EVOLVE

Big Yellow, Staples Corner.

Drainage Strategy

3727-EVE-XX-XX-T-C-0002

Revision C

11/12/2023

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Checked by:	Lance Greenaway, Associate

Revision	Date	Prepared By	Checked By	Purpose
A	27/10/23	PW	LG	Issued for Planning
B	07/12/23	PW	JT	Issued for Planning
C	11/12/23	PW	LG	Revised to latest drawings

Contents

1 Site Location and Setting

Evolve Consulting Engineers Limited has been appointed by .Big Yellow Self Storage Company Limited in respect to the proposed development centred at approximate National Grid Reference TQ 22620 87382 (E 522620, N 187382) What3Words chains.drama.rats Renault/ Dacia, Staples Corner, North Circular Road, Brent Cross, NW2 1LY. Refer to Appendix A – Site Location Plan.

The site is located approximately 1.1 kilometres (km) south-southeast of Hendon train station and 2.23km northeast of Neasden tube station. The area of the site is 8444m^2 with this being split into 2,411m^2 of roof area, 5,585m^2 of hardstanding and 448m^2 soft landscaping.

According to the London Borough of Barnet Surface Water Management Plan (SWMP) there are 33 Critical Drainage Areas (CDA) within the London Borough of Barnet. Reference to the SWMP shows that the site is not shown to be located in a CDA.

The site is occupied approximately 29.1% by building footprint, 65.1% by hardstanding and 5.8% by soft landscaping.

2 Proposed Development

The proposed development comprises the demolition of the existing building and the construction of a self-storage facility (Use Class B8), with flexible office space (Use Class E(g)(i)) and external storage units (Use Class B8), with associated parking and servicing areas.

3 Local Policy Guidance

3.1 The London Plan 2021

This drainage strategy has been written with reference to The London Plan 2021. This document is the Spatial Development Strategy for Greater London. It sets out a framework for how London will develop over the next 20-25 years and the Mayor's vision for Good Growth.

The Plan is part of the statutory development plan for London, meaning that the policies in the Plan should inform decisions on planning applications across the capital. Borough's Local Plans must be in 'general conformity' with the London Plan, ensuring that the planning system for London operates in a joined-up way and reflects the overall strategy for how London can develop sustainably, which the London Plan sets out. Relevant points have been extracted below:

Policy SI 13 Sustainable Drainage States:

"Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2) rainwater infiltration to ground at or close to source
3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) controlled rainwater discharge to a surface water sewer or drain
6) controlled rainwater discharge to a combined sewer.

Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

Policy 9.13.1 *London is at particular risk from surface water flooding, mainly due to the large extent of impermeable surfaces. Lead Local Flood Authorities have responsibility for managing surface water drainage through the planning system, as well as ensuring that appropriate maintenance arrangements are put in place. Local Flood Risk Management Strategies and Surface Water Management Plans should ensure they address flooding from multiple sources including surface water, groundwater and small watercourses that occurs as a result of heavy rainfall.*

Policy 9.13.2 *Development proposals should aim to get as close to greenfield run-off rates as possible depending on site conditions. The well-established drainage hierarchy set out in this policy helps to reduce the rate and volume of surface water run-off. Rainwater should be managed as close to the top of the hierarchy as possible. There should be a preference for green over grey features, and drainage by gravity over pumped systems. A blue roof is an attenuation tank at roof or podium level; the combination of a blue and green roof is particularly beneficial, as the attenuated water is used to irrigate the green roof.*

Policy 9.13.3 *For many sites, it may be appropriate to use more than one form of drainage, for example a proportion of rainwater can be managed by more sustainable methods, with residual rainwater managed lower down the hierarchy. In some cases, direct discharge into the watercourse is an appropriate approach, for example rainwater discharge into the tidal Thames or a dock. This should include suitable pollution prevention filtering measures, ideally by using soft engineering or green infrastructure. In addition, if direct discharge is to a watercourse where the outfall is likely to be affected by tide-locking, suitable storage should be designed into the system. However, in other cases direct discharge will not be appropriate, for example discharge into a small stream at the headwaters of a catchment, which may cause flooding. This will need to be assessed on a case-by-case basis, taking into account the location, scale and quality of the discharge and the receiving watercourse. The maintenance of identified drainage measures should also be considered in development proposals.*

3.2 London Borough of Barnet Council Website.

When considering SuDS as part of a planning application, we need to satisfy ourselves that:

Surface water is managed in accordance with the surface water discharge hierarchy for discharge destinations.

The aim of the surface water discharge hierarchy is to ensure that surface water runoff is treated at source and managed in a way which minimises the negative impact of the proposed development on flood risk and the water quality of receiving waters.

Early consideration must be given to the use of rainwater harvesting systems and / or the use of green roofs, to both manage surface water runoff and deliver a source of non-potable water for the proposed development where practical.

A detailed surface water drainage strategy should be submitted which will set out the appropriateness of SuDS to manage surface water runoff and provision of maintenance for the lifetime of the development which they serve. Major applications which do not meet this requirement will not be made valid.

The surface water drainage strategy for the proposed development must have evidence of Adopting Body(ies) accepting responsibility for the safe operation and maintenance of the proposed SuDS.

The surface water drainage strategy should include detailed calculations to demonstrate that post-development surface water discharge rate is limited to greenfield runoff rates, for all return periods up to 1 in 100 year plus climate. This is applicable for both Greenfield and previously developed sites. Greenfield runoff rate is the runoff rate from a site in its natural state, prior to any development.

Proposals for higher discharge rates should be agreed with the LBB ahead of submission of the Planning Application. Clear evidence should be provided with the Planning Application to show why greenfield rates cannot be achieved.

3.3 Barnet's Local Plan (Core Strategy) Development Plan Document - September 2012.

DM04: Environmental considerations for development.

g. Development should demonstrate compliance with the London Plan water hierarchy for run off especially in areas identified as prone to flooding from surface water run off. All new development in areas at risk from fluvial flooding must demonstrate application of the sequential approach set out in the NPPF (paras 100 to 104) and provide information on the known flood risk potential of the application site.

h. Development proposals will wherever possible be expected to naturalise a water course, ensure an adequate buffer zone is created and enable public accessibility. Where appropriate, contributions towards river restoration and de-culverting will be expected.

5.9 Surface water run off and drainage

5.9.1 Reducing or slowing the amount of rainfall (run off) entering the drainage network is important to help reduce flood risk both in Barnet and further downstream. The borough has 14kms of streams and brooks. The North London Strategic Flood Risk Assessment identified fluvial flooding from Dollis Brook, Silk Stream, Pymmes Brook and their associated tributaries as the primary source of flood risk in the borough. Surface water flooding in Barnet presents a low to moderate risk, and sewer flooding as low risk. Groundwater flooding was also found to be a relatively low risk due to the impermeable geology (primarily London Clay) and depth of the groundwater table.

5.9.2 In line with national policy a sequential riskbased approach to determining the suitability of land for development in flood risk areas will be applied. Flood risk assessments will be expected on all applicable sites to inform the sequential approach. Sustainable Urban Drainage techniques such as porous paving should be used where possible to reduce flood risk and the Mayor's drainage hierarchy applied. The principle of the Mayors drainage hierarchy is for a greenfield rate of run off to be maintained. A greenfield run-off rate is one that reflects the natural rate of water runoff from a site before development. Further detail is provided in the Sustainable Design and Construction SPD.

5.9.3 The Surface Water Management Plan (SWMP) for Barnet, Brent and Harrow is designed to fulfil the requirements of the Flood Risk regulations 2009 and to identify areas more at risk from surface water flooding. Proposals which create impact in these areas identified at risk will need to demonstrate through hydrological investigations and modelling how they will reduce that risk. Where they require permission, front garden alterations for parking or basement developments are examples which can impact local run off. Further guidance on basement development is set out in Design Guidance Note 5 – Extensions to Houses which seeks to ensure that such development does not harm the established architectural character of buildings and surrounding areas.

3.4 Remaining Policies of the Unitary Development Plan for Brent Cross and Cricklewood

Sustainable Design

12.3.11 The Brent Reservoir is a Site of Special Scientific Interest (SSSI) and is located adjacent to West Hendon, sharing a 1.5 kilometre section of its boundary with the Regeneration Area. It was formed in 1835 by the damming of the River Brent, and its unusually shallow depth and sloping banks have supported a particularly interesting habitat for breeding wetland birds, waterfowl and a variety of plants. Any development will be required to respect a buffer zone and protect this area of nature conservation interest. In such areas of nature conservation interest, development can also include proposals that contribute to extending and protecting the area's biodiversity and which take opportunities to create new habitats for wildlife colonisation. The nature conservation and amenity value of the Brent River should therefore be enhanced where it is in an open concrete channel (with due regard being given to any advice from the Environment Agency). There must be no building within eight metres of the brink of the River Brent.

12.3.12 Development will only be acceptable in floodplains where issues of flood risk have been addressed, in line with PPG25, and both environmental and ecological mitigation have been agreed with the Environment Agency. These may include providing more flood water storage outside the floodplain. The council would welcome the application of the innovative, sustainable principles of the Millennium Villages.

4 Hierarchy of Surface Water Disposal

When developing or redeveloping a site, the control and dispersion of surface water falling on the site's catchment always must be considered. Wherever possible runoff from developments should be managed on the surface. This enables their performance to be more easily inspected and managed with pollution incidents and potential flood risk being visible. But due to the nature of some developments this is not always possible.

If surface water is to be discharged from the site, The London Plan requires that it should be to discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable. The proposed development has been developed in accordance with this hierarchy.

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2) rainwater infiltration to ground at or close to source
3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) controlled rainwater discharge to a surface water sewer or drain
6) controlled rainwater discharge to a combined sewer.

It is recommended to manage surface water as close to the source i.e., where the rain falls. The effective use of control and management of surface water runoff will need to be addressed through the application of the above drainage hierarchy.

4.1 Rainwater Harvesting

As the site is proposed to be used as a storage facility the cost and maintenance required for a centralised rainwater harvesting system that will serve less than 5 toilets makes it financially unviable.

4.2 Discharge to Ground (Infiltration)

The BGS's online geology map shows the superficial geology to be Alluvium, this member is formed of clay, silt, sand and gravel. The bedrock geology is shown to be London Clay underlying the Gravel Member as expected. This member comprises blue/grey clay with silt and sandy layers common.

There are two historical borehole records within the site boundary on the BGS website. The closest to the centre of the site shows the following geology.

Ground Type	Elevation (mAOD)	Depth (mbgl)	Thickness (m)	Description
Made Ground	40.17	0.00	3.55	Gravel, ash, broken glass & rubble.
Alluvium	36.62	3.55	1.00	Stiff to Firm slightly fissured silty CLAY.
Gravel	35.62	4.55	0.75	Medium dense to dense, coarse to medium very sandy GRAVEL
London Clay Formation	34.87	5.30	Not Proven	Firm to stiff, brown locally mottled orangish brown slightly silty fissured CLAY

The bedrock geology of London Clay is not suitable for infiltration due to the poor soakage rates.

4.3 Blue/Green Roofs and Rain Gardens

The design of the proposed building and the subsequent pitch of the roofs does not allow for the use of blue roofs on the development. Due to the loading on the structure associated with a green roof, this is not proposed, with the client focusing on drainage measures at ground level. Although not currently shown on the design it may be possible to use rain gardens within adjacent planted areas shown on the plans. These could be considered in detailed design subject to client approval.

4.4 Discharge to Surface Water Body

Reference to OS Mapping shows that the River Brent flows broadly west directly adjacent to the northern boundary of the site. The river discharges into the Brent Reservoir some 500m to the west of the site. The Thames Water surface water network plans show two 225mm diameter surface water sewers draining south from the road under the railway line, which then combine to a 300mm diameter sewer as it enters the North Circular. The eventual outfall from the public surface water sewer downstream from the site has been proved to flow beneath the carriageway of Edgeware Road, before discharging into the River Brent.

It is our intention to discharge the surface water from the redeveloped site to the River Brent using the existing outfall point to the public sewer.

4.5 Discharge to Surface Water Sewer

it is our intention to discharge the surface water from the redeveloped site using the existing outfall point albeit at a restricted and attenuated rate.

4.6 Discharge to Combined Sewer

Not required as discharging to an outfall higher up the hierarchy.

5 Surface Water Runoff Rates

The discharge from the site must not impact the flood risk of the surrounding developments both upstream and downstream of the site.

As stated in the guidance taken from Barnet Council's website, the post-development surface water discharge rate should be limited to greenfield runoff rates, for all return periods up to 1 in 100 year plus climate change. This is applicable for both Greenfield and previously developed sites. Refer to section 6 for details.

The catchment areas for the existing site drainage layout have been taken from the topographical survey drawings and are broken down as follows:

	Area (m^2)	**Runoff Coefficient**	**Factored Area (m^2)**	**Total (m^2)**	**Total Factored (m^2)**
Roof	2,460	0.95	2,337	8,444	7,099
Hardstanding	5,496	0.85	4,672		
Soft Landscaping	488	0.20	89		

5.1 Existing Flow – Modified Rational Method

In order to calculate the existing flow from the site the Modified Rationale Method has been used. Using the FSR rainfall intensities for Brent Cross area the following values have been calculated for the 0.161ha development site catchments. The results of the calculation are shown below:

The Modified Rationale Method Q=2.78CiA

	mm/hr	Roof	Qroof	Hard	Qhard	Soft	Qsoft	Total (l/s)
1YR	32.37	0.2337	19.975733	0.4672	35.730753	0.0089	0.2402324	**55.95**
30YR	79.46	0.2337	49.042847	0.4672	87.723331	0.0089	0.5897998	**137.36**
100YR	103.28	0.2337	63.74706	0.4672	114.02487	0.0089	0.7666358	**178.54**

5.2 Existing Flow – Greenfield Runoff Rate

Using IH124 which specifically addresses the runoff from small catchments (Institute of Hydrology, 1994) we have calculated the greenfield runoff rate. The results are as follows:

- Qbar (l/s) = 3.76
- 1:1yr (l/s) = 3.20
- 1:30yr (l/s) = 8.66
- 1:100yr (l/s) = 12.01

5.3 Proposed Flow

It is proposed to match the existing greenfield runoff rate. Through the use of a complex flow restrictor, it will be possible to provide multiple flow controls that will cover the 1:1yr, 1:30yr and 1:100yr storms.

- 1:1yr 3.2l/s
- 1:30yr 8.7l/s
- 1:100yr 12.0l/s

Having multiple discharge rates will reduce the amount of attenuation storage required whilst still ensuring that the greenfield runoff rate is achieved.

It is also possible to use the QBAR rate of 3.8l/sec for all storm events but this will increase the attenuation volume requirements. For the purposes of this report we are proceeding utilising multiple discharge rates.

5.4 Climate Change

Referencing the gov.uk website we have used table 2 to set our climate change values.

Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

The proposed development is for commercial/business units which is considered to have a lifetime of 50 years. The range of climate change allowances to be considered for the proposed development is 40%.

6 Inclusion of Sustainable Drainage Systems (SuDS)

Sustainable drainage is a departure from the traditional approach to draining sites. There are some key principles that influence the planning and design process enabling SuDS to mimic natural drainage by:

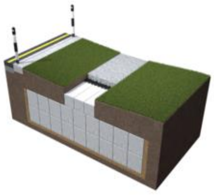
- Storing runoff and releasing it slowly (attenuation)
- Harvesting and using the rain close to where it falls
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

To fall in line with the recommendations of The Flood and Water Management Act which requires that "developers are to put SUDS in place in new developments wherever practicable.", we have reviewed the main SuDS components in line with the suitability for the proposed development.

SuDS components are a physical part of the drainage system and can be categorised as follows:

Suds Component	Example	Description	Suitability for Development
Green Roof		A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	Due to design pitch of the roof this is not possible. Not Feasible.
Blue Roof		Storage of water at roof/podium level.	Due to design pitch of the roof this is not possible. Not Feasible.
Rainwater Harvesting		Rainwater is collected from the roof of a building or from other paved surfaces and stored in an over ground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	A centralised rainwater harvesting system that will serve less than 5 toilets makes it financially unviable. Not Feasible.
Soakaway		A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	Due to underlying strata, infiltration drainage will not be possible. Not Feasible
Filter Drains & Filter Strip		Filter drains are shallow trenches filled with stone, gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration.	Not currently shown. Could be incorporated in the landscaping shown on the plans. Potentially Feasible

Permeable Paving		Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	A tanked permeable paving to be used in all car parking areas. Void volume in subbase to be used as part of the attenuation. Feasible
Bioretention Area		*A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens*	Due to the layout and site constraints, the use of a Bioretention area will not be possible. Not Feasible
Swales		Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration	Not currently shown. Could be incorporated in the landscaping shown on the plans. Potentially Feasible
Rills and Channels		Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance; they also provide effectiveness in pretreatment removal of silt	Due to the layout and site constraints, the use of a Bioretention area will not be possible. Not Feasible
Pond/Basin		Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge	Due to the layout and site constraints, the use of ponds or basins is not possible. Not Feasible
Wetland		Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment	Due to the layout and site constraints, the use of a Wetland area will not be possible. Not Feasible
Proprietary Treatment System		Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS	Can be used to capture the flow from the service yards. Alternatives solutions should be sought in preference to these. Feasible

Geocellular Systems		Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site	To be used to provide attenuation volume in addition to the swales (if adopted as part of the detailed design) and permeable paving subbase voids. Feasible.
Natural Aquifer Blocks		A natural product that absorbs water and releases it in a controlled manner. Can be used as part of blue roofs, soakaways, filter strips, rainwater gardens, irrigation areas, swales & attenuation.	Can be used as part of multiple SuDS techniques. Feasible

7 Design of Drainage Infrastructure

The below ground drainage will be designed to ensure:

- No surcharging for the 1:1yr storm
- No flooding for all storms up to and including the critical 1:30yr storm.
- Any flooding experienced for all storms in excess of 1:30yr and up to and including the 1:100yr storm will need to be contained on site posing no risk to the building or affecting safe egress from site.
- The design will be checked for the impact of climate change on the 1:100yr storm.

The catchment areas for the development are broken down as follows:

	Area (m^2)	**Runoff Coefficient**	**Factored Area (m^2)**	**Total (m^2)**	**Total Factored (m^2)**
Roof	3,277	0.95	3,113	8,444	6515
Hardstanding	3,644	0.85	3,097		
Soft Landscaping	1,523	0.20	305		

Following redevelopment, the 0.844ha site will be occupied approximately 36.8% by building footprint, 36.6% by hardstanding and 26.6% by soft landscaping.

7.1 Attenuation Volume

In order to ensure that no flooding occurs:

For the 1:100yr + 40% climate change event with a discharge rate 12.0l/s an attenuation volume of 401m^3 must be provided.

For the 1:100yr event with a discharge rate 12.0l/s an attenuation volume of 260m^3 must be provided.

For the 1:30yr event with a discharge rate 8.7l/s an attenuation volume of 200m^3 must be provided.

For the 1:1yr event with a discharge rate 3.2l/s an attenuation volume of 92m^3 must be provided.

Refer to Appendix B for MicroDrainage Calculations and Appendix C for the drainage layout.

8 Maintenance for All Drainage Elements

On the 25th of October 2019, the documentation submitted by Water UK concerning sewerage was approved by Ofwat. It is designed to guide water companies and developers when planning, designing, and constructing foul and surface water drainage systems which are intended for adoption, as per the Section 104 agreement under the Water Industry Act 1991. The documents provide updated guidance for all standards and specifications required when designing new water or drainage infrastructure and aim to accelerate the uptake of sustainable drainage (SuDS), by smoothing out the transfer of ownership, responsibility and ensure the assets are effectively managed and maintained. They will also allow English water and sewerage companies to adopt a wider range of drainage types, including those with sustainable elements.

Practically and in terms of SuDS, the basic criteria that need to be achieved for a surface water drainage system to be "adoptable" or "not adoptable", will mainly require the following.

Adoptable	**Non-Adoptable**
It is constructed for the drainage of buildings and yards appurtenant to buildings	Watercourses as defined in law (these included rivers, streams and can include some ditches)
It has a channel (a depression between banks or ridges with a definite boundary)	Components build primarily for the drainage of surface water from streets or the drainage of land
It conveys and returns flows to a sewer or to a surface water body or to groundwater	Components built to manage groundwater
It has an effective point of discharge, which must have lawful authority to discharge into a watercourse or other water body or into land. As with conventional piped systems, this right to discharge must be secured by the developer and transferred to the sewerage company on adoption	Components which are part of the structure of a building or yard (e.g., green roof, pervious driveway or guttering and rainwater pipes attached to the building)
	Components which are an integral part of the structure of a street (e.g., a pervious street or channel formed by kerb of a conventional road or channel formed by a depression in the centre of a street

Using the above criteria, it will not be possible to offer any part of the system for adoption as no "adoptable" drainage features are being constructed.

On completion of the construction, an operation and maintenance manual will be written setting out the maintenance regime for the surface water and the foul water drainage system. This will recommend the following:

- The entire drainage system should be monitored monthly by lifting the covers to the manholes and chambers to monitor debris build-up. If required, these are to be cleaned at the earliest opportunity to prevent blockages.
- Every six months, the drainage system should be inspected to identify areas that are not operating as required and any remedial works identified should be carried out at the earliest opportunity.
- The system should be cleaned out at 12 monthly intervals and includes the removal of sediment from all structures that have capacity to accommodate sediment storage.
- Debris removed from the catch pits should be removed by a suitably qualified and accredited contractor and an appropriate waste transfer or waste disposal certificate should be kept as record.

A full CCTV survey of the surface water drainage system should also be carried out at 10 yearly intervals to assess the condition of the drainage system.

9 Foul Drainage

The foul flow from the development will be collected in a below ground gravity drainage system and discharge to the existing outfall from the site. This will be subject to the capacity of the receiving system and whether it can accommodate the additional flows from the proposed development, but this is not expected to be an issue as any increase in foul water flows would be minimal.

10 Conclusion

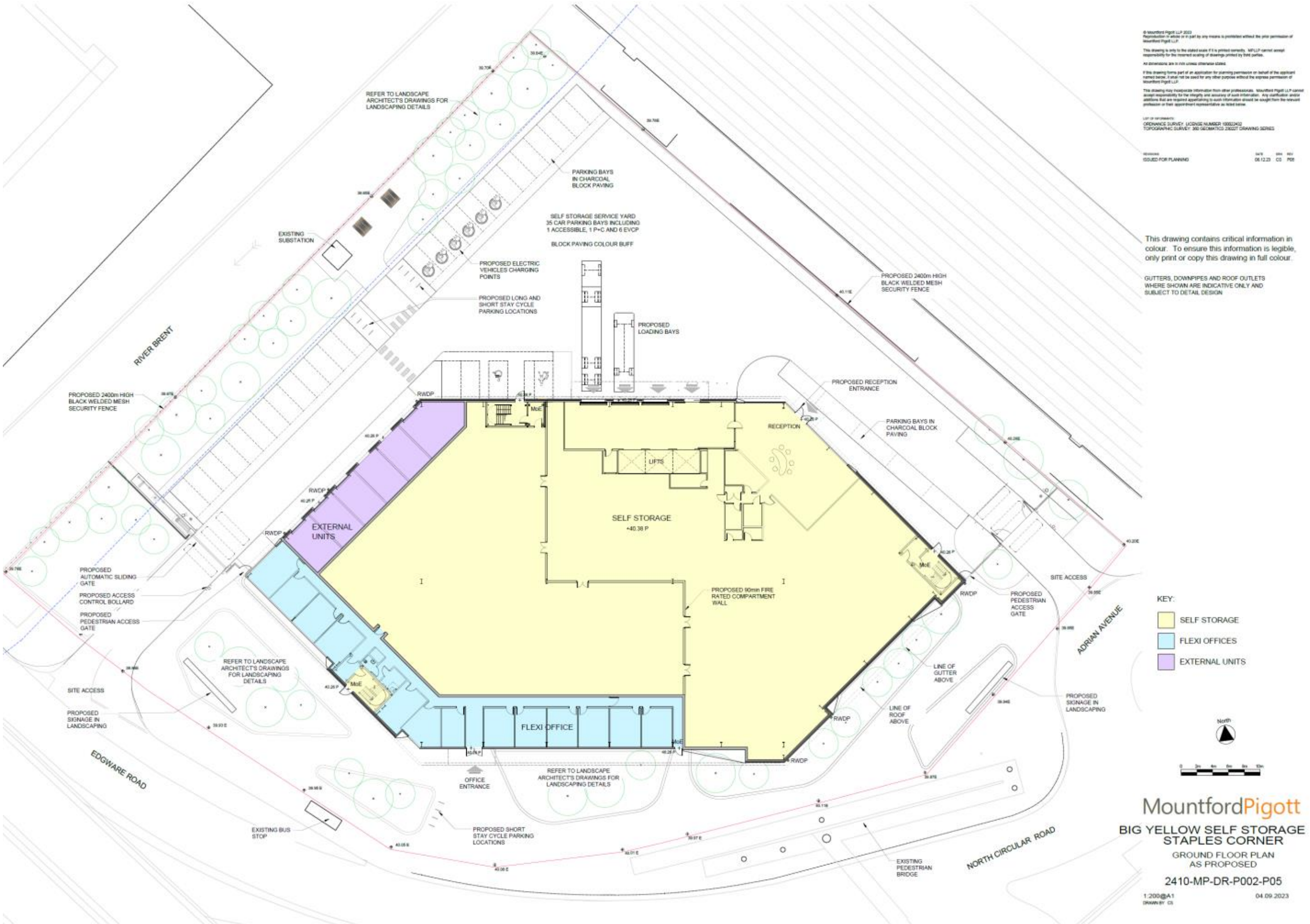
The post development surface water flow from the site will be restricted to match the greenfield runoff rate for the 1:1yr, 1:30yr and 1:100yr storms. A total of 314m^3 of attenuation will be provided.

The post development flow from the site will be discharged to the existing connections to the public sewer currently serving the site.

Permeable paving and propriety treatment systems will be used to improve water quality and remove hydrocarbons and suspended solids from the hard standing runoff.

All relevant policy requirements have been addressed within the proposed drainage strategy.

Appendix A -Site Location



Site Location Plan

Appendix B – MicroDrainage Calculations

- Greenfield Runoff Calculations
- 1yr Attenuation Calculations
- 30yr Attenuation Calculations
- 100yr Attenuation Calculations
- 100yr + 40% Attenuation Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Paul White
Site name:	Staples Corner
Site location:	Barnet

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

Site Details

Latitude:	51.57202° N
Longitude:	0.23199° W
Reference:	2713447137
Date:	Dec 11 2023 15:06

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): .8444

Methodology

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

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	654	654
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	3.76	3.76
1 in 1 year (l/s):	3.2	3.2
1 in 30 years (l/s):	8.66	8.66
1 in 100 year (l/s):	12.01	12.01
1 in 200 years (l/s):	14.08	14.08

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.037	0.437	3.2	50.3	O K
30 min Summer	9.158	0.558	3.2	64.2	O K
60 min Summer	9.270	0.670	3.2	77.1	O K
120 min Summer	9.358	0.758	3.2	87.1	O K
180 min Summer	9.386	0.786	3.2	90.4	O K
240 min Summer	9.391	0.791	3.2	91.0	O K
360 min Summer	9.381	0.781	3.2	89.8	O K
480 min Summer	9.363	0.763	3.2	87.7	O K
600 min Summer	9.342	0.742	3.2	85.3	O K
720 min Summer	9.320	0.720	3.2	82.8	O K
960 min Summer	9.275	0.675	3.2	77.6	O K
1440 min Summer	9.185	0.585	3.2	67.3	O K
2160 min Summer	9.031	0.431	3.2	49.6	O K
2880 min Summer	8.913	0.313	3.2	36.0	O K
4320 min Summer	8.774	0.174	3.1	20.0	O K
5760 min Summer	8.715	0.115	2.9	13.3	O K
7200 min Summer	8.696	0.096	2.6	11.1	O K
8640 min Summer	8.685	0.085	2.3	9.7	O K
10080 min Summer	8.676	0.076	2.0	8.8	O K
15 min Winter	9.037	0.437	3.2	50.3	O K
30 min Winter	9.158	0.558	3.2	64.2	O K
60 min Winter	9.271	0.671	3.2	77.2	O K
120 min Winter	9.361	0.761	3.2	87.5	O K
180 min Winter	9.391	0.791	3.2	91.0	O K
240 min Winter	9.398	0.798	3.2	91.7	O K
360 min Winter	9.380	0.780	3.2	89.7	O K
480 min Winter	9.354	0.754	3.2	86.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	32.914	0.0	53.2	25
30 min Summer	21.228	0.0	68.7	40
60 min Summer	13.233	0.0	86.0	68
120 min Summer	8.073	0.0	104.9	124
180 min Summer	6.014	0.0	117.3	182
240 min Summer	4.874	0.0	126.7	226
360 min Summer	3.603	0.0	140.5	286
480 min Summer	2.900	0.0	150.8	352
600 min Summer	2.450	0.0	159.3	420
720 min Summer	2.134	0.0	166.5	490
960 min Summer	1.717	0.0	178.6	630
1440 min Summer	1.264	0.0	197.2	908
2160 min Summer	0.931	0.0	218.0	1280
2880 min Summer	0.749	0.0	234.1	1620
4320 min Summer	0.551	0.0	258.1	2296
5760 min Summer	0.443	0.0	277.0	2952
7200 min Summer	0.375	0.0	292.5	3672
8640 min Summer	0.326	0.0	305.9	4408
10080 min Summer	0.291	0.0	317.6	5136
15 min Winter	32.914	0.0	53.2	25
30 min Winter	21.228	0.0	68.7	39
60 min Winter	13.233	0.0	86.0	66
120 min Winter	8.073	0.0	104.9	122
180 min Winter	6.014	0.0	117.3	178
240 min Winter	4.874	0.0	126.7	232
360 min Winter	3.603	0.0	140.5	294
480 min Winter	2.900	0.0	150.8	370

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	9.322	0.722	3.2	83.1	O K
720 min Winter	9.289	0.689	3.2	79.2	O K
960 min Winter	9.217	0.617	3.2	71.0	O K
1440 min Winter	9.048	0.448	3.2	51.5	O K
2160 min Winter	8.853	0.253	3.2	29.1	O K
2880 min Winter	8.749	0.149	3.1	17.1	O K
4320 min Winter	8.692	0.092	2.5	10.5	O K
5760 min Winter	8.676	0.076	2.0	8.7	O K
7200 min Winter	8.667	0.067	1.7	7.6	O K
8640 min Winter	8.661	0.061	1.5	7.0	O K
10080 min Winter	8.657	0.057	1.3	6.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	2.450	0.0	159.3	448
720 min Winter	2.134	0.0	166.5	526
960 min Winter	1.717	0.0	178.6	678
1440 min Winter	1.264	0.0	197.2	950
2160 min Winter	0.931	0.0	218.0	1284
2880 min Winter	0.749	0.0	234.1	1592
4320 min Winter	0.551	0.0	258.1	2212
5760 min Winter	0.443	0.0	277.0	2936
7200 min Winter	0.375	0.0	292.5	3600
8640 min Winter	0.326	0.0	305.9	4408
10080 min Winter	0.291	0.0	317.7	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.651

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.217	4	8	0.217	8	12	0.217

Time Area Diagram

Total Area (ha) 0.000

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.000

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	115.0	2.400	0.0	4.800	0.0	7.200	0.0	9.600	0.0
0.400	115.0	2.800	0.0	5.200	0.0	7.600	0.0	10.000	0.0
0.800	115.0	3.200	0.0	5.600	0.0	8.000	0.0		
0.801	0.0	3.600	0.0	6.000	0.0	8.400	0.0		
1.600	0.0	4.000	0.0	6.400	0.0	8.800	0.0		
2.000	0.0	4.400	0.0	6.800	0.0	9.200	0.0		

Hydro-Brake® Optimum Outflow Control

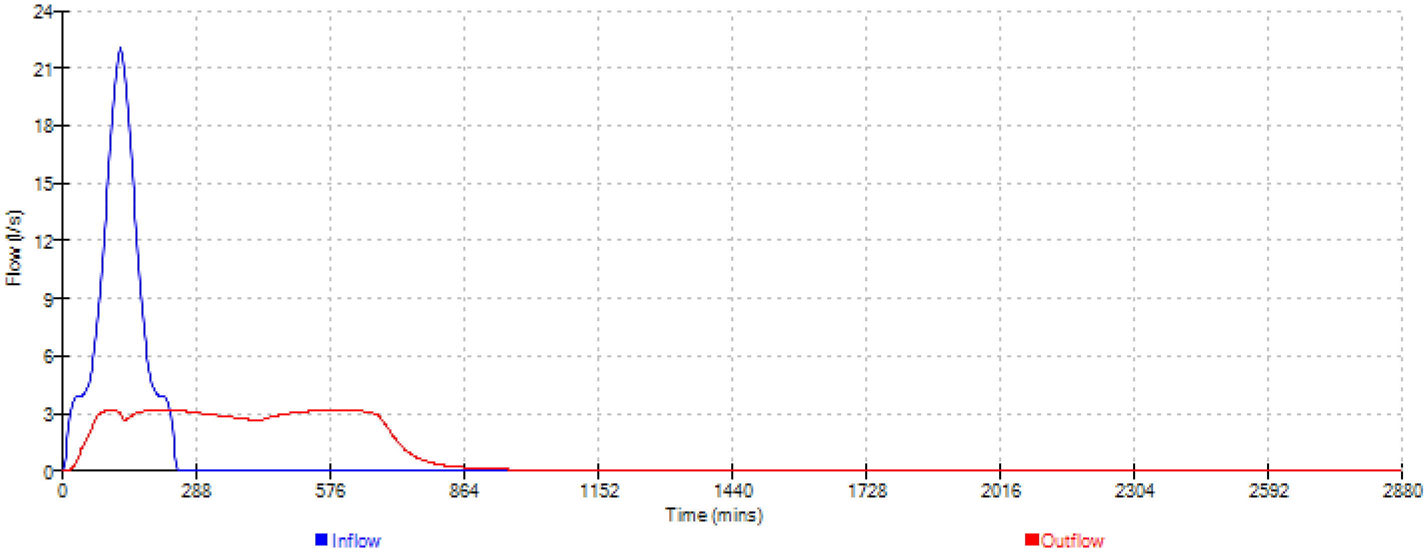
Unit Reference	MD-SHE-0088-3200-0800-3200
Design Head (m)	0.800
Design Flow (l/s)	3.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	88
Invert Level (m)	8.600
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

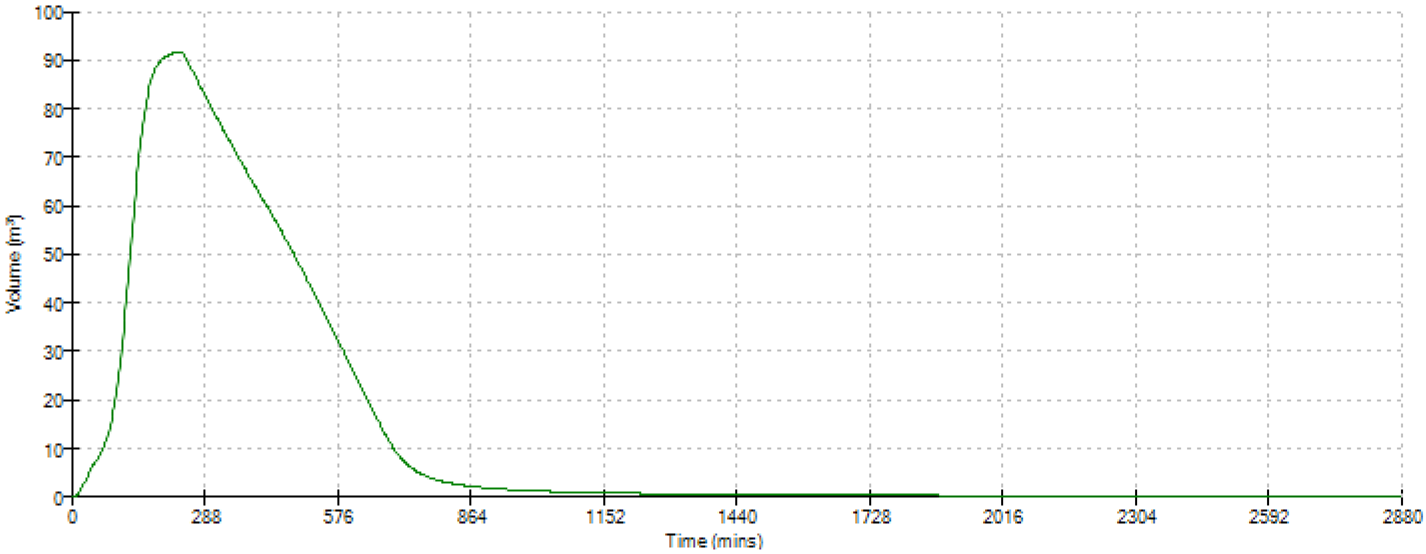
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	3.2	Kick-Flo®	0.517	2.6
Flush-Flo™	0.237	3.2	Mean Flow over Head Range	-	2.8

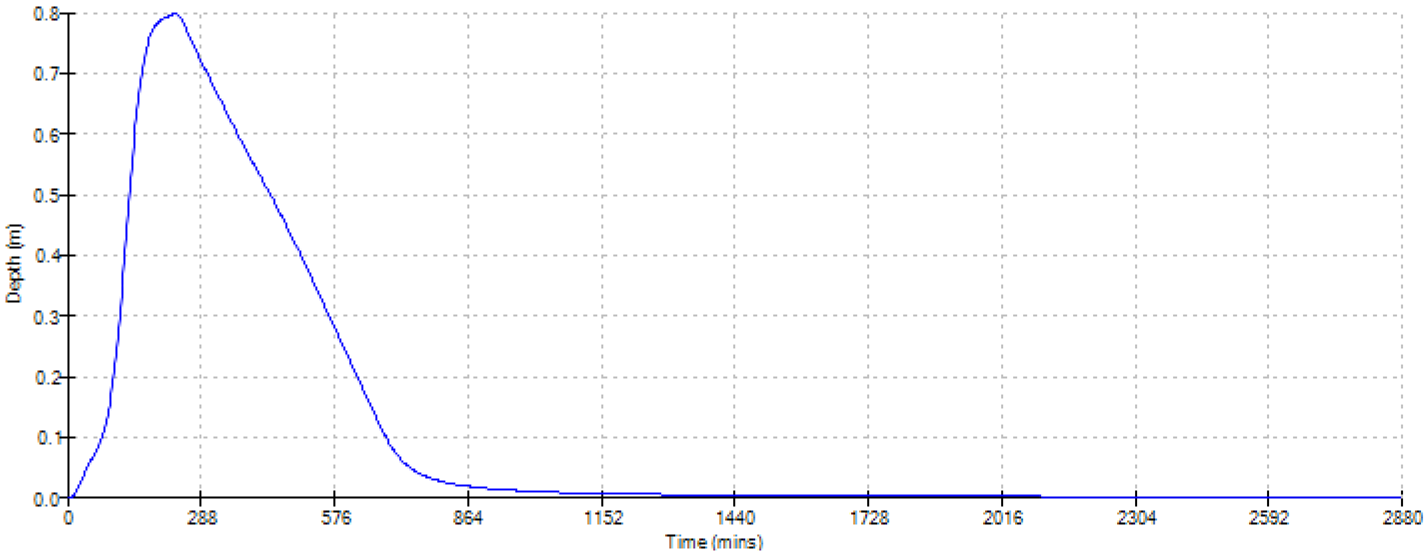
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	3.2	2.000	4.9	4.000	6.8	7.000	8.8
0.200	3.2	1.000	3.5	2.200	5.1	4.500	7.2	7.500	9.1
0.300	3.2	1.200	3.9	2.400	5.3	5.000	7.5	8.000	9.4
0.400	3.1	1.400	4.1	2.600	5.5	5.500	7.9	8.500	9.7
0.500	2.7	1.600	4.4	3.000	5.9	6.000	8.2	9.000	9.9
0.600	2.8	1.800	4.7	3.500	6.4	6.500	8.5	9.500	10.2

Event: 240 min Winter







Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.082	0.482	8.7	122.9	O K
30 min Summer	9.211	0.611	8.7	155.7	O K
60 min Summer	9.317	0.717	8.7	182.9	O K
120 min Summer	9.381	0.781	8.7	199.2	O K
180 min Summer	9.384	0.784	8.7	199.8	O K
240 min Summer	9.371	0.771	8.7	196.6	O K
360 min Summer	9.340	0.740	8.7	188.6	O K
480 min Summer	9.306	0.706	8.7	180.0	O K
600 min Summer	9.271	0.671	8.7	171.1	O K
720 min Summer	9.236	0.636	8.7	162.1	O K
960 min Summer	9.163	0.563	8.7	143.6	O K
1440 min Summer	9.022	0.422	8.7	107.5	O K
2160 min Summer	8.874	0.274	8.7	70.0	O K
2880 min Summer	8.790	0.190	8.6	48.5	O K
4320 min Summer	8.733	0.133	7.3	34.0	O K
5760 min Summer	8.712	0.112	5.9	28.6	O K
7200 min Summer	8.699	0.099	5.0	25.4	O K
8640 min Summer	8.691	0.091	4.3	23.1	O K
10080 min Summer	8.684	0.084	3.8	21.4	O K
15 min Winter	9.082	0.482	8.7	123.0	O K
30 min Winter	9.211	0.611	8.7	155.8	O K
60 min Winter	9.318	0.718	8.7	183.1	O K
120 min Winter	9.384	0.784	8.7	199.8	O K
180 min Winter	9.388	0.788	8.7	200.9	O K
240 min Winter	9.370	0.770	8.7	196.3	O K
360 min Winter	9.329	0.729	8.7	185.9	O K
480 min Winter	9.282	0.682	8.7	173.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	80.827	0.0	130.3	25
30 min Summer	51.838	0.0	167.4	39
60 min Summer	31.749	0.0	206.1	66
120 min Summer	18.872	0.0	245.1	124
180 min Summer	13.779	0.0	268.4	176
240 min Summer	10.980	0.0	285.2	204
360 min Summer	7.955	0.0	310.0	268
480 min Summer	6.327	0.0	328.8	336
600 min Summer	5.294	0.0	343.9	406
720 min Summer	4.575	0.0	356.7	474
960 min Summer	3.633	0.0	377.5	614
1440 min Summer	2.622	0.0	408.6	858
2160 min Summer	1.890	0.0	442.5	1196
2880 min Summer	1.498	0.0	467.4	1532
4320 min Summer	1.078	0.0	504.3	2208
5760 min Summer	0.853	0.0	533.0	2936
7200 min Summer	0.712	0.0	555.5	3672
8640 min Summer	0.613	0.0	574.4	4400
10080 min Summer	0.541	0.0	590.5	5136
15 min Winter	80.827	0.0	130.3	25
30 min Winter	51.838	0.0	167.4	39
60 min Winter	31.749	0.0	206.1	66
120 min Winter	18.872	0.0	245.1	122
180 min Winter	13.779	0.0	268.4	176
240 min Winter	10.980	0.0	285.2	224
360 min Winter	7.955	0.0	310.0	280
480 min Winter	6.327	0.0	328.8	358

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	9.230	0.630	8.7	160.8	O K
720 min Winter	9.176	0.576	8.7	146.8	O K
960 min Winter	9.056	0.456	8.7	116.3	O K
1440 min Winter	8.878	0.278	8.7	70.9	O K
2160 min Winter	8.752	0.152	8.3	38.6	O K
2880 min Winter	8.724	0.124	6.7	31.5	O K
4320 min Winter	8.698	0.098	4.9	25.0	O K
5760 min Winter	8.685	0.085	3.9	21.6	O K
7200 min Winter	8.676	0.076	3.2	19.4	O K
8640 min Winter	8.670	0.070	2.8	17.9	O K
10080 min Winter	8.665	0.065	2.5	16.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	5.294	0.0	343.9	436
720 min Winter	4.575	0.0	356.7	512
960 min Winter	3.633	0.0	377.6	638
1440 min Winter	2.622	0.0	408.6	870
2160 min Winter	1.890	0.0	442.5	1148
2880 min Winter	1.498	0.0	467.4	1500
4320 min Winter	1.078	0.0	504.3	2208
5760 min Winter	0.853	0.0	533.0	2944
7200 min Winter	0.712	0.0	555.5	3672
8640 min Winter	0.613	0.0	574.4	4392
10080 min Winter	0.541	0.0	590.6	5112

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.651

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.217	4	8	0.217	8	12	0.217

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	255.0	2.400	0.0	4.800	0.0	7.200	0.0	9.600	0.0
0.400	255.0	2.800	0.0	5.200	0.0	7.600	0.0	10.000	0.0
0.800	255.0	3.200	0.0	5.600	0.0	8.000	0.0		
0.801	0.0	3.600	0.0	6.000	0.0	8.400	0.0		
1.600	0.0	4.000	0.0	6.400	0.0	8.800	0.0		
2.000	0.0	4.400	0.0	6.800	0.0	9.200	0.0		

Hydro-Brake® Optimum Outflow Control

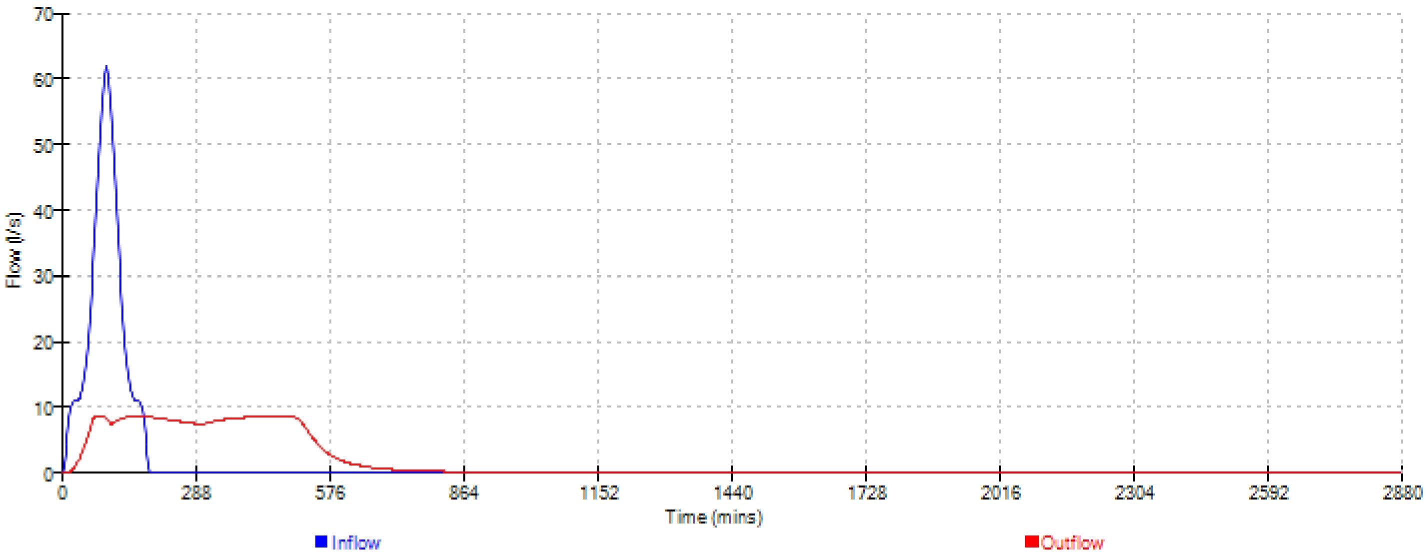
Unit Reference	MD-SHE-0140-8700-0800-8700
Design Head (m)	0.800
Design Flow (l/s)	8.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	140
Invert Level (m)	8.600
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

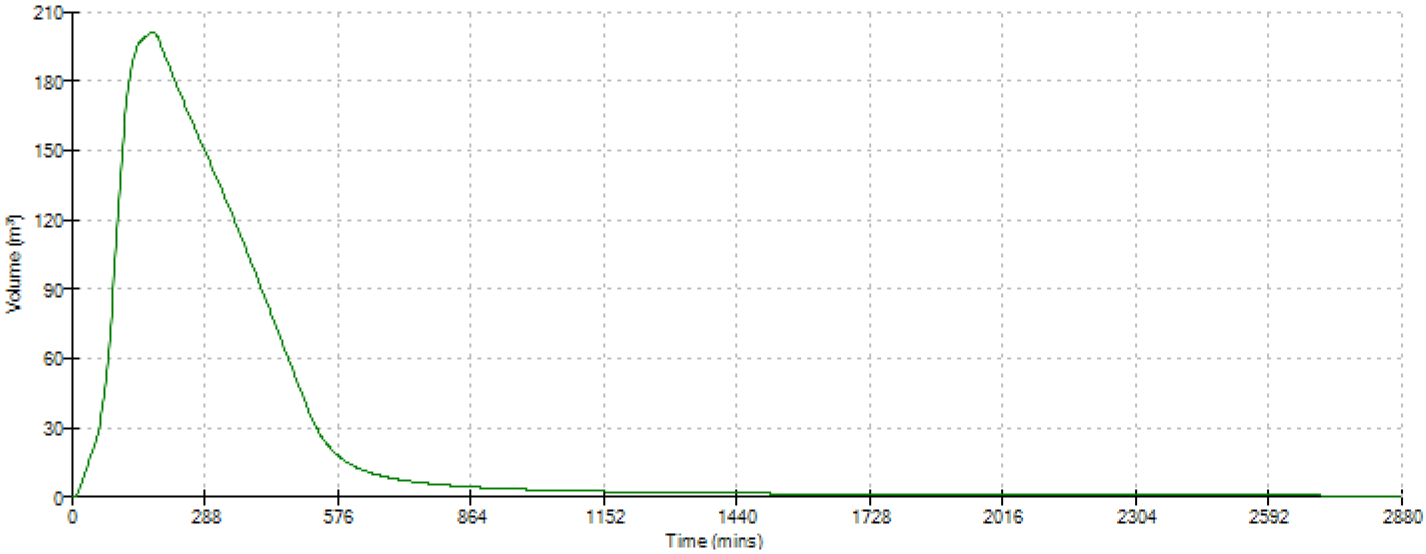
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	8.7	Kick-Flo®	0.562	7.4
Flush-Flo™	0.254	8.7	Mean Flow over Head Range	-	7.4

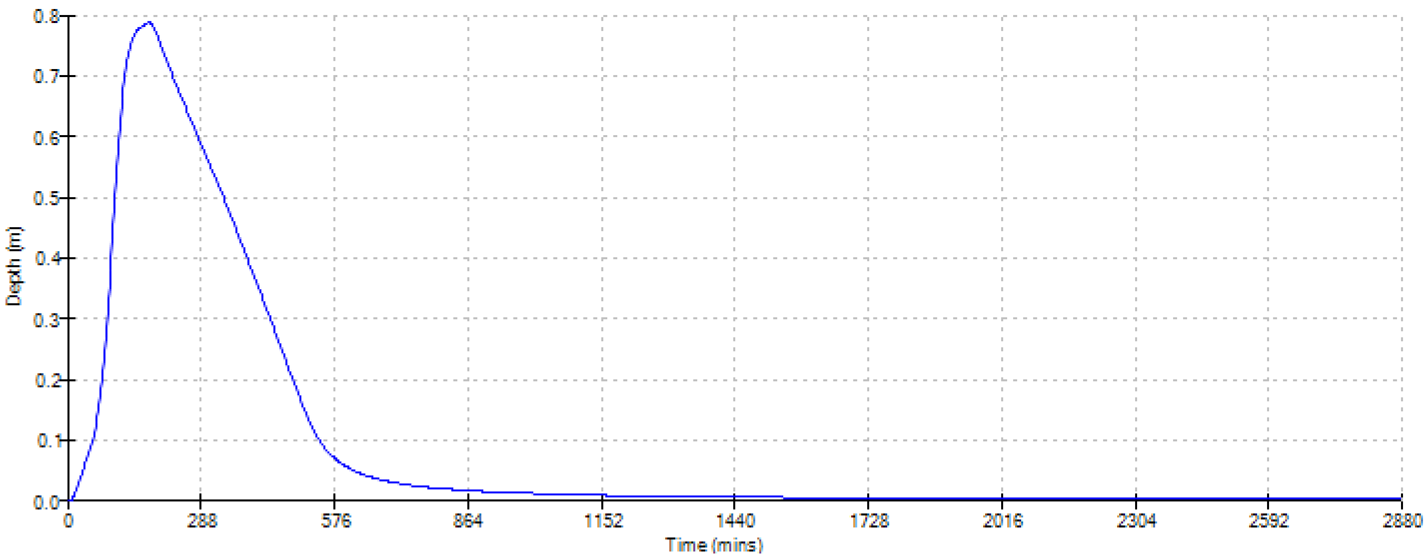
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.0	0.800	8.7	2.000	13.4	4.000	18.7	7.000	24.4
0.200	8.6	1.000	9.7	2.200	14.0	4.500	19.7	7.500	25.2
0.300	8.7	1.200	10.5	2.400	14.6	5.000	20.8	8.000	26.0
0.400	8.4	1.400	11.3	2.600	15.2	5.500	21.7	8.500	26.7
0.500	8.0	1.600	12.1	3.000	16.3	6.000	22.7	9.000	27.5
0.600	7.6	1.800	12.8	3.500	17.5	6.500	23.6	9.500	28.3

Event: 180 min Winter







Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.082	0.482	12.0	159.4	O K
30 min Summer	9.215	0.615	12.0	203.5	O K
60 min Summer	9.324	0.724	12.0	239.7	O K
120 min Summer	9.385	0.785	12.0	260.0	O K
180 min Summer	9.383	0.783	12.0	259.3	O K
240 min Summer	9.368	0.768	12.0	254.1	O K
360 min Summer	9.331	0.731	12.0	242.0	O K
480 min Summer	9.293	0.693	12.0	229.3	O K
600 min Summer	9.254	0.654	12.0	216.3	O K
720 min Summer	9.214	0.614	12.0	203.2	O K
960 min Summer	9.129	0.529	12.0	175.0	O K
1440 min Summer	8.988	0.388	12.0	128.6	O K
2160 min Summer	8.850	0.250	12.0	82.6	O K
2880 min Summer	8.780	0.180	11.6	59.4	O K
4320 min Summer	8.737	0.137	9.1	45.3	O K
5760 min Summer	8.717	0.117	7.3	38.7	O K
7200 min Summer	8.704	0.104	6.2	34.5	O K
8640 min Summer	8.695	0.095	5.3	31.5	O K
10080 min Summer	8.688	0.088	4.7	29.2	O K
15 min Winter	9.082	0.482	12.0	159.5	O K
30 min Winter	9.215	0.615	12.0	203.5	O K
60 min Winter	9.325	0.725	12.0	239.9	O K
120 min Winter	9.387	0.787	12.0	260.6	O K
180 min Winter	9.386	0.786	12.0	260.3	O K
240 min Winter	9.363	0.763	12.0	252.6	O K
360 min Winter	9.316	0.716	12.0	237.1	O K
480 min Winter	9.263	0.663	12.0	219.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	105.122	0.0	169.1	25
30 min Summer	67.935	0.0	219.0	39
60 min Summer	41.754	0.0	270.9	66
120 min Summer	24.792	0.0	321.8	122
180 min Summer	18.043	0.0	351.4	170
240 min Summer	14.324	0.0	371.9	198
360 min Summer	10.321	0.0	402.1	262
480 min Summer	8.179	0.0	424.9	332
600 min Summer	6.825	0.0	443.1	402
720 min Summer	5.884	0.0	458.4	470
960 min Summer	4.653	0.0	483.3	600
1440 min Summer	3.338	0.0	519.9	844
2160 min Summer	2.391	0.0	559.7	1180
2880 min Summer	1.885	0.0	588.3	1504
4320 min Summer	1.347	0.0	630.1	2208
5760 min Summer	1.061	0.0	662.6	2944
7200 min Summer	0.881	0.0	687.6	3672
8640 min Summer	0.756	0.0	708.4	4408
10080 min Summer	0.665	0.0	725.9	5136
15 min Winter	105.122	0.0	169.1	25
30 min Winter	67.935	0.0	219.0	39
60 min Winter	41.754	0.0	270.9	66
120 min Winter	24.792	0.0	321.8	120
180 min Winter	18.043	0.0	351.4	174
240 min Winter	14.324	0.0	371.9	206
360 min Winter	10.321	0.0	402.1	278
480 min Winter	8.179	0.0	424.9	356

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	9.205	0.605	12.0	200.2	O K
720 min Winter	9.138	0.538	12.0	178.1	O K
960 min Winter	9.020	0.420	12.0	139.0	O K
1440 min Winter	8.849	0.249	12.0	82.5	O K
2160 min Winter	8.755	0.155	10.5	51.3	O K
2880 min Winter	8.729	0.129	8.5	42.7	O K
4320 min Winter	8.704	0.104	6.1	34.3	O K
5760 min Winter	8.690	0.090	4.8	29.8	O K
7200 min Winter	8.681	0.081	4.0	26.7	O K
8640 min Winter	8.674	0.074	3.5	24.5	O K
10080 min Winter	8.669	0.069	3.1	22.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	6.825	0.0	443.1	432
720 min Winter	5.884	0.0	458.5	500
960 min Winter	4.653	0.0	483.4	626
1440 min Winter	3.338	0.0	519.9	846
2160 min Winter	2.391	0.0	559.7	1148
2880 min Winter	1.885	0.0	588.3	1500
4320 min Winter	1.347	0.0	630.1	2208
5760 min Winter	1.061	0.0	662.6	2944
7200 min Winter	0.881	0.0	687.6	3672
8640 min Winter	0.756	0.0	708.4	4376
10080 min Winter	0.665	0.0	726.0	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.651

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.217	4	8	0.217	8	12	0.217

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	331.0	2.400	0.0	4.800	0.0	7.200	0.0	9.600	0.0
0.400	331.0	2.800	0.0	5.200	0.0	7.600	0.0	10.000	0.0
0.800	331.0	3.200	0.0	5.600	0.0	8.000	0.0		
0.801	0.0	3.600	0.0	6.000	0.0	8.400	0.0		
1.600	0.0	4.000	0.0	6.400	0.0	8.800	0.0		
2.000	0.0	4.400	0.0	6.800	0.0	9.200	0.0		

Hydro-Brake® Optimum Outflow Control

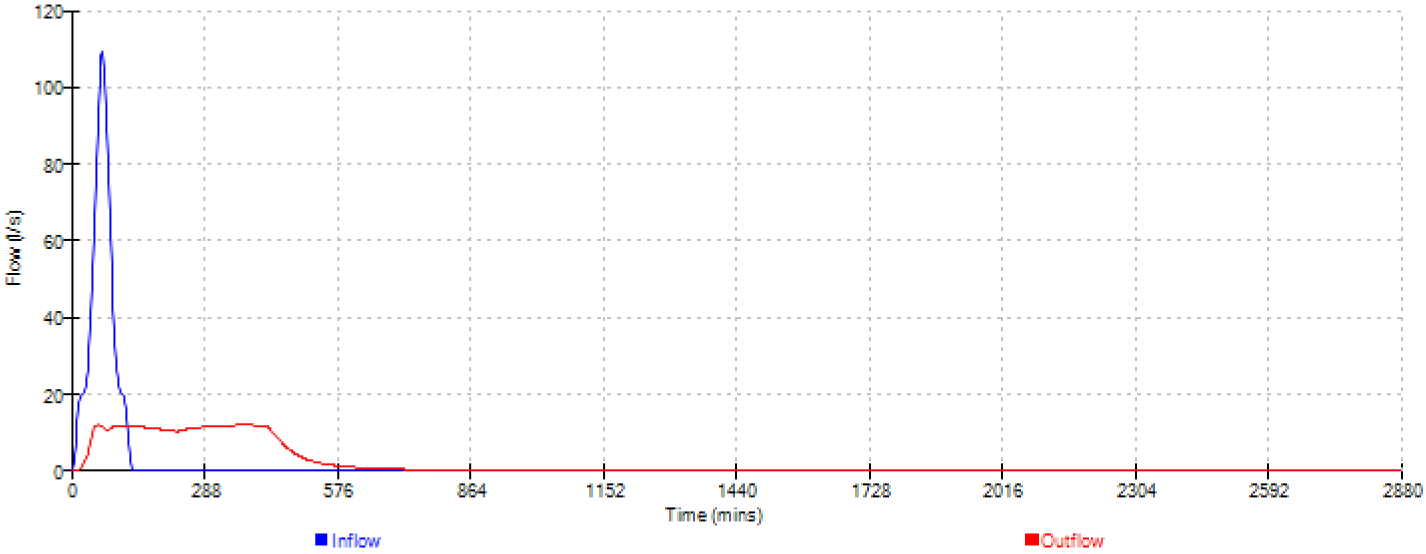
Unit Reference	MD-SHE-0161-1200-0800-1200
Design Head (m)	0.800
Design Flow (l/s)	12.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	8.600
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

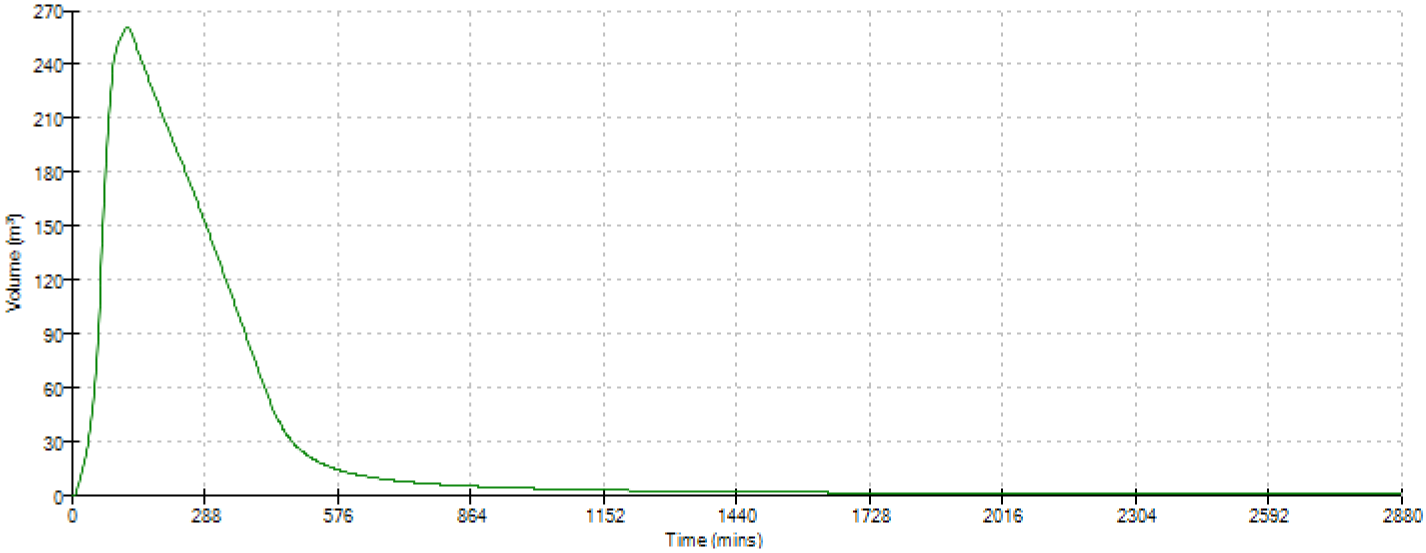
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	12.0	Kick-Flo®	0.579	10.3
Flush-Flo™	0.272	12.0	Mean Flow over Head Range	-	10.1

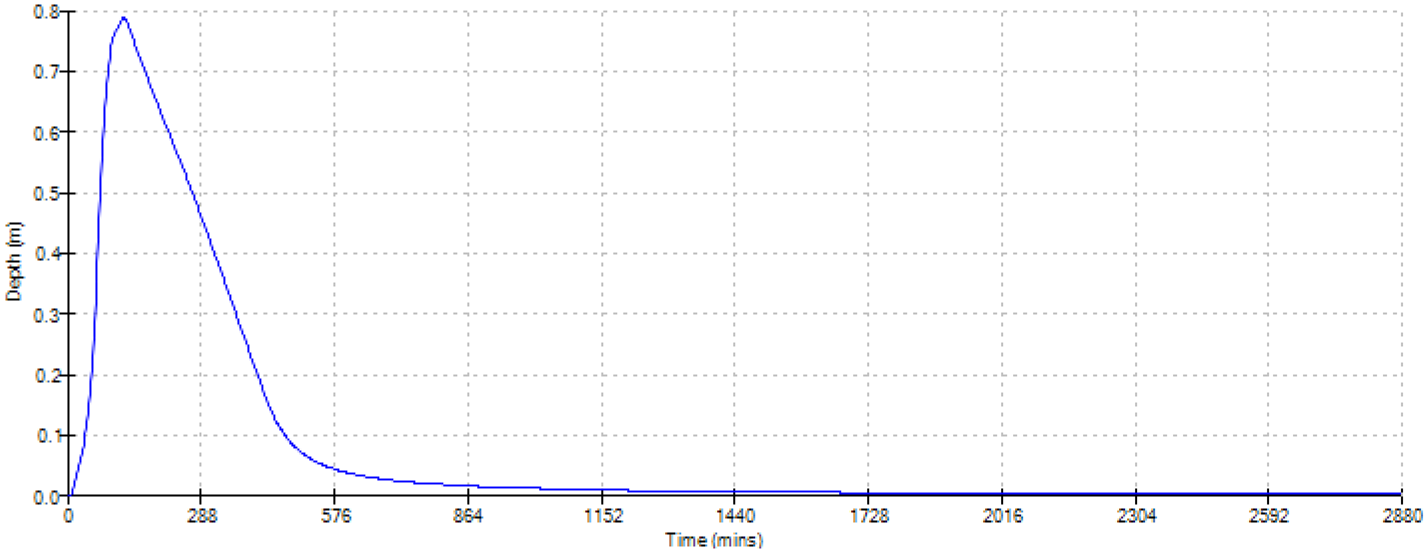
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	0.800	12.0	2.000	18.5	4.000	25.8	7.000	33.8
0.200	11.8	1.000	13.3	2.200	19.4	4.500	27.3	7.500	34.9
0.300	12.0	1.200	14.5	2.400	20.2	5.000	28.7	8.000	36.1
0.400	11.7	1.400	15.6	2.600	21.0	5.500	30.1	8.500	37.0
0.500	11.2	1.600	16.6	3.000	22.5	6.000	31.4	9.000	38.1
0.600	10.5	1.800	17.6	3.500	24.2	6.500	32.6	9.500	39.1

Event: 120 min Winter







Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.054	0.454	12.0	227.7	O K
30 min Summer	9.182	0.582	12.0	291.8	O K
60 min Summer	9.296	0.696	12.0	348.6	O K
120 min Summer	9.377	0.777	12.0	389.1	O K
180 min Summer	9.397	0.797	12.0	399.2	O K
240 min Summer	9.393	0.793	12.0	397.1	O K
360 min Summer	9.370	0.770	12.0	385.7	O K
480 min Summer	9.346	0.746	12.0	373.6	O K
600 min Summer	9.320	0.720	12.0	360.9	O K
720 min Summer	9.294	0.694	12.0	347.8	O K
960 min Summer	9.241	0.641	12.0	321.2	O K
1440 min Summer	9.129	0.529	12.0	264.9	O K
2160 min Summer	8.988	0.388	12.0	194.5	O K
2880 min Summer	8.887	0.287	12.0	143.7	O K
4320 min Summer	8.779	0.179	11.6	89.9	O K
5760 min Summer	8.747	0.147	9.9	73.5	O K
7200 min Summer	8.729	0.129	8.5	64.6	O K
8640 min Summer	8.717	0.117	7.3	58.6	O K
10080 min Summer	8.708	0.108	6.5	54.1	O K
15 min Winter	9.055	0.455	12.0	227.8	O K
30 min Winter	9.183	0.583	12.0	291.9	O K
60 min Winter	9.296	0.696	12.0	348.6	O K
120 min Winter	9.378	0.778	12.0	389.7	O K
180 min Winter	9.399	0.799	12.0	400.4	O K
240 min Winter	9.396	0.796	12.0	399.0	O K
360 min Winter	9.366	0.766	12.0	383.6	O K
480 min Winter	9.336	0.736	12.0	368.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.171	0.0	234.9	26
30 min Summer	95.108	0.0	304.4	40
60 min Summer	58.456	0.0	378.2	68
120 min Summer	34.709	0.0	449.5	126
180 min Summer	25.261	0.0	490.8	182
240 min Summer	20.053	0.0	519.6	240
360 min Summer	14.450	0.0	561.7	296
480 min Summer	11.451	0.0	593.5	358
600 min Summer	9.554	0.0	619.1	426
720 min Summer	8.237	0.0	640.4	496
960 min Summer	6.514	0.0	675.2	634
1440 min Summer	4.673	0.0	726.3	898
2160 min Summer	3.347	0.0	782.9	1260
2880 min Summer	2.639	0.0	822.9	1596
4320 min Summer	1.886	0.0	880.8	2252
5760 min Summer	1.485	0.0	927.2	2944
7200 min Summer	1.233	0.0	962.1	3680
8640 min Summer	1.059	0.0	991.0	4408
10080 min Summer	0.931	0.0	1015.1	5144
15 min Winter	147.171	0.0	234.9	25
30 min Winter	95.108	0.0	304.4	39
60 min Winter	58.456	0.0	378.2	68
120 min Winter	34.709	0.0	449.5	124
180 min Winter	25.261	0.0	490.8	180
240 min Winter	20.053	0.0	519.6	234
360 min Winter	14.450	0.0	561.7	306
480 min Winter	11.451	0.0	593.6	376

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	9.302	0.702	12.0	351.5	O K
720 min Winter	9.265	0.665	12.0	333.1	O K
960 min Winter	9.186	0.586	12.0	293.4	O K
1440 min Winter	9.021	0.421	12.0	210.9	O K
2160 min Winter	8.850	0.250	12.0	125.3	O K
2880 min Winter	8.769	0.169	11.5	84.5	O K
4320 min Winter	8.729	0.129	8.5	64.6	O K
5760 min Winter	8.710	0.110	6.7	55.2	O K
7200 min Winter	8.698	0.098	5.6	49.2	O K
8640 min Winter	8.690	0.090	4.8	45.0	O K
10080 min Winter	8.683	0.083	4.2	41.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	9.554	0.0	619.1	452
720 min Winter	8.237	0.0	640.5	530
960 min Winter	6.514	0.0	675.2	684
1440 min Winter	4.673	0.0	726.4	938
2160 min Winter	3.347	0.0	782.9	1268
2880 min Winter	2.639	0.0	823.0	1536
4320 min Winter	1.886	0.0	881.0	2252
5760 min Winter	1.485	0.0	927.2	2944
7200 min Winter	1.233	0.0	962.2	3680
8640 min Winter	1.059	0.0	991.1	4408
10080 min Winter	0.931	0.0	1015.3	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.651

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.217	4	8	0.217	8	12	0.217

Time Area Diagram

Total Area (ha) 0.000

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.000

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	501.0	2.400	0.0	4.800	0.0	7.200	0.0	9.600	0.0
0.400	501.0	2.800	0.0	5.200	0.0	7.600	0.0	10.000	0.0
0.800	501.0	3.200	0.0	5.600	0.0	8.000	0.0		
0.801	0.0	3.600	0.0	6.000	0.0	8.400	0.0		
1.600	0.0	4.000	0.0	6.400	0.0	8.800	0.0		
2.000	0.0	4.400	0.0	6.800	0.0	9.200	0.0		

Hydro-Brake® Optimum Outflow Control

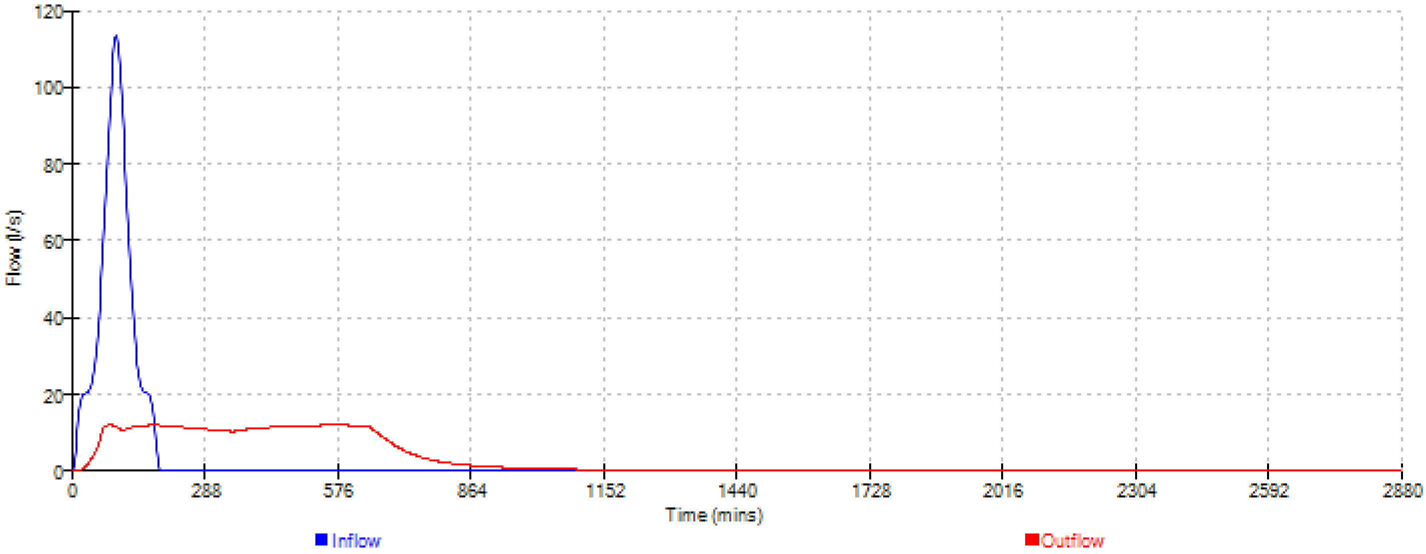
Unit Reference	MD-SHE-0161-1200-0800-1200
Design Head (m)	0.800
Design Flow (l/s)	12.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	8.600
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

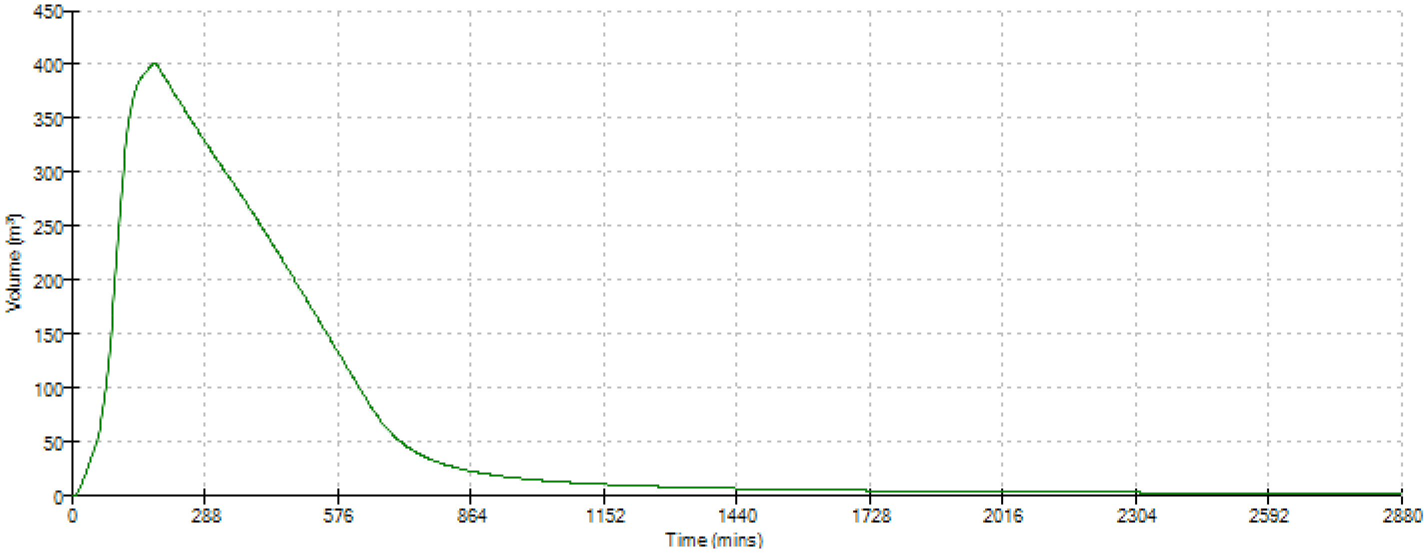
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	12.0	Kick-Flo®	0.579	10.3
Flush-Flo™	0.272	12.0	Mean Flow over Head Range	-	10.1

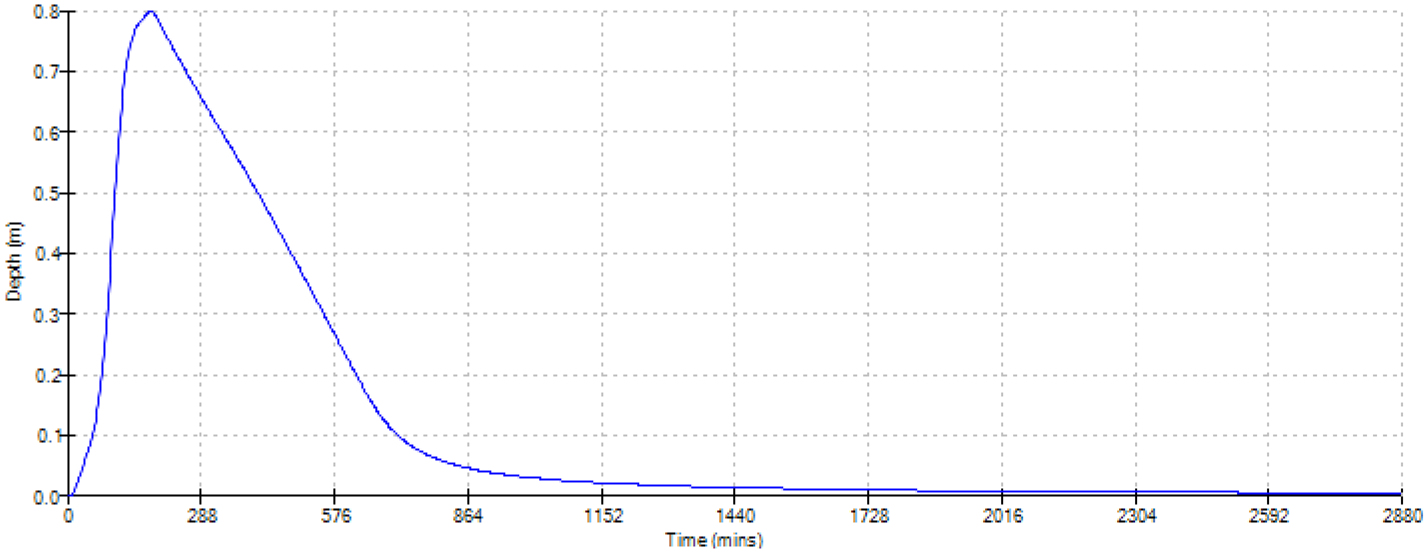
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	0.800	12.0	2.000	18.5	4.000	25.8	7.000	33.8
0.200	11.8	1.000	13.3	2.200	19.4	4.500	27.3	7.500	34.9
0.300	12.0	1.200	14.5	2.400	20.2	5.000	28.7	8.000	36.1
0.400	11.7	1.400	15.6	2.600	21.0	5.500	30.1	8.500	37.0
0.500	11.2	1.600	16.6	3.000	22.5	6.000	31.4	9.000	38.1
0.600	10.5	1.800	17.6	3.500	24.2	6.500	32.6	9.500	39.1

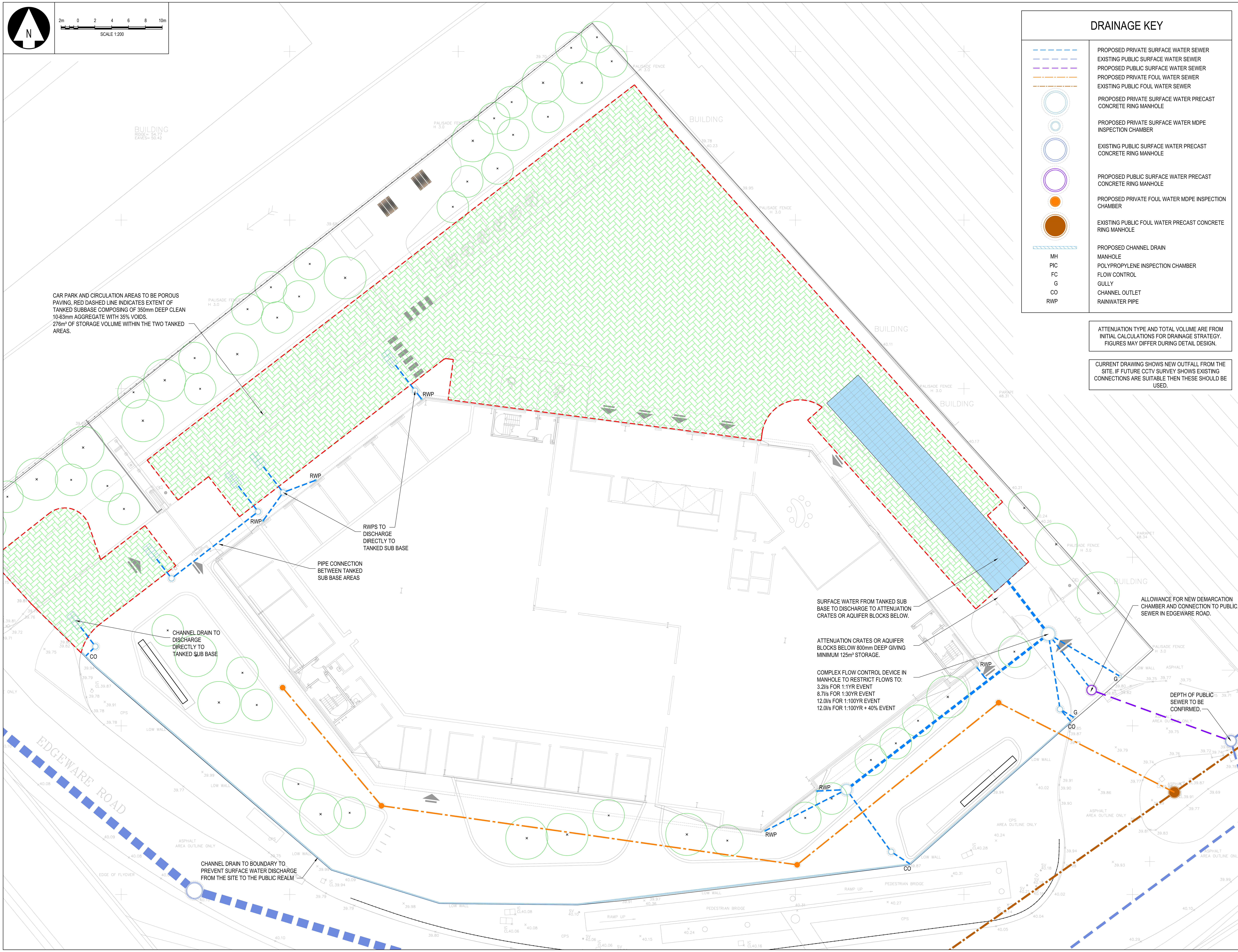
Event: 180 min Winter







Appendix C – Drainage Layout



DRAINAGE KEY

	PROPOSED PRIVATE SURFACE WATER SEWER
	EXISTING PUBLIC SURFACE WATER SEWER
	PROPOSED PUBLIC SURFACE WATER SEWER
	PROPOSED PRIVATE FOUL WATER SEWER
	EXISTING PUBLIC FOUL WATER SEWER
	PROPOSED PRIVATE SURFACE WATER PRECAST CONCRETE RING MANHOLE
	PROPOSED PRIVATE SURFACE WATER MDPE INSPECTION CHAMBER
	EXISTING PUBLIC SURFACE WATER PRECAST CONCRETE RING MANHOLE
	PROPOSED PUBLIC SURFACE WATER PRECAST CONCRETE RING MANHOLE
	PROPOSED PRIVATE FOUL WATER MDPE INSPECTION CHAMBER
	EXISTING PUBLIC FOUL WATER PRECAST CONCRETE RING MANHOLE
	PROPOSED CHANNEL DRAIN
MH	MANHOLE
PIC	POLYPROPYLENE INSPECTION CHAMBER
FC	FLOW CONTROL
G	GULLY
CO	CHANNEL OUTLET
RWP	RAINWATER PIPE

ATTENUATION TYPE AND TOTAL VOLUME ARE FROM INITIAL CALCULATIONS FOR DRAINAGE STRATEGY. FIGURES MAY DIFFER DURING DETAIL DESIGN.

CURRENT DRAWING SHOWS NEW OUTFALL FROM THE SITE. IF FUTURE CCTV SURVEY SHOWS EXISTING CONNECTIONS ARE SUITABLE THEN THESE SHOULD BE USED.

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE EVOLVE DESIGN STATEMENT.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SERVICES & SPECIALIST MANUFACTURERS DETAILS, DRAWINGS AND SPECIFICATIONS.

3. DO NOT SCALE THIS DRAWING. IF IN DOUBT ASK. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL DIMENSIONS TO EXISTING ELEMENTS ARE TO BE CHECKED AND CONFIRMED ON SITE BY CONTRACTOR.

Rev.	Date	Revision	By	Chk
P02	11.12.23	SITE LAYOUT UPDATED	PW	JT
P01	07.12.23	ISSUED FOR APPROVAL	PW	JT

APPROVAL

Client
.BIG YELLOW SELF STORAGE COMPANY LIMITED

Project
BIG YELLOW STAPLES CORNER

Drawing Title
PROPOSED DRAINAGE GENERAL ARRANGEMENT

Drawn by	Checked by	Scale @ A1
PW	JT	1:200

Drawing No. 3727-EVE-XX-XX-DR-C-9000
Revision P02

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Appendix D – Barnet SuDS Proforma

BARNET LONDON BOROUGH

GREATER**LONDON**AUTHORITY

LoDEG

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Big Yellow, Staples Corner.
Address & post code	Renault/ Dacia, Staples Corner, North Circular Road, Brent Cross, NW2 1LY
OS Grid ref. (Easting, Northing)	E 522620
	N 187382
LPA reference (if applicable)	
Brief description of proposed work	Demolition of the existing building and the construction of a self-storage facility (Use Class B8), with flexible office space (Use Class E(g)(i)) and external storage units (Use Class B8), with associated parking and servicing areas.
Total site Area	8444 m^2
Total existing impervious area	7956 m^2
Total proposed impervious area	6921 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	Gravity to public sewer.
Designer Name	Paul White
Designer Position	Civil Engineer
Designer Company	Evolve Consulting Engineers

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility	
Superficial geology classification	Alluvium
Bedrock geology classification	London Clay
Site infiltration rate	m/s
Depth to groundwater level	m below ground level
Is infiltration feasible?	No

2b. Drainage Hierarchy	*Feasible (Y/N)*	*Proposed (Y/N)*
1 store rainwater for later use	N	N
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	Y	N
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	Y	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	ing connection with public surface water se
Has the owner/regulator of the discharge location been consulted?	No

3. Drainage Strategy

3a. Discharge Rates & Required Storage				
	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m³)*	*Proposed discharge rate (l/s)*
Qbar	3.76			
1 in 1	3.2	55.95	92	3.2
1 in 30	8.66	137.36	200	8.7
1 in 100	12.01	178.54	260	12
1 in 100 + CC			401	12
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Complex flow restrictor.		

3c. Proposed SuDS Measures			
	Catchment area (m²)	*Plan area (m²)*	*Storage vol. (m³)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	0	0
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	0	0	276
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	8444		125
Total	8444	0	401

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	3727-EVE-XX-XX-T-C-0002 - Sctn 4.2
Drainage hierarchy (2b)	3727-EVE-XX-XX-T-C-0002 - Sctn 4
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	3727-EVE-XX-XX-T-C-0002 - Sctn 7
Proposed SuDS measures & specifications (3b)	3727-EVE-XX-XX-T-C-0002 - Sctn 6

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	
Detailed drainage design drawings, including exceedance flow routes	
Detailed landscaping plans	
Maintenance strategy	3727-EVE-XX-XX-T-C-0002 - Sctn 8
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	
b) biodiversity?	
c) amenity?	

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