4599 Pope's Road

Drainage Strategy

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1	Blue Roof Options
2	Drainage Proforma
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Revision	Date	Status
B	27.03.2020	Issued for Planning
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1 Introduction

AKT II have been commissioned to provide engineering design services for the Pope's Road redevelopment within the London Borough of Lambeth (LBL). The purpose of this report is to provide information on the proposed foul & surface water drainage strategy in support of the planning submission.

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 drainage strategy has been developed in accordance with national and local planning policy.

- The National Planning Policy Framework (NPPF)
- The Intend to Publish London Plan (2019) - Policies 5.12 and 5.13.
- Policy EN5 (Flood Risk) of the Lambeth Local Plan
- Policy EN6 (Sustainable drainage systems and water management) of the Lambeth Local Plan

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.

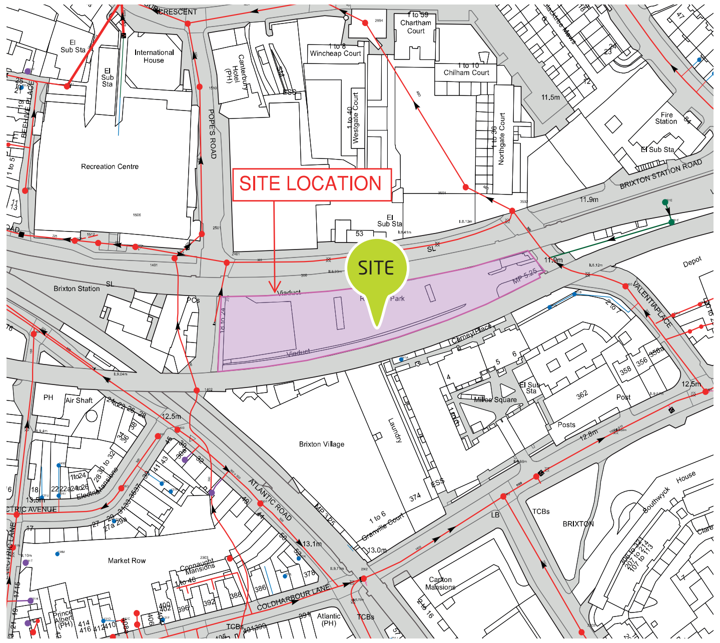


Figure 2.1 Map of site

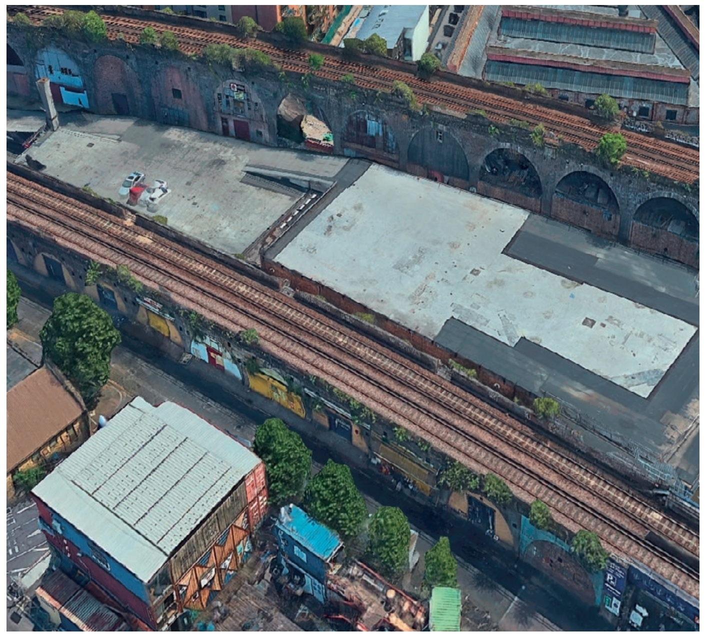


Figure 2.2 Existing site - aerial view

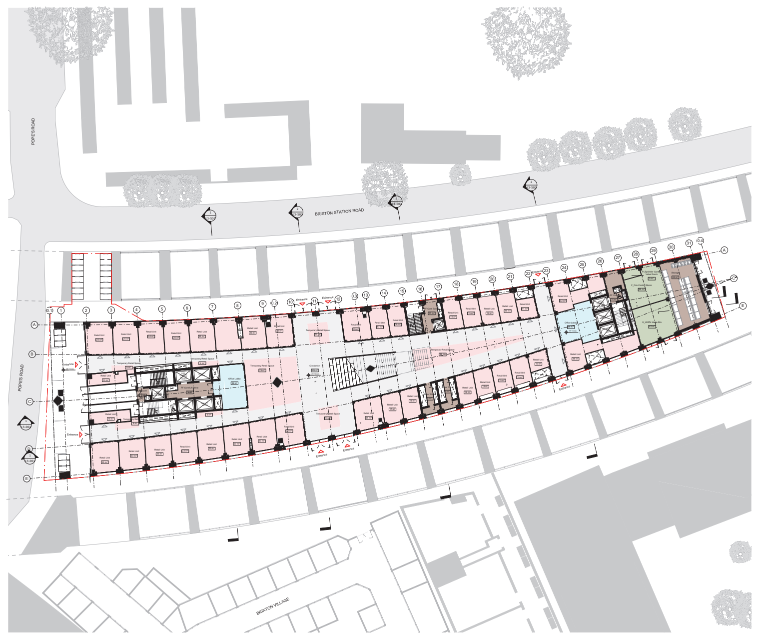


Figure 3.1 Proposed scheme ground floor plan

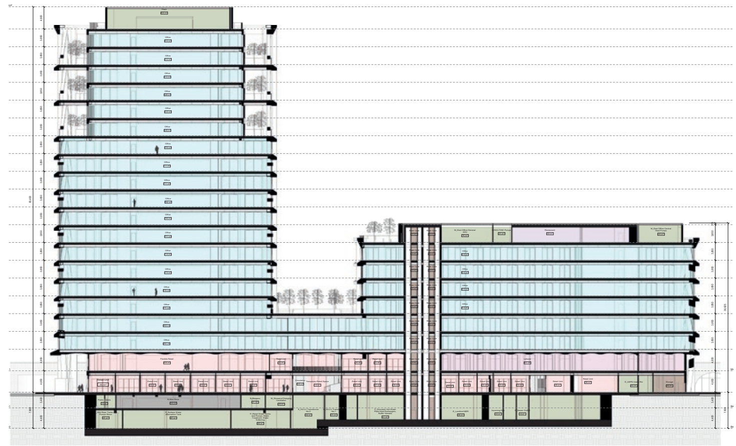


Figure 3.2 Proposed scheme long section

4 Surface water drainage

4.1 Existing scheme

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 north-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 Figure 4.1 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 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:

$Q_1 = 3.61 \times 0.75 \times 0.247 \times 32.3 =$ **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:

$Q_{100} = 3.61 \times 0.75 \times 0.247 \times 102.5 =$ **68.6 litres/sec**

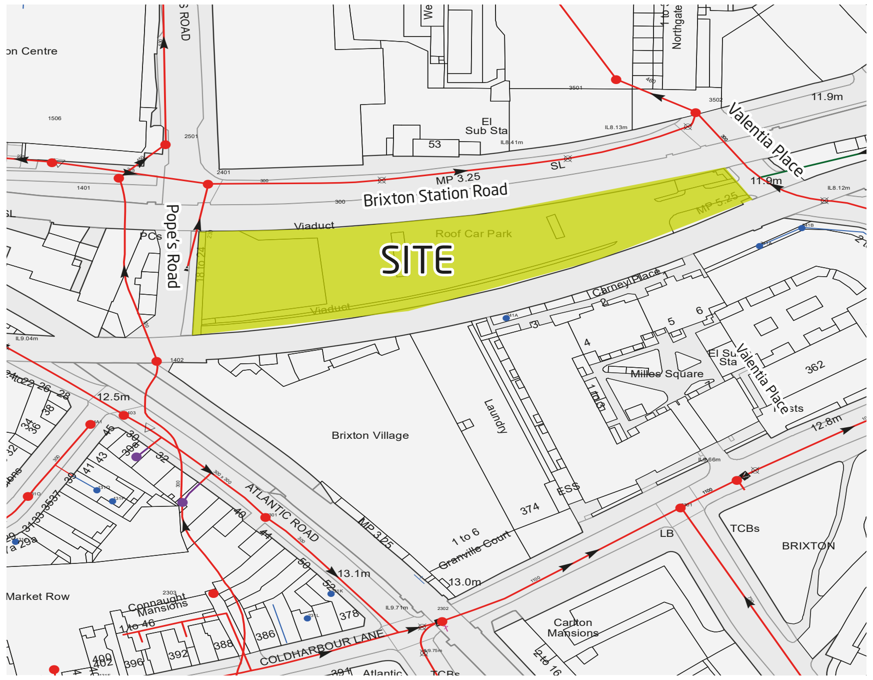


Figure 4.1 Thames Water Sewer Map

4.2 Proposed scheme

The total run-off catchment area is 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:

$Q_{100} = 3.61 \times 0.75 \times 0.247 \times 102.5 =$ **68.6 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 4.2 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 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 litres/sec, the maximum permissible discharge from the site would be **68.6** litres/sec.

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 4.2 Thames Water Sewer Record

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 as possible. 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.

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

Figure 4.3 Peak rainfall intensity allowance

4.3 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.

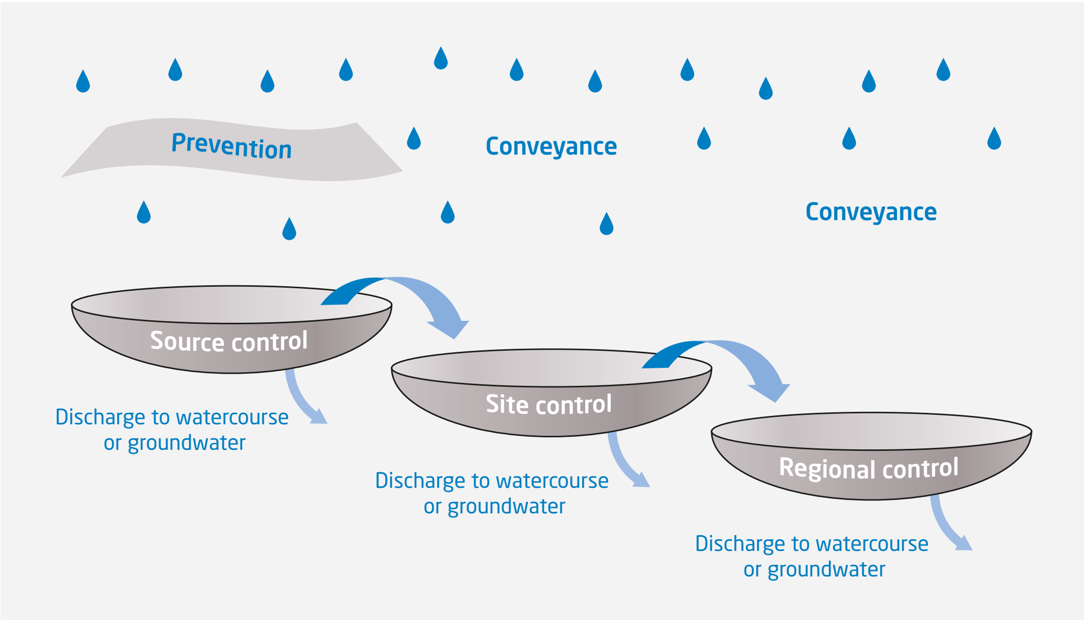


Figure 4.4 SuDS management train

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 accomodated on the roof at levels 21, 9 and 4. Refer to appendix 1. 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 the 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 4.5 and 4.6, 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.

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 levels 21, 9 and 4. The architect and MEP engineer will need to confirm at the next design stage how the blue/green or brown roof 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 litre/sec.

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 1 for reference.

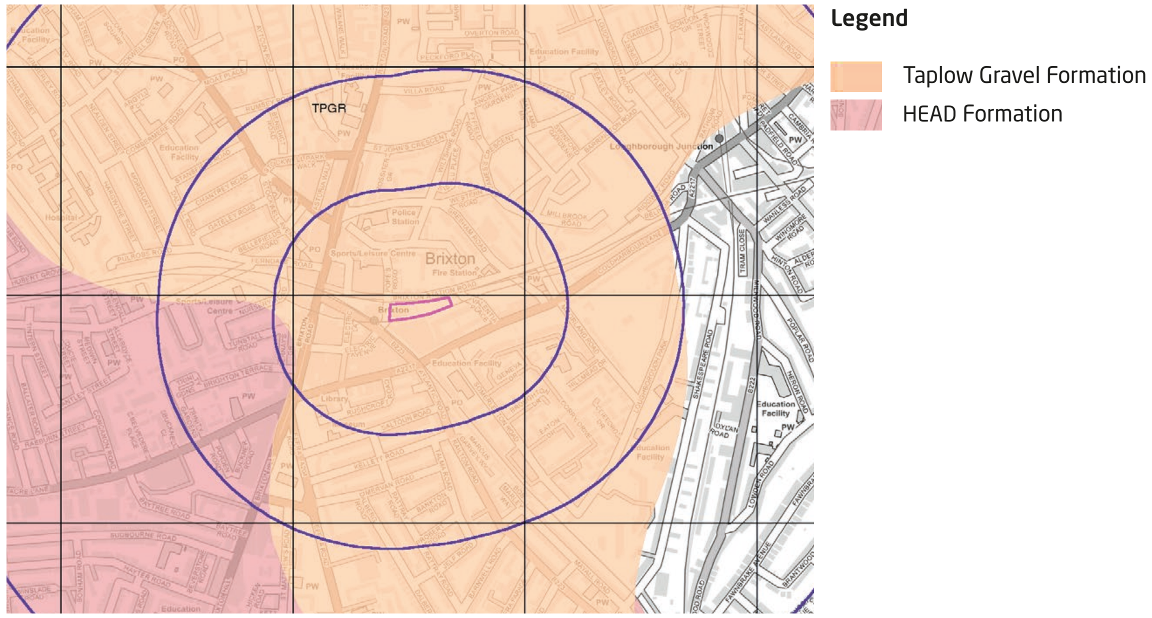


Figure 4.5 BGS map showing superficial geology

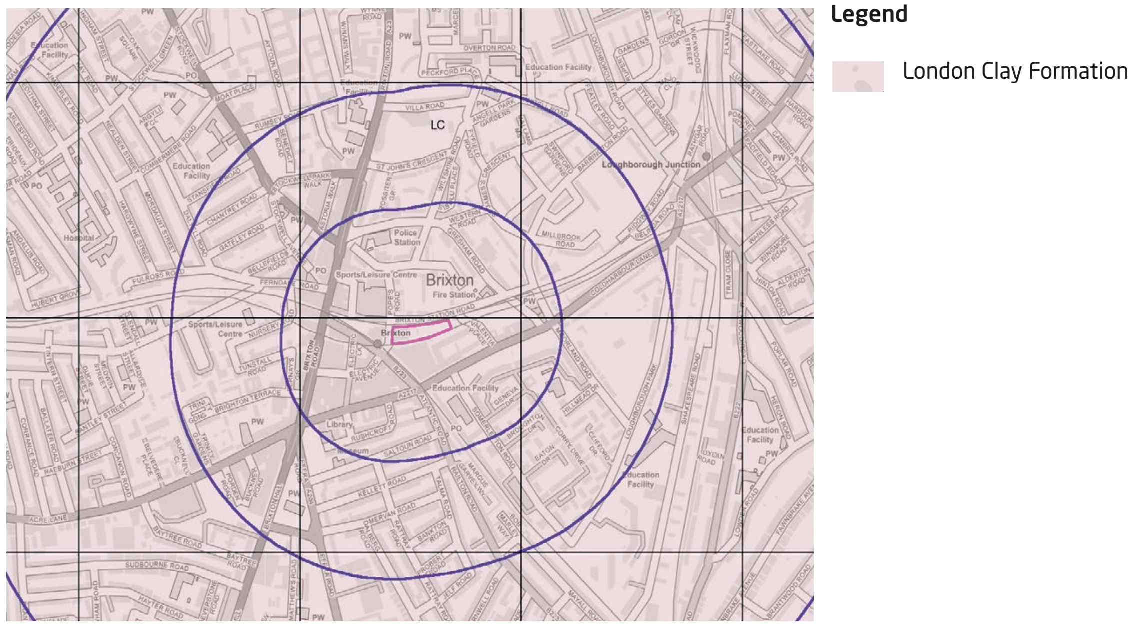


Figure 4.6 BGS map showing bedrock geology

Element	Management stage	Water quantity	Water quality	Amenity & biodiversity	Potential 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 4.7 Summary of potential SuDS devices

5 Flood risk assessment requirements

The Environment Agency's Indicative Floodplain Map (see Figure 5.1) shows that the site lies in Zone 1 - an area with a low probability of flooding. A detailed Flood Risk Assessment has been carried out by AKT II and the findings are summarised in section 5.1.

Legend

- Flood Zone 3
- Flood Zone 3: areas benefitting from flood defence
- Flood Zone 2
- Flood Zone 1
- Flood Defence
- Main river

Figure 5.1 Environment Agency indicative flood map

5.1 FRA 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 measures 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 consulted 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.`

6 Foul water drainage

6.1 Existing scheme

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

- A 300mm dia. combined sewer running under Brixton Station Road to the north of the site.
- A 230 mm dia. combined sewer in Pope's Road to the north-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 Figure 3.1 for reference.

It is believed that all foul water from the building currently discharges directly to one of these public sewers but it is not clear which one and it is therefore recommended that a CCTV survey of the existing site drainage network is undertaken to confirm the location and size of all existing connections from the site.

No information on the type and number of foul appliances (such as sinks and toilets) in the existing building has been made available and so it has not been possible to assess the current foul water discharge rate from the site.

6.2 Proposed scheme

The draft architectural layouts have been used to estimate the number of foul appliances in the proposed office space. Using the guidelines for commercial developments given in BS EN 12056-2:2000 - "Gravity Drainage Systems Inside Buildings - Part 2: Sanitary Pipework, layout and calculation", the proposed foul flow is calculated from the formula:

$Q = K \times \sqrt{DU}$

For 'intermittent use' (representing dwellings, offices, etc.) K has a value of 0.5 giving:

Appliance	No.	Discharge units per appliance	Total number of discharge units
Wash hand basin	424	0.5	217
Urinal	100	0.5	50
Shower	10	0.6	6
kitchen Sinks	38	0.8	30.4
WC	434	2	868
Dishwasher	36	0.8	28.8
		Total discharge units for site =	**1200.2**
		Therefore, total flow from site =	**17.32 litres/sec**

Although it has not been possible to make an assessment of the existing foul water flow, it is believed that there will be an increase in the peak flow water rate from the proposed development. This increase will need to be agreed with Thames Water.

It is assumed that any foul water drainage from ground floor level and above will be drained by gravity in order to minimise the amount of pumping required. Until the levels of the existing connections and public sewers are confirmed it is unclear whether the basement level will need to be pumped although this appears to be likely. It is therefore recommended that an allowance is made at this stage for pumping foul water from below the basement level slab up to high level in the basement to allow discharge by gravity to the public sewer.

As with the surface water drainage, due to the depth of the public sewers it is recommended that, if possible, the existing drainage connection(s) should be reused. At this early design stage it is suggested an allowance is made for **20 litres/sec** for foul water discharge, to accomodate any design development until more accurate figures are available from the MEP engineer.

7 BREEAM

Pol 03: Flood and surface water management

Prerequisite

1. An appropriate consultant is appointed to carry out and demonstrate the development's compliance with all criteria.

Up to two credits – Flood resilience

Two credits – Low flood risk

2. A site specific flood risk assessment (FRA) confirms the development is in a flood zone that is defined as having a low annual probability of flooding. The FRA takes all current and future sources of flooding into consideration.

One credit – Medium or high flood risk

3. A site specific FRA confirms the development is in a flood zone that is defined as having a medium or high annual probability of flooding and is not in a functional floodplain. The FRA must take all current and future sources of flooding into consideration.
4. To increase the resilience and resistance of the development to flooding, one of the following must be achieved:
   - **a.** The ground level of the building and access to both the building and the site, are designed (or zoned) so they are at least 600 mm above the design flood level of the site's flood zone; **OR**
   - **b.** The final design of the building and the wider site reflects the recommendations made by an appropriate consultant in accordance with the hierarchy approach outlined in Section 5 of BS 8533 : 2017.

Two credits – Surface water run-off

Prerequisite for surface water run-off credits

5. Surface water run-off design solutions must be bespoke, i.e. they must take account of the specific site requirements and natural or man-made environment of and surrounding the site. The priority levels detailed in the Methodology must be followed, with justification given by the appropriate consultant where water is allowed to leave the site.

One credit – Surface Water Run-Off – Rate

6. Drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) shows a 30 % improvement for the developed site compared with the pre-developed site. This should comply at the 1-year and 100-year return period events.
7. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified Sustainable Drainage Systems (SuDS) are in place.
8. Calculations include an allowance for climate change. This should be made in accordance with current best practice planning guidance.

One Credit – Surface Water Run-Off – Volume

9. Flooding of property will not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance); **AND EITHER**
10. Drainage design measures are specified so that the post-development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development. This must be for the 100-year 6-hour event, including an allowance for climate change.
11. Any additional predicted volume of run-off for this event is prevented from leaving the site by using infiltration or other SuDS techniques.

OR (only where Criteria 10 & 11 cannot be achieved)

12. Justification from the appropriate consultant indicating why the above criteria cannot be achieved, i.e. where infiltration or other SuDS techniques are not technically viable options.
13. Drainage design measures are specified so that the post-development peak rate of run-off is reduced to the limiting discharge. The limiting discharge is defined as the highest flow rate from the following options:
    - **a.** The pre-development one-year peak flow rate **OR**
    - **b.** The mean annual flow rate Q_{BAR} **OR**
    - **c.** 2 litres / sec / ha

    For the one-year peak flow rate, the one year return period event criterion applies.
14. Relevant maintenance agreements for the ownership, long-term operation and maintenance of all specified SuDS are in place.
15. For either option, above calculations must include an allowance for climate change; this should be made in accordance with current best practice planning guidance.

One credit – Minimising watercourse pollution

One credit

16. There is no discharge from the developed site for rainfall up to 5 mm (confirmed by the appropriate consultant).
17. Areas with a low risk source of watercourse pollution, an appropriate level of pollution prevention treatment is provided, using appropriate SuDS techniques.
18. Areas with a high risk of contamination or spillage of substances, such as petrol and oil, have separators (or an equivalent system) installed in surface water drainage systems.
19. Chemical or liquid gas storage areas have a means of containment fitted to the site drainage system (i.e. shutoff valves). This is to prevent the escape of chemicals to natural watercourses in the event of a spillage or bunding failure.
20. All water pollution prevention systems have been designed and installed in accordance with the recommendations of documents such as the SuDS Manual and other relevant industry best practice. They must be bespoke solutions taking account of the specific site requirements and natural or man-made environment of and surrounding the site.
21. A comprehensive and up-to-date drainage plan of the site will be made available for the building or site occupiers.
22. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS must be in place.
23. All external storage and delivery areas designed and detailed in accordance with the current best practice planning guidance.

Up to two credits – Simple buildings – Surface water run-off

Two credits

For "simple buildings", the criteria below should be applied to award one or two credits. Alternatively, two credits and an Exemplary credit is awarded where criteria 5-15 are achieved.

24. Either 24a below or 24b below is met:
    - **a.** There is a decrease in the impermeable area by 50 % or more, from the pre-existing impermeable hard surfaces; **OR**
    - **b.** All run-off from the roof, including new and existing parts of the building, has been managed on site using source control methods. This must be achieved for rainfall depths up to 5 mm.

One credit – Simple buildings – Surface water run-off

25. Either 25a below or 25b below is met:
    - **a.** There is no increase in the impermeable surfaces as a result of the new construction; **OR**
    - **b.** If there is an increase in the impermeable surface as a result of the new construction then the following must be met:
      - **i.** Hard standing areas: additional (or equivalent area of) hardstanding must be permeable or be provided with on-site SuDS to allow full infiltration of the additional volume. The permeable hardstanding must include all pavements and public rights of way, car parks, driveways and non-adoptable roads. Small garden paths which will drain onto a naturally permeable surface can be excluded.
      - **ii** Building (new-build or extension): for an increase in building footprint, extending onto any previously permeable surfaces, the additional run-off caused by the area of the new construction must be managed on site using an appropriate SuDS technique for rainfall depths up to 5 mm.

Assessment of available credits

Prerequisite

Criterion	AKT II assessment	
1.	AKT II are appropriate consultants with the relevant qualifications and experience to design SuDS and flood prevention measures and completing peak rate of run-off calculations.	✔

Flood resilience

Criterion	AKT II assessment	
2.	The site is situated in Zone 1 – an area with a low probability of flooding according to the Environment Agency's Indicative Floodplain Map. The site-specific FRA carried out by AKT II confirms that the site is at a low risk of flooding.	✔
3.	Not applicable – the site is located in Flood Zone 1.	N/A
4a.	Not applicable – the site is located in Flood Zone 1.	N/A
4b.	Not applicable – the site is located in Flood Zone 1.	N/A

Based on this we believe that potentially two credits out of a possible two can be awarded under these criteria.

Surface water run-off

Run-off criteria	AKT II assessment	
5.	The drainage strategy has been prepared in line with the London Plan drainage hierarchy and the priority levels detailed in the BREEAM Methodology.	✔
6.	As confirmed in section 5.3, it is proposed to reduce the peak discharge rate by more than 30% at the 1-year and 100-year event to Greenfield run-off rate of 2.9 litres/sec.	✔
7.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O&M Manual for the site.	✔
8.	An allowance of 40% has been made for climate change in all calculations in line with the Environment Agency's guidance.	✔
9.	The site-specific FRA confirms that the site is at a low risk of flooding from local drainage system failure.	✔
10.	As the pre and post development hard standing areas are the same then there cannot be any more run-off volume over the lifetime of the building and this criteria is met by default.	✔
11.	Infiltration techniques are not viable therefore this criterion can not be achieved.	✘
12.	As confirmed in Section 4.3 infiltration techniques are not technically viable.	✔
13.	Pre-development 1-year peak flow rate = 21.6 litres/sec Mean annual flow rate Q_{bar} = 0.91 litres/sec 2 litres/sec/ha = 0.49 litres/sec The site is proposed to discharge at Greenfield runoff rate of 2.9 litres/sec.	✔
14.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O&M Manual for the site.	✔
15.	An allowance of 40% has been made for climate change.	✔

Based on this we believe that potentially two credits out of a possible two can be awarded under these criteria.

Minimising watercourse pollution

Pollution criteria	AKT II assessment	
16.	As confirmed in Section 5.3, no infiltration is possible and there is insufficient green roof coverage therefore this criterion cannot be achieved.	✘
17.	SuDS devices will be specified where possible within the limitations of the development.	✔
18.	As there are no high risk areas being provided as part of the scheme and therefore no separators require to be provided.	N/A
19.	There are no chemical/liquid gas storage areas proposed as part of the scheme.	N/A
20.	All water pollution prevention and SuDS devices will be designed in accordance with the SuDS Manual.	✔
21.	An up-to-date drainage plan will be made available to the site occupiers upon completion.	✔
22.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O&M Manual for the site.	✔
23.	There are no external storage or delivery areas proposed as part of the scheme.	N/A

Based on this we believe that potentially no credit can be awarded under these criteria.

Overall, we believe that potentially four credits out of a possible five can be awarded under the Pol03 criteria outlined above.

8 Maintenance and operation

Before cleaning, final testing and immediately before handover the Contractor will:

- Lift covers to manholes, inspection chambers and access points. Remove mortar droppings, debris and loose wrappings.
- Thoroughly flush pipelines with water to remove silt and check for blockages. Rod pipelines between access points if there is any indication that they may be obstructed.
- Carry out a CCTV of the pipework to ensure that it is free of silt and blockages.

The End User shall then follow the "Waste Management, The Duty of Care – A Code of Practice (Revised 1996)" and shall ensure that their waste does not escape from their control and is transferred only to a registered waste carrier to be sent for recycling or disposal at a suitably licensed facility.

All waste arising from the maintenance of the drains and sewers shall be handled, stored and disposed of correctly to avoid pollution. Waste may be designated as hazardous / special waste and, as such, the End User shall ensure that they comply with the Hazardous Waste (England and Wales) Regulations 2005.

Reference shall be made to CIRIA publication C753 - The SuDS Manual by the Contractor and the End User. A suitable maintenance schedule must be developed, maintained, followed and updated as required to reflect observed performance. The following items are highlighted for guidance.

8.1 General drainage

The below ground drainage network will be designed in accordance with the requirements of the Building Regulations whilst acknowledging the need to limit the number of inspection chambers within "front of house" areas. To this end, all main runs will have rodding eyes, manholes or inspection chambers at the head of the run and at all changes of direction to provide access to rod or jet the main pipework.

Where possible, connections from stacks or gullies will be made directly to these manholes or inspection chambers to allow the connection to be rodded or jetted from the downstream end. Where this is not possible, each stack will be detailed to have an access hatch provided just above floor level (see Figure 8.1) to allow the connection to be rodded or jetted from the upstream end. Similarly, the gullies will have a rodding access provided within their body allowing the pipework to be rodded or jetted from the gully downstream.

Gullies and channels will be specified with silt buckets and silt trap manholes have been provided upstream of all tanks and infiltration structures to prevent the ingress of silts into the drainage network and impairing the performance of the system.

Maintenance schedule	Required action	Recorded frequency
Regular maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action.	Monthly for the first three months then six-monthly
	Remove sediment from pre-treatment structures (e.g. gullies, channels, silt traps).	Six-monthly or as required
Occasional maintenance	Debris removal from catchment surface where this may cause risks to performance.	Monthly
Remedial actions	Repair / rehabilitation of inlets, outlets, overflows and vents.	As required
Monitoring	Inspect all manholes, inspection chambers, inlets, outlets, overflows and vents to ensure they are in good condition and operating as designed.	Annually and after large storms

8.2 Pumped systems

Pumps will be designed as duplex units operating on a duty / standby based on hours run, pump failure and high / high water level. A suitable BMS interface shall be provided monitoring each pump system for the following status points:

- Pump 1 running / Pump 2 running – These statuses shall be provided to the BMS in the form of a volt free contact that is closed when the pump is running.
- Pump 1 failed / Pump 2 failed – These statuses shall be provided to the BMS in the form of a volt free contact that is closed when the pump has deemed to have failed, i.e. failed to run when requested. This shall cause a latched general alarm on the BMS.
- High water level – This status shall be provided to the BMS in the form of a volt free contact that is closed when a high water level is breached. The level shall set at a level that is higher than the normal pump control level switch. This shall cause a latched general alarm on the BMS.
- High / High water level – This status shall be provided to the BMS in the form of a volt free contact that is closed when a high / high water level is breached. The level shall set at a level that is higher than the high water level switch. This shall cause a critical latched alarm on the BMS.
- System not in automatic / not available – This status shall be provided to the BMS in the form of a volt free contact that is open (failsafe) when the system is not available to operate. This shall operate should any event occur that could prevent the system from operating, such as power loss to the control panel, hand / off / auto switches not in Auto, isolators opened. This shall cause a critical latched alarm on the BMS.

The BMS shall be capable of raising the following alarms:

- Excessive Pump Running Alarm – The BMS shall monitor the running status of each pump. Should any pump run for longer than 20 minutes, a general alarm shall be raised on the BMS.
- Excessive Pump Starts Alarm – The BMS shall calculate from the running status the number of starts per hour. Should the number of starts per hour exceed 4, a general alarm shall be raised on the BMS.

A control panel local to each pump station shall be provided to monitor the same status points and alarms as defined for the BMS Interface above.

9 Drainage design standards

The following guides and current British Standards will be used for the design of the drainage elements on this project:

- BS EN 752:2017 Drain and Sewer Systems Outside Buildings. Sewer System Management
- BS EN 12056 Gravity Drainage Systems Inside Buildings: Part 2
- Building Regulations 2010 Part H1 – Foul Water Drainage (2015 Edition)
- Building Regulations 2010 Part H2 – Wastewater Treatment Systems and Cesspools (2015 Edition)
- Building Regulations 2010 Part H3 – Rainwater Drainage (2015 Edition)
- Building Regulations 2010 Part H4 – Building Over Sewers (2015 Edition)
- Building Regulations 2010 Part H5 – Separate Systems of Drainage (2015 Edition)
- Building Regulations 2010 Part H6 – Solid Waste Storage (2015 Edition)
- Environment Agency "Control of Runoff from New Developments Interim Regional Guidance"
- National Planning Policy Framework
- Planning Practice Guidance

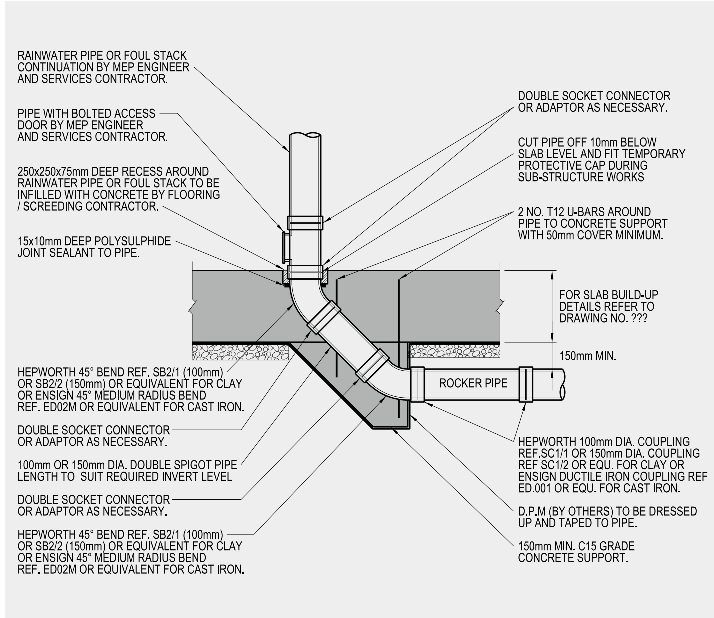


Figure 8.1 Rodding / jetting access detail

10 Materials

	Item	Material	British standard
a)	Drainage pipe work	Vitrified clayware	BS EN 295-1
		Cast iron	BS EN 877
		Concrete	BS 5911-1 and BS EN 1916
		uPVC	BS EN 1401-1
b)	Precast inspection chambers	Precast concrete	BS 5911 Part 200
c)	Drainage gullies and gratings	Vitrified clayware	BS EN 295-1
		Ductile iron	BS EN 124 D 400
d)	Drainage channels and gratings	Polymer concrete	
		Ductile iron	BS EN 124 D 400
e)	Access covers	Grey iron	BS EN 124
		Galvanised steel	Facta Class A, B & D
f)	Cellular units	Polypropylene	
g)	Geotextiles		

11 Risks and unknowns

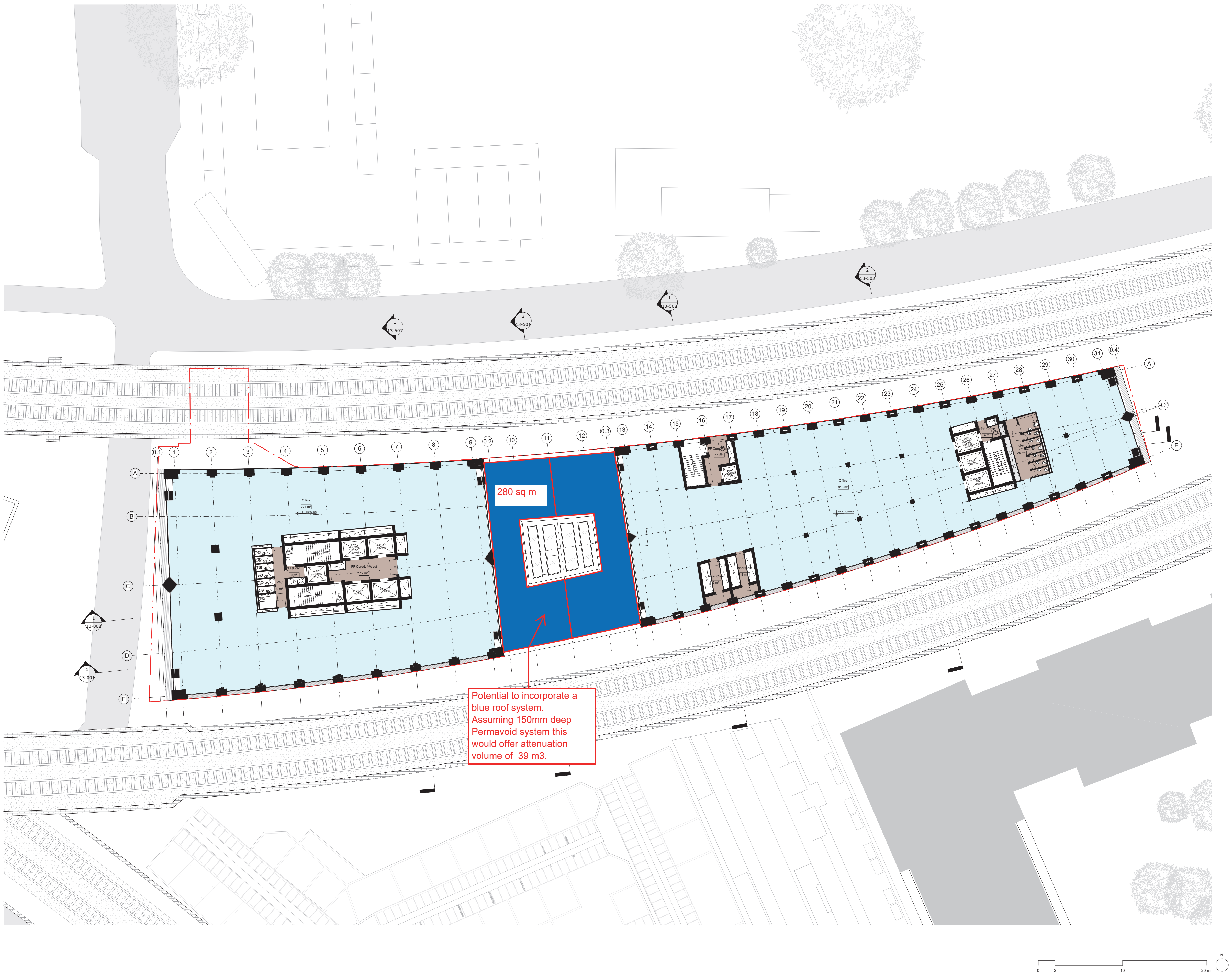
The main risk items relating to the drainage which have been identified during the scheme design stage are as follows. These areas will be addressed during the ongoing stages of the design with the goal of minimising or removing them.

1. **Existing drainage network**
   The location, level and condition of the discharge point(s) for the existing drainage network are currently unknown. A CCTV survey of the existing network is therefore required in order to determine this and allow the drainage design to proceed.
2. **Public sewers**
   At present, the invert levels of the existing public sewers are unknown. In order to finalise a connection level to the existing sewer and to design the sewer diversion a survey will be required to determine these levels and the condition of the pipes.
3. **Water authority discharge agreement**
   Permission will be required from the Water Authority to discharge surface and foul water to the existing public sewer and an agreement reached as to an acceptable discharge rate from the site to allow the drainage design to proceed.
4. **Network rail sewer connection approval**
   Any new sewer connection to the sewer under Brixton Station Road might need approval from Network Rail as the construction of the outfall would be under Network Rail demise.
5. **MEP layout and flows**
   The proposed MEP drainage layout and flows will be required to allow the below ground drainage design to be progressed. At present, only a very approximate assessment of the likely flows has been made.
6. **Architectural layout**
   Once the architectural layout has been finalised it will be possible to undertake a more accurate assessment of the proposed foul water flows as the M & E engineer will be able to finalise their proposals.
7. **Cavity wall drainage system**
   The architect would need to confirm the waterproofing requirements for the basement.
8. **Attenuation volume**
   It is recommended that at this stage a cost and space allowance is made for a storage volume of 160 m^3 based upon the Greenfield discharge rate of 2.9 litres/sec.

Whilst this list is not exhaustive it covers the main areas that affect the cost of the drainage.

Appendix 1

Blue Roof Options



General Notes:

Drawing to be read in conjunction with the specification and all relevant drawings.

Do not scale from this drawing.

Contractor to check all dimensions on site. Adjaye Associates to be advised of any discrepancies between this drawing and site conditions immediately.

By Department Legend

- Office
- Servicing

Revision	Date	Description
R7	25/02/20	Design Freeze
R6	17/01/20	Design Freeze
R3	06/09/19	Revision 3
R2	21/06/19	Revision 2

Status: Hondo Enterprises
Rev.: R7

Client: Hondo Enterprises

Project: Pope's Road Development

Drawing Title: GA L4 FOURTH & SIXTH FLOOR

Drawing No.: PRD-11-040

Scale: 1 : 200 @ A1
Drawn By: MZ, SC, PK, CF

Date: 25/02/20
Checked By: MZ

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