whitby wood

Hayes Park West

Drainage Strategy Report

Client: Shall Do Hayes Developments Ltd

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1 INTRODUCTION

Whitby Wood have been commissioned for the design of the below ground foul and surface water drainage systems for the development at Hayes Park West (hereafter referred to as "the Site").

This Drainage Strategy Report (DSR) has been prepared in accordance with National Planning Policy Framework (NPPF) in support of the detailed planning being submitted Shall Do Hayes Developments Ltd ('the Applicant'). The application will be submitted to London Borough of Hillingdon ('the Council'). This report has been undertaken to ascertain the constraints of below ground drainage in order to redevelop the Site and allow to the introduction of Sustainable Drainage Systems (SuDS) to manage surface water.

Sources of Information:

A review of the relevant information from a range of sources has been undertaken and includes the following:

- BS EN12056-2:2000, Gravity drainage systems inside buildings (2010);
- CIRIA, The SuDS Manual (2016);
- Building Regulations Part H;
- BS EN 752:2017, Drainage & Sewer Systems Outside Buildings;
- Design and Construction Guidance (DCG) – Sewerage Sector Guidance (for adopted connections);
- Hillingdon Borough Council, Local Plan part one (2012) and two (2020).
- Hillingdon Borough Council, Local Flood Risk Management Strategy (2015).
- West London, Strategic Flood Risk Assessment (2017).
- British Geology Survey [Accessed August 2025];
- National Planning Policy Framework (2025);

1.1 Site Location and Description

The Site is located at Hayes Park West, Hayes Park, Uxbridge, UB4 8FE in the London Borough of Hillingdon. The Site is centred on a National Grid Reference Number of 508815E, 182574N. A Site Location Plan is shown in Figure 1, which can also be found in Appendix A. The existing Site is comprised of 2 storey car park.

FIGURE 1 – SITE LOCATION PLAN

1.2 Existing Drainage

A Thames Water Asset search has demonstrated that there are surface and foul water sewers Hayes Site Road and Mead House Lane to the South of the Site as shown in **Appendix B**. The Asset map does not include the diameter of either the foul or surface water sewers. The cover level and invert level of the manholes are also not provided. There is private drainage within the Site boundary, a CCTV survey was conducted which provides information on the line and level of the existing drainage.

1.3 Geology

Information published by the British Geological Survey indicates that the bedrock geology of the Site is London Clay which consists of clay and silt. The Site belongs to soilscape 18 – slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

1.4 Proposed Development

Partial demolition and redevelopment of the existing multi storey car park to provide new homes (Use Class C3), landscaping, car and cycle parking, and other associated works.

In summary, this application is seeking to deliver the following:

- The partial demolition of the existing multistorey car park and construction of new 4 storey residential development.

- 52 new homes (Class C3) comprising a mix of 1-bedroom and 3-bedroom homes.
- A high proportion of open space and amenity space across the site totalling 3599 sqm, including the provision private gardens, terraces and balconies, new play spaces, internal ancillary facilities, and extensive communal areas surrounding the building. This includes:
- The proposed development will seek to promote sustainable modes of transport and will provide the following:
  - 46 sqm internal communal amenity
  - 1733 sqm external communal amenity
  - 1655 sqm private external amenity
  - 161 sqm play space (doorstep play for children aged 0-4 years)
- The proposed development will seek to promote sustainable modes of transport and will provide the following:
  - 107 cycle parking spaces allocated as follows:
  - 97 cycle parking spaces allocated to the new homes.
  - 10 cycle parking spaces allocated to visitors to the site.
  - 52 vehicle parking spaces allocated as follows:
  - 52 (49 standard and 3 accessible) vehicle parking spaces allocated to the new homes.

2 DRAINAGE DESIGN POLICIES

The following design guidance will need to be adhered to for the proposed foul and surface water drainage system that will serve the Site.

- Building Regulations Part H.
- National Planning Policy Framework (NPPF).
- Design and Construction Guidance (DCG) – Sewerage Sector Guidance (for adopted connections).
- BS EN 752:2017, Drainage & Sewer Systems Outside Buildings.
- BS EN 12056-1:2000, Gravity Drainage Inside Buildings.

2.1 Overall Site Drainage Requirements

There are a range of requirements which the proposed drainage system is expected to meet. These have been set out by various guidance documents and stakeholders. The main requirements from each guidance document or stakeholder have been set out in the table below.

TABLE 1 – REQUIREMENTS FOR THE PROPOSED DRAINAGE SYSTEM

Source/Stakeholder	Requirements
National standards for sustainable drainage systems (SuDS)	• Where runoff from the development is to an above ground surface water body that can accommodate uncontrolled surface water discharges without any associated environmental impact, then the peak flow control and volume control standards may not need to apply, subject to written approval by the relevant risk management authority. • The first 5mm of rainfall for the majority of rainfall events should not result in runoff from the site to surface waters or piped drainage systems. • When discharging to an above ground surface water body, sewer or other piped drainage system, the surface water runoff rate for the 1 in 2-year event shall be controlled to ensure development runoff from an event of this magnitude has no negative impact, and the 1 in 100-year event shall be controlled to ensure the runoff from the development does not increase flood risk elsewhere. • Any flooding from the surface water drainage system for events up to the 1 in 100-year event shall be managed within the development. • The risks (both on and off the development) associated with flooding from the surface water drainage system for exceedance events greater than the 1 in 100-year event shall be appropriately managed. • The peak allowable discharge rate from the development to surface waters or sewers for the 1 in 2-year event shall be limited to the equivalent 1 in 2-year greenfield runoff rate, or 3 l/s/ha, whichever is the greater. • Where the volume of runoff discharged from the development to surface waters or sewers for the 1 in 100-year, 6-hour rainfall event is greater than the volume of greenfield runoff for the same rainfall event, the peak allowable discharge rate from the development for the 1 in 100-year event shall be limited to the 1 in 2-year greenfield runoff rate or 3l/s/ha, whichever is the greater. • Where the volume of runoff discharged from the development to surface waters or sewers for the 1 in 100-year, 6-hour rainfall event is less than or

	equivalent to the volume of greenfield runoff for the same event, the peak allowable discharge rate from the development for the 1 in 100-year event shall be limited to the 1 in 100-year greenfield runoff rate or 3l/s/ha, whichever is the greater. • For previously developed sites a 'relaxation factor' shall be applied to the target 1 in 2-year and 1 in 100-year greenfield runoff rates where evidence is provided that demonstrates why greenfield runoff or 3l/s/ha rates cannot be achieved and this is agreed with the approving body. This relaxation factor shall be no greater than 5 times the greenfield runoff rate
Design and Construction Guidance – Sewerage Sector Guidance Appendix C (2020)	• Where a component is designed to convey or store flows in excess of the 1 in 30-year return period event, the designer should demonstrate that the upstream system (including any inlets such as gullies or pervious paving) has the capacity to allow the flows to reach the component. • Where an overland flow route is used, it should not be designed to operate more frequently than in a 1 in 30-year return period design rainfall event. • Design foul water peak flow rates should be 4000L per dwelling per day.
Building Regulations Approved Document H	• Surface water shall discharge to one of the following listed in order of priority: a) An adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable, b) A watercourse; or where that is not reasonably practicable, c) A sewer.
Sewerage Undertaker (Thames Water)	• A pre-development application is required to check the public sewer has capacity for the proposed discharge rates. No final consent has been received at the time of drafting the report. • A section 106 application to connect to the public sewer will need to be submitted for any new connections to the public sewer. • If the network is to be adopted, then a S104 application will need to be made in this instance. • If any existing sewers require diverting, then an application to Thames Water to divert a public sewer under section 185 will need to be made. • A section 116 application for the removal of public sewers will be required for any abandoned public sewers. • A build-over agreement is required to build over any existing assets.
Hillingdon Borough Council (LLFA)	• Acting as the LLFA, any guidelines and policies outlined in the local Surface Water Management Plan or Local Plan should be adhered to. • Where possible the proposed discharge rates should be discussed and approved with the LLFA as early as possible. Conversations with the LLFA to agree discharge rates are ongoing.

2.2 Planning Policy Requirements

The NPPF (National Planning Policy Framework) specifies that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the Site prior to the Proposed Development. Opportunities to reduce the flood risk to the Site itself and elsewhere, taking climate change into account, should be investigated. The drainage proposals within this strategy have been prepared to meet planning policy requirements.

2.3 London Plan

The London Plan is a framework which should be used for all developments within London. Policy SI 12 of the London Plan 2021 is specific to flood risk management and all development proposals should adhere to; the policy has been reproduced below.

A. Current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers, and infrastructure providers.
B. Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London.
C. Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.
D. Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.
E. Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.
F. Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.
G. Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat.

2.4 Local Plan

Hillingdon's Local Plan is a framework which should be used for all developments within the borough. Within the this documents are Polices that outlines the strategic principles, spatial strategy and technical criteria to follow and implement when considering flood risk management:

2.4.1 Local Plan part one (2012)

The Council will require new development to be directed away from Flood Zones 2 and 3 in accordance with the principles of the National Planning Policy Framework (NPPF). The subsequent Hillingdon Local Plan: Part 2 -Site Specific Allocations LDD will be subjected to the Sequential Test in accordance with the NPPF. Sites will only be allocated within Flood Zones 2 or 3 where there are overriding issues that outweigh flood risk. In these instances, policy criteria will be set requiring future applicants of these sites to demonstrate that flood risk can be suitably mitigated. The Council will require all development across the borough to use sustainable urban drainage systems (SUDS) unless demonstrated that it is not viable. The Council will encourage SUDS to be linked to water efficiency methods. The Council may require developer contributions to guarantee the long-term maintenance and performance of SUDS is to an appropriate standard.

2.4.2 Local Plan part two (2020)

Management of Flood Risk:

A. Development proposals in Flood Zones 2 and 3a will be required to demonstrate that there are no suitable sites available in areas of lower flood risk. Where no appropriate sites are available, development should be located on the areas of lowest flood risk within the site. Flood defences should provide protection for the lifetime of the development. Finished floor levels should reflect the Environment Agency's latest guidance on climate change.
B. Development proposals in these areas will be required to submit an appropriate level Flood Risk Assessment (FRA) to demonstrate that the development is resilient to all sources of flooding.
C. Development in Flood Zone 3b will be refused in principle unless identified as an appropriate development in Flood Risk Planning Policy Guidance. Development for appropriate uses in Flood Zone 3b London Borough of Hillingdon Local Plan Part 2 - Development Management Policies 80 will only be approved if accompanied by an appropriate FRA that demonstrates the development will be resistant and resilient to flooding and suitable warning and evacuation methods are in place.
D. Developments may be required to make contributions (through legal agreements) to previously identified flood improvement works that will benefit the development site.
E. Proposals that fail to make appropriate provision for flood risk mitigation, or which would increase the risk or consequences of flooding, will be refused.

Water Management, Efficiency, and Quality:

A. Applications for all new build developments (not conversions, change of use, or refurbishment) are required to include a drainage assessment demonstrating that appropriate sustainable drainage systems (SuDS) have been incorporated in accordance with the London Plan Hierarchy (Policy 5.13: Sustainable drainage).
B. All major new build developments, as well as minor developments in Critical Drainage Areas or an area identified at risk from surface water flooding must be designed to reduce surface water run-off rates to no higher than the pre-development greenfield run-off rate in a 1:100 year storm scenario, plus an appropriate allowance for climate change for the worst storm duration. The assessment is required regardless of the changes in impermeable areas and the fact that a site has an existing high run-off rate will not constitute justification.
C. Rain Gardens and non householder development should be designed to reduce surface water run-off rates to Greenfield run-off rates.
D. Schemes for the use of SuDS must be accompanied by adequate arrangements for the management and maintenance of the measures used, with appropriate contributions made to the Council where necessary.

E. Proposals that would fail to make adequate provision for the control and reduction of surface water run-off rates will be refused.
F. Developments should be drained by a SuDs system and must include appropriate methods to avoid pollution of the water environment. Preference should be given to utilising the drainage options in the SuDS hierarchy which remove the key pollutants that hinder improving water quality in Hillingdon. Major development should adopt a 'treatment train' approach where water flows through different SuDS to ensure resilience in the system.
G. All new development proposals (including refurbishments and conversions) will be required to include water efficiency measures, including the collection and reuse of rainwater and grey water.
H. All new residential development should demonstrate water usage London Borough of Hillingdon Local Plan Part 2 - Development Management Policies 83 rates of no more than 105 litres/person/day. I) It is expected that major development8 proposals will provide an integrated approach to surface water run-off attenuation, water collection, recycling and reuse.
I. All new development proposals will be required to demonstrate that there is sufficient capacity in the water and wastewater infrastructure network to support the proposed development. Where there is a capacity constraint the local planning authority will require the developer to provide a detailed water and/or drainage strategy to inform what infrastructure is required, where, when and how it will be delivered.

2.5 Strategic Flood Risk Assessment

1. Boroughs should adopt a sequential approach for planning and development to identify areas that are not susceptible to flood risk impacts posed by climate change. Development should be encouraged in these identified areas to make properties more resilient to increasing flood risk and reduce the reliance on property level protection methods.

2. Boroughs should apply the Sequential Test to Allocated Sites within the LPA area at an early stage in the Local Plan development process to help identify any lower flood risk areas that may not be suitable for development. This can be used to inform spatial planning and identify key growth locations, increasing the possibility of facilitating development which is not exposed to flood risk whilst meeting development objectives.

3. Boroughs should implement measures through their Local Plans to deal with the Sequential Test acceptability of windfall site development proposals at the strategic level. The measure could set out locations and quantities of windfall sites that would or would not be acceptable in Sequential Test terms (to provide input to the process defined in *Section 4.2.1*). This would help create efficiencies in the process.

4. If it is determined by evidence that there are insufficient sites within Flood Zone 1 to meet the borough's housing development targets, then windfall developments in Flood Zone 2 or 3 might be acceptable and should be considered (preferably with support of a Level 2 SFRA). This would inform an approach determining locations where the Sequential Test would be passed. Conversely, if the borough has sufficient land available in Flood Zone 1 to accommodate windfall development sites,

then it may not be possible or prudent to consider windfall development in Flood Zone 2 or 3 as acceptable.

5. Existing and planned flood alleviation schemes should be incorporated into Borough Infrastructure Delivery Plans (IDPs). Where these IDPs, or similar corporate work programmes (e.g. planned highway improvement works or Green Infrastructure Plans), identify predicted or actual flood risks, new potential strategic level flood alleviation schemes should be developed.
6. Boroughs should make space for water storage by identifying strategic locations that are required for current and future flood risk management. These identified areas of land should be safeguarded via Local Plans to facilitate links between flood risk management and other environmental priorities.
7. Boroughs should adopt a Catchment Based Approach to ensure recognition of catchment wide flood issues to justify the collection and use of S106 funding to investigate and develop flood alleviation schemes within the catchment the development falls within. CDAs defined by the Borough SWMPs (for surface water flooding) or policy sub-areas defined by EA CFMPs (for fluvial / tidal flooding) provide an established technical basis for this approach.
8. Boroughs should set up mechanisms to enable the use of CIL charges to be used for flood alleviation schemes across the borough to address the cumulative impact of development on flood risk.
9. Boroughs should use their Local Plans to ensure developments within CDAs (as defined by SWMPs) provide increased surface water drainage requirements. Examples could include increased storage through the use of SuDS to restrict off-site runoff rates to greenfield (or lower) conditions.
10. Boroughs should develop standing advice for the assessment of minor development planning applications with surface water implications. This will aid LPAs in making informed and consistent decisions where the EA and / or LLFA has no statutory duty to provide comments as part of an application's review exercise.
11. Boroughs should review the benefits of removing Permitted Development rights for sites which fall within Flood Zones 3a and / or 3b, collaborating on Article 4 Directions where justifiable, defendable and beneficial. This could include provisions around sub-divisions, extensions and paving of gardens in specific areas.
12. Boroughs should use their Local Plans to ensure developments with a high susceptibility to groundwater flooding (as identified in the Sewer, Groundwater & Artificial Flood Risk Interactive Web Map and other available data) demonstrate that increased groundwater mitigation and management measures have been implemented to protect people from groundwater flooding. Any known groundwater and flow routes should be safeguarded to ensure ground water flood risk is not increased on site or elsewhere.
13. Boroughs should consider implementation of further surface water flood risk mitigation requirements for proposed developments within Flood Zone 3a (surface water) where the development is also within the 1 in 30yr RoFSW mapped extents. These requirements could be similar to those adopted for Flood Zone 3b (fluvial / tidal) Functional Floodplain with modifications as follows:

A. Development within the 1 in 30yr RoFSW mapped extent will be treated as if it were Flood Zone 3b (Functional Floodplain) as defined in PPG Table 1 (Paragraph 065).

B. Development may be possible within the 1 in 30yr RoFSW mapped extents outside of existing infrastructure or solid building footprints.

C. To enable development, the proposals must provide mitigation and resilience against flood risks (taking advice from the LLFA as appropriate) and provide appropriate compensation on existing flood risk levels (addressing the predicted 1 in 30yr and 1 in 100yr RoFSW mapped depths as a minimum), supported by detailed flood risk modelling if appropriate.

D. The development must not increase flood risk elsewhere and where possible reduce flood risk overall.

E. Where beneficial to flood risk and/or other planning requirements, it may also be possible for development to occur within the functional floodplain through the relocation (but not increase of footprint size) of an existing building's footprint within a site.

3 SURFACE WATER MANAGEMENT

3.1 Greenfield Runoff Rates and Volumes

Greenfield runoff rates have been calculated using FEH 22 catchment data method and a 6-hour rainfall event, these can be found in **Appendix C**. The total area of the Site is 1.21 hectares, however 0.31 hectares is private existing highway which was required to provide a connection to the public highway. For this proposed development, it can be stated that only the building footprint and immediate catchment (0.9 ha) will be used when calculating the existing and proposed discharge rates. The table below shows the greenfield runoff rates for the development and factored to provide a runoff rate per hectare. The table also illustrates the current discharge rates based on existing Site conditions. The existing discharge rates have been calculated using the Modified Rational Method as recommended in table 24.1 of the CIRIA SuDS manual. A percentage of impermeable area (PIMP) of 100% and a time of concentration of 5 minutes were assumed. A runoff coefficient of 1 has been used.

TABLE 2 – GREENFIELD RUNOFF AND EXISTING DISCHARGE RATES

Return Period	Greenfield runoff rates		Existing Discharge Rates (l/s)
	Site [0.9ha] (l/s)	Per hectare (l/s/ha)	
QBAR	4.4	4.9	-
1-year	3.7	4.1	179.9
30-year	10.5	11.7	425.3
100-year	13.9	15.4	539.1

3.1.1 Proposed Discharge Rates

It is proposed that surface water runoff from the site is 4.4l/s (QBar), a vortex flow control device will restrict the outflow for the corresponding storm event, up to a maximum rate 1 in 100 year storm event (including an allowance of 40% for climate change).

3.2 Delivering a SuDS Scheme

The philosophy of SuDS is about maximising the benefits and minimising the negative impacts of surface water runoff from developed areas. The 'four pillars' of SuDS design as described by the SuDS Manual are;

- Water Quantity;
- Water Quality;
- Amenity; and
- Biodiversity.

SuDS deliver high quality drainage while supporting areas to cope better with severe rainfall both now and in the future. SuDS can improve the quality of life in developments by making them more vibrant, visually attractive, sustainable and more resilient to change, by improving urban air quality, regulating building temperatures, reducing noise and delivering recreation and education opportunities.

SuDS design should maximise the use of the available space by delivering efficient drainage together with other functions to help meet the objectives of the Site. The SuDS design should, as much as possible, be based around the following;

- Using surface water runoff as a resource;
- Managing rainwater close to where it falls;
- Managing runoff on the surface;
- Allowing rainfall to soak into the ground;
- Promoting evapotranspiration;
- Slowing and storing runoff to mimic natural runoff characteristics;
- Reducing contamination of runoff through pollution prevention and controlling the runoff at source; and
- Treating runoff to reduce the risk of urban contaminants causing environmental pollution.

Any Proposed Development on the Site has the potential to maximise SuDS and conform to SuDS best practice. Ultimately a well designed and constructed SuDS scheme will provide a robust and reliable surface water drainage network, whilst providing increased amenity and biodiversity.

3.2.1 SuDS Component Performance

The effectiveness of SuDS components in improving development surface water runoff quality is summarised in table 3 below. Combinations of treatments can be used to reduce potential pollutants from reaching the receiving course.

TABLE 3 – SUDS TREATMENT TRAIN

SuDS Component	Interception	Peak flow control: Low	Peak flow control: High	Volume reduction	Volume control	Gross sediments	Fine sediments	Hydrocarbons/PAHs	Metals	Nutrients
Rainwater Harvesting	Y	Y	S	Y	N	N	N	N	N	N
Pervious Pavement	Y	Y	Y	Y	Y	Y	Y	Y	Y	Varies
Filter Strips	Y	N	N	N	N	Y	N	Y	Y	Varies
Swales	Y	Y	S	Y (*)	N	Y	Y (+)	Y	Y	Y (-)
Trenches	Y	Y	S	Y (*)	N	N	N	Y	Y	Y (-)
Detention Basins	Y	Y	Y	N	Y	Y	Y (+)	Y	Y	Varies
Ponds	N	Y	Y	N	Y	N (~)	Y	Limited	Y	Varies
Wetlands	N	Y	S	N	Y	N (~)	Y	Limited	Y	Y
Green Roofs	Y	Y	N	N	N	N	N	Y	N	N
Bioretention Systems	Y	Y	S	Y (*)	N	N (~)	Y	Y	Y	Y
Proprietary Treatment Systems	N	N	N	N	N	Y	Y	Y (!)	Y (!)	Y (!)
Subsurface Storage	N	Y	Y	N	Y	N (~)	N	N	N	N
Subsurface Conveyance Pipes	N	N	N	N	Y	N (~)	N	N	N	N

Notes:

- S: Not normally with standard designs, but possible where space is available, and designs mitigate impact of high flow rates.
- Y (*): Where infiltration is facilitated by the design.
- N (~): Gross sediment retention is possible, but not recommended due to negative maintenance and performance implications.
- Y (+): Where designs minimise the risk of fine sediment mobilisation during larger events.
- Y (!): Where designs specifically promote the trapping and breakdown of soils and PAH based constituents.
- Y ("): Where subsurface soil structure facilitates the trapping and breakdown of oils and PAH based constituents.
- Varies: The nutrient removal performance is variable and can be negative in some situations.
- Y (~): Good nutrient removal performance where subsurface bio-filtration system with a permanently saturated zone included within the design.

4 DRAINAGE DESIGN PROPOSAL

4.1 Surface Water

The design of a surface water drainage system to serve the Proposed Development considers both water treatment and on-Site attenuation in accordance with CIRIA C753. The SuDS components proposed aim to emulate the natural drainage system of the Site through attenuation of flows and imitating natural percolation where possible. This has the added benefit of alleviating water quality issues associated with urban drainage runoff.

The current proposal for the surface water drainage strategy for the development can be found in **Appendix D**.

Permeable paving is proposed on the ground floor level in parking areas and the central courtyard area as well as areas of planting with rain gardens. This not only provides a biodiversity benefit but also provides treatment of surface water runoff as it percolates through the growing medium within the rain garden build-up and therefore provides water quality enhancement. Finally there are a series of attenuation tanks near the outfall which provide the majority of the attenuation provided. The system will ultimately discharge, via a vortex flow control, at 4.4 l/s, into the Thames Water Sewer. A pre-planning enquiry has been submitted to Thames Water to agree the discharge location and rates. At the time of writing, we have yet to receive a response.

A computational model of the proposed system has been developed using Causeway Flow+. The model results indicate no pluvial flooding of the Proposed Development up to and including the 1 in 100 year event + 40% climate change allowance. The results are presented in **Appendix E**.

4.1.1 Drainage Hierarchy

The drainage hierarchy that should be considered for any new development. The following list details these requirements and which elements can be achieved for this Site. Where possible elements as high up the hierarchy have been selected:

- Rainwater use as a resource (for example rainwater harvesting, green roofs for irrigation);
    - Rainwater will be harvested passively for the inclusion of rain gardens. No active rainwater harvesting is currently proposed for the scheme.
- Rainwater infiltration to ground at or close to source;
    - Infiltration is not currently deemed feasible due to the presence of Clay.
- Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens);
    - Rain gardens are currently part of the proposed scheme.
- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
    - Attenuation tanks are part of the proposed strategy, a hydrobrake flow control will gradually release the water stored inside.
- Discharge rainwater direct to a watercourse;

  - Discharging into a watercourse is not feasible as it would require excavation through third party land.
- Discharge rainwater to a surface water sewer/drain;
  - This is the current proposal for the scheme.
- Discharge rainwater to the combined sewer;
  - This is not required as a surface water sewer is available near the Site.

4.1.2 Water Cycle

The water cycle strategy puts emphasis on four key areas of interest:

- Consumption;
- Quality;
- Re-use; and
- Re-cycle.

Rainwater will be heavily 'treated' through its discharge process by passing through numerous stages through its cycle. Soft landscaping and rain gardens will provide water treatment. As a result of the rain gardens, rainwater is harvested passively, and used to support plant growth and biodiversity.

4.1.3 Water Quality Management

Wherever possible, when discharging runoff from the Site to surface waters, SuDS should be designed to intercept runoff for most rainfall events up to approximately 5 mm in depth in allowance for treatment for pollutants.

This approach has been taken to minimise the impact of the Proposed Development on the environment. Techniques that control pollution close to the source, offer a suitable means of treatment for run-off from low-risk areas such as roofs and non-operational areas as currently proposed.

Table 4 has been extracted from the CIRIA SuDS Manual 26.2 and can be used to provide an understanding of the pollution hazard for the proposed land use. The land use within the Proposed Development is categorised as a very low pollution hazard. With the introduction of the permeable paving and rain gardens this will mitigate any residual risk. No formal interceptor or treatment system is deemed required for the scheme.

TABLE 4 – POLLUTION HAZARD INDICES FOR DIFFERENT LAND USE CLASSIFICATIONS

Land use	Pollution hazard level	Total suspended solids (TTS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways1	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

TABLE 5 – SUDS MITIGATION INDICES FOR DISCHARGES TO SURFACE WATERS

	Mitigation Indices		
Land use	Total suspended solids (TTS)	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Green Roof	0.8-0.9	0.9	0.5
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8

4.2 Foul Water

Foul Water is expected to drain via gravity towards the outfall at the western end of the Site into an existing Thames Water foul water sewer. The peak design foul water flow rate has been estimated based on the recommendation of 0.05 l/s per dwelling as set out in the Sewerage Sector Guidance Appendix C. Based on 52 dwellings proposed this equates to a rate of 2.6 l/s. A pre-planning enquiry has been submitted to Thames Water to agree the discharge location and rates. At the time of writing, we have yet to receive a response.

4.3 Internal Drainage

Foul water stacks and rainwater pipes dropping below slab level internal to the buildings will be picked up by inspection chambers situated outside the building. Where this is not possible, due to Site constraints and building foundations, inspection chambers may need to be positioned internally. In this instance, the chambers will be double sealed and situated within areas that are publicly accessible to ensure the system can be inspected or accessed at all times. Any internal chambers will be positioned at the next design stage once a set of frozen MEP drawings are available.

5 ADOPTION AND MAINTENANCE

It is assumed that drainage on Site will not be adopted by Thames Water. However, where applicable, drainage will be designed to adoptable standards set out by the Design and Construction Guidance, Sewerage Sector guidance Appendix C.

5.1.1 Pipework

Pipework should usually be jetted and cleaned as and when blockages appear to have occurred. Pipes should be checked for build-up of debris and other waste that could cause blockages or damage to the pipework. Occasional maintenance should be carried out annually or as required.

5.1.2 Bioretention Systems (Rain Gardens)

Bioretention systems (including rain gardens) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution through the use of engineered soils and vegetation. Table 7 below is extracted from table 18.3 of the SuDS manual and provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive, and some actions may not always be required.

TABLE 6 – OPERATION AND MAINTENANCE REQUIREMENTS FOR BIORETENTION SYSTEMS

Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quaterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockages	Quaterly
Regular Maintenance	Remove litter and surface debris and leaves	Quarterly (or more frequently for tidiness and aesthetic reasons)
	Replace and plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets and from forebays	Quarterly or biannually
Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required

	Repair minor accumulations of silt by raking away surface mulch, scarifying of medium and replacing mulch	As required
Remedial Actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

5.1.3 Flow Controls

Maintenance is required within the Flow Control. Experience has shown that if blockages occur, they do so at the intake. Maintenance for the pumping station should be in alignment to manufacturers recommendations. It is recommended that a service and maintenance contract is taken out with the provider.

Following the installation of the Flow Control it is vitally important that any extraneous material i.e. building materials are removed from the unit and the chamber. After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. If problems are experienced contact the manufacturer so that an investigation may be made.

All Flow Control units are typically manufactured from grade 304 Stainless Steel, and if required they can also be manufactured in grade 316 Stainless Steel. Both materials have an estimated life span in excess of the design life of drainage systems.

5.1.4 Timetable

Maintenance should be carried out and timetabled from the date of installation. Each feature a recommended and typical frequency for inspection which should be adhered to as close as practically possible. Where not adopted, the landowner or private management company are responsible for its implementation.

6 RISKS AND UNCERTAINTIES

The following outlines the current uncertainties and associated risks for aspects related to drainage for this Proposed Development.

- **MEP Coordination** – The proposed drainage layout is subject to change upon receipt of a proposed above ground drainage plan from the appointed MEP engineer. Any amendments made to the above ground drainage design will likely to cause subsequent changes to the below ground drainage.
- **Connection Levels** – The network is designed on the assumption that foul water will discharge into the existing Thames Water network and levels will allow for connection.
- **Thames Water Capacity** – A pre-planning enquiry has been submitted to Thames Water to agree the discharge location and rates. At the time of writing, we have yet to receive a response.

7 CONCLUSIONS AND RECOMMENDATIONS

The main conclusions from this drainage strategy report are detailed below.

- Currently the surface water is proposed to discharge at 4.4 l/s, which is QBar, with foul water unrestricted.
- Ultimately, the proposed foul and surface water networks will discharge into separate Thames Water public networks.
- A pre-planning enquiry has been submitted to Thames Water to agree the discharge location and rates. At the time of writing, we have yet to receive a response.
- The surface water network will utilise green roofs, rain gardens and permeable paving to attenuate peak flows and provide water quality, biodiversity and amenity enhancements.
- A model has been developed using Causeway Flow+ to verify no pluvial flooding of the Proposed Development up to and including the 1 in 100year storm event + 40% climate change allowance.
- Typical maintenance for the drainage network has been identified in Section 5.

Appendix A – SITE LOCATION

whitby wood

LEVEL 1, FRIARS YARD
160 BLACKFRIARS ROAD
LONDON SE1 8EZ
UNITED KINGDOM

HAYES PARK WEST
HILLINGDON, LONDON
P451907
DECEMBER 2025

SITE LOCATION PLAN

Legend

Site Boundary

1:5,000

Appendix B – THAMES WATER ASSET LOCATION MAP

CommercialDW Drainage and Water Enquiry Sewer Map- CDWS/CDWS Standard/2021_4522806

The width of the displayed area is 500m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Appendix C – GREENFIELD & EXISTING RUNOFF RATES

HAYES PARK WEST

PRELIMINARY

ATTENUATION CALCULATIONS

GENERAL NOTES:

GREENFIELD RUNOFF RATE

Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	FEH
Positively Drained Area (ha)	0.900
SAAR (mm)	629
Host	1
BFIHost	0.175
Region	6
QBar/QMed conversion factor	1.136
Betterment (%)	0
	Calc
QMed (l/s)	3.8
QBar (l/s)	4.4

Return Period (years)	Growth Factor	Q (l/s)
1	0.85	3.7
30	2.40	10.5
100	3.19	13.9

BROWNFIELD RUNOFF RATE

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	MRM
Contributing Area (ha)	0.900
PIMP (%)	100
CV	1.000
Time of Concentration (mins)	5.00
Betterment (%)	0
	Calc

Return Period (years)	Q (l/s)
1	178.0
30	420.6
100	533.1

50% BETTERMENT RUNOFF RATE

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	MRM
Contributing Area (ha)	0.900
PIMP (%)	100
CV	1.000
Time of Concentration (mins)	5.00
Betterment (%)	50
	Calc

Return Period (years)	Q (l/s)
1	89.0
30	210.3
100	266.6

81% BETTERMENT RUNOFF RATE

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	MRM
Contributing Area (ha)	0.900
PIMP (%)	100
CV	1.000
Time of Concentration (mins)	5.00
Betterment (%)	81
	Calc

Return Period (years)	Q (l/s)
1	33.8
30	79.9
100	101.3

QBAR STORAGE CALCULATION

Storage Estimate

Return Period (years)	100
Climate Change (%)	40
Impermeable Area (ha)	0.900
Peak Discharge (l/s)	4.400
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	852
to	1010

GREENFIELD STORAGE CALCULATION

Storage Estimate

Return Period (years)	100
Climate Change (%)	40
Impermeable Area (ha)	0.900
Peak Discharge (l/s)	13.900
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	664
to	860

100 l/s STORAGE CALCULATION

Storage Estimate

Return Period (years)	100
Climate Change (%)	40
Impermeable Area (ha)	0.900
Peak Discharge (l/s)	100.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	294
to	510

50% BETTERMENT STORAGE CALCULATION

Storage Estimate

Return Period (years)	100
Climate Change (%)	40
Impermeable Area (ha)	0.900
Peak Discharge (l/s)	269.500
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	160
to	326

BROWNFIELD STORAGE CALCULATION

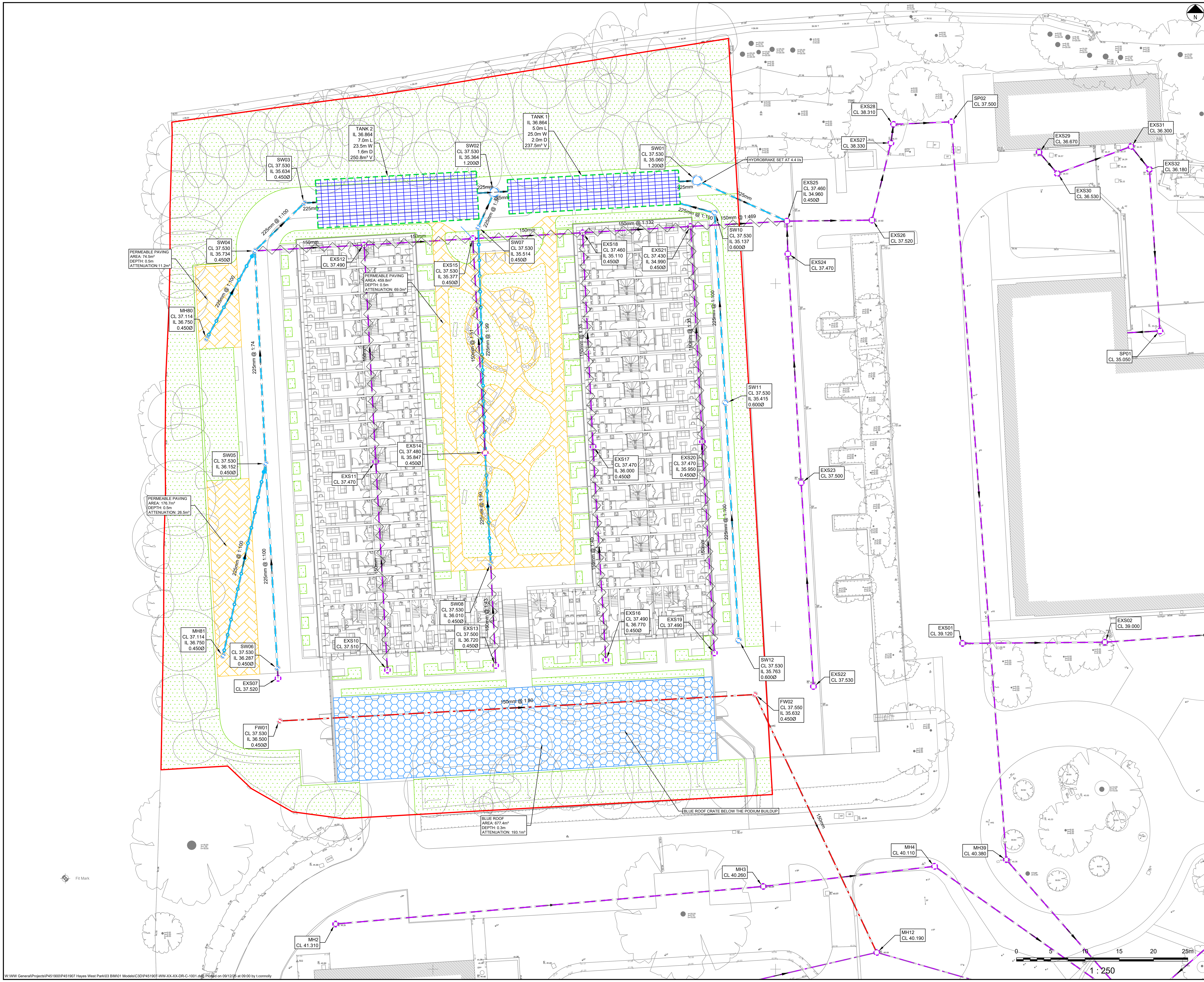
Storage Estimate

Return Period (years)	100
Climate Change (%)	40
Impermeable Area (ha)	0.900
Peak Discharge (l/s)	539.100
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	72
to	230

whitby wood

Project Title:	HAYES PARK WEST			
Project No:	P451907			
Sketch No:	P451907-WW-XX-XX-SK-C-1001			
Title:	ATTENUATION CALCULATIONS			
Scale:	Rev:	Date:	Eng:	Checked:
NTS	P3	06/11/25	TC	RW

Appendix D – SURFACE WATER DRAINAGE STRATEGY



HEALTH AND SAFETY INFORMATION

CONSTRUCTION
THIS DRAWING SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

MAINTENANCE/CLEANING/OPERATION.
MAINTENANCE OF SUDS FEATURES AND THE DRAINAGE SYSTEM SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE CIRIA SUDS MANUAL AND MANUFACTURERS SPECIFICATIONS

DECOMMISSIONING/DEMOLITION.
REFER TO DRAWING FOR EXTENT OF EXISTING SITE DRAINAGE TO BE ABANDONED/REMOVED

NOTES

1. DO NOT SCALE FROM THIS DRAWING. ONLY FIGURED DIMENSIONS ARE TO BE USED.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
5. ALL FOUL AND SURFACE WATER PIPEWORK TO BE LAID AT MINIMUM GRADIENTS OF 1:40 AND 1:100 RESPECTIVELY UNLESS NOTED OTHERWISE.
6. ALL PIPEWORK TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.
7. ROCKER PIPES TO BE INSTALLED AT CONNECTION POINTS TO STRUCTURES TO ALLOW FOR MOVEMENT CAUSED BY SETTLEMENT.
8. ALL DRAINAGE IS DESIGNED TO ADOPTABLE STANDARDS WHERE POSSIBLE, AND BUILDING REGULATIONS PART H.
9. INVERT LEVEL REFERS TO THE INTERNAL BASE OF THE CHAMBER, INCLUDING SUMP DEPTH WHERE APPLICABLE.

KEY

POSITIVE DRAINAGE BOUNDARY
EXISTING FOUL WATER SEWER
EXISTING SURFACE WATER SEWER
PROPOSED FOUL WATER SEWER
PROPOSED SURFACE WATER SEWER
PROPOSED PERFORATED PIPE
SEWER TO BE REMOVED / ABANDONED
ATTENUATION TANK
BLUE ROOF
SOFT LANDSCAPING / PERMEABLE PAVING
BD SURFACE WATER BACKDROP
EXISTING MANHOLE
FOUL / SURFACE WATER MANHOLE

AC	-	ACCESS FITTING/CHAMBER	IC	-	INSPECTION CHAMBER
CL	-	COVER LEVEL	IL	-	INVERT LEVEL
CW	-	COMBINED WATER	MH	-	MANHOLE
CP	-	CATCHPIT	SW	-	SURFACE WATER
EX	-	EXISTING	SL	-	SOFFIT LEVEL
FW	-	FOUL WATER	TBC	-	TO BE CONFIRMED

REV	DESCRIPTION	DRN	CHK	APP	DATE
P04	UPDATED ISSUE	TC	RS	RW	09.12.25
P03	UPDATED ISSUE	TC	RS	RW	06.11.25
P02	UPDATED ISSUE	TC	RS	RW	21.10.25
P01	FIRST ISSUE	TC	RS	RW	01.09.25

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LONDON SE1 8EZ, UNITED KINGDOM
+44 (0)20 7442 2216

CLIENT
SHALL DO HAYES DEVELOPMENT LTD

PROJECT
HAYES PARK WEST

PRELIMINARY

DRAWING TITLE
SITEWIDE DRAINAGE GENERAL ARRANGEMENT

DATE	SCALES @ A1	DRAWN BY	CHECKED	APPROVED
09.12.25	1:250	TC	RS	RW

DRAWING NUMBER	REVISION
P451907-WW-XX-XX-DR-C-1001	P04

Appendix E – CAUSEWAY FLOW+ MODEL RESULTS

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
R01	0.038	5.00	52.500	450	44.125	101.949	1.300
R02	0.037	5.00	52.500	450	70.060	84.350	1.300
R03	0.038	5.00	52.500	450	94.061	104.735	1.300
R04	0.036	5.00	49.500	450	52.340	97.700	1.300
R05	0.037	5.00	49.500	450	84.667	98.655	1.300
EXS14	0.030	5.00	37.500	450	65.528	109.018	1.653
P01	0.084	5.00	40.500	450	74.408	68.096	1.300
SW06	0.023	5.00	37.500	450	35.253	77.569	1.050
SW05	0.025	5.00	37.500	450	33.509	107.364	1.348
SW04	0.027	5.00	37.500	450	31.890	138.462	1.766
SW03	0.008	5.00	37.500	450	39.113	145.411	1.866
SW08	0.005	5.00	37.500	450	66.344	92.745	1.490
SW07	0.056	5.00	37.500	450	63.577	142.247	1.986
SW02	0.017	5.00	37.500	1200	66.195	146.954	2.136
SW12	0.013	5.00	37.500	600	102.546	81.526	1.737
SW11	0.017	5.00	37.500	600	100.627	116.257	2.085
SW01	0.022	5.00	37.500	1200	96.504	148.761	2.440
OUTFALL			37.500	450	109.502	142.843	2.540
SW09	0.003	5.00	37.530	600	95.116	145.688	2.436
SW10	0.013	5.00	37.530	600	99.064	143.980	2.393
PP01	0.007	5.00	37.530	450	26.808	130.131	0.780
PP02	0.018	5.00	37.530	450	28.828	90.612	0.780

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
6.000	R01	SW05	11.917	0.600	51.200	36.152	15.048	0.8	150	5.02	50.0
2.000	R04	P01	36.924	0.600	48.200	39.200	9.000	4.1	150	5.12	50.0
8.002	EXS14	SW07	33.286	0.600	35.847	35.514	0.333	100.0	225	5.67	50.0
4.002	SW04	SW03	10.023	0.600	35.734	35.634	0.100	100.2	225	5.85	50.0
1.001	P01	SW12	31.179	0.600	39.200	35.763	3.437	9.1	150	5.28	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
6.000	11.420	201.8	9.6	1.150	1.198	0.038	0.0
2.000	5.010	88.5	9.1	1.150	1.150	0.036	0.0
8.002	1.307	52.0	18.2	1.428	1.761	0.072	0.0
4.002	1.306	51.9	35.2	1.541	1.641	0.139	0.0
1.001	3.365	59.5	49.3	1.150	1.587	0.195	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.000	SW06	SW05	29.846	0.600	36.450	36.152	0.298	100.0	225	5.38	50.0
4.001	SW05	SW04	31.140	0.600	36.152	35.734	0.418	74.5	225	5.72	50.0
4.003	SW03	SW02	27.126	0.600	35.634	35.364	0.270	100.5	225	6.20	50.0
1.002	SW12	SW11	34.784	0.600	35.763	35.415	0.348	100.0	225	5.72	50.0
3.000	R02	P01	16.826	0.600	51.200	39.200	12.000	1.4	150	5.03	50.0
8.001	SW08	EXS14	16.293	0.600	36.010	35.847	0.163	100.0	225	5.25	50.0
1.000	R03	P01	41.577	0.600	51.200	39.200	12.000	3.5	150	5.13	50.0
8.000	R05	SW08	19.253	0.600	48.200	36.010	12.190	1.6	150	5.04	50.0
1.003	SW11	SW10	27.767	0.600	35.415	35.137	0.278	99.9	225	6.08	50.0
1.006	SW01	OUTFALL	14.282	0.600	35.060	34.960	0.100	142.8	225	6.80	50.0
1.004	SW10	SW09	4.302	0.600	35.137	35.094	0.043	100.0	225	6.13	50.0
8.003	SW07	SW02	5.386	0.600	35.514	35.364	0.150	35.9	225	5.71	50.0
4.004	SW02	SW01	30.363	0.600	35.364	35.060	0.304	99.9	225	6.58	50.0
1.005	SW09	SW01	3.372	0.600	35.094	35.060	0.034	100.0	225	6.18	50.0
7.000	PP01	SW04	9.759	0.600	36.750	35.734	1.016	9.6	225	5.04	50.0
5.000	PP02	SW05	17.394	0.600	36.750	36.152	0.598	29.1	225	5.12	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
4.000	1.307	52.0	5.8	0.825	1.123	0.023	0.0
4.001	1.516	60.3	26.4	1.123	1.541	0.104	0.0
4.003	1.304	51.9	37.2	1.641	1.911	0.147	0.0
1.002	1.307	52.0	52.7	1.512	1.860	0.208	0.0
3.000	8.580	151.6	9.4	1.150	1.150	0.037	0.0
8.001	1.307	52.0	10.6	1.265	1.428	0.042	0.0
1.000	5.453	96.4	9.5	1.150	1.150	0.038	0.0
8.000	8.083	142.8	9.3	1.150	1.340	0.037	0.0
1.003	1.308	52.0	57.0	1.860	2.168	0.225	0.0
1.006	1.092	43.4	140.5	2.215	2.315	0.556	0.0
1.004	1.307	52.0	60.3	2.168	2.211	0.238	0.0
8.003	2.190	87.1	32.4	1.761	1.911	0.128	0.0
4.004	1.308	52.0	73.9	1.911	2.215	0.292	0.0
1.005	1.307	52.0	61.1	2.211	2.215	0.241	0.0
7.000	4.246	168.8	1.9	0.555	1.541	0.007	0.0
5.000	2.435	96.8	4.5	0.555	1.123	0.018	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.000	11.917	0.8	150	Circular	52.500	51.200	1.150	37.500	36.152	1.198
2.000	36.924	4.1	150	Circular	49.500	48.200	1.150	40.500	39.200	1.150
8.002	33.286	100.0	225	Circular	37.500	35.847	1.428	37.500	35.514	1.761
4.002	10.023	100.2	225	Circular	37.500	35.734	1.541	37.500	35.634	1.641

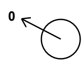
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.000	R01	450	Manhole	Adoptable	SW05	450	Manhole	Adoptable
2.000	R04	450	Manhole	Adoptable	P01	450	Manhole	Adoptable
8.002	EXS14	450	Manhole	Adoptable	SW07	450	Manhole	Adoptable
4.002	SW04	450	Manhole	Adoptable	SW03	450	Manhole	Adoptable

Pipeline Schedule

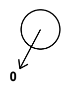
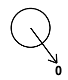
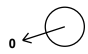
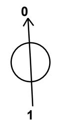
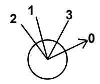
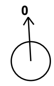
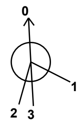
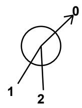
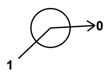
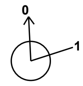
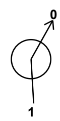
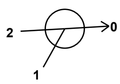
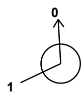
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	31.179	9.1	150	Circular	40.500	39.200	1.150	37.500	35.763	1.587
4.000	29.846	100.0	225	Circular	37.500	36.450	0.825	37.500	36.152	1.123
4.001	31.140	74.5	225	Circular	37.500	36.152	1.123	37.500	35.734	1.541
4.003	27.126	100.5	225	Circular	37.500	35.634	1.641	37.500	35.364	1.911
1.002	34.784	100.0	225	Circular	37.500	35.763	1.512	37.500	35.415	1.860
3.000	16.826	1.4	150	Circular	52.500	51.200	1.150	40.500	39.200	1.150
8.001	16.293	100.0	225	Circular	37.500	36.010	1.265	37.500	35.847	1.428
1.000	41.577	3.5	150	Circular	52.500	51.200	1.150	40.500	39.200	1.150
8.000	19.253	1.6	150	Circular	49.500	48.200	1.150	37.500	36.010	1.340
1.003	27.767	99.9	225	Circular	37.500	35.415	1.860	37.530	35.137	2.168
1.006	14.282	142.8	225	Circular	37.500	35.060	2.215	37.500	34.960	2.315
1.004	4.302	100.0	225	Circular	37.530	35.137	2.168	37.530	35.094	2.211
8.003	5.386	35.9	225	Circular	37.500	35.514	1.761	37.500	35.364	1.911
4.004	30.363	99.9	225	Circular	37.500	35.364	1.911	37.500	35.060	2.215
1.005	3.372	100.0	225	Circular	37.530	35.094	2.211	37.500	35.060	2.215
7.000	9.759	9.6	225	Circular	37.530	36.750	0.555	37.500	35.734	1.541
5.000	17.394	29.1	225	Circular	37.530	36.750	0.555	37.500	36.152	1.123

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	P01	450	Manhole	Adoptable	SW12	600	Manhole	Adoptable
4.000	SW06	450	Manhole	Adoptable	SW05	450	Manhole	Adoptable
4.001	SW05	450	Manhole	Adoptable	SW04	450	Manhole	Adoptable
4.003	SW03	450	Manhole	Adoptable	SW02	1200	Manhole	Adoptable
1.002	SW12	600	Manhole	Adoptable	SW11	600	Manhole	Adoptable
3.000	R02	450	Manhole	Adoptable	P01	450	Manhole	Adoptable
8.001	SW08	450	Manhole	Adoptable	EXS14	450	Manhole	Adoptable
1.000	R03	450	Manhole	Adoptable	P01	450	Manhole	Adoptable
8.000	R05	450	Manhole	Adoptable	SW08	450	Manhole	Adoptable
1.003	SW11	600	Manhole	Adoptable	SW10	600	Manhole	Adoptable
1.006	SW01	1200	Manhole	Adoptable	OUTFALL	450	Manhole	Adoptable
1.004	SW10	600	Manhole	Adoptable	SW09	600	Manhole	Adoptable
8.003	SW07	450	Manhole	Adoptable	SW02	1200	Manhole	Adoptable
4.004	SW02	1200	Manhole	Adoptable	SW01	1200	Manhole	Adoptable
1.005	SW09	600	Manhole	Adoptable	SW01	1200	Manhole	Adoptable
7.000	PP01	450	Manhole	Adoptable	SW04	450	Manhole	Adoptable
5.000	PP02	450	Manhole	Adoptable	SW05	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
R01	44.125	101.949	52.500	1.300	450	 0	6.000	51.200	150
R02	70.060	84.350	52.500	1.300	450	 0	3.000	51.200	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
R03	94.061	104.735	52.500	1.300	450		0	1.000	51.200	150
R04	52.340	97.700	49.500	1.300	450		0	2.000	48.200	150
R05	84.667	98.655	49.500	1.300	450		0	8.000	48.200	150
EXS14	65.528	109.018	37.500	1.653	450		1	8.001	35.847	225
							0	8.002	35.847	225
P01	74.408	68.096	40.500	1.300	450		1	3.000	39.200	150
							2	2.000	39.200	150
							3	1.000	39.200	150
							0	1.001	39.200	150
SW06	35.253	77.569	37.500	1.050	450		0	4.000	36.450	225
SW05	33.509	107.364	37.500	1.348	450		1	6.000	36.152	150
							2	5.000	36.152	225
							3	4.000	36.152	225
							0	4.001	36.152	225
SW04	31.890	138.462	37.500	1.766	450		1	7.000	35.734	225
							2	4.001	35.734	225
							0	4.002	35.734	225
SW03	39.113	145.411	37.500	1.866	450		1	4.002	35.634	225
							0	4.003	35.634	225
SW08	66.344	92.745	37.500	1.490	450		1	8.000	36.010	150
							0	8.001	36.010	225
SW07	63.577	142.247	37.500	1.986	450		1	8.002	35.514	225
							0	8.003	35.514	225
SW02	66.195	146.954	37.500	2.136	1200		1	8.003	35.364	225
							2	4.003	35.364	225
							0	4.004	35.364	225
SW12	102.546	81.526	37.500	1.737	600		1	1.001	35.763	150
							0	1.002	35.763	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW11	100.627	116.257	37.500	2.085	600	1	1.002	35.415	225
						0	1.003	35.415	225
SW01	96.504	148.761	37.500	2.440	1200	1	4.004	35.060	225
						2	1.005	35.060	225
						0	1.006	35.060	225
OUTFALL	109.502	142.843	37.500	2.540	450	1	1.006	34.960	225
SW09	95.116	145.688	37.530	2.436	600	1	1.004	35.094	225
						0	1.005	35.094	225
SW10	99.064	143.980	37.530	2.393	600	1	1.003	35.137	225
						0	1.004	35.137	225
PP01	26.808	130.131	37.530	0.780	450	0	7.000	36.750	225
PP02	28.828	90.612	37.530	0.780	450	0	5.000	36.750	225

Simulation Settings

Rainfall Methodology	FEH-22	Starting Level (m)	
Rainfall Events	Singular	Check Discharge Rate(s)	✓
Summer CV	1.000	1 year (l/s)	0.0
Winter CV	1.000	30 year (l/s)	41.2
Analysis Speed	Detailed	100 year (l/s)	51.9
Skip Steady State	x	Check Discharge Volume	✓
Drain Down Time (mins)	240	100 year +40% 360 minute (m^3)	1447
Additional Storage (m^3/ha)	20.0		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	5.00
Brownfield Method	MRM	Betterment (%)	0
Contributing Area (ha)	0.900	Q 1 year (l/s)	
PIMP (%)	100	Q 30 year (l/s)	41.2
CV	1.000	Q 100 year (l/s)	51.9

Pre-development Discharge Volume

Site Makeup	Brownfield	CV	1.000	Betterment (%)	0
Brownfield Method	MRM	Return Period (years)	100	PR	1.000
Contributing Area (ha)	0.900	Climate Change (%)	40	Runoff Volume (m³)	930
PIMP (%)	100	Storm Duration (mins)	360		

Node SW01 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	35.060	Product Number	CTL-SHE-0082-4400-2440-4400
Design Depth (m)	2.440	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	4.4	Min Node Diameter (mm)	1200

Node P01 Online Depth/Flow Control

Flap Valve	x	Replaces Downstream Link	✓	Invert Level (m)	39.200

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.010	1.800	0.050	3.000	0.090	4.200	0.130	4.800	0.170	5.400
0.020	1.800	0.060	3.000	0.100	4.200	0.140	4.800	0.180	5.400
0.030	2.400	0.070	3.600	0.110	4.200	0.150	4.800	0.190	5.400
0.040	2.400	0.080	3.600	0.120	4.200	0.160	5.400	0.200	6.000

Node SW02 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	35.364	Product Number	CTL-SHE-0069-3000-2136-3000
Design Depth (m)	2.136	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.0	Min Node Diameter (mm)	1200

Node PP01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	36.830
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	70.0	70.0	0.500	70.0	84.8	0.501	0.0	84.8

Node PP02 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	36.830
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	180.0	180.0	0.500	180.0	203.8	0.501	0.0	203.8

Node P01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	39.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	680.0	680.0	0.300	680.0	707.7	0.301	0.0	707.7

Node P01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	40.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	240.0	240.0	0.200	240.0	251.0	0.201	0.0	251.0

Node EXS14 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	36.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	150.0	150.0	0.500	150.0	171.7	0.501	0.0	171.7

Node SW07 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	36.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	310.0	310.0	0.500	310.0	341.2	0.501	0.0	341.2

Node SW01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	35.060
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	125.0	125.0	2.000	125.0	204.3	2.001	0.0	204.3

Node SW02 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	35.364
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	165.0	165.0	1.600	165.0	237.9	1.601	0.0	237.9

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.04%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	R01	10	51.215	0.015	3.9	0.0239	0.0000	OK
15 minute summer	R02	10	51.215	0.015	3.8	0.0241	0.0000	OK
15 minute summer	R03	10	51.220	0.020	3.9	0.0333	0.0000	OK
15 minute summer	R04	10	48.221	0.021	3.7	0.0149	0.0000	OK
15 minute summer	R05	10	48.216	0.016	3.8	0.0116	0.0000	OK
15 minute summer	EXS14	11	35.903	0.056	7.3	0.0295	0.0000	OK
240 minute summer	P01	148	39.703	0.503	9.8	2.9046	0.0000	SURCHARGED
15 minute summer	SW06	10	36.482	0.032	2.4	0.0194	0.0000	OK
15 minute summer	SW05	11	36.215	0.063	10.6	0.0338	0.0000	OK
15 minute summer	SW04	11	35.820	0.086	13.8	0.0402	0.0000	OK
15 minute summer	SW03	11	35.727	0.093	14.7	0.0226	0.0000	OK
15 minute summer	SW08	10	36.053	0.043	4.3	0.0099	0.0000	OK
480 minute summer	SW07	312	35.595	0.081	4.9	0.0587	0.0000	OK
480 minute summer	SW02	328	35.595	0.231	11.2	36.4692	0.0000	SURCHARGED
15 minute summer	SW12	10	35.820	0.057	7.4	0.0250	0.0000	OK
15 minute summer	SW11	11	35.478	0.063	9.2	0.0282	0.0000	OK
480 minute summer	SW01	392	35.430	0.370	9.2	44.3682	0.0000	SURCHARGED
480 minute summer	OUTFALL	392	35.001	0.041	3.1	0.0000	0.0000	OK
480 minute summer	SW09	392	35.430	0.336	6.9	0.1030	0.0000	SURCHARGED
480 minute summer	SW10	392	35.430	0.293	7.0	0.1150	0.0000	SURCHARGED
15 minute summer	PP01	10	36.761	0.011	0.8	0.0039	0.0000	OK
15 minute summer	PP02	10	36.771	0.021	1.8	0.0130	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	R01	6.000	SW05	3.9	1.416	0.019	0.0467	
15 minute summer	R02	3.000	P01	3.8	1.482	0.025	0.1559	
15 minute summer	R03	1.000	P01	3.9	0.955	0.040	0.3957	
15 minute summer	R04	2.000	P01	3.7	1.073	0.041	0.3522	
15 minute summer	R05	8.000	SW08	3.8	1.862	0.027	0.0498	
15 minute summer	EXS14	8.002	SW07	7.2	0.810	0.139	0.3143	
240 minute summer	P01	Depth/Flow	SW12	6.0				
15 minute summer	SW06	4.000	SW05	2.4	0.388	0.045	0.1872	
15 minute summer	SW05	4.001	SW04	10.4	0.911	0.172	0.3578	
15 minute summer	SW04	4.002	SW03	13.9	0.950	0.268	0.1476	
15 minute summer	SW03	4.003	SW02	14.9	1.613	0.288	0.2798	
15 minute summer	SW08	8.001	EXS14	4.2	0.653	0.081	0.1061	
480 minute summer	SW07	8.003	SW02	7.8	0.832	0.090	0.1419	
480 minute summer	SW02	4.004	SW01	2.0	0.123	0.039	0.7506	
15 minute summer	SW12	1.002	SW11	7.4	0.885	0.142	0.2958	
15 minute summer	SW11	1.003	SW10	9.1	0.842	0.175	0.3031	
480 minute summer	SW01	1.006	OUTFALL	3.1	0.631	0.072	0.0712	96.1
480 minute summer	SW09	1.005	SW01	6.8	0.684	0.130	0.1341	
480 minute summer	SW10	1.004	SW09	6.8	0.584	0.130	0.1711	
15 minute summer	PP01	7.000	SW04	0.8	0.193	0.005	0.0713	
15 minute summer	PP02	5.000	SW05	1.8	0.355	0.018	0.0947	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.04%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	R01	33	51.232	0.032	20.5	0.0530	0.0000	OK
60 minute summer	R02	33	51.233	0.033	19.6	0.0531	0.0000	OK
60 minute summer	R03	33	51.246	0.046	20.4	0.0755	0.0000	OK
15 minute summer	R04	10	48.246	0.046	18.3	0.0329	0.0000	OK
15 minute summer	R05	10	48.234	0.034	18.6	0.0249	0.0000	OK
720 minute winter	EXS14	735	36.378	0.531	2.6	0.2784	0.0000	SURCHARGED
180 minute summer	P01	164	39.829	0.629	44.8	84.2685	0.0000	SURCHARGED
15 minute summer	SW06	12	36.524	0.074	11.7	0.0445	0.0000	OK
15 minute summer	SW05	12	36.510	0.358	52.7	0.1924	0.0000	SURCHARGED
720 minute winter	SW04	735	36.378	0.644	7.1	0.3014	0.0000	SURCHARGED
720 minute winter	SW03	735	36.378	0.744	7.2	0.1801	0.0000	SURCHARGED
720 minute winter	SW08	735	36.378	0.368	1.5	0.0843	0.0000	SURCHARGED
720 minute winter	SW07	735	36.378	0.864	7.9	0.6230	0.0000	SURCHARGED
720 minute winter	SW02	735	36.378	1.014	15.1	160.2747	0.0000	SURCHARGED
600 minute winter	SW12	645	36.417	0.654	6.6	0.2864	0.0000	SURCHARGED
600 minute winter	SW11	645	36.412	0.997	7.3	0.4445	0.0000	SURCHARGED
600 minute winter	SW01	645	36.409	1.349	10.5	161.9644	0.0000	SURCHARGED
600 minute winter	OUTFALL	645	35.002	0.042	3.3	0.0000	0.0000	OK
600 minute winter	SW09	645	36.409	1.315	7.6	0.4038	0.0000	SURCHARGED
600 minute winter	SW10	645	36.410	1.273	7.6	0.5001	0.0000	SURCHARGED
15 minute summer	PP01	10	36.773	0.023	3.8	0.0082	0.0000	OK
15 minute summer	PP02	10	36.796	0.046	9.0	0.0282	0.0000	OK

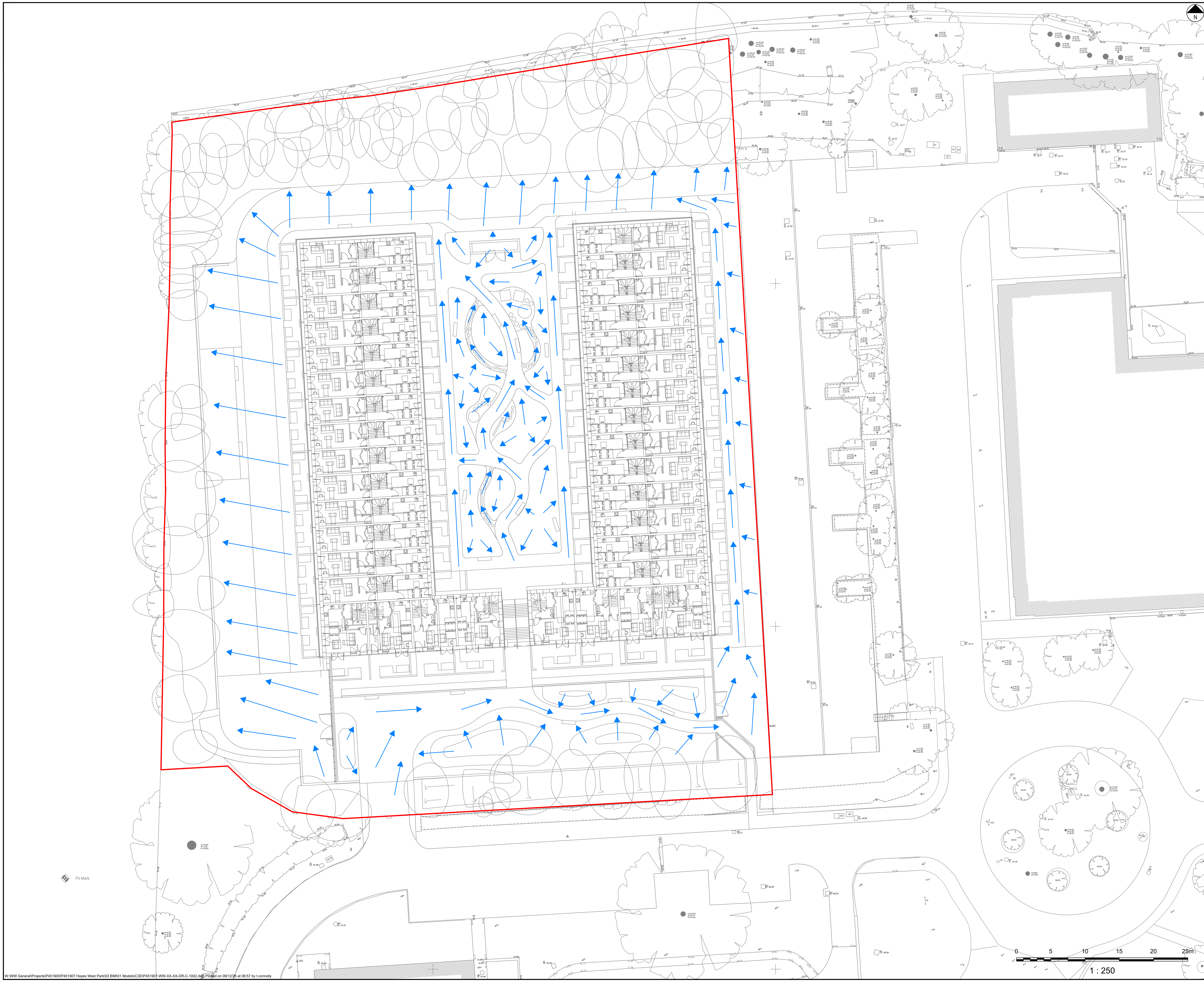
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	R01	6.000	SW05	20.4	2.014	0.101	0.1207	
60 minute summer	R02	3.000	P01	19.5	1.575	0.128	0.1726	
60 minute summer	R03	1.000	P01	20.3	1.528	0.210	0.4620	
15 minute summer	R04	2.000	P01	18.2	1.378	0.206	0.4094	
15 minute summer	R05	8.000	SW08	18.6	2.308	0.130	0.1567	
720 minute winter	EXS14	8.002	SW07	2.6	0.563	0.050	1.3238	
180 minute summer	P01	Depth/Flow	SW12	6.0				
15 minute summer	SW06	4.000	SW05	11.6	0.562	0.223	0.7639	
15 minute summer	SW05	4.001	SW04	45.1	1.210	0.749	1.2385	
720 minute winter	SW04	4.002	SW03	6.9	0.832	0.132	0.3986	
720 minute winter	SW03	4.003	SW02	7.0	0.670	0.134	1.0788	
720 minute winter	SW08	8.001	EXS14	1.5	0.476	0.029	0.6480	
720 minute winter	SW07	8.003	SW02	9.3	0.893	0.106	0.2142	
720 minute winter	SW02	4.004	SW01	2.0	0.120	0.039	1.2076	
600 minute winter	SW12	1.002	SW11	6.6	0.869	0.127	1.3834	
600 minute winter	SW11	1.003	SW10	7.1	0.653	0.136	1.1043	
600 minute winter	SW01	1.006	OUTFALL	3.3	0.639	0.076	0.0736	128.8
600 minute winter	SW09	1.005	SW01	7.6	0.846	0.146	0.1341	
600 minute winter	SW10	1.004	SW09	7.5	0.595	0.145	0.1711	
15 minute summer	PP01	7.000	SW04	3.8	0.273	0.022	0.2046	
15 minute summer	PP02	5.000	SW05	9.0	0.514	0.092	0.3953	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.04%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	R01	18	51.249	0.049	47.0	0.0810	0.0000	OK
30 minute summer	R02	18	51.251	0.051	44.9	0.0812	0.0000	OK
30 minute summer	R03	18	51.273	0.073	46.6	0.1186	0.0000	OK
15 minute summer	R04	10	48.263	0.063	33.2	0.0452	0.0000	OK
15 minute summer	R05	10	48.247	0.047	33.8	0.0337	0.0000	OK
1440 minute winter	EXS14	1380	37.446	1.599	2.5	23.3826	0.0000	FLOOD RISK
240 minute winter	P01	236	40.073	0.873	48.5	201.0307	0.0000	SURCHARGED
1440 minute winter	SW06	1380	37.443	0.993	0.8	0.5946	0.0000	FLOOD RISK
1440 minute winter	SW05	1380	37.443	1.291	5.8	0.6934	0.0000	FLOOD RISK
1440 minute winter	SW04	1380	37.443	1.709	6.9	0.8000	0.0000	FLOOD RISK
1440 minute winter	SW03	1380	37.443	1.809	7.0	0.4378	0.0000	FLOOD RISK
1440 minute winter	SW08	1380	37.445	1.435	1.5	0.3287	0.0000	FLOOD RISK
1440 minute winter	SW07	1380	37.444	1.930	4.4	47.9848	0.0000	FLOOD RISK
1440 minute winter	SW02	1380	37.444	2.080	11.8	253.5701	0.0000	FLOOD RISK
1440 minute winter	SW12	1350	37.481	1.718	6.5	0.7526	0.0000	FLOOD RISK
1440 minute winter	SW11	1350	37.476	2.061	7.0	0.9191	0.0000	FLOOD RISK
1440 minute winter	SW01	1350	37.469	2.409	10.0	240.7171	0.0000	FLOOD RISK
1440 minute winter	OUTFALL	1350	35.008	0.048	4.3	0.0000	0.0000	OK
1440 minute winter	SW09	1350	37.470	2.376	7.5	0.7294	0.0000	FLOOD RISK
1440 minute winter	SW10	1350	37.471	2.334	7.5	0.9173	0.0000	FLOOD RISK
1440 minute winter	PP01	1380	37.444	0.694	0.4	10.7638	0.0000	FLOOD RISK
1440 minute winter	PP02	1380	37.442	0.692	1.2	27.4782	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	R01	6.000	SW05	47.0	3.486	0.233	0.1350	
30 minute summer	R02	3.000	P01	44.8	3.300	0.296	0.1925	
30 minute summer	R03	1.000	P01	46.5	3.108	0.483	0.5420	
15 minute summer	R04	2.000	P01	33.1	2.303	0.374	0.4551	
15 minute summer	R05	8.000	SW08	33.8	2.553	0.236	0.2143	
1440 minute winter	EXS14	8.002	SW07	2.4	0.483	0.047	1.3238	
240 minute winter	P01	Depth/Flow	SW12	6.0				
1440 minute winter	SW06	4.000	SW05	0.8	0.230	0.015	1.1870	
1440 minute winter	SW05	4.001	SW04	5.6	0.756	0.093	1.2385	
1440 minute winter	SW04	4.002	SW03	6.7	0.725	0.129	0.3986	
1440 minute winter	SW03	4.003	SW02	6.9	0.625	0.134	1.0788	
1440 minute winter	SW08	8.001	EXS14	1.4	0.434	0.027	0.6480	
1440 minute winter	SW07	8.003	SW02	7.5	0.787	0.086	0.2142	
1440 minute winter	SW02	4.004	SW01	2.2	0.114	0.041	1.2076	
1440 minute winter	SW12	1.002	SW11	6.4	0.811	0.124	1.3834	
1440 minute winter	SW11	1.003	SW10	7.0	0.601	0.134	1.1043	
1440 minute winter	SW01	1.006	OUTFALL	4.3	0.691	0.100	0.0895	312.1
1440 minute winter	SW09	1.005	SW01	7.5	0.716	0.144	0.1341	
1440 minute winter	SW10	1.004	SW09	7.4	0.553	0.143	0.1711	
1440 minute winter	PP01	7.000	SW04	0.5	0.084	0.003	0.3881	
1440 minute winter	PP02	5.000	SW05	1.2	0.203	0.013	0.6918	

Appendix F – CONVEYANCE ROUTE DRAWING



W:\WW General\Projects\P451900\P451907 Hayes West Park\03 BIM\01 Models\C3D\P451907-WW-XX-XX-DR-C-1002.dwg Plotted on 09/12/25 at 08:57 by t.connolly

HEALTH AND SAFETY INFORMATION

CONSTRUCTION
THIS DRAWING SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

MAINTENANCE/CLEANING/OPERATION.
MAINTENANCE OF SUDS FEATURES AND THE DRAINAGE SYSTEM SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE CIRIA SUDS MANUAL AND MANUFACTURERS SPECIFICATIONS

DECOMMISSIONING/DEMOLITION.
REFER TO DRAWING FOR EXTENT OF EXISTING SITE DRAINAGE TO BE ABANDONED/REMOVED

NOTES

1. DO NOT SCALE FROM THIS DRAWING. ONLY FIGURED DIMENSIONS ARE TO BE USED.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
5. ALL FOUL AND SURFACE WATER PIPEWORK TO BE LAID AT MINIMUM GRADIENTS OF 1:40 AND 1:100 RESPECTIVELY UNLESS NOTED OTHERWISE.
6. ALL PIPEWORK TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.
7. ROCKER PIPES TO BE INSTALLED AT CONNECTION POINTS TO STRUCTURES TO ALLOW FOR MOVEMENT CAUSED BY SETTLEMENT.
8. ALL DRAINAGE IS DESIGNED TO ADOPTABLE STANDARDS WHERE POSSIBLE, AND BUILDING REGULATIONS PART H.
9. INVERT LEVEL REFERS TO THE INTERNAL BASE OF THE CHAMBER, INCLUDING SUMP DEPTH WHERE APPLICABLE.

KEY

POSITIVE DRAINAGE BOUNDARY
CONVEYANCE ROUTE

REV	DESCRIPTION	DRN	CHK	APP	DATE
P02	UPDATED ISSUE	TC	RS	RW	09.12.25
P01	FIRST ISSUE	TC	RS	RW	06.11.25

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CLIENT
SHALL DO HAYES DEVELOPMENT LTD

PROJECT
HAYES PARK WEST

PRELIMINARY

DRAWING TITLE
SITEWIDE CONVEYANCE DRAWING

DATE	SCALES @ A1	DRAWN BY	CHECKED	APPROVED
09.12.25	1:250	TC	RS	RW

DRAWING NUMBER	REVISION
P451907-WW-XX-XX-DR-C-1002	P02

Appendix G – SuDS PROFORMA

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Hayes Park West
Address & post code	Hayes Park West, Hayes Park, Uxbridge, UB4 8FE
OS Grid ref. (Easting, Northing)	E 508815 N 182574
LPA reference (if applicable)	
Brief description of proposed work	Partial demolition and redevelopment of the existing multi story car park to provide new homes (Use Class C3), landscaping, car and cycle parking, and other associated works.
Total site Area	9,000 m^2
Total existing impervious area	8,000 m^2
Total proposed impervious area	8,000 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	No
Existing drainage connection type and location	Thames Water Surface Water Chamber, MH8406
Designer Name	Tom Connolly

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	X
Bedrock geology classification	London Clay Formation
Site infiltration rate	X m/s
Depth to groundwater level	X m below ground level
Is infiltration feasible?	No

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	Y	Y
2 use infiltration techniques, such as porous surfaces in non-clay areas	N	N
3 attenuate rainwater in ponds or open water features for gradual release	N	N
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	N	N
6 discharge rainwater to a surface water sewer/drain	Y	Y
7 discharge rainwater to the combined sewer.	N	N

2c. Proposed Discharge Details

Proposed discharge location	hames Water Surface Water Chamber, MH840
Has the owner/regulator of the	

3. Drainage Strategy

Designer Position	Design Engineer
Designer Company	Whitby Wood

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	4.4			
1 in 1	3.7	179.9	1040	4.4
1 in 30	10.5	425.3	900	4.4
1 in 100	13.9	539.1	860	4.4
1 in 100 + CC			860	4.4
Climate change allowance used		40%		

3b. Principal Method of Flow Control	Hydrobrake

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^3)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	0	0
Blue roofs	1000	677	193
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	1000	711	107
Swales	0	0	0

discharge location been consulted?	Yes

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	1.3
Drainage hierarchy (2b)	4.1.1
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	4
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	3.1
Proposed SuDS measures & specifications (3b)	3.2.1

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix D
Detailed drainage design drawings, including exceedance flow routes	Appendix D
Detailed landscaping plans	Appendix D, Appendix F
Maintenance strategy	5
Demonstration of how the proposed SuDS measures improve:	3.2.1

Basins/ponds	0	0	0
Attenuation tanks	7000		489
Total	**9000**	**1388**	**789**

a) water quality of the runoff?	3.2.1
b) biodiversity?	3.2.1
c) amenity?	3.2.1

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