 9.2 BGS map showing bedrock geology

Summary of the proposed SuDS strategy

A rainwater harvesting tank could be incorporated into the scheme. As it is believed there are sufficient roof area to collect the rainwater for later use. MEP would need to confirm whether the demand exceeds the yield, which would make the system inefficient to implement, to confirm whether rainwater harvesting is feasible.

Based on the roof layout, it is believed blue/green or brown roof could be accomodated on the roof at level 21, 9 and 4. The architect and MEP engineer will need to confirm at the next design stage how the blue/green or brown rood will be incorporated into the development.

An attenuation tank of 140 m³ is proposed which will reduce the peak discharge rate from the site to 5.0 litres/sec runoff rate (DEFRA and EA recommendations).

The outfall from the site will connect to the existing public sewer either with a new connection or, preferably, by reusing one of the existing connections.

Once the CCTv and level survey of the existing network has been undertaken, the location and layout of the outfall(s) can be determined. Due to the depth of the existing public combined sewers it is recommended that, if possible, the existing drainage connection(s) should be reused to prevent the need for constructing a new, deep connection. This would minimise both the cost of the work and the disruption to the surrounding roads which are busy thoroughfares and consequently would require significant traffic management to be provided during the work.

A schematic SuDS layout is contained in Appendix B for reference.

Element	Management stage	Water quantity	Water quality	Amenity & biodiversity	Proposed in scheme
Rainwater harvesting	Prevention	✓	✗	✗	✗/✓
Green / brown / blue roof	Source control	✓	✓	✓	✗/✓
Raingardens	Source control	✓	✓	✓	✗
Bio-retention	Source control	✓	✓	✓	✗
Permeable surfacing	Source control	✓	✓	✗	✗
Swales	Source control	✓	✓	✓	✗
Detention basin / ponds	Source control	✓	✓	✓	✗
Discharge to tidal river / dock / canals	Site control	✓	✗	✗	✗
Storage tanks / Geocellular storage	Site control	✓	✗	✗	✓
Oversized piping	Site control	✓	✗	✗	✗
Design for exceedance	Site control	✓	✗	✗	✗

Figure 7.5 Summary of SUDS devices

8 Conclusions

- In accordance with the National Planning Policy Framework, the site would be categorised as lying within Flood Zone 1 - an area assessed as having 1 in 1000 or less annual probability of river or sea flooding (<0.1%).
- In accordance with the NPPF, the proposed development is classified as "less vulnerable" for the office and retail and "more vulnerable" for non-residential institution class D1/D2 land use.
- Land use in the proposed development is acceptable under the terms of the Sequential Test and there is no requirement for an Exception Test to be carried out.
- The site has been assessed as being at very low probability of flooding from fluvial and tidal sources.
- The site has been assessed as being at low risk of flooding from sewers and other drainage networks as long as they are adequately maintained.
- The site has been assessed as being at a low risk from groundwater sources, subject to a suitable waterproofing strategy at basement level.
- The site has been assessed as being at low risk from artificial sources.
- The site has been assessed as being at a low risk from surface water flooding. The site is located in a very low to low risk area, however, the areas to the west (Pope's Road) and east (Valentia Place) of the site have been identified as medium to high risk. The area north of the site (Brixton Station Road) is classified as low to very low risk of flooding
- The proposed development has an acceptable flood risk within the terms and requirements of the National Planning Policy Framework.
- The site lies within a critical drainage area, so flooding during severe weather might affect the infrastructure around the site.
- The site does not currently cause flooding to adjacent sites and SUDs measure are proposed, therefore, the risk to adjacent properties will be limited. A sustainable drainage system is to be specified to reduce the peak surface water discharge from the proposed development. In order to reduce the risk of flooding from sewer to the site and other properties downstream, the proposed peak discharge rate from the development will need to be agreed with the local authority, Thames Water and the MEP.
- Safe access should be provided to the north of the development, an area with a lower risk of surface water flooding.

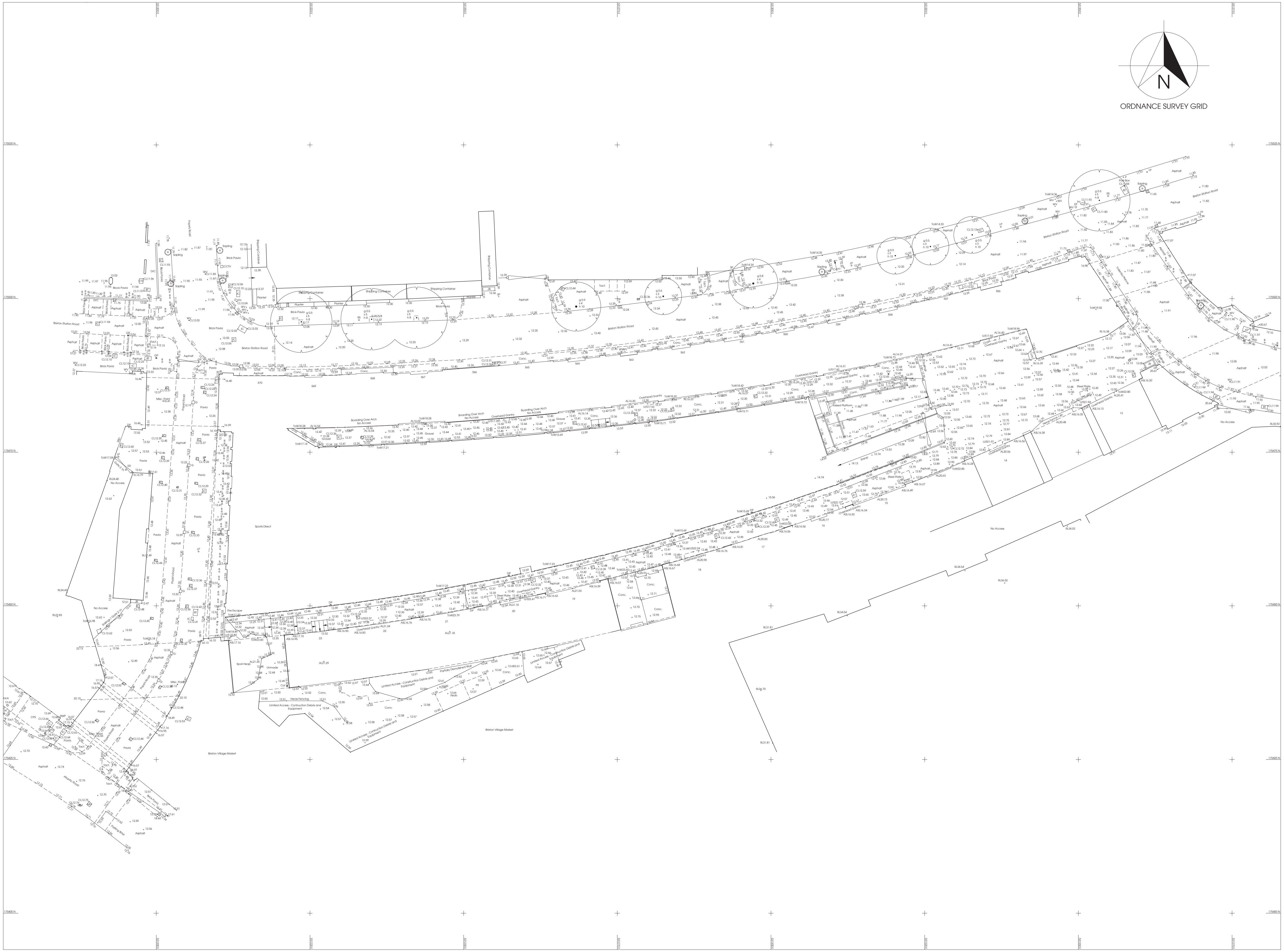
The comments stated above are based on information received from other consultees. The flood risk classification of this site has been based on the above observations, and the recommendations stated.

9 References

- London Borough of Lambeth, Strategic Flood Risk Assessment, URS, March 2013
- Preliminary Flood Risk Assessment London Borough of Lambeth 2011
- Lambeth Local Flood Risk Management Strategy 2014 - 2020.
- London Borough of Lambeth Strategic Flood Risk Assessment March 2013
- London Borough of Lambeth Preliminary Flood Risk Assessment Appendix 2011.
- CIRIA report C624, Development and Flood Risk: guidance for the construction industry 2004
- BS 8533:2011 Assessing and managing flood risk in development: code of practise October 2011
- DEFRA/Environment Agency flood and coastal defence R+D programme, phase 2 FD2321/TR2 the flood risks to people evidence document March 2006
- Thames Water Asset Map July 2018
- AKT II Drainage Strategy Report

Appendix A

Existing Site Topographical Survey



NOTES

1) ALL DIMENSIONS TO BE CHECKED ON SITE AND NOT SCALED FROM THIS DRAWING.
2) MALCOLM HOLLIS SHALL BE INFORMED IN WRITING OF ANY DISCREPANCIES.
3) ALL DIMENSIONS ARE IN METRES ONLY.
4) THE ORIGIN AND ORIENTATION OF THE SURVEY GRID RELATE TO A GPS TIE TO ORDNANCE SURVEY GRID.
5) ALL LEVELS ARE BASED ON A GPS TIE TO OS LEVEL DATUM.

KEY

A	Alarm	L	Light
A/C	Air Conditioner	LB	Litter Bin
AL	Arch Level	LP	Lamp Post
ASL	Arch Spring Level	Max	Maximum
B	Bollard	Mb	Multibole
BB	Belisha Beacon	MH	Manhole
Bh	Borehole	Min	Minimum
Br	Brick	Mkr	Marker
BrS	Brick Setts	NB	Notice Board
BRW	Brick Retaining Wall	NP	Name Plate
BS	Bus Stop	O/H	Overhead
BSL	Beam Soffit Level	OBF	Open Boarded Fence
BT	British Telecom IC	OSBM	Ordnance Survey Bench Mark
BW	Brick Wall	P	Post
BWF	Barbed Wire Fence	PB	Pillar Box
CBF	Close Boarded Fence	PGM	Permanent Ground Marker
CCTV	Closed Circuit Television	PLt	Pavement Light
Chy	Chimney	PM	Parking Meter
CIF	Corrugated Iron Fence	PRF	Post and Rail Fence
CL	Cover Level	PS	Paving Stones
CLF	Chain Link Fence	PWF	Post and Wire Fence
Col	Column	RE	Rodding Eye
Conc	Concrete	RG	Road Gully
CoW	Cable on Wall	RL	Ridge Level
CPS	Concrete Paving Slabs	RS	Road Sign
CTV	Cable Television IC	RSD	Roller Shutter Door
d	depth	RWP	Rain Water Pipe
DC	Duct Cover	s	spread
DP	Down Pipe	SB	Sign Board
DrC	Drainage Channel	SBM	Site Bench Mark
EIC	Electrical Inspection Cover	SC	Stop Cock
EJB	Electrical Junction Box	SF	Security Fence
EL	Eave Level	ShB	Shrub Bed
EM	Electricity Meter	SL	Sump Level
EP	Electricity Pole	SO	Smoke Outlet
ER	Earthing Rod	SP	Sign Post
ESG	Electrical Switchgear	Tac	Tactile Paving
FA	Fire Alarm	TBM	Temporary Bench Mark
FB	Flower Bed	TCB	Telephone Call Box
FH	Fire Hydrant	TCP	Traffic Control Post
Flt	Floodlight	TIC	Telephone Inspection Cover
g	girth	TJB	Telephone Junction Box
G	Gully	TL	Traffic Light
GC	Gas Cock	TLCB	Traffic Light Control Box
GM	Gas Meter	TLIC	Traffic Light Inspection Cover
GP	Gate Post	ToW	Top Of Wall
GV	Gas Valve	TP	Telephone Pole
h	height	Typ	Typical
HR	Handrail	UTL	Unable To Lift
IB	Illuminated Bollard	V	Vent
IC	Inspection Cover	VP	Vent Pipe
ICTL	Traffic Light Inspection Cover	W	Window
IL	Invert Level	WCL	Window Cill Level
IRF	Iron Railing Fence	WHL	Window Head Level
IRS	Illuminated Road Sign	WIC	Water Inspection Cover
JB	Junction Box	WM	Water Meter
KO	Kerb Outlet	WV	Water Valve

TOPOGRAPHICAL SYMBOLS

25.50	Spot Level
25.00	Soffit Level
	Stair/Ramp Arrow (points up)
	Structural Overhead Slope (points up)
	Roof Slope (points down)
	Bank Slope
	Gate
	Survey Control Station

REVISIONS

REV.	DATE	AMENDMENTS	INITIAL

THIS DRAWING IS FOR THE FOLLOWING PURPOSE ONLY:
PRELIMINARY ☐ TENDER ☐ CONSTRUCTION ☐
SKETCH ☐ MEASURED SURVEY ☒ CONTRACT ☐

TITLE

TOPOGRAPHICAL

CLIENT

Quartz Project Services Limited
34 Dover Street
London
W1S 4NG

PROJECT NAME

Pope's Road
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London
SW9 8JB

malcolm hollis
140 London Wall
London
EC2Y 5DN

T 020 7622 9555
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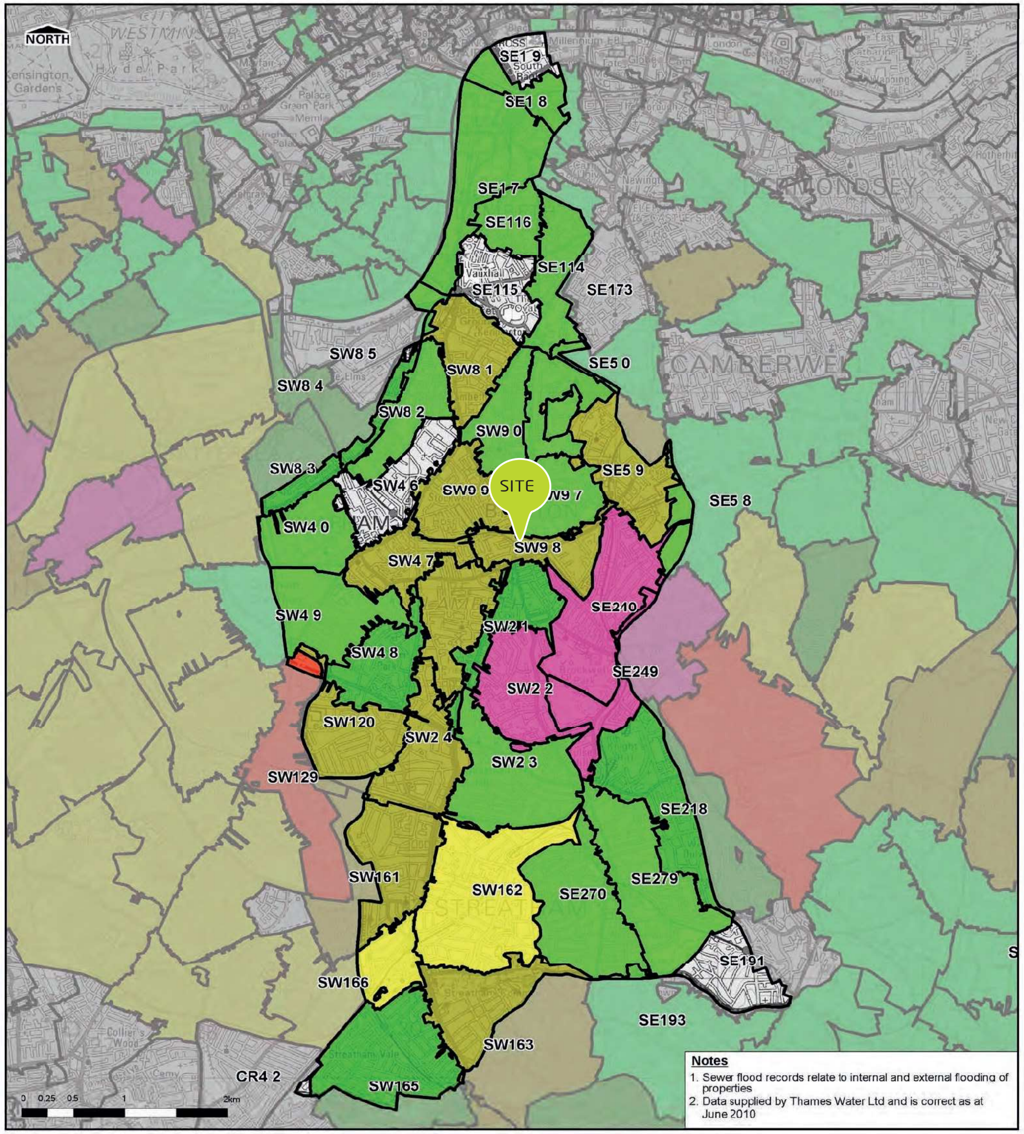
RICS

DATE	DRAWN BY
04.08.2019	TB
SCALE	CHECKED
1:200 @A0	XX

PROJECT	ORIGINATOR	VOLUME/ ZONE/BLDG	LEVEL	FILE TYPE
78639	MHL	00	Z0	M2
DISCIPLINE/ROLE	NUMBER		STATUS	REVISION
G	10100		A7	---

Appendix B

London Borough of Lambeth SFRA and SWMP maps



Notes

1. Sewer flood records relate to internal and external flooding of properties
2. Data supplied by Thames Water Ltd and is correct as at June 2010

Filepath: L:\Water\Projects & Jobs\D134000\Drain London Tier 2\D134785 Group 7\GIS\Workspaces

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary

No. of Sewer Flood Records

- None
- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 50
- 51 - 100
- 101+

London Borough of Lambeth

Lambeth

Surface Water Management Plan

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Scale at A3	Date	Drawn by	Approved by
1:35,000	28/07/2011	D.SKILTON	J.ROBINSON

Recorded Incidents of Sewer Flooding

Consultants

CAPITA SYMONDS Flood Risk Management

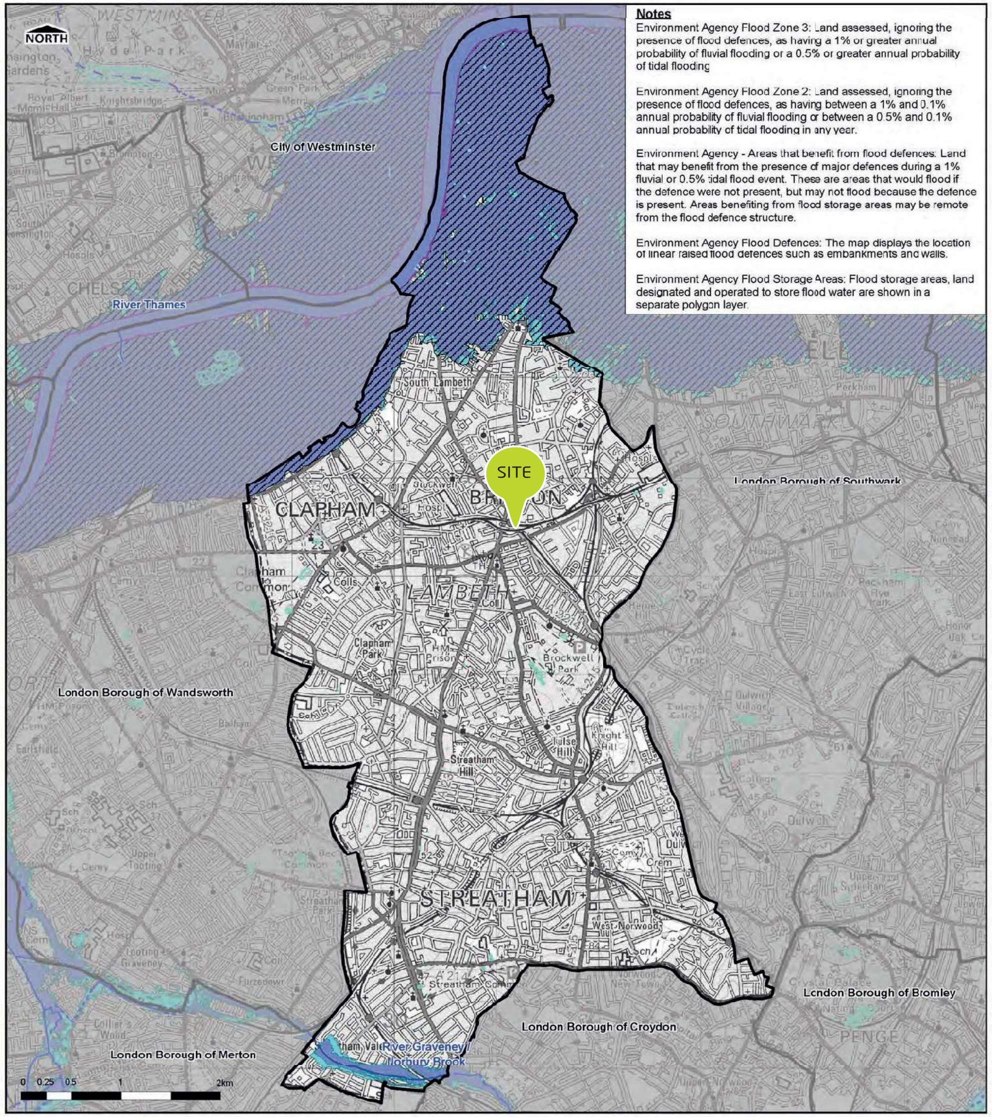
Scott Wilson — URS / Scott Wilson, 6 - 8 Greencoat Place, London, SW1P 1PL

Drain London Programme Board Members

Environment Agency — Thames Water — LONDON COUNCILS

GREATER LONDON AUTHORITY

FIGURE D-5



Notes

Environment Agency Flood Zone 3: Land assessed, ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding

Environment Agency Flood Zone 2: Land assessed, ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.

Environment Agency - Areas that benefit from flood defences: Land that may benefit from the presence of major defences during a 1% fluvial or 0.5% tidal flood event. These are areas that would flood if the defence were not present, but may not flood because the defence is present. Areas benefiting from flood storage areas may be remote from the flood defence structure.

Environment Agency Flood Defences: The map displays the location of linear raised flood defences such as embankments and walls.

Environment Agency Flood Storage Areas: Flood storage areas, land designated and operated to store flood water are shown in a separate polygon layer.

Filepath: L:\Water\Projects & Jobs\D134000\Drain London Tier 2\D134785 Group 7\GIS\Workspaces

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Flood Zone 2
- Flood Zone 3
- Main River
- Ordinary Watercourse
- Culverted Watercourse
- Permanent Water Bodies
- Areas Benefitting from Flood Defences
- Flood Storage Areas
- Defences

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Environment Agency Flood Map

Consultants

CAPITA SYMONDS Flood Risk Management

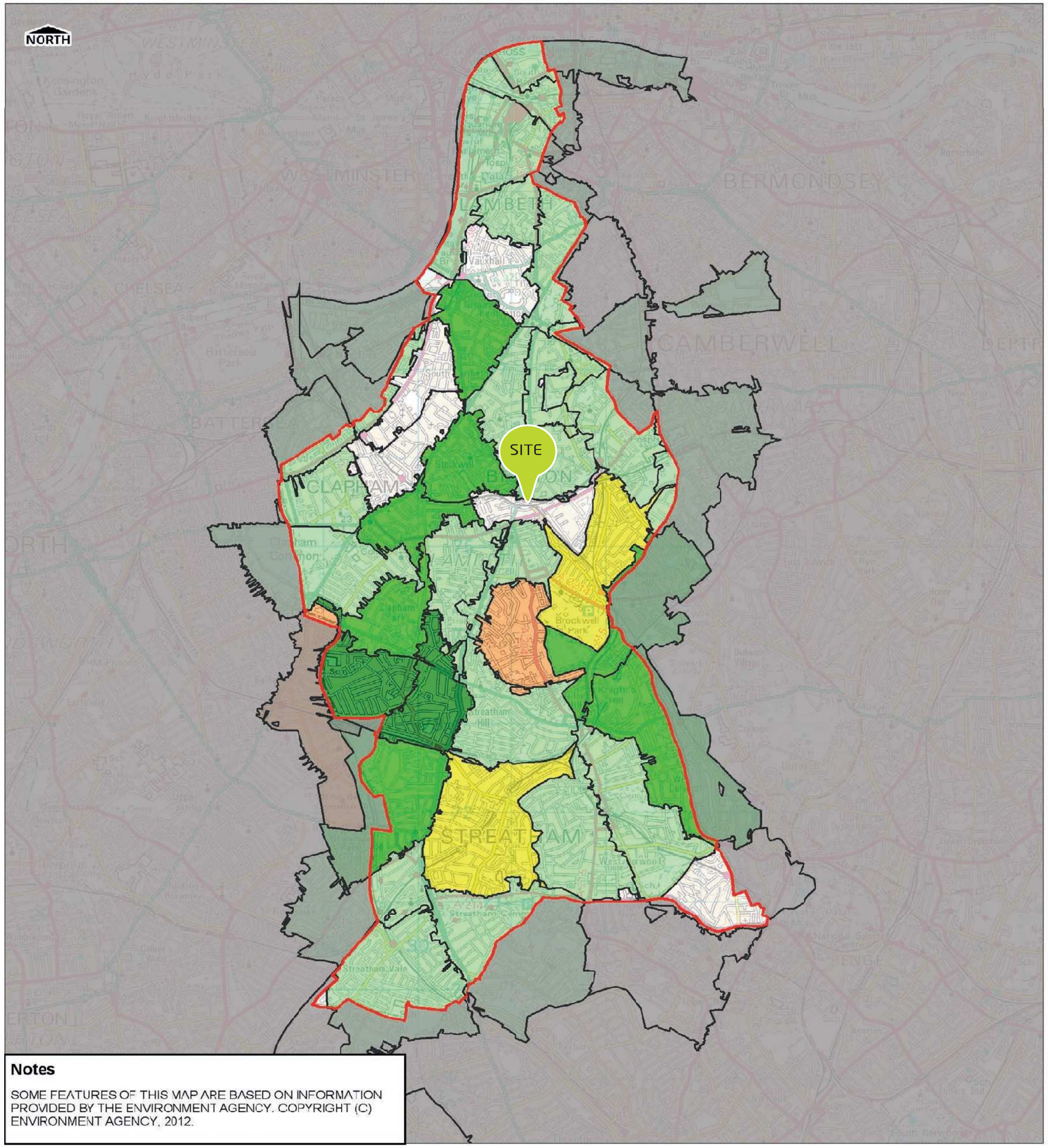
Scott Wilson — URS / Scott Wilson, 6 - 8 Greencoat Place, London, SW1P 1PL

Drain London Programme Board Members

Environment Agency — Thames Water — LONDON COUNCILS

GREATER LONDON AUTHORITY

FIGURE D-3



Legend

- Lambeth Boundary

No. of Sewer Flooding Records

- None
- 0 - 5
- 6 - 10
- 11 - 20
- 21 - 50
- 51 - 100
- 101 +

Lambeth

Lambeth SFRA

Thames Water DG5 Register Cumulative Sewer Flooding Incidents

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FIGURE 8

Legend

- Lambeth Boundary
- Main Rivers
- Flood Zone 2
- Flood Zone 3a
- Flood Zone 3b (River Wandle 1 in 20 year floodplain)

Lambeth

Lambeth SFRA

Environment Agency Main Rivers and Flood Zones

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FIGURE 2