Structural and Civil Engineers

Camden Goods Yard

Below Ground Drainage & SUDS Strategy

March 2021

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Camden Goods Yard

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Revision	Date	Notes	Prepared by	Checked by	Approved by
P01	26/03/21	First Issue	WR	JK	JK
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Contents

Glossary

AEP	Annual Exceedance Probability
BGS	British Geological Survey
cc	Climate change
CGY	Camden Goods Yard
CLP	Camden Local Plan
DEFRA	Department for Environmental Food & Rural Affairs
EA	Environmental Agency
FRA	Flood Risk Assessment
LBCFRMS	The London Borough of Camden Flood Risk Management Strategy
NPPF	National Planning Policy Framework
RP	Return Period
SFRA	Strategic Flood Risk Assessment
SI	Site Investigation
Topo	Topographical survey
TWU	Thames Water Utilities
WIA	Water Industry Act 1991

Executive Summary

This Drainage Strategy has been prepared by Walsh on behalf of St George West London Limited (SGWL) and in support of the approved planning application 2017/3116/P and the S73 variation application 2020/3166/P for the regeneration of the 'Camden Goods Yard' (CGY).

The works discussed herewith form the 'main site' of the wider development area and shall henceforth be referred to as such. The site comprises a mixed-use development consisting of a newly built under croft Morrisons supermarket with a two storey basement car park and 644 residential properties ranging between 1 and 4 bed flats and maisonettes. Occupying an area of 2.84 ha the site located on Chalk Farm Road, Camden Town, London NW1 8AA with approximate National grid reference 528412, 184106.

This report aims to outline the existing and proposed below ground drainage strategies and SUDS opportunities for the proposed development and address Condition 47 of 2020/3116/P for the 'main site' works.

This report demonstrates that the proposed drainage strategy is in-line with the principles of the strategy presented by AECOM in the Surface Water Drainage Strategy', May 2020, submitted in support of planning application 2020/3116/P and addresses the requirements of Condition 47.

Surface water from main development site, excluding the access road, will not exceed the Greenfield 3%-1% run-off rate, but will marginally exceed the 50% calculated Greenfield rate. The existing access road will continue to discharge unrestricted via the existing 'highway' network to minimise disruption to the neighbouring site and in-line with the approved strategy.

Surface water will be attenuated on-site through a cascading system of flow controls and attenuation provided at various levels below ground and at podium levels. A total estimated volume of 2256m^3 will be provided as below ground attenuation tanks as well as blue roof attenuation located at podium level and incorporated into the landscaped finishes.

Additional SUDS features in the form of green roofs, permeable paving and rain gardens are proposed to improve water quality, provide habitat for wildlife and reduce run-off to the sewer during low intensity rainfall events through evaporation and evaportranspiration.

Peak surface water discharge to sewer from the main site, excluding the access road, will not exceed 35.1l/s for storm event up to and including the 1% AEP, with an additional 40% allowance for climate change.

The proposed development will significantly decrease peak surface water discharge to the local sewer network, decreasing flood risk both on and off-site post development.

Foul water from the site will discharge by gravity to the existing combined sewers on the site where feasible. Basement areas will be pumped to high level, before discharging via gravity and the low-lying areas will be backed up by pumps to mitigate against potential sewer surcharge events.

The total peak foul flow generated by the development is estimated to be 34.5 l/s. Whilst the development proposes a significant increase in foul water flows post development, the reduction in surface water

discharge to the combined sewers more than mitigates the increase in foul flows, decreasing flood risk off-site.

TWU were consulted on the proposed drainage strategy by AECOM during Stage 2 of the design in May 2020 and confirmed capacity within their existing network for the proposed development.

Additional flow and rainfall monitoring has been installed by SGWL across the site to inform TWU's hydraulic models and clarify the potential risk of surcharging of the public sewers within the development. Additional backflow prevention has been proposed to mitigate against the potential risk of surcharging sewers to the lower areas of the proposed site, until such time that TWU can confirm the risk has been negated.

Additional sewer surveys are proposed to be undertaken to clarify the existing size and location of the outfall of the public sewers from the site.

1. Introduction

This Drainage Strategy has been prepared by Walsh on behalf of St George West London Limited (SGWL) and in support of the approved planning application 2017/3847/P and the S73 variation application 2020/3116/P for the regeneration of the 'Camden Goods Yard' (CGY).

The works discussed herewith form the main site. The site comprises a mixed-use development consisting of a newly built under croft Morrisons supermarket with a two storey basement car park and 644 residential properties ranging between 1 and 4 bed flats and maisonettes. Occupying an area of 2.84 ha the site located on Chalk Farm Road, Camden Town, London NW1 8AA with approximate National grid reference 528412, 184106.

This report aims to outline the existing and proposed below ground drainage strategies and SUDS opportunities for the proposed development and address Condition 47 of 2020/3116/P for the 'main site' works.

Condition 47:

Drainage strategy

Development on the PFS land parcel for the temporary building (Phase 1a) shall be carried out in accordance with the approved drainage strategy approved on 29/06/2020 under reference 2020/0396/P or other such details which have been submitted to and approved in writing by the local planning authority.

Prior to commencement of piling on the PFS land parcel for the permanent building (Phase 1b) a drainage strategy for that parcel of land detailing any on and/or off site drainage works shall be prepared in consultation with the sewerage undertaker and submitted to and approved in writing by the local planning authority.

Prior to commencement of piling on the Main Site land parcel a drainage strategy for that parcel of land detailing any on and/or off site drainage works shall be prepared in consultation with the sewerage undertaker and submitted to and approved in writing by the local planning authority.

The drainage strategy for the relevant parcel of land shall include details of the following unless otherwise agreed:

(i) a sustainable urban drainage system (SUDs) which is based on a 1 in 100 year event with 40% provision for climate change demonstrating attenuation to support no more than three times greenfield runoff rate.

(ii) Goods Yard rain garden and any other SUDs features within the public realm including a plan of maintenance.

The drainage works and features approved for the relevant parcel of land shall be implemented in full prior to first discharge of foul or surface water from the relevant parcel of land into the public system.

Reason: To ensure reduce the rate of foul and surface water run-off from the buildings and limit the impact on the storm-water drainage system in accordance with Policy CC3 of the Camden Local Plan 2017.

A desk-top study has been undertaken in the preparation of this report. The following list includes documents that have been reviewed and are referenced within this report, but is not exhaustive.

- Camden Local Plan – Policy CC3
- The London Borough of Camden Flood Risk Management Strategy
- Topographical survey – *Murphy surveys, 12th June 2020*
- CCTV survey - *Plowman Craven, 15th January 2021*
- Thames Water Asset Plans (extract from AECOM drainage strategy) - *Thames Water, 2019*
- Architects site plans/elevations – *PTAL 21st January 2021*
- Camden Goods Yard Flood Risk Assessment and Drainage Strategy – Aecom June 2017
- Stage 3 SudS Strategy plan – *Place, March 2021*
- Geoenvironmental Appraisal - Sirius in 2010
- Ground Investigation Report – Geo-Environmental 12th *October 2020*

This assessment has been undertaken under the direction and approval of Andy Stanford, a Walsh Group Director with over 25 years professional experience and an expert in Sustainable Urban Drainage Systems (SUDS). Additional checking has been undertaken by Jacqui Kantor, an Associate Director with over 16 years professional experience and proven experience in SUDS design.

Within this report risks are expressed as an annual exceedance probability (AEP). This is the percentage probability that a given event could occur in any given year.

2. Background

2.1. Site

2.1.1. General

The Camden Goods Yard is an irregular shaped plot of land covering an area of approximately 2.84 ha, currently occupied by Morrisons supermarket, associated access road, car-parking and a bus turning area. The existing site access road runs along the northern boundary of the site, connecting the site to Chalk Farm Road to the east. The site is bounded by four storey residential properties to the south along Gilbeys Yard, which borders Regents Canal. Railway lines run along the eastern and western boundaries and Juniper Crescent, a residential development comprising a mix of two to four storey residential buildings is located along the northern boundary.

The site access road serves both the site and Juniper Crescent to the north and passes beneath the railway line on the approach to site from Chalk Farm Road. A high-level retaining wall runs alongside the access road, separating it from the main site area. Levels on the road near the railway bridge are at circa 26.5m AOD, some 6.5m lower than the adjacent levels within the site. The road ascends steeply after the railway bridge to a level of circa 33m AOD at the western end, where a roundabout serves the respective site access points. The main site area is relatively flat, with levels in the south east corner at the highest of circa 34m AOD. (*see figure 2.1 and Appendix A*)

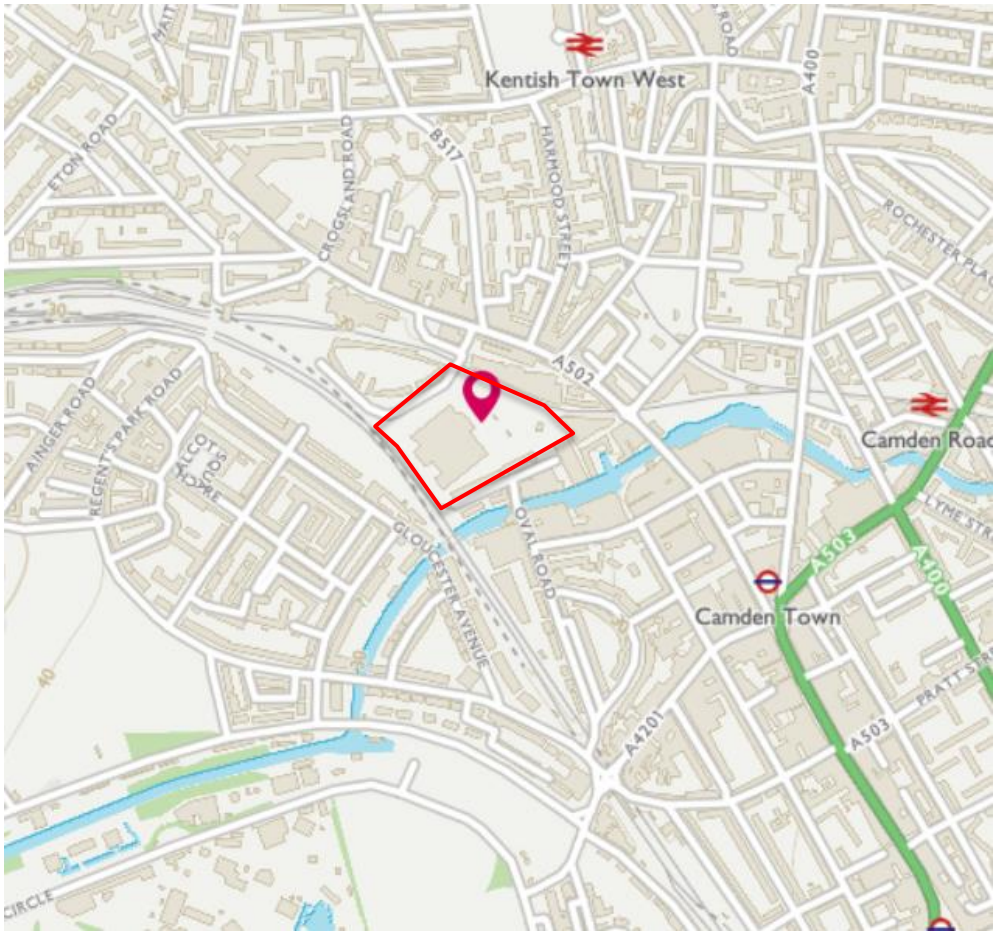


Figure 2.1 – Extract of site from OS maps, Appendix A - Site Location plan

2. 1. 2. Flood Risk

The London Borough of Camden (LBC) local plan highlights Policy CC3 Water and Flooding which states the following:

The council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to.

a. Incorporate water efficiency measures;
b. Avoid harm to the water environment and improve water quality;
c. Consider the impact of development in areas at risk of flooding (including drainage);
d. Incorporate flood resilient measures in areas prone to flooding;
e. Utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and
f. Not locate vulnerable development in flood-prone areas.

These requirements will be implemented in the strategy through mitigation of on-site flooding with climate change consideration and addition of SUDS systems to satisfy an agreed discharge rate.

The site is located within Flood Zone 1 on the Gov.uk Flood Maps for Planning, which is consists of land assessed as having a 1 in 1000 (0.1% AEP) or less annual exceedance probability of river flooding.

A flood risk assessment was undertaken by Aecom in support of the approved planning application 2017/3847/P and their report 'Camden Goods Yard Flood Risk Assessment and Drainage Strategy' Revision 6, October 2017 is listed in the decision notice. This document is included in *Appendix F* and referred to hereafter as the FRA.

The FRA separates the application site into two land parcels; Petrol Filling Station (PFS) and Morissons supermarket and car park (MS). PFS forms Phase 1A of the development which has recently been completed as part of a temporary Morrisons store and is not discussed further in this report. MS comprises Phases 2A, 2B and phase 3 as well as the existing site access road and is the subject of this report.

The FRA identifies the existing site to be at medium risk of surface water flooding with a low risk of flooding from all other sources. The proposed site flood risk is identified as low to negligible following mitigation proposed through reduction in surface water discharge to the public sewer, as proposed in the drainage strategy and discussed in detail within this report.

LBC have identified critical drainage areas which are defined in the surface water management plan as:

"*A Discrete geographic area (usually a hydrological catchment) where multiple interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.*"

As such, whilst the site is not at risk of flooding, it may pose a risk to more critical flood zones. The critical drainage areas can be seen in *figure 2.2 and Appendix J*

This report demonstrates that the site will reduce peak surface water discharge to the local sewerage network which will decrease the flood risk off site and improve the burden on the critical drainage area.

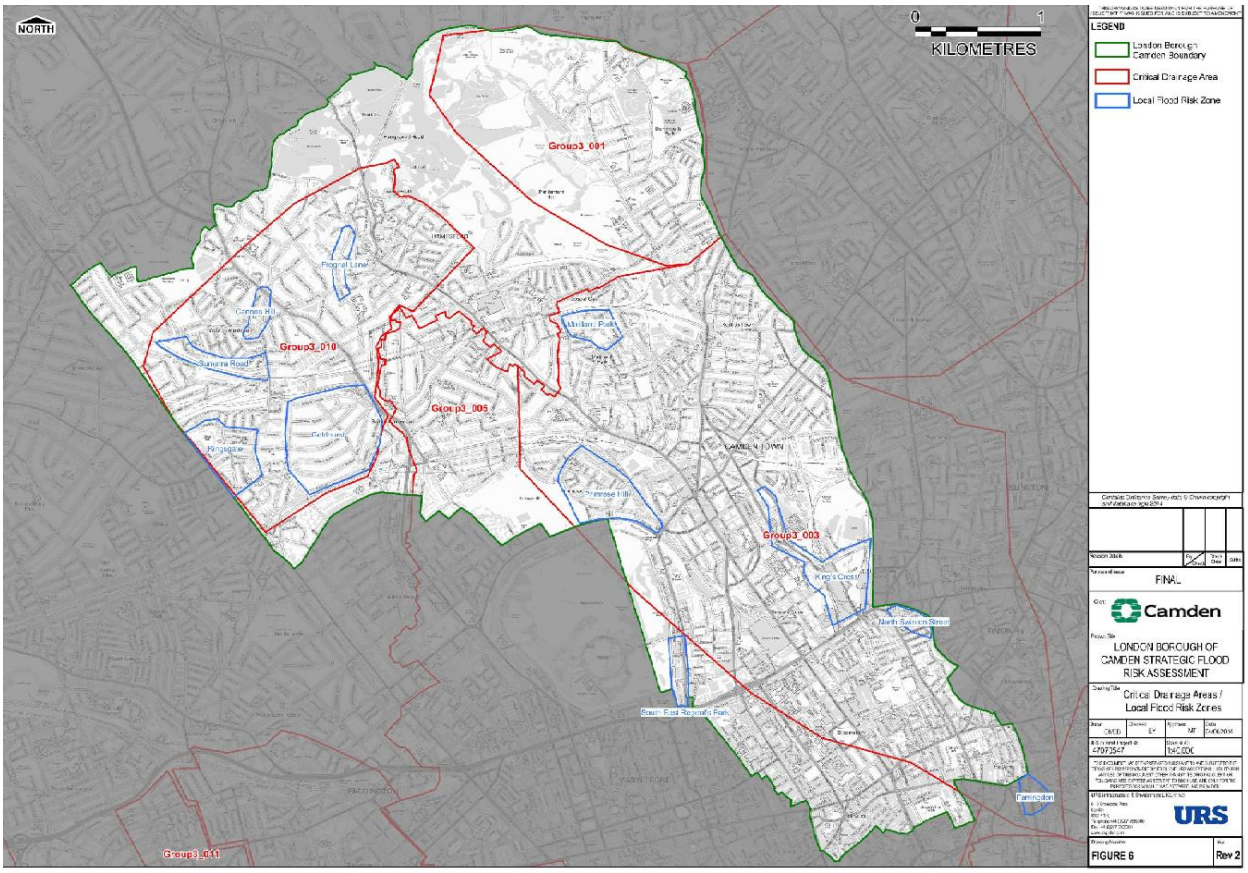


Figure 2.2 London Borough of Camden SFRA critical drainage areas

2.1.3. Hydrology

The site is not located within the groundwater source protection zone and considered to have a bedrock classed as *unproductive strata* according to the DEFRA's magic map. This means any risk for pollutant discharged at ground level has negligible effect on the sub-terranean drift deposits. Similarly, the DEFRA magic map shows no sign of productive strata in Principal or secondary aquifers in the superficial drift or bedrock suggesting there is almost no external influence to the groundwater hydrology in this region *figure 2.3.*

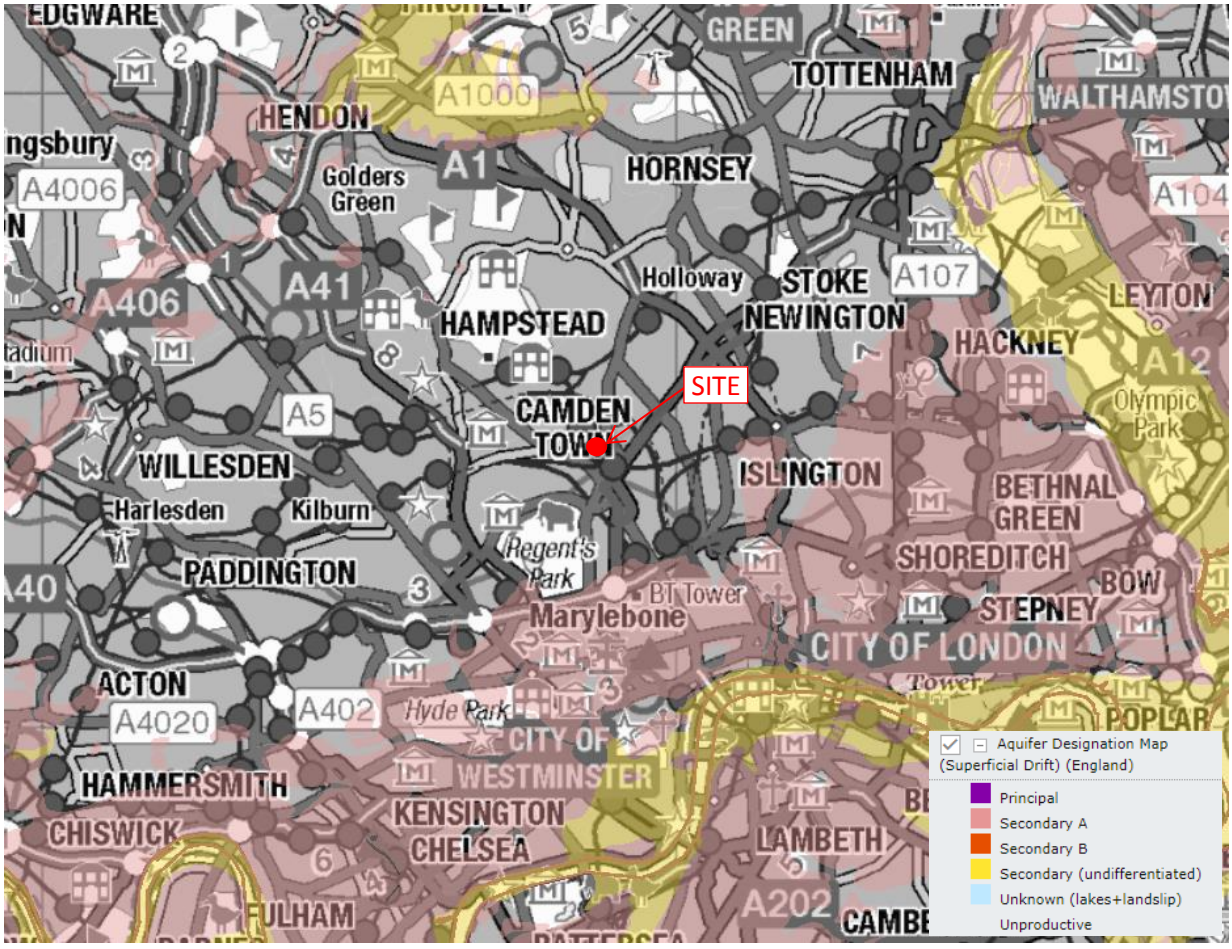


Figure 2.3 - Aquifer Designation Map - Superficial Drift

2.1.4. Existing Flood Protection Measures

There are no known existing flood protection zone measures on site. The site is approximately 4.1km from the nearest area considered by the EA as *'Area benefitting from flood defences'* on the border of the Thames by Strand. As such it is not deemed necessary to consider flood protection measures.

2.1.5. Topography

The site topography is considerably flat with no evident drops of elevation apart from along the site access road which connects the site at circa 33m AOD to Chalk Farm Road at circa 27m AOD. The Morrisons parcel ranges from 32.8m to 34.2m AOD and has a gentle slope from the high point in the east to low points along the western boundary.

2.1.6. Geology

The BGS map shows this region of London having no superficial geology data available and a bedrock formation of the Thames group silty/ clay mudstone, sandy silts and sandy clayey silts of marine origin.

A Geoenvironmental Appraisal undertaken by Sirius in 2010 notes the existing stratum a made ground underlain by London Clay. The made ground is typically at depths of 1.1-2.4m below ground level, which an area in the western part of the site being 6.75-8.1m deep. A later ground investigation report undertaken by Geo-Environmental on 12th October 2020 identified water table and below ground rock formations as supporting evidence for the SUDS hierarchy strategy

2. 2. Proposed Development

The proposed development includes the demolition of the existing Morrisons store and car park to make way for seven new blocks of varying heights and mixed uses, including a new Morrisions store and associated car parking, offices, affordable work spaces and residential units.

The proposals include opening up pedestrian access from the site access road in the rest of the development by significantly lowering existing levels in the north east corner of the site, removing the existing retaining wall separating the two areas and creating a multi levelled development with external spaces.

Current site constraints have been identified as the existing railway acting as a barrier between the site and its surrounding area, a number of large diameter sewers crossing the site and the significant proposed level changes across the site.

2. 2. 1. Proposed Topography

The proposed development topography will be significantly altered where the retaining wall running along the current access road will be removed and the site will be lowered to the North to tie into existing levels. Spot levels can be seen across the site in *Appendix C* where the access road will retain its slope on approach to the entrance roundabout elevating approximately between +28mOD and +34mOD. For this report we will refer to the podium level as the elevation approximate to +34mOD. *Appendix G* shows the layout of the basement wall. All levels above the basement walls are considered within the podium decking. Ground level areas (approx. +28mOD), can be seen in the newly proposed ‘Camden yard’ to the north east of block F, it can be seen to the south stairs connecting Camden yard to podium level whereas to the north of the yard will be podium decking running along the north boundary as can be seen in the section drawings *appendix C.* The newly proposed goods yard public realm will also rise from ground level as you head south west toward blocks A and F with a transition to podium level as you traverse Roundhouse Way.

The floor level along the proposed ‘Goods Yard’ is expected to camber along the line of the 1524mm brick sewer and as such will cause falls to both sides which will be picked up in the drainage strategy.

3. Drainage Strategy

3. 1. Existing Drainage Regime

3. 1. 1. Public Sewers

The existing site is served by Thames Water Utilities (TWU) as seen in the site surveys *in Appendix D* and the Asset plans included in *Appendix E.* There are a number of large diameter sewers traversing the site, some of which will be diverted, whilst others will be built-over to facilitate the development. TWU have been consulted on the proposed development and various applications relating to their sewers are highlighted on the Thames Water Approvals Key Plan included in *Appendix B*.

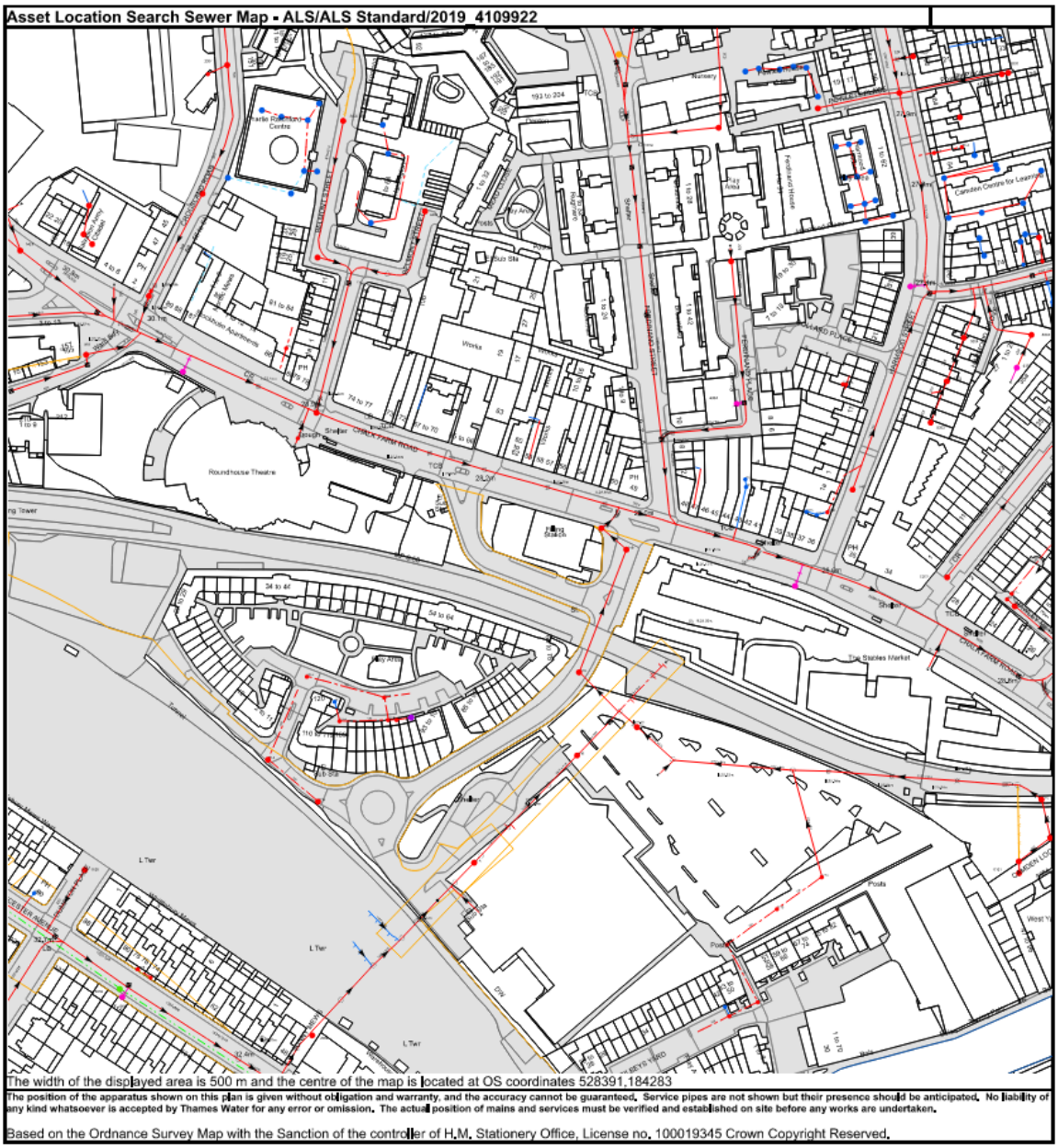


Figure 3.1 Extract from Thames Water Asset Plans

A number of surveys have been undertaken across the site to identify the existing on-site drainage network. Additional condition and line and level surveys of the existing Thames Water sewers have also been carried to more accurately locate the existing sewers and record their condition prior to start of works. These sewers can be seen on the site surveys *appendix D.*

The numerous surveys undertaken to date have shown a slightly different existing arrangement to that recorded on the TWU asset plans, which is not unusual. The TWU plans indicate that the existing 1524x914mm and 1372x914mm sewers meet near the north east corner of the site and continue north to connect to a sewer running beneath the railway bridge under the access road. Whilst the asset plans do not note the diameter of the sewer after the two large diameter sewers combine, following TWU's own internal consultation with their railway engineer it was confirmed to be a 300mm pipe and the following was advised; *"The 1524x914mm BR sewer originally crossed under the railway but was diverted under the later road bridge at some point. We confirmed this in 2007 and checked again last year. I don't think that the stub north remains unless in part."*

CCTV survey footage of the 1524x914mm sewer from June 2020 shows the full length of the sewer beneath the site and just past the eastern site boundary and does not pick up the 300mm outfall towards the road as on the asset plans. However, it should be noted that there was a large amount of debris in the sewer at this time, as well as standing water, such that a 300mm low level outfall could have been obstructed from the view of the camera. Subsequent survey attempts within the large diameter sewer have had to be abandoned due to the level of debris preventing the camera from traversing, which it has not been possible to clear with significant jetting. Attempts to trace the outfall downstream where it connects into the road have proved inconclusive. Alternative survey options are being investigated and Thames Water have informed their operations team of the ongoing issues.

The main sewers affected by the development are as follows;

- 1524x914 combined brick sewer running west to east under the existing Morrisons store and car park, will fall beneath the proposed Block A basement car park and lowered external landscaping fronting the new Morrsions store, referred to as 'Goods Yard'. This sewer will be subject to 'Building over' approval as well as approval under Section 185 of the Water Industry Act 1991 (WIA) for the amendment of existing chambers.
- 1372x914mm combined brick sewer running south to north under the existing Morrisons car park will pass beneath the proposed Block C and lowered external landscaping area referred to as 'Camden Yard'. This sewer will be subject to 'Building over' approval as well as approval under Section 185 WIA for part diversion and of the amendment of existing chambers.
- 610x457mm combined brick sewer coming into the site from Gilbeys Yard and running east near the southern boundary to discharge into the 1372x914mm combined sewer. This sewer will be built over by blocks D and C and will be subject to building over approval.
- 375mm existing concrete surface water sewer serving Gibleys Yard, enters the site approximately halfway along the southern boundary with Gilbeys Yard and crosses the site northwards, before connecting to the 1372x914mm combined sewer just prior to it merging with the 1524x914mm sewer. The sewer will be diverted under Section 104 WIA along the southern boundary between Blocks B, C and D to discharge to the 1372x914mm in the south eastern corner of the site. The existing run will be divested under Section 116 WIA
- 150mm clay foul water sewer serving Gibleys Yard enters the site approximately halfway along the southern boundary with Gilbeys Yard and crosses the site northwards, before connecting to 225mm diameter foul water serer in the access road just prior to railway bridge. The sewer will be diverted under Section 104 WIA along the southern boundary between Blocks B, C and D to discharge to the

1372x914mm in the south eastern corner of the site. The existing run will be divested under Section 116 WIA

3. 1. 2. On-site Private Drainage Network

The surveys suggest that all existing on-site surface water from roofs and hard standing areas in the car park, discharge to the large diameter combined TWU surface water sewers on site. The access road is served by its own surface water network which runs down the access road and discharges to the public sewer in Chalk Farm Road. Surveys indicate that some of the gullies around the roundabout at the western end of the access road discharge to the 225mm diameter foul water sewer coming from Juniper Crescent, which runs beneath the length of the access rod to discharge to the sewer in Chalk Farm Road.

The surveys show that the site foul water discharges to the 225mm foul water sewer running down the access road, just prior to the railway bridge.

Surface water peaks flows generated by the existing site are estimated to be around 400 l/s based on a rainfall event of 50mm/m^2/hr (BS EN 752:2008 Fig. NA.1-Storm with a 1-year return period, 5 mins duration).

Foul water peak flows generated by the existing site are estimated to be 0.91 l/s as noted in the FRA which references usage based on "*Water key performance indicators and Benchmarks for Offices and Hotels, CIRIA C657, 2006*"

3. 2. Proposed Drainage

3. 2. 1. Sewers

With the proposed external areas to the north of Blocks B and C (Goods Yard and Camden Yard) being lowered to meet the existing levels along the access road, levels above the exiting sewers running beneath these are areas will also be lowered considerably.

Through ongoing consultation with TWU, the sewers have been assessed for the relative 'Building over' and diversion applications on the basis that the sewer could potentially surcharge to a level of 30m AOD, which is 1.5m above the proposed external level in this area. This impacts both the structure, in that the sewer requires 'holding down' to mitigate against the surcharge pressure in such an event, as well as the potential for surface flooding.

TWU has advised that this surcharge level is a conservative value based on their current hydraulic model which does not have significant measured data. SGWL have installed flow monitors and rain gauges across a number of manholes on the existing sewers on the site, to collect data to further inform the hydraulic models, which in time can be used to confirm whether this surcharge level is realistic or if it can be reduced.

It should be noted that the cover levels to the sewer which the on-site sewers connect to, whether it be under the access road or in Chalk Farm Road, are at or below the lowest proposed level for the site in the vicinity of the connection and as such it is considered that the surcharge level of 30m AOD is conservative. Nevertheless, until such a time as TWU confirm that this can be relaxed, the potential for the sewer surcharging to this level has been considered within the proposed design.

A holding down structure has been designed as part of the ongoing 'Buildover' approval and new chambers within the external areas of the proposed Goods Yard and Camden Yard have been designed to have pressure rated covers, able to withstand the surcharge pressure.

Drainage serving level B1 of Blocks B and C, which are level with the external ground in these areas, will discharge to the combined sewers via Type 2/3 backflow valves. Should surcharge occur, the valves will shut off and the relative systems will have overflow's to below ground pumps which will continue to pump flows to discharge to the sewers at a higher part of the site, during a surcharge event.

A copy of the drawings detailing the proposed works to the TWU sewers are included in *Appendix B.*

3. 2. 2. Surface Water

Access Road

The proposed site is 2.86 ha including the access road, which is approximately 0.22ha. The access road drains via an existing separate 'highway' network and whilst the road is private, it provides access to the neighbouring site and serves the local bus network. Some alterations are proposed to the road which need to be constructed to adoptable standards, in agreement with the London Borough of Camden, as such this road is considered to be a public highway for the purpose of design.

The approved drainage strategy under application 2017/3847/P proposed the entire 2.86ha would be restricted to a maximum of 3x the Greefield run-off rate. However, the strategy approved under the S73 variation application 2020/3116/P, revised the strategy to exclude the 0.22ha access road area and proposed the following;

- 0.22ha access road to drain as per existing drainage arrangement
- 2.64ha remaining site to be restricted to Greenfield run-off rates (outlined in 3.2.3)

The existing drainage and services beneath the road, as well as the requirement to maintain access to the neighbouring site during development, restrict the ability to install significant attenuation below the road. It is therefore proposed that the access road area will discharge as per the existing situation, unattenuated.

The Plowman Craven survey taken on the 13/07/2020 suggest that surface water catchment by the roundabout drains to a foul network while the remainder of the access road drains to a 150/225mm diameter surface water sewer, both sewers connect downstream to a TW combined sewer running along Chalk Farm Road. The existing sewers have been modelled to check the existing capacity to accommodate future climate change and the following can be noted;

- The combined peak flow in both sewers is estimated to be 149 l/s for a 15-minute winter storm at a 1% AEP and 40% climate change factor, based on Microdrainage modelling.
- The estimated surface volume flooding , during the 1%AEP +40%cc, is 1.25m3, which would collect beneath the overhead railway bridge not exceeding a depth of around 20mm.

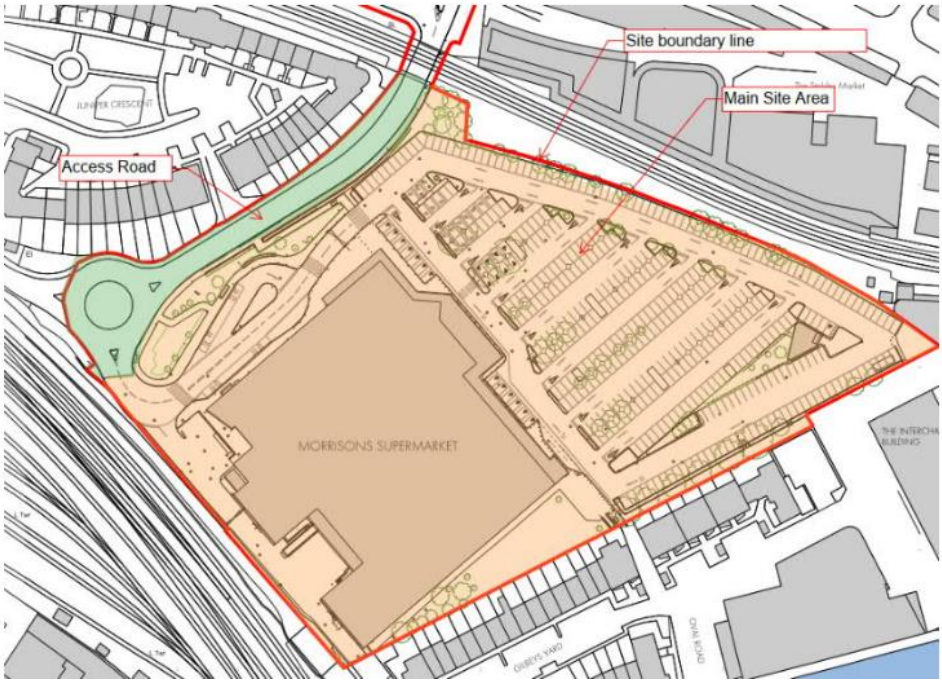


Figure 3.1 Extract from Aecom's Camden Goods Yard Stage 2+ Report' Aug. 2020

Main Site

It is proposed to restrict run-off from the remaining site to Greenfield run-off rates, as outlined in 3.2.3.

The existing 2.64 ha site area is estimated to generated around 370 l/s peak flow discharge to the sewers based on 50mm/m^2/hr rainfall (BS EN 752/:2008 Fig NA.1 – Storm with 1 year return period, 5 mins duration).

Whilst areas of soft landscaping and green roofs are proposed as part of the development, a majority of these areas are located over podiums, attenuation tanks and concrete structures and as such it has been assumed for the purpose of this report and calculation that the site is 100% impermeable. A copy of the proposed landscape layout and SUDS strategy are included in *Appendix C.*

The site, excluding the access road, can be split into two main catchments as outlined in the extract below;

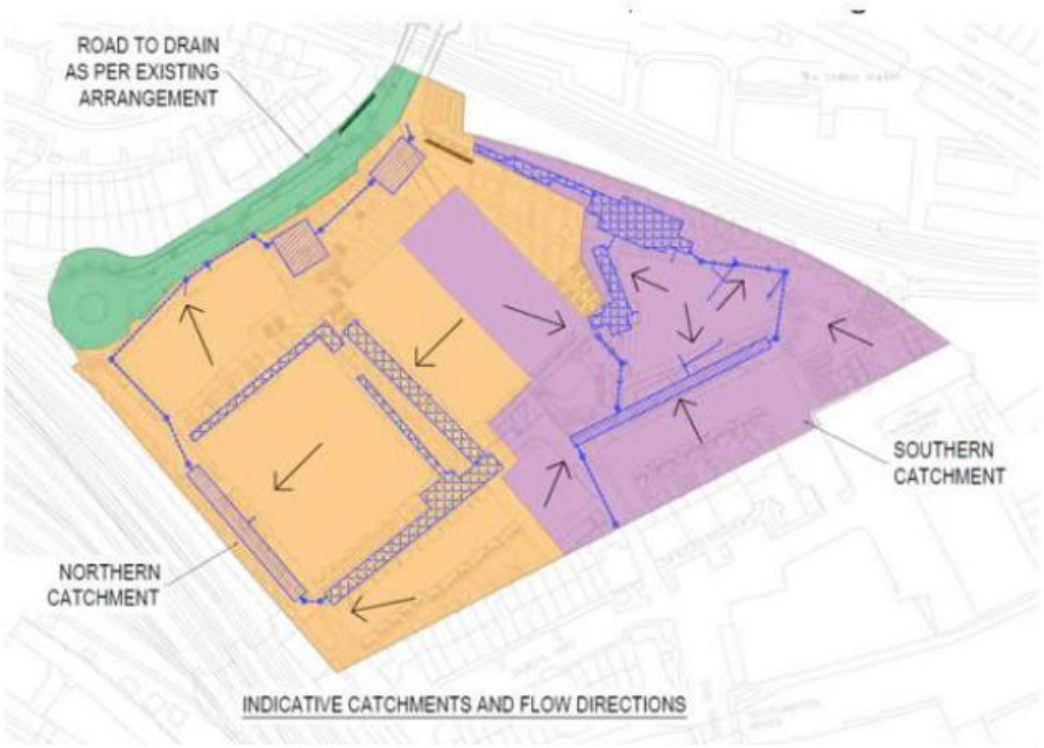


Figure 3.2 Extract from Aecom's Camden Goods Yard Stage 2+ Report' Aug. 2020

Northern Catchment

The northern catchment collects surface water from the roof and associated hardstanding areas and landscaped areas of Blocks A, F and E1 and approximately 50% of Block B roof, as well as Goods Yard and Camden Yard (lower external areas fronting the north of Blocks B and C).

Attenuation is provided within the podium landscaping between Blocks B and F and Blocks A and F. Below ground attenuation is provided beneath the western access road, beneath the terraced landscaping to the north of Block B/Goods Yard and beneath the paving in Camden Yard between Blocks B and C.

Due to the level difference across the site, with ground levels at the head of the run being some 6m higher than at the outfall location, the network has been designed as a cascading system, with multiple flow controls to attenuate water at the various levels.

The majority of the northern catchment (Catchment 1, Fig. 3.4) discharges to the existing 1524x914mm sewer via gravity, via a new combined outfall located to the north of the sewer, subject to TWU Section 106 consent. Should the sewer surcharge, which is considered to be an 'exceedance event' excess flows will overtop at the final manhole prior to connection to the sewer, which is located at the lowest point on the system and flow towards the access road, where local levels fall to a low point beneath the railway bridge.

The areas of Goods Yard and Camden Yard located to the south of the sewer (Catchment 2, Fig. 3.4) are served by a separate outfall and attenuation tank. As the proposed holding down structure and lowered cover levels mean there is insufficient depth to run drainage over the top of the existing sewers, surface water from this network will be restricted via a hydrobrake flow control and discharge to the new proposed

chamber, CWMH06, on the existing 1372x914mm sewer, via a Type 2 backflow valve (BS EN 13564). Should the sewer surcharge, the backflow valve will shut off and flows will surcharge to a pump located upstream of the attenuation tank, where flows will be pumped to the south of Block C to discharge via gravity to the same sewer, where the ground levels are some 6 m higher.

The total peak flow and storage volumes from this catchment are outlined in *table 3.1 and 3.2.*

Southern Catchment

The Southern Catchment (Catchment 3) collects surface water from the roof and associated hardstanding and landscaped areas of Blocks E2, D, C and approximately 50% of Block B roof.

Attenuation is provided within the podium landscaping around Block C and below ground between Blocks B/C and D. Whilst Blocks E1, E2 and D will be designed during Phase 2B, an allowance for the catchment of these areas are included within the design.

Due to localised level differences and to maximise the storage within the podium area, flow controls are proposed immediately downstream of the podium storage around Block C, as well as just prior to discharging to the 1372x914mm sewer.

The Southern catchment is proposed to discharge to the existing 1372x914mm sewer on the western side of Block C via a new combined outfall, subject to TWU Section 106 consent.

The total peak flow and storage volumes from this catchment are outlined in *table 3.1.*

The proposed drainage network is included in *Appendix A* and Microdrainage Simulations calculations are included in *Appendix I*

TWU have been consulted on the proposed surface water flows via a pre-planning consultation undertaken by Aecom during Stage 2 of the design. A copy of their letter is included in *Appendix E.*

Applications for the various TWU approvals pertaining to the existing sewers have been made and the consultation process is ongoing. At the time of writing this report TWU have granted technical approval for the S104/116 and Approval in Principle to the S185 proposals. A copy of these are included in *Appendix E.*

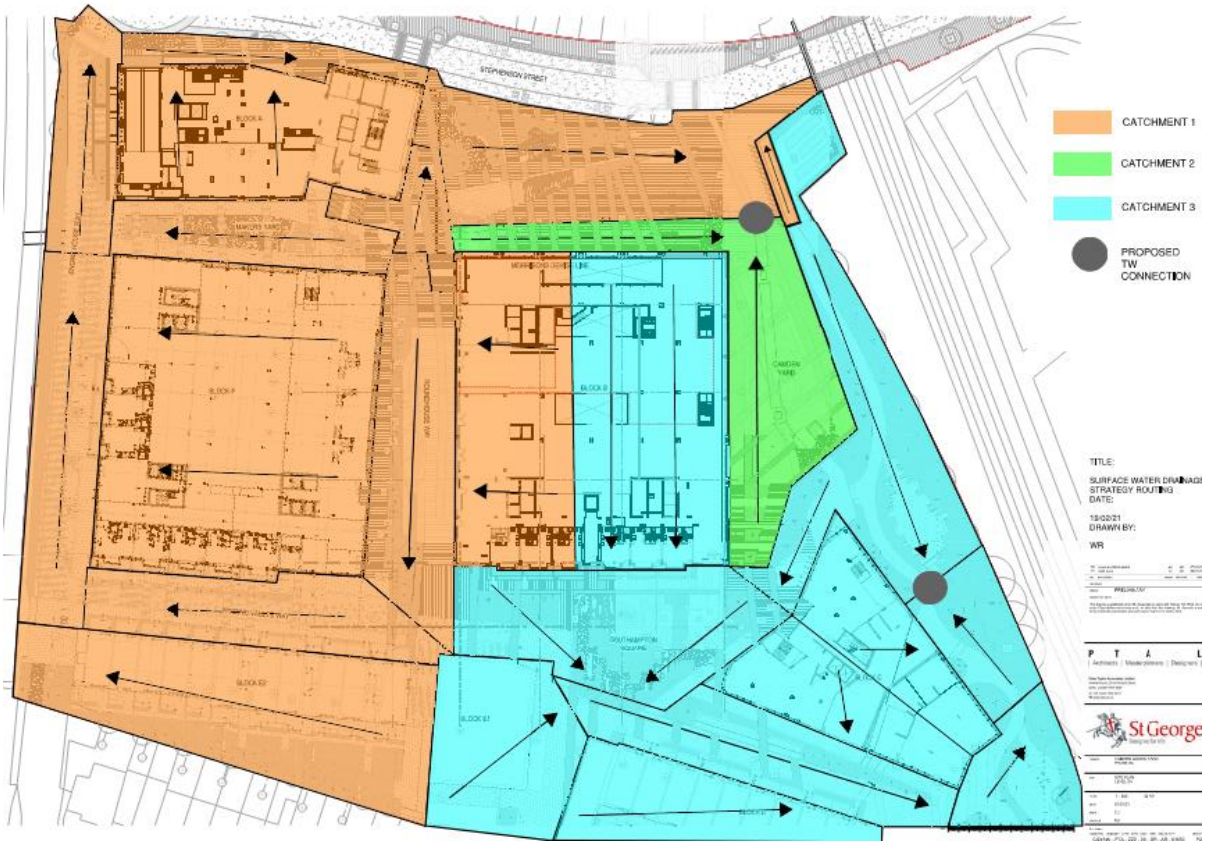


Figure 3.3 sitewide surface drainage strategy routing

3. 2. 3. Surface Water Peak Flow Tables (Main site)

The surface water network proposal is designed to contain up to the 1% AEP event, with a 40% allowance for climate change consideration. For the purpose of drainage modelling the entire site has been assumed to be hardstanding and does not account for landscape attenuating features. The following discharges have been presented to TWU in the Aecom's pre-planning consultation and capacity confirmed subsequently.

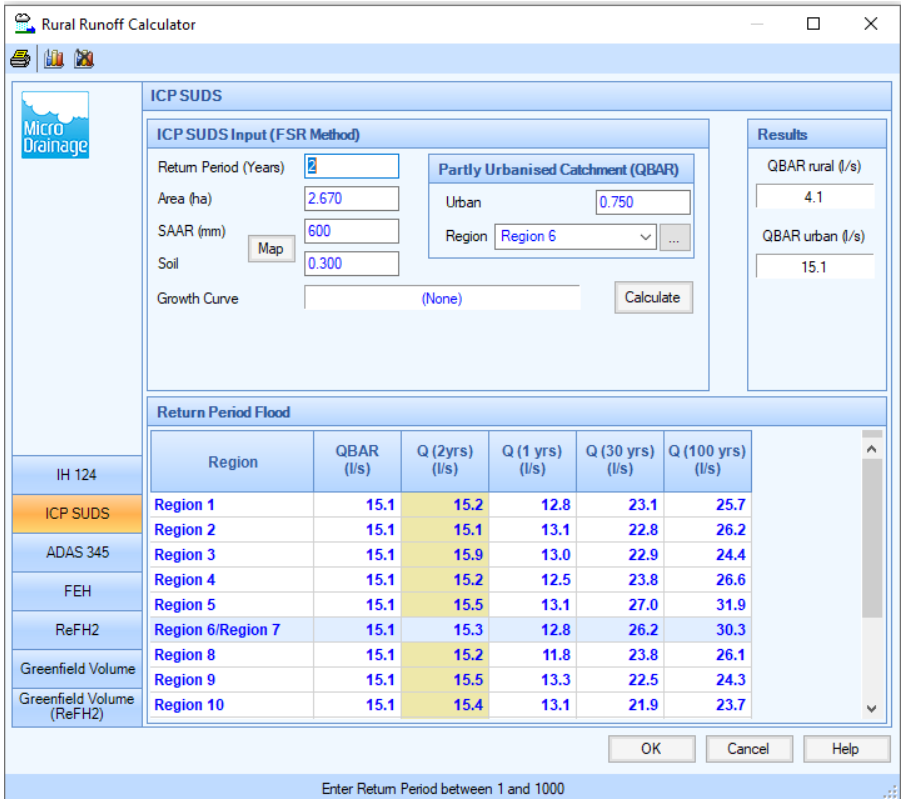
- 9.4 l/s for 100% AEP (+40cc)
- 25 l/s for 3.3% AEP (+40cc)
- 35.1 l/s for 1% AEP (+40cc)

This flows are based on Greenfield run-off as assessed by Aecom during the Stage 2 design for the site area of 2.64 ha, which excludes the site access road.

The surface water peak flow tables can be calculated using the Flood Estimation Handbook (FEH) or the Flood Studies Report (FSR). While both methods have their advantages; the FEH method has been used to outline the surface flow in this report as it is considered to be the most conservative.

Where critical storms are typically greater than 60 minutes and datasets are more recent and wider in range the FEH13 theory is used in preference to the FSR/FEH99 method. Furthermore, the FEH data tends to give higher rainfall intensity compared to FSR according to *Kellagher, R., Preliminary rainfall runoff management for developments, R&D Technical Report W5-074/A/TR1 Revision E, Joint Defra/EA*.

Data for FEH13, however, means short return periods of less than 2 years are not considered accurate and as such It is worth noting that the proposed discharges will include the 50% AEP rather than 100% AEP. To give an appropriate estimate for a 50% AEP a rural runoff calculator was run on Microdrainage using the ICP SUDS method. Assuming a partly urbanised catchment of 0.75 it can be seen *in figure 3.4* that Qbar is given as approximately 15 l/s for a 50% AEP.



Region	QBAR (l/s)	Q (2yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	15.1	15.2	12.8	23.1	25.7
Region 2	15.1	15.1	13.1	22.8	26.2
Region 3	15.1	15.9	13.0	22.9	24.4
Region 4	15.1	15.2	12.5	23.8	26.6
Region 5	15.1	15.5	13.1	27.0	31.9
Region 6/Region 7	15.1	15.3	12.8	26.2	30.3
Region 8	15.1	15.2	11.8	23.8	26.1
Region 9	15.1	15.5	13.3	22.5	24.3
Region 10	15.1	15.4	13.1	21.9	23.7

Figure 3.4 greenfield runoff calculator for 2 year return period (50% AEP)

The model results presented in the tables below have the 1%, 3.3% and 50% AEP events with up to 40% climate change as indicated, for the 480 mins, winter storm event, as this event generally provided the greatest outflow rate. A copy of the full Microdrainage model results are included in *Appendix I.*

It should be noted that it has not been possible to achieve the 50% AEP Greenfield rates due to the complex nature of the cascading drainage system, which utilises multiple complex controls. However, the 3.3% and 1% AEP Greenfield rates are achieved, in line with Aecom's strategy.

It is also worth noting that the Greenfield rates presented in Aecom's May 2020 strategy assumed a 0% urbanised catchment. Given the fully developed, impermeable nature of the existing site it would be more usual to apply the highest urbanisation factor of 75% to the calculations, which would have produced Greenfield rates of 60.7 l/s, 52.2 l/s and 25.5 l/s for the 1%, 3.3% and 100% AEP storm events respectively. As such we conclude that the proposed peak discharge rates are below the Greenfield rates for this catchment.

Sitewide peak flow rates l/s			
Catchment	Annual exceedance probability		
	50%	3.3%	1%
1	13	13	20.9
2	1.8	1.9	1.8
3	6.1	9.4	11.7
Total	20.9	24.3	34.4

Table 3.1 – sitewide peak flow rates for a 480 minute winter rainfall event (+40cc)

SITE WIDE CATCHMENT		
Catchment	**Area (ha)**	**Storage volume (m^3)**
Northern - 1	1.36	1123
Northern - 2	0.141	106
Southern - 3	1.136	1027
Total	2.637	2257

Table 3.2 – network associated areas and storage volume

3. 2. 4. Foul Water

Foul water from the site is proposed to discharge to the existing combined sewers as per the S106 application to connect to a public sewer. The five connection points are illustrated on the extract below and can be seen in more detail on the attached S106 application in *Appendix K.*

Connection 1

Foul water from the Block F residential units is collected at high level basement and discharges to a new below ground network located within the access road to the west of Block F via gravity. Foul drainage generated from the gullies within the car parking areas and plant rooms in the basement levels, will be collected below ground before being pumped to the high-level network within the block.

Drainage from Block F and part of future Block E2 will discharge to a new 3.6m diameter chamber, CWMH05, constructed on the existing 1524x914mm sewer located just outside the basement line, subject to TWU Section 106 consent. The estimated peak flow rate for this connection is 9.3 l/s assuming half of block E2 drains along this route pending confirmation by M&E engineers.

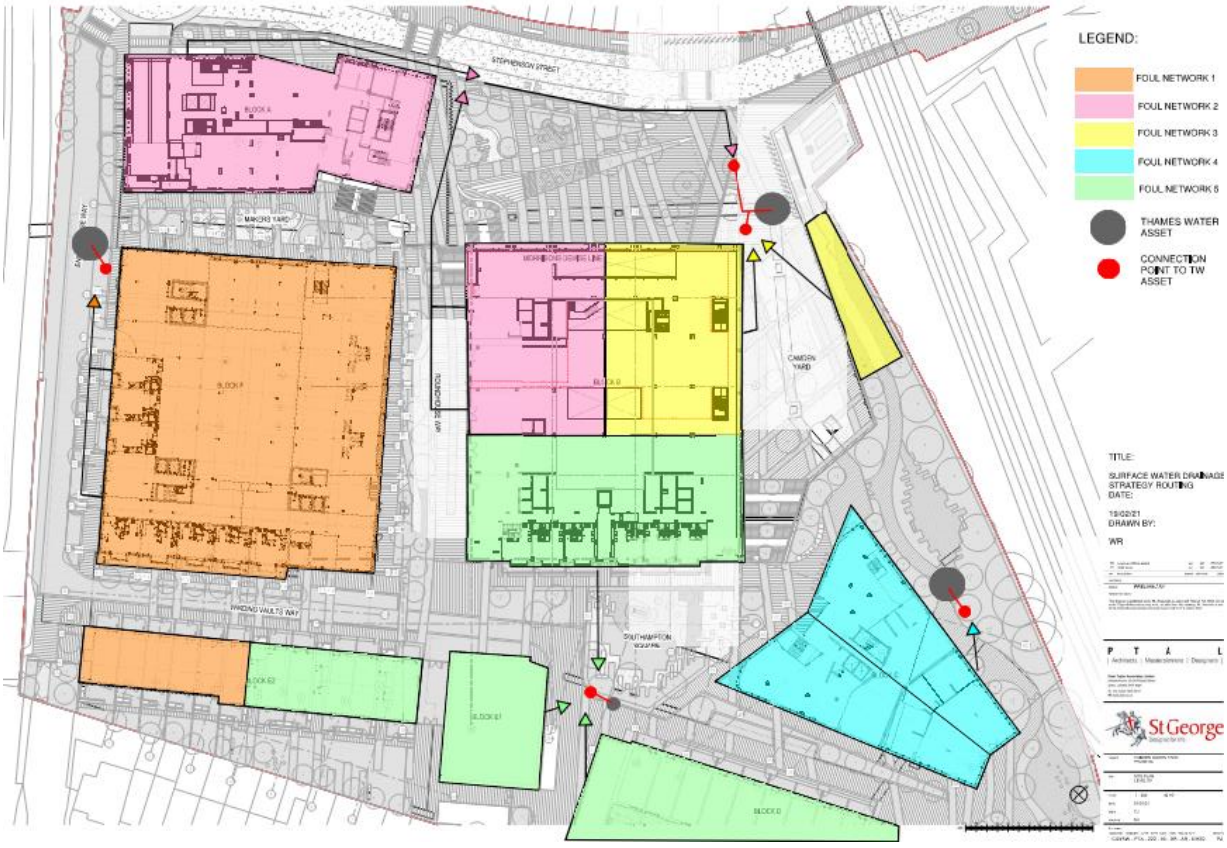


Figure 3.5 foul network strategy routing

Connection 2

Foul water from Block A residential units discharges via gravity to a new below ground network running to the north of Block A along the access road. Foul drainage generated from the gullies within the car parking areas and plant rooms in the basement levels, as well as the spa and cinema will be collected below ground before being pumped to the high-level network within the block.

Drainage from the upper levels of the western side of Block B will discharge to a below ground network located within the podium landscaped build-up and discharge under gravity to the north, to connect to the below ground network serving Block A. This network will discharge to the 1524x914mm sewer via a new combined connection just upstream of existing manhole EXMH 4 located in the north east corner of the site where the two large diameter sewers combine. The estimated peak foul flow rate for this connection is 6.3l/s (this will also serve surface water running into this connection).

Connection 3

Foul water from the majority of the lower ground B1 areas of Blocks B (Morissons) and C, together with the upper levels on the eastern half of Block B, will discharge via a gravity below ground network to the 1372x914mm sewer in Camden Yard. Flows will discharge through a Type 3 backflow valve (BS EN 13564) just prior to connection to the sewer, which will shut off in the event of a sewer surcharge.

The Morrison's delivery area is located to the south east corner of Block B level B1 and is some 2m lower than the external ground levels. This area, together with a small section of the adjacent Morrisons shop floor will discharge to a below ground gravity system which discharges to a pump located at the bottom of the stairs between Block B and C.

And overflow from the gravity system serving the rest of Blocks B and C will connect to the pump. Should a surcharge event occur, flows from this network will overflow to the pump where they will be pumped to the outfall to the south of Block C and continue to discharge.

The pump will be designed on a duty/assist basis, with the duty pump sized for the Morissons delivery area and adjacent shop floor. The second (assist) pump will be sized to take the flow of the additional Block B and C areas. It is proposed that he pump will be designed to have 24hr storage based on the peak flows generated by the duty system only, subject to building control approval.
The estimated peak foul flows from these areas are 4.7 l/s

Connection 4

Connection 4 serves the upper levels of Block C, which discharge via gravity to the new combined manhole CWMH02 on the existing 1372x914mm sewer. The estimate peak foul flows are 4.8l/s

Some of the level B1 units in Block C will need to be pumped directly at source due to the location and level of the existing sewer in this location. These units, together with the pumped foul water drainage from the 'Connection 3' area discussed above, will also discharge via connection 4.

Connection 5

Connection 5 serves the Town houses to south of Block B as well as the upper levels in the south western corner of Block B and future Blocks E1, E2 and D.

Drainage from these blocks discharge via a proposed gravity system to outfall to the newly diverted sewer from Gilbey's Yard. The estimate peak foul flows are 11l/s

The proposed foul water drainage strategy is included in *Appendix B.* Proposed peak flows Frome the relative blocks have been estimated using the population method, the results of which are included in *appendix H.*

Thames water have previously confirmed the pre-planning enquiry capacity for foul flow subject to design changes on the 4th May 2020.

It is assumed that any future commercial kitchen or food and beverage establishment will provide grease traps at source, which should be stipulated within the tenancy agreements and Operations and Maintenance manuals.

3. 2. 5. Design Criteria

When designing the new surface water drainage network, it should be assessed against the following criteria to comply with British and European Standards BS EN 16933-2:2017;

- No significant surcharging (gravity flow only) for storm flows with a 50% AEP
- No flooding for storm flows with a 3.3% AEP
- No flooding off-site or flooding that would present a risk to person or property for storms with a 1% AEP
- An additional 40% allowance for climate change will be applied to all calculations

Based on the above assessment, the volume of water to be stored will be determined using the MicroDrainage analysis software based on the following input variables;

- Storm Water Return Period - 1 in 100 years + 40%
- Site location – to determine the rainfall hyetograph characteristics
- Pipe network volume – calculated by the automated process

Foul water drainage design will be in accordance with BS EN 752:2017 and BS EN 16933-2:2017.

Flow rates will be based on the following;

- The frequency factor will be determined by the buildings use. (Table 3 BS EN 12056-2:2000)
- The volume of discharge will be determined by the number of appliances. (Table 2 BS EN 12056-2:2000)

The value of the summation of discharge units is then converted into a flow rate using where applicable cl 6.3.3 of BS EN 12056-2:2000.

Where the flow rate requires the use of a sewer greater than 150mmØ, the Population Method will be used based on flows of 0.015 l/s/person.

For peak flow, the maximum proportional depth is to be no more than 0.75.

Minimum gradients to achieve self-cleansing velocities will be in accordance with BS EN 16933-2:2017 NA.5.2.4. Where it is not possible to achieve self-cleansing velocities the following table will be used;

Table NA.7 — Minimum recommended gradients for foul drains and sewers

Peak flow [l/s][a]	Pipe size [mm]	Minimum gradient[b,c,d]
<1	75	1 in 40
	100	1 in 40
>1	75	1 in 80
	100	1 in 80[e]
	150	1 in 150[f,g]

a Peak flows should be based on probability flow calculation methods.

b These gradients have been empirically demonstrated on the basis of 6 l WC flush volumes. Further research is necessary to evaluate the recommended gradients for use in systems with very low WC flush volumes.

c Exceptionally, where the length of drain or sewer serving a small number of properties is very long, steeper gradients may be required.

d Where ground settlement is expected, steeper gradients are recommended.

e Minimum of one WC connected.

f Minimum of five WCs connected.

g Exceptionally, where a 150 mm diameter pipe is used to carry flows from fewer than five WCs, the minimum gradient should be 1 in 60.

Table 3.3 – National Annex table for minimum recommended pipe gradients

It may be possible to use flatter gradients if standards of design and workmanship are high, and where buildings are close together so that the lengths of drain or sewer are short. Exceptionally, where the length of drain or sewer serving a small number of properties is very long, steeper gradients may be required.

4. SUDS

4. 1. 1. SUDS Assessment

Guidance from the Camden local plan Policy CC3 states that the council require developments to utilise SuDS in line with the drainage hierarchy to achieve greenfield run-off rate where feasible. The following list

a) Store rainwater for later use
b) Use infiltration techniques, such as porous surfaces in non-clay areas
c) Attenuate rainwater in ponds or open water features for gradual release
d) Attenuate rainwater by storing in tanks or sealed water features for gradual release
e) Discharge rainwater direct to a watercourse
f) Discharge rainwater to a surface water sewer/drain
g) Discharge rainwater to the combined sewer

A copy of the SUDs Strategy Plan by Place, is included in *Appendix C* which outlines the key SUDs strategy across the site and addresses the hierarchy as follows;

a) Store rainwater for later use

A number of green roofs are proposed across the development which will store water for short periods of time, encouraging evaporation and evapotranspiration and reducing run-off to sewers during low intensity rainfall events.

There are also significant podium landscaped areas across the site which will act similarly to the green roof areas. These will also be linked to podium storage features/blue roof areas, allowing excess stored water to be re-used for short periods of time.

Proposed rain gardens also intercept surface water run-off from adjacent areas, allowing water passing through to be used for by the vegetation prior to discharging to the sewers.

b) Use infiltration techniques, such as porous surfaces in non-clay areas

The proposed development is dense, underlain by London Clay, with the sewers creating significant below ground obstructions in the external areas. As such, features which infiltrate into the ground are not feasible. However, it is proposed that tanked permeable paving and rain gardens are used across various external proposed areas, which would be positively drained to the site drainage network.

These features would encourage evaporation and evapotranspiration, reducing run-off to sewer during low intensity rainfall as well as offering additional benefits through filtering run-off at source and providing a natural wildlife habitat.

"*Due to thickness of mainly clayey Made ground it is considered that soakaways are not appropriate for the disposal of storm water – Off-site storm water disposal should therefore be sought" – Ground Investigation report, Geo Environmental 12th October 2020.*

c) Attenuate rainwater in ponds or open water features for gradual release

Due to the dense nature of the development, open water features or ponds are not feasible for use on the site.

d) Attenuate rainwater by storing in tanks or sealed water features for gradual release

The surface water strategy proposes to use geocellular attenuation tanks both on podium, integrating the landscaping into a blue roof storage system, as well as below ground.

e) Discharge rainwater direct to a watercourse

Whilst the Regent's Canal is located near the southern site boundary, the Gilbey's Yard development lies in-between, requiring any route to the canal to cross 3rd party land.

It is known that all surface water from Gilbeys Yard discharges to the public combined sewers on the site rather than to the canal and this network is being diverted as part of the development proposals. As such it is not considered feasible to discharge surface water to the canal.

f) Discharge rainwater to a surface water sewer/drain

On-site surveys have demonstrated that there are no surface water sewers within the main site area, with only a small 'highway' drain running down the access road, which in turn connects to the combined sewer in Chalk Farm Road.

All existing surface water drainage on-site discharged to the public combined sewers crossing the site. As such it is not considered feasible to discharge surface water to dedicated surface water sewer.

g) Discharge rainwater to the combined sewer

It is proposed to discharge surface water to the public combined sewers on-site at a significantly reduced rate to existing.

The proposed strategy considers the drainage hierarchy within the feasibility of the development following guidance from Ciria Report 609.

4. 1. 2. SUDS Features

Green Roofs

Green roofs are proposed across a number of the roof areas as identified on the 'SUDS Strategy' by Place, included in *Appendix C* The detailed design of these areas will be developed by Place during detailed design. Maintenance requirements for these areas are noted on the SUDS strategy.

Rain Gardens

Rain gardens are proposed to intercept run-off from adjacent paved areas between Blocks F and B at podium level and in front of Block B/Morrisons store at level B1. A typical section through these areas is included on the SUDS Strategy plan. Excess water will drain via a below ground filter drain (perforated pipe) which will in turn discharge to the podium attenuation in this area.

The detailed design of the rain gardens will be developed by Place during detailed design. Maintenance requirements for these areas are noted on the SUDS strategy.

Permeable Paving

Numerous areas of permeable paving are proposed across the site, on top of the podium as well as over ground. All permeable paving will be tanked, due to their location over the podium, concrete obstruction of existing London Clay substrata which is impervious. Water will pass through the permeable paving and be collected within the sub-base layer, draining either;

- directly to attenuation tanks located immediately beneath the permeable paving
- attenuation tanks located adjacent to the permeable paving via a below ground pipe
- to the adjacent surface water drainage network via a below ground pipe

Indicative sections showing these arrangements are included in *Appendix C* Maintenance requirements for these areas are outlined in section 5.

5. Below Ground Drainage & SUDS Maintenance Plan

5. 1. Introduction

All below ground drainage components on the development should be inspected regularly and maintained to ensure design flow conditions are maintained. Inspection and maintenance will be the responsibility of the Client appointed building management company.

It is recommended that a Below Ground Drainage Maintenance Plan is implemented. Reference should be made to Section 6 of BS EN 752:2017 but in general, maintenance activities are likely to comprise of:

- Regular Maintenance – Litter collection, gardening to control vegetation growth, inlet checks.
- Occasional Tasks – Checking the SuDS features and removing any silt/blockages that build up.
- Occasional Tasks – Checking blue roof drainage/outlets as specified by specialists.
- Occasional Tasks – Schedule checks on flow monitoring and quality control carried out by laboratory tenant
- Remedial Work – Repairing damage where necessary.

5. 2. Proposed Below Ground Drainage Maintenance Plan

Below is an indication of the minimum expected undertakings to inspect and monitor the onsite below ground drainage at Camden goods yard. The below list is not extensive and is to be read in conjunction with any specific inspection and maintenance requirements set by product manufacturers.

A land ownership boundary will demarcate the region in which the owner or appointed building management company will maintain drainage features inside of this boundary. The owner or appointed building management company will be responsible for the maintenance of drainage features inside this boundary.

	Regular Maintenance	Frequency	Responsibility
1	Litter management		
1.1	*Regularly remove litter from paving, drainage channels, blue roofs, permeable paving, gullies and manhole sumps*	Monthly	Client or appointed Maintenance Contractor
2	Inlets and Outlets		
2.1	*Inspect inlet structures such as RWP's, channel drains and gullies removing silt, as necessary. Check for any physical damage.*	Monthly	Client or appointed Maintenance Contractor
3	Subterranean Works		
3.1	*Inspection of flow control device to identify any areas that are not operating correctly and clear out and debris from chamber.*	Monthly for first 3 months then every 6 months	Client or appointed Maintenance Contractor
3.2	*Inspect and identify any areas of pipework that are not operating correctly, undertake*	Monthly for first 3 months then annually	Client or appointed Maintenance Contractor

	remedial works if required.		
	Occasional Maintenance		
3.3	*Inspect drainage runs using CCTV technology and clean with powered jet cleaner where required*	Every 6-8 Years	Client or appointed Maintenance Contractor
4	Inspection and control chambers		
4.1	*Inspect and clear out sediment from catchpit*	Annually	Client or appointed Maintenance Contractor
4.2	*Remove inspection chamber covers, inspect for free-flowing water and remove debris/silt as required*	Annually	Client or appointed Maintenance Contractor
4.3	*Inspect quality control and flow monitoring chambers for laboratory usage*	Monthly for first 3 months then annually	Specialist Maintenance Contractor
5	**Remedial Management**		
5.1	*Remedial works carried out as required following maintenance inspections*	As required	Specialist Maintenance Contractor

Note:

- Special inspection and immediate appraisal may be required in the event of a structural accident, fire, flooding, reported structural distress or suspected inadequacy.
- It is recommended that in situations where an expected severe storm is to hit that all gullies, drainage channels and manhole sumps are cleared of any debris material.
- Refer to the manufactures of all attenuation systems and flow control devises for their specific inspection regime requirements for their products.
- All inspections should be carried out by the appropriate persons and they should be confined space trained if entering below ground structures such as manholes.

5. 3. SUDS Maintenance Requirements

Regular maintenance on SuDS is required for blue roofs, permeable paving and attenuation systems. *Appendix C* drainage strategy will show indicative locations of the SuDS to be maintained. Further information will be provided in the detailed design. The owner or appointed building management company will be responsible for maintaining continual operation of SuDS within the site boundary to a minimum of CIRI SuDS Manual guidance.

Maintenance Schedule	Action	Frequency
Green roofs operations and Maintenance Requirements (taken from green and brown roofs guidance)		

Regular inspections	*Inspect components including soil substrates, vegetation, irrigation systems, membranes and roof structure for proper operation, integrity of waterproofing and structural stability*	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drainage system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	*Remove debris and litter to prevent clogging of inlet drains and interference with plant growth*	Six monthly and annually or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly and annually or as required
Remedial Actions	*if drain outlet has settled, cracked or moved, investigate and repair as appropriate*	As Required
<u>Attenuation Storage tanks Operations and Maintenance Requirements</u>		
Regular Maintenance	*Inspect and identify areas that are not operating to requirement. Take remedial action if needed*	Monthly for 3 months, then annually
	Remove debris from catchment ingress where it may affect performance of system	Monthly
	For system where rainfall infiltrates into tank above check ingress at filter point, vent pipes and rodding eyes for sediment blockage	Annually
Remedial actions	*Repair/replace inlets, outlets, overflows and vents*	As Required
Monitoring	*Survey inside of tank for sediment build-up and remove if necessary*	Every 5 years or as required
<u>Permeable Paving Operations and Maintenance Requirements</u>		
Monitoring	*Ensure that any joints don't get blocked. (avoid placing loose materials onto the surface – this could block joints)*	As required
Monitoring	*Every 12 months, undertake a visual inspection to detect detritus and silt build up*	Annually
Regular Maintenance	*Gently sweep joints with a stiff brush to clean surface and dislodge any build-up in joints*	As required
Remedial Actions	*Remove any excessive vegetation growth in the joints manually. Avoid using herbicides*	Annually
Remedial Actions	*In winter months, pure rock salts as a de-icer is preferred – avoid salts which contain abraisive sand or grit*	As required
<u>Rain Gardens Operations and Maintenance Requirements</u>		
Regular	*Mulching – keeps soils moist, reducing watering, reduces weed*	Annually

Maintenance	*growth*	
Regular Maintenance	*Adding compost material – to retain water and maintain nutrients*	Annually
Regular Maintenance	*Vegetation management – remove and replace dead plants*	Annually
Regular Maintenance	*Weeding – Ensure root removal*	Six months and annually or as required
Remedial Actions	*Litter removal*	As required
Monitoring	*Inlet/Outlet cleaning*	Annually
Remedial Actions	*Watering – plants should be drought tolerant, but may need some assistance in long periods of heat and dryness*	As required

6. Conclusions

This report demonstrates that the proposed drainage strategy is in-line with the principles of the strategy presented by AECOM in the Surface Water Drainage Strategy', May 2020, submitted in support of planning application 2020/3116/P and addresses the requirements of Condition 47.

Surface water from main development site, excluding the access road, will not exceed the Greenfield 3%-1% run-off rate, but will marginally exceed the 50% calculated Greenfield rate. The existing access road will continue to discharge unrestricted via the existing 'highway' network to minimise disruption to the neighbouring site and in-line with the approved strategy.

Surface water will be attenuated on-site through a cascading system of flow controls and attenuation provided at various levels below ground and at podium levels. A total estimated volume of 2257m^3 will be provided through below ground attenuation storage in addition to blue roof attenuation located at podium level and incorporated into the landscaped finishes.

Additional SUDS features in the form of green roofs, permeable paving and rain gardens are proposed to improve water quality, provide habitat for wildlife and reduce run-off to the sewer during low intensity rainfall events through evaporation and evapotranspiration.

Peaks surface water discharge to sewer from the main site, excluding the access road, will not exceed 35.1l/s for storm event up to and including the 1% AEP, with an additional 40% allowance for climate change.

The proposed development will significantly decrease peak surface water discharge to the local sewer network, decreasing flood risk both on and off-site post development.
Foul water from the site will discharge by gravity to the existing combined sewers on the site where feasible. Basement areas will be pumped to high level, before discharging via gravity and the low-lying areas will be backed up by pumps to mitigate against potential sewer surcharge events.

The total peak foul flow generated by the development is estimated to be 34.5 l/s. Whilst the development proposes a significant increase in foul water flows post development, the reduction in surface water discharge to the combined sewers more than mitigates the increase in foul flows, decreasing flood risk off-site.

TWU were consulted on the proposed drainage strategy by AECOM during Stage 2 of the design in May 2020 and confirmed capacity within their existing network for the proposed development.

Additional flow and rainfall monitoring has been installed by SGWL across the site to inform TWU's hydraulic models and clarify the potential risk of surcharging of the public sewers within the development. Additional backflow prevention has been proposed to mitigate against the potential risk of surcharging sewers to the lower areas of the proposed site, until such time that TWU can confirm the risk has been negated.

Additional sewer surveys are proposed to be undertaken to clarify the existing size and location of the outfall of the public sewers from the site.