

Drainage Strategy Report

The Curlew,

Petersfield Road,

Havant, PO9 2HU

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1.0 Introduction

- 1.1 Scott White and Hookins have been instructed by Fortitudo Ltd to provide a drainage strategy as part of the planning submission for the proposed residential development on the site of the former The Curlew public house, Petersfield Road, Havant.
- 1.2 This report considers the flood risk to the proposed development and the impact that the development will have in relation to flooding of adjacent areas and watercourses. It considers any limits relating to flooding that are likely to be imposed to allow the development to be undertaken. The report also provides a foul and surface water drainage strategy to cater for the proposed development using sustainable drainage techniques where possible. This report addresses the requirements of an outline drainage strategy report as required by the Lead Local Flood Authority for a major development.
- 1.3 This report is based on information received from the Environment Agency, Southern Water, in addition to a desk top study to assess the existing conditions on site. Scott White and Hookins cannot accept liability for the accuracy or otherwise of any information derived from third party sources.
- 1.4 This report is for the private and confidential use of Fortitudo Ltd and its agents and may not be copied in whole or in part without the written permission of Scott White and Hookins.

2.0 Government Policy on Flood Risk and Drainage of Development

- 2.1 The frequency and severity of river flooding is perceived to have increased in recent years and in an attempt to mitigate the flood risk the Government published Planning Policy Statement Note 25: Development and Flood Risk (PPS25) in December 2006. PPS25 details the importance of the effective management and reduction of flood risk in the land use planning process and attempts to address the issue of climate change. This has since been updated and is set out in The National Planning Policy Framework and the supporting technical guidance.
- 2.2 Traditionally surface water run off from developments has been conveyed by pipe systems to the nearest watercourse or sewer. This tends to increase the rate and volume of the run off often leading to flooding downstream of the new development. Latest policy promotes the use of sustainable urban drainage systems (SUDS) whereby the control of run off is to be as close to source as possible. This can be achieved by utilizing techniques which mimic the natural drainage processes, the use of direct infiltration for example. The Environment Agency will, in general, seek to restrict the allowable discharge from a new development to that previously expected from the undeveloped land.
- 2.3 The requirements of the revised Building Regulations which came into force on 1st April 2002 are that adequate provision should be made for dealing with rainwater from the roofs of buildings and certain paved areas providing access to the buildings. Run off from such drainage systems are to be discharged to one of the following systems listed in order of priority:-
- A soakaway or other infiltration system
 - A watercourse
 - A sewer or drain

- 2.4 The revised Building Regulations were drafted to reinforce the requirements for SUDS wherever possible.

2.5 The Requirements of a Flood Risk Assessment

- 2.5.1 A Flood Risk Assessment is required in order to ascertain whether a development will exacerbate the risk of flooding elsewhere in the catchment or is at risk of flooding itself.

3.0 Development Site

- 3.1 The proposed development is to be located on the site of the Curlew public house on Petersfield Road, Havant. The site is broadly triangular with the top of the triangle pointing in a northerly direction.
- 3.2 On the existing site, the Curlew public house is located in the centre of the site with a large parking area to the east and soft landscaped garden to the west with a prominent Weeping Willow. The main access is from Petersfield Road on the northern side of the site although there is a second access from Leigh Road on the south-east corner of the site. There is currently a car wash business located within the car park area.
- 3.3 The site is bounded by Petersfield Road to the north, residential properties to the south and the Parkway Centre medical centre on the eastern boundary. See Appendix 1 for site aerial photographs.
- 3.4 The nearest watercourse to the site is a tributary which ultimately flows into Chichester Harbour and is located approximately 200m to the east of the site.
- 3.5 The pre-development site consists of a mix of impermeable tarmac hardstanding, existing buildings, and soft landscaping. The overall site area is 3740m² with the existing building comprising an area of 450m² and the existing hardstanding surrounding the existing public house and the link road comprises approximately 1450m².

- 3.6 From Southern Water sewer maps there is an existing 675mm diameter public foul water sewer flowing east to west across the southern half of the site. The sewer records indicate the invert is approximately 3.6m below ground level. There is a 225mm diameter public foul sewer in the adjacent Petersfield Road and Leigh Road, and the residential properties to the south of the site are served by public foul and surface water sewers of unknown depth.
- 3.7 It is unclear how the existing site drains. The existing building roof appears to collect surface water via downpipes however these appear to discharge on to the surrounding hardstanding. From the topographical survey there are a limited number of gullies noted to the existing car park although their ultimate discharge point is unknown. It should be noted that the original planning submission for the car wash service was submitted in 2011 and shows the drainage being connected to an existing foul water chamber on site.
- 3.7.1 It will be necessary to carry out a full below ground drainage CCTV survey to determine the exact arrangements and final connection points of the existing system.

3.8 Ground Conditions

- 3.8.1 The geology of the area is shown on British Geological Survey map which indicates the site is underlain by bedrock geology of clay, silt and sand of the London Clay formation with superficial deposits of clay, silt and sand of the River Terrace Deposits. Nearby borehole records from the opposite side of Petersfield Road confirm the presence of stiff clay with flints and gravel all underlain by sand at approximately 4m depth.
- 3.8.2 The boreholes in the local area have identified the presence of groundwater at approximately 2.4m below ground level. The use of traditional deep soakaways is unlikely to be suitable due to the historic groundwater table although this should be investigated further on site. Whilst the cohesive nature of the clay geology would

normally restrict the use of infiltration devices, the presence of gravels and flints within the geology may provide some scope to use a shallow solution.

4.0 Development Proposals

- 4.1 The proposed development involves the demolition of the existing building on site and construction of a new three storey residential block, providing 31 new apartments with parking at the rear of the site and soft landscaping surrounding the new building. Main vehicular access to the site will be from Leigh Road on the south-east corner of the site. A separate bin store and cycle store are to be provided within the new car park. See Appendix 3 for proposed site plans.
- 4.2 The existing building is to be demolished and the new building is to be located over the footprint of the existing building and hardstanding. The area of the proposed building is 675m² and the new car park and access to Leigh Road is 1200m² resulting in an overall developed area of 1875m² compared to the pre-development area of 1900m². It is proposed that the new car park will be constructed from permeable paving with block paved finish over a stone sub-base to provide attenuation and infiltration. The soft landscaping and the existing Weeping Willow on the western side of the site are to be retained.
- 4.3 With reference to National Planning Policy Framework (NPPF): Table 2, as residential buildings used for dwellings, the flood risk vulnerability classification will be 'More Vulnerable'.

5.0 Flood risks

5.1 River Catchment and Flooding

- 5.1.1 Based on the Environment Agency flood map the site is located in Flood Zone 1 which indicates this area has an annual probability of river flooding of less than 1 in 1000 (<0.1%).
- 5.1.2 With reference to Section 4 and NPPF: Table 3, a development classified as 'More Vulnerable' within Flood Zone 1 is deemed appropriate.

5.2 Overland flow

- 5.2.1 The existing site has been visually assessed for overland flows. Due to the nature and relatively flat topography of the existing site and building, although not calculated, the depth of potential flow across the site is thought likely to be very small, and the general velocity over the ground will be minor.
- 5.2.2 The Environment Agency surface water modelling demonstrates the site is at low risk of surface water flooding from overland flow although there are areas of high and medium risk along Petersfield Road. Based upon the modelled flow paths, it appears that the route of overland flow occurs from surface water on Petersfield Road which overflows through the main entrance and across the site. The surface water flows around the building and onto the soft landscaping to the west and along the tarmac access road onto Leigh Road. Generally the depth of water is modelled as less than 300mm however there are isolated locations where the depth exceeds 300mm. These flows paths are based upon a surface water flood event in excess of 1 in 100 year (1% annual exceedance probability).
- 5.2.3 The proposed development represents a slight reduction in impermeable area and with the introduction of permeable paving to the car park the overall surface water drainage strategy for the site will be improved. Therefore it is considered that any risk from overland flow will be reduced by the proposed development and overall the

situation will be improved. The proposed surface water drainage strategy is discussed further in section 6.

5.3 Local flooding of surface water sewer

- 5.3.1 The PUSH Strategic Flood Risk Assessment identifies that the site is located in an area of low risk of sewer flooding, and there are no incidents recorded in the area of the development site. The proposed development will replicate the existing situation, and should an existing connection to public surface water sewer be found, the development will incorporate suitable attenuation to ensure the proposed development does not increase the flow to the public surface water sewers. Therefore the proposed development does not increase the risk of flooding to the site or surrounding areas.

5.4 Groundwater flooding

- 5.4.1 The PUSH SFRA map illustrates instances of groundwater flooding events occurring, however these are not within the vicinity of the site. Whilst the local ground conditions indicate a standing water level at around 2.5m below ground level, this level is unlikely to fluctuate significantly within the underlying soil and therefore we would conclude that the site is at low risk of groundwater flooding.

6.0 Surface Water Drainage Strategy

- 6.1 In the document 'Control of Run-off from New Development' the Environment Agency state that their run-off policy seeks to sustain the natural process within catchments. Surface water drainage should seek to replicate the existing condition where possible such that run off is discharged from site by one of the following systems listed in order of priority; soakaway or other infiltration system, a watercourse or finally a sewer or drain.
- 6.2 As discussed above, the cohesive nature of the site geology is considered unsuitable for traditional deep soakaways however it is proposed the car park will be constructed as permeable paving to allow shallow infiltration. Details of the existing drainage connections should be confirmed on site, however for the purposes of this outline application, we will indicate an option for shallow infiltration and a connection to the public surface water sewer with attenuation. To achieve these aims it is recommended that the source control and Sustainable Drainage Systems (SuDS) are implemented, where practical constraints allow. This will also ensure that flood risk to the surrounding area is minimised.

6.3 Permeable paving car park

- 6.3.1 The proposed car park comprises an overall area of 1200m². Permeable paving construction typically comprises a surface layer of block pavements which allow rainwater to percolate between the blocks. The blocks are laid on a 50mm layer of sand bedding which is laid on a 100mm layer of 5-20mm granular stone, with a single layer of geotextile providing a silt barrier over a sub-base comprising 10-63mm sized angular stone at a depth to suit the water storage requirements.
- 6.3.2 With reference to the Microdrainage calculations provided in Appendix 4 we have assumed a conservative infiltration rate of 1x10⁻⁶m/s for the site. The whole parking impermeable area of 1200m² can be infiltrated by a permeable paving system for all storms up to and including 1 in 100 year plus 30% allowance for climate change. It is

recommended that a minimum 300mm deep sub-base is provided to achieve adequate hydraulic and structural performance.

6.4 Building drainage – attenuation option

6.4.1 The overall impermeable area of the existing building and car park is 1900m², therefore the existing pre-development flows are as follows.

- Existing 1 in 1 year flow = 26.2 litres/second (6.2 litres/second from existing building)
- Existing 1 in 30 year flow = 63.9 litres/second
- Existing 1 in 100 year flow = 82.6 litres/second

6.4.2 If it is found that the existing site is connected to the public surface water sewer, we would propose maintaining that connection but with a flow control to limit discharge to less than the existing 1 in 1 year flow for the existing building. Limiting the flow to 6 litres/second matches the flow from the existing building and achieves 75% reduction on the 1 in 1 year rate from the overall site, and 92% reduction on the existing 1 in 100 year event for the overall site, thus providing a significant improvement upon the existing situation and demonstrating sustainable development.

6.5 The proposed impermeable area of the building is 675m². For the purposes of design an additional 10% is to be included for allowance of urban creep, therefore the design impermeable area = 740m². The main principle will be to deal with surface water on site as an improvement on the existing condition and therefore not increase flood risk on site or to surrounding areas.

6.5.1 With reference to the Microdrainage calculations provided in Appendix 4, the proposed development requires attenuation volume of 18m³ to adequately deal with a 1 in 100 year storm plus 30% allowance for climate change. It is proposed the attenuation takes the form of 6m long x 3m wide x 1m deep storage located below the car park and constructed from cellular storage such as SDS Geolight. Flow off site will be controlled with vortex flow control device in a new manhole located on the proposed site.

- 6.5.2 The attenuation storage should be located to the front of the building below the new car park and landscaped area. We recommend installing the cellular units with approximately 600mm cover but to suit manufacturer requirements. Surface water will be collected by traditional rainwater pipes from the building and discharged via pipes and inspection chambers to the attenuation tank.
- 6.5.3 The outfall from the attenuation tank will pass through a final manhole located on the development site before connecting directly to Southern Water public sewer. A vortex flow control device, by Hydro International or similar should be installed in this final private manhole to limit the flow off site to a maximum of 6 litres/second for a 1m head. The final manhole should be installed 50-100mm below the level of the attenuation tank whilst ensuring there is sufficient fall to discharge out to the public sewer connection.
- 6.6 The above calculations demonstrate through the use of on-site attenuation that surface water can be adequately dealt with on site and does not increase the flood risk of the site or surrounding areas. Final details should be determined following further investigation of the existing site and should be discussed and agreed with Southern Water.

6.7 Building drainage – infiltration option

- 6.7.1 Assuming a conservative infiltration rate of $1 \times 10^{-6} \text{m/s}$, the use of cellular crate soakaways to drain the building are not technically feasible as the design is unable to satisfy the requirement to drain to half volume within 24 hours as set out in the Building Regulations.

- 6.7.2 It is recommended that the existing site is investigated to determine the final discharge point of the existing car park gullies. If these are found to discharge to soakaways, the proposed site can replicate the existing situation based upon new infiltration testing to BRE Digest 365. Alternatively the final discharge point should be confirmed and attenuation used as described above.
- 6.8 Considering the effect of exceedance flows, the calculations demonstrate that for a 1 in 200 year storm, the proposed attenuation tank is sufficient to deal with surface water. For 1 in 200 year storm plus 30% allowance for climate change, there remains a flood risk for 30 and 60 minute storm duration however any exceedance flow is likely to discharge through the car park to the access road and does not create an immediate flood risk to the building.
- 6.9 In accordance with the Ciria SUDS manual, the proposed car park should be constructed with a permeable surfacing and sub-base in order to provide initial treatment stage at source. The permeable sub-base should be wrapped in permeable membrane with an appropriate discharge to the proposed attenuation tank.
- 6.10 Based on the extent of the works and proposed SUDs system on the development site, we would therefore conclude the site is at low risk of flooding due to overland flow.

7.0 Foul Water Drainage Strategy

- 7.1 It will be proposed to discharge foul water via the existing drainage connection on site. The final discharge point of the private manholes serving the public house should be determined in order undertake a preliminary capacity check with Southern Water. The final connection should be confirmed on site during detailed design stage.
- 7.2 Southern Water should be consulted during detailed design stage to confirm there is adequate capacity within the foul network to accommodate the flow. The existing dry weather flow for the existing public house can be calculated assuming 150 litres per seat within the pub, and 270 litres per seat within the restaurant. For example, if there are 30 seats in the pub and 30 seats within the restaurant, the existing dry weather flow equates to $(150 \times 30) + (270 \times 30) = 12600$ litres per day or 0.146 litres per second over a 24 hour period or 0.88 litres per second as a peak flow.
- 7.3 The dry weather flow (DWF) rate in litres per second for the proposed foul water is calculated on the basis of 150 litres of discharge per person per day. British Water 'Flows and Loads' document states the design flow per property is based upon the number of beds. Two bed apartments should be designed for 4 persons, with 31 no. apartments the number of persons at full occupancy is 124.
- 7.4 Based upon a rate of 150 litres of discharge per person per day, the total flow from the site is $150 \times 124 = 18600$ litres per day. To calculate the DWF take $18600 / (24 \times 60 \times 60) = 0.215$ litres per second as an average flow or 1.3 litres per second as a peak flow.
- 7.5 It will be necessary to carry out a detailed check of existing pipe gradients and levels; however it is anticipated the existing private drains on site will be adequate for the proposed flow. Southern Water should be consulted to determine if there is capacity in the public system and it will be necessary to submit a formal connection application.

8.0 Maintenance

- 8.1 This section sets out the inspection and maintenance requirements for long term management of the development's surface water drainage system. This work is to be undertaken by a private maintenance company.
- 8.2 All those responsible for maintenance should take appropriate health, safety and welfare precautions for all activities including lone working, if relevant, and risk assessments should always be undertaken. The site's infrastructure Health and Safety File should be consulted before carrying out any works either inside or outside of the development's boundary and information regarding the location of existing utilities passed on to operatives.
- 8.3 The requirements of the Health and Safety at Work Act 1974 and The Construction (Design and Management) Regulations 2015 should be adhered to and any residual risks identified in the Health and Safety File should be managed and information passed on to maintenance operatives through task specific risk assessments.
- 8.4 There are three types of maintenance activities associated with surface water drainage systems.
- The SuDS Manual, CIRIA C753, defines these as:
- Regular Maintenance – *'basic tasks undertaken on a frequent and predictable schedule' including vegetation management, litter and debris removal, and inspections.'*
 - Occasional Maintenance – *'tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).'*
 - Remedial Maintenance – *'intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.'*

Operation and Maintenance Activity	SuDs Component		
	Piped Network / Inspection Chambers	Cellular / Modular Storage	Permeable Pavement
Regular Maintenance			
Inspection	■	■	■
Litter and debris removal	■	□	■
Grass cutting		□	□
Weed and invasive plant control			□
Occasional Maintenance			
Sediment management	■	■	■
Vacuum sweeping and brushing			■
Remedial Maintenance			
Structure rehabilitation/ repair	□	□	□
Infiltration surface reconditioning			□
■ Will be required □ May be required			
Extract from The SuDs Manual Table 32.1 : Typical key SuDs components operation and maintenance activities			

Piped Network/Chambers Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required take remedial action	Monthly for three months, then six monthly
	Debris removal from catchment surface / gratings (where may cause risks to performance)	Monthly (and after large storms)
	Remove sediment from trapped sumps, manholes and catchpits.	Annually or as required
Remedial Maintenance	Repair / rehabilitation of gratings, inlets and outlets	As required
Monitoring	Inspect / check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed	Annually and after large storm events
Structure Rehabilitation / Repair	Regular Maintenance and Monitoring to identify if repair and / or replacement of features or pipework is required.	As required

Permeable Pavement Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over the whole surface). Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material if present. Any lost material should be replaced.	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers' recommendations – pay particular attention to areas where water runs from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weed or management using glyphosate applied directly to the weeds by an applicator rather than spraying.	As required – once per year on less frequently used pavements
Remedial Maintenance	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structured performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 year or as required (if infiltration and filtration performance is reduced due to significant clogging)

Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and / or weed growth - If required, take remedial action.	Three-monthly, forty-eight hours after large rainfall events in the first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually
The SuDS Manual Table 20.15: Operation and maintenance requirements for pervious pavements		

Cellular Storage Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required take remedial action	Monthly for three months, then annually.
	Remove debris from catchment surface (where may cause risks to performance)	Monthly
	Remove debris from catchment surface (where may cause risks to performance)	Annually or as required
Remedial Maintenance	Repair / rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect / check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually and after large storm events
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required
Structure Rehabilitation / Repair	Regular Maintenance and Monitoring to identify if repair and / or replacement of storage units is required.	As required
The SuDS Manual Table 21.3: Operation and maintenance requirements for attenuation storage tanks		

9.0 Summary

- 9.1 Based on the Environment Agency map the proposed development lies in Flood Zone 1 which is outside a flood risk area and is considered to not be at risk from nearby watercourses.
- 9.2 With reference to section 5.1.2, the proposed development is considered appropriate for Flood Zone 1.
- 9.3 The proposed works will connect to the existing foul drainage on site. Therefore an application will need to be made to Southern Water once the design is to be developed in order to connect the new proposed properties to the existing drainage on site.
- 9.4 The proposed development results in a reduction of impermeable area, thus providing an improvement on the existing situation. The proposed development is to incorporate permeable paving and new attenuation storage to limit the peak flow off site to no greater than existing plus an allowance for climate change. The 1 in 100 year storm achieves a 90% reduction in peak flow off site.
- 9.5 A full below ground CCTV survey should be conducted on site to confirm the drainage arrangement of the existing site, and confirm the existing discharge points. The proposed drainage solution should be discussed and agreed with Southern Water.

Appendix 1



Photograph 1:
Aerial View of Site

Appendix 2

Southern Water sewer maps



Scott-White & Hookins
Harman House
Andover Road
Winchester
Hampshire
SO23 7BS

Your ref W01651
Our ref 247293
Date 07 June 2017
Contact searches@southernwater.co.uk
Tel 0845 272 0845
0330 303 0276
Fax 01634 844514

Attention: Ian Llewellyn

Dear Customer

Re: Provision of public sewer record extract

Location: The Curlew, Petersfield Road, Havant, PO9 2HU

Thank you for your order regarding the provision of extracts of our sewer and/or water main records. Please find enclosed the extracts from Southern Water's records for the above location.

We confirm payment of your fee in the sum of £49.92 and enclose a VAT receipt for your records.

Customers should be aware that there are areas within our region in which there are neither sewers nor water mains. Similarly, whilst the enclosed extract may indicate the approximate location of our apparatus in the area of interest, it should not be relied upon as showing that further infrastructure does not exist and may subsequently be found following site investigation. Actual positions of the disclosed (and any undisclosed) infrastructure should therefore be determined on site, because Southern Water does not accept any responsibility for inaccuracy or omission regarding the enclosed plan. Accordingly it should not be considered to be a definitive document.

Should you require any further assistance regarding this matter, please contact the LandSearch team.

Yours faithfully

LandSearch

VAT receipt

Ordered by:

Scott-White & Hookins
Andover Road
Winchester
Hampshire
SO23 7BS

VAT registration number: 813 0378 56

Order reference: 247293

Your reference: W01651

Receipt for provision of an extract from the public sewer and/or water main records.

Location	Costs
The Curlew Petersfield Road Havant PO9 2HU	£41.60
Net total	£41.60
VAT	£8.32
Total	£49.92
Paid	Paid in full

Thank you for your payment:

Received on: 31 May 2017

For enquiries regarding the information provided in this receipt, please contact the LandSearch team:

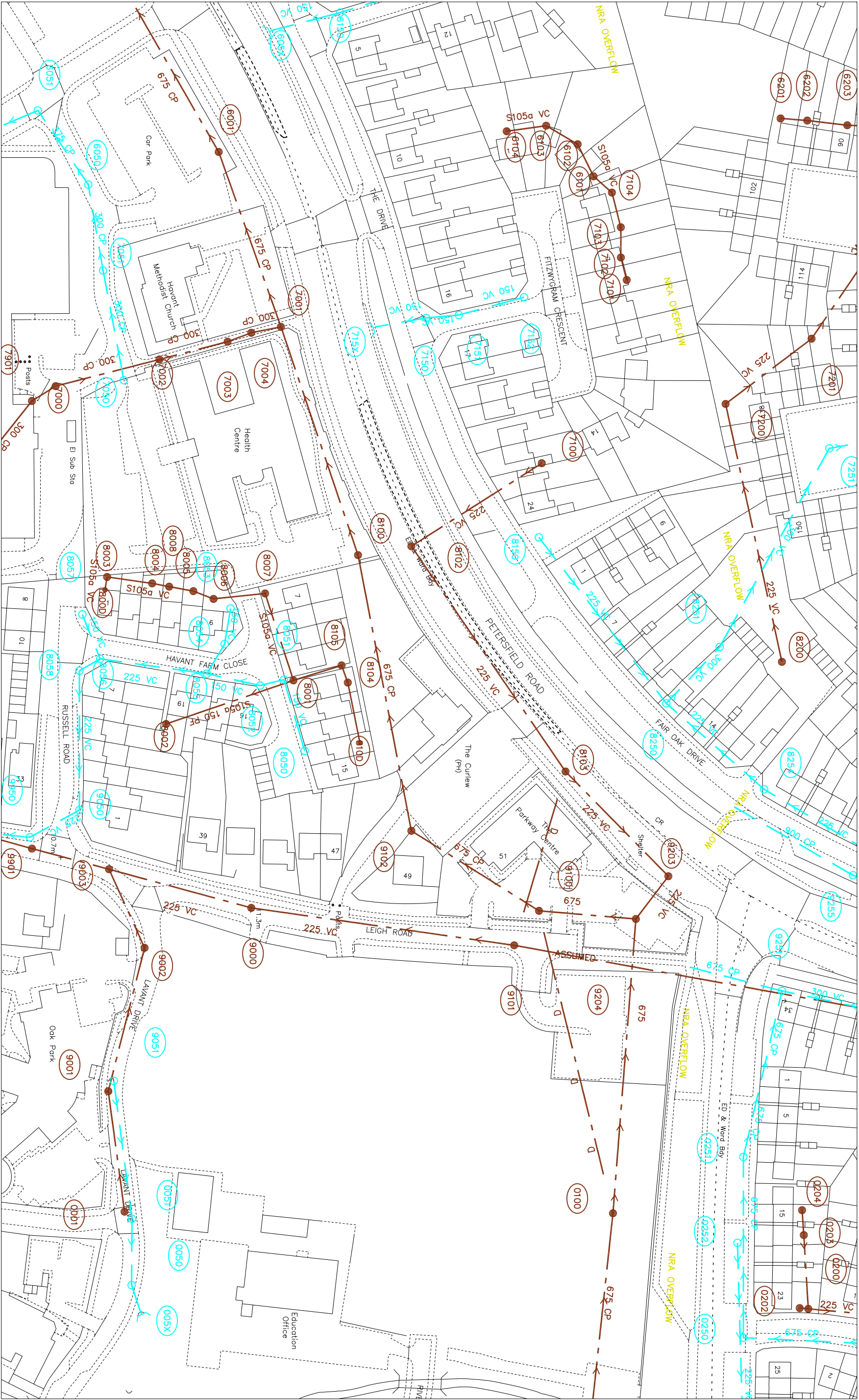
Tel: 0845 270 0212
0330 303 0276 (individual consumers)

Email: searches@southernwater.co.uk

Web: www.southernwater.co.uk

LandSearch
Southern Water Services
Southern House
Capstone Road
Chatham
Kent
ME5 7QA





107277

106989

O.S. REF. SU7107SE		Drawn by: chowdha		The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement
		Scale: 1:1250		
Title: 247293_The Curlew, Petersfield		Date: 07/06/2017		Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.
		N		

471631

472103

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shope	Node	Cover	Invert	Size	Material	Shope	Node	Cover	Invert	Size	Material	Shope
0001X	11.97	10.6	150	UNK	CIRC	8250X	14.16	11.98	300	VC	CIRC						
0050X	12.46	10.55	450	UNK	CIRC	8251X	14.57	11.73	300	VC	CIRC						
0051Y	12	10.66	450	UNK	CIRC	8254X	14.7	12.61	225	VC	CIRC						
0100X	13.09		675	UNK	CIRC	9000X	11.35		225	VC	CIRC						
0200X	13.7	12.45	225	VC	CIRC	9001X	12.44	10.34	150	UNK	CIRC						
0202X			225	VC	CIRC	9002X	12.13	9.98	225	UNK	CIRC						
0203X			UNK	UNK	CIRC	9003X	11.098		225	VC	CIRC						
0204X			UNK	UNK	CIRC	9050X	12.07		225	VC	CIRC						
0250X	13.48	11.68	675	CP	CIRC	9051X	12.25	11.08	300	UNK	CIRC						
0251X	13.99	11.44	675	CP	CIRC	9100X	13.317		675	CP	CIRC						
0252X	13.83	12.73	225	VC	CIRC	9101X	12.81	10.71	225	VC	CIRC						
6001X	12.87	8.85	675	VC	CIRC	9102X	12.94	9.34	675	CP	CIRC						
6050X	11.83	9.33	375	CP	CIRC	9203X	14.365	10.808	225	VC	CIRC						
6051X	12		225	UNK	CIRC	9204X	13.8		675	UNK	CIRC						
6101X			UNK	VC	CIRC	9251X	14.24	9.53	675	CP	CIRC						
6102X			UNK	VC	CIRC	9255X	14.92		900	CP	CIRC						
6103X			UNK	VC	CIRC	9901X			225	UNK	CIRC						
6150X	13.47	12.7	150	VC	CIRC	9950X	10.79	10.33	225	CP	CIRC						
6201X			UNK	UNK	CIRC												
6202X			UNK	UNK	CIRC												
6203X			UNK	UNK	CIRC												
7000X	11.49	9.79	300	CP	CIRC												
7001X	12.82	8.52	675	CP	CIRC												
7002X	11.78	9.36	300	CP	CIRC												
7003X	12.2	9.3	300	CP	CIRC												
7004X	12.8	9.3	300	CP	CIRC												
7050X	11.43	10.29	300	CP	CIRC												
7051X	11.68	10.03	300	CP	CIRC												
7100X	13.59	11.56	225	VC	CIRC												
7101X			UNK	VC	CIRC												
7102X			UNK	VC	CIRC												
7103X			UNK	VC	CIRC												
7104X			UNK	VC	CIRC												
7150X	13.66	12.71	150	VC	CIRC												
7151X	13.87	12.92	150	VC	CIRC												
7152X	14.14	13.38	150	VC	CIRC												
7200X	14.98	12.98	225	VC	CIRC												
7201X	14.7	12.6	225	VC	CIRC												
7251X	14.88	11.43	300	VC	CIRC												
7901X			UNK	UNK	CIRC												
8001X			150	PF	CIRC												
8003X			UNK	VC	CIRC												
8004X			UNK	VC	CIRC												
8005X			UNK	VC	CIRC												
8006X			UNK	VC	CIRC												
8007X			UNK	VC	CIRC												
8008X			UNK	UNK	CIRC												
8009X			UNK	UNK	CIRC												
8050X	12.88	11.66	150	VC	CIRC												
8051X	12.65	11.49	150	VC	CIRC												
8052X	12.62	11.44	150	VC	CIRC												
8053X	12.59	11.57	150	VC	CIRC												
8054X	12.57	11.38	150	VC	CIRC												
8055X	12.37	11.15	225	VC	CIRC												
8056X	12.37	10.83	225	VC	CIRC												
8057X	12.39	11.02	150	VC	CIRC												
8058X	12.49	10.7	225	VC	CIRC												
8100X	12.29		UNK	UNK	CIRC												
8102X	13.77	12.52	225	VC	CIRC												
8103Y	13.77	11.28	225	VC	CIRC												
8104X			UNK	UNK	CIRC												
8105X			UNK	UNK	CIRC												
810DX			UNK	UNK	CIRC												
8150X	13.77	12.44	225	VC	CIRC												
8200X	14.53	13.14	225	VC	CIRC												

LINE STYLES / COLOURS

[illegible]

MATERIALS

	Methanol (SV)
	Methylamine (F&C)
	Lamp test (F&C)
	Lamp test (F&C)
	Pumping Station (SV)
	Pumping Station (F&C)
	Side entry methanol (SV)
	Side entry methanol (F&C)
	Blind shaft (SV)
	Blind shaft (F&C)
	Ejector station (SV)
	Ejector station (F&C)
	Waterlight door (F&C)
	Waterlight door (SV)
	Flushing on, Where (F&C)
	Flushing on, Where (SV)
	Flushing on, No-Id (SV)
	Flushing on, No-Id (F&C)
	Denaturation Chamber

LEGEND - SEWERS

[illegible]

EWERS

	Other (S)
	Change in sea level
	Change in sea level
	Relief valve
	Flap valve
	Cascade
	Anode
	Valve
	Closed Valve
	Air Valve
	Hatch box (SV)
	Hatch box (RF)
	Direction arrow
	Emptying valve
	Catchpit
	Sewerway
	Inlet
	Ballasting Port

4th digit:	Water-soluble treatment works
3rd digit:	Neutral treatment works
2nd digit:	Crystalline headworks
1st digit:	Vault
0th digit:	Vertical column
	Trunk and tank
	Head of Public Sewer
	Micro Pumping Station

Archid	R	Reinforced
A	S	Square
B	S	Square
B	S	Square
E	U	U Shape
H	X	Other
Horsehoe	U	U Shape

NOTE REFERENCING SYSTEM

1st digit: hunched man seating identifier
 2nd digit: hunched man numbering identifier
 3rd digit: hunched man numbering identifier
 4th digit: hunched man numbering identifier
 5th digit: hunched man numbering identifier
 6th digit: hunched man numbering identifier
 7th digit: hunched man numbering identifier
 8th digit: hunched man numbering identifier
 9th digit: hunched man numbering identifier
 10th digit: hunched man numbering identifier

Drawn by: chowdha	
Title: 247293_The Curnew, Petersfield	
Date: 07/06/2017	

Appendix 3

Proposed Site Plan

SOAKAWAY CALCULATION

$983.5 \times 0.018 = 17.70\text{M}^3$

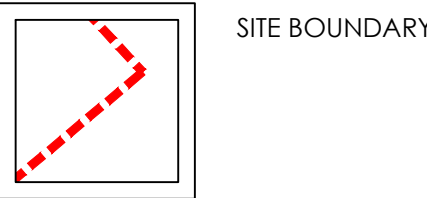
$(\text{CRATE AREA} - 1.0\text{M} (\text{HEIGHT}) \times 0.5\text{M} (\text{WIDTH}) \times 0.4\text{M} (\text{HEIGHT})) = 0.190\text{M}^3$

$17.07\text{M}^3 (\text{ROOF AREA}) / 0.190\text{M}^3 (\text{CRATE AREA}) = 93 \text{ CRATES}$

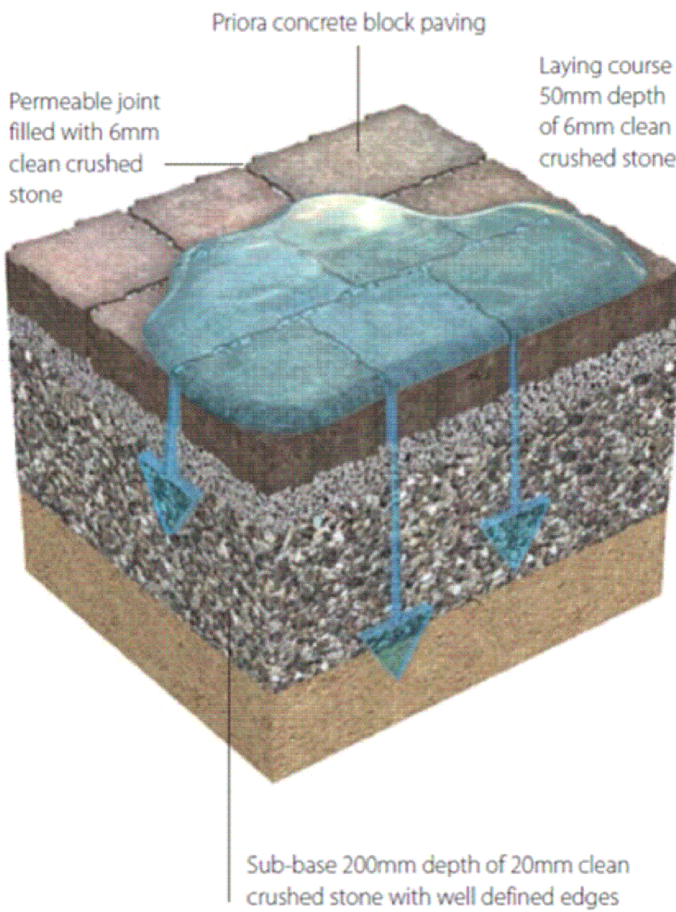
NOTES

- 1 The contents of this drawing are copyright.
2 Do not scale. Figured dimensions only to be used.
3 Contractors must verify all dimensions and report any discrepancies before putting work in hand or making any shop drawings.
4 All flat roofs to be fitted with a man safe system.
5 Please note a domestic sprinkler system may be required
6 Fixed shut fire safety glass windows may be required where windows are in close proximity to boundaries (subject to building regulations)

LEGEND

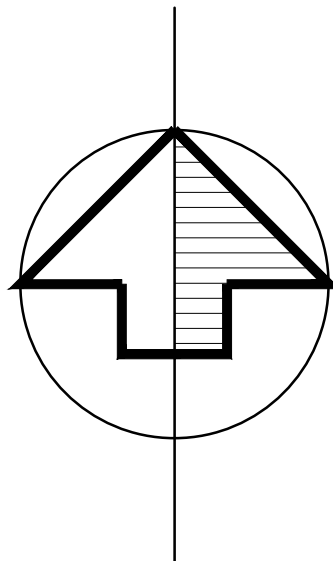


PARKING CONSTRUCTION



SITE AREA: 0.374 HECTARES / 0.924 ACRES

32 CYCLE SPACES
40 PARKING SPACES



- C. Revised building shown. 04.04.17 JA
B. Parking spaces 11,12 & 13 moved back 200mm following transport planners comments. 29.03.17 WD
A. Boundary treatment revised & proposed trees added. 07.03.17 WD

No.	Revision.	date	by
-----	-----------	------	----

PROPOSED DEVELOPMENT
THE CURLEW, PETERSFIELD ROAD
HAVANT
HAMPSHIRE
PO9 2HU

SUDS PLAN

scale	AS SHOWN @ A1	checked	//
date	FEBRUARY 2017	drawn	WD

FB 5728 / 104

ARC Architecture Ltd.

Chapel Studios, 14 Purewell,
Christchurch, Dorset, BH23 1EP

Tel: +44 (0)1202 479919
E-mail: enquiries@andersrobertscheer.co.uk
Web: www.andersrobertscheer.co.uk



SUDS PLAN : BASED ON TOPOGRAPHICAL SURVEY INFORMATION
SCALE 1:250

10m @ 1:100

Appendix 4

Microdrainage calculations

Scott-White & Hookins					Page 1	
42 West Street London House Carshalton SM5 2PR						
Date 12/06/2017 16:58						
File EXISTING 1900M2 1 IN 1 ...						
Designed by I Llewellyn			Checked by			
Micro Drainage			Source Control 2017.1			
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	98.124	0.124	26.0	0.2	O K	
30 min Summer	98.114	0.114	23.0	0.1	O K	
60 min Summer	98.096	0.096	17.2	0.1	O K	
120 min Summer	98.079	0.079	11.5	0.1	O K	
180 min Summer	98.071	0.071	8.9	0.1	O K	
240 min Summer	98.066	0.066	7.5	0.1	O K	
360 min Summer	98.061	0.061	5.9	0.1	O K	
480 min Summer	98.055	0.055	4.8	0.1	O K	
600 min Summer	98.050	0.050	4.1	0.1	O K	
720 min Summer	98.046	0.046	3.6	0.1	O K	
960 min Summer	98.041	0.041	3.0	0.0	O K	
1440 min Summer	98.036	0.036	2.3	0.0	O K	
2160 min Summer	98.033	0.033	1.8	0.0	O K	
2880 min Summer	98.029	0.029	1.4	0.0	O K	
4320 min Summer	98.022	0.022	1.1	0.0	O K	
5760 min Summer	98.019	0.019	0.9	0.0	O K	
7200 min Summer	98.016	0.016	0.8	0.0	O K	
8640 min Summer	98.015	0.015	0.7	0.0	O K	
10080 min Summer	98.012	0.012	0.6	0.0	O K	
15 min Winter	98.124	0.124	26.2	0.2	O K	
30 min Winter	98.105	0.105	19.9	0.1	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer	28.417	0.0	10.1	10		
30 min Summer	18.860	0.0	13.4	17		
60 min Summer	12.227	0.0	17.4	32		
120 min Summer	7.783	0.0	22.2	60		
180 min Summer	5.952	0.0	25.4	96		
240 min Summer	4.917	0.0	28.0	126		
360 min Summer	3.727	0.0	31.9	182		
480 min Summer	3.055	0.0	34.8	246		
600 min Summer	2.619	0.0	37.3	304		
720 min Summer	2.309	0.0	39.5	366		
960 min Summer	1.894	0.0	43.2	488		
1440 min Summer	1.433	0.0	49.0	726		
2160 min Summer	1.083	0.0	55.6	1084		
2880 min Summer	0.888	0.0	60.7	1456		
4320 min Summer	0.672	0.0	68.6	2196		
5760 min Summer	0.552	0.0	76.6	2832		
7200 min Summer	0.474	0.0	80.1	3656		
8640 min Summer	0.417	0.0	82.6	4328		
10080 min Summer	0.374	0.0	84.7	7544		
15 min Winter	28.417	0.0	11.3	10		
30 min Winter	18.860	0.0	15.1	17		
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Scott-White & Hookins					Page 2
42 West Street London House Carshalton SM5 2PR					
Date 12/06/2017 16:58 File EXISTING 1900M2 1 IN 1 ...			Designed by I Llewellyn Checked by		
Micro Drainage			Source Control 2017.1		
Summary of Results for 1 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	98.084	0.084	13.1	0.1	O K
120 min Winter	98.070	0.070	8.8	0.1	O K
180 min Winter	98.064	0.064	6.7	0.1	O K
240 min Winter	98.060	0.060	5.6	0.1	O K
360 min Winter	98.051	0.051	4.2	0.1	O K
480 min Winter	98.045	0.045	3.4	0.0	O K
600 min Winter	98.042	0.042	3.0	0.0	O K
720 min Winter	98.039	0.039	2.6	0.0	O K
960 min Winter	98.036	0.036	2.2	0.0	O K
1440 min Winter	98.032	0.032	1.7	0.0	O K
2160 min Winter	98.026	0.026	1.2	0.0	O K
2880 min Winter	98.021	0.021	1.0	0.0	O K
4320 min Winter	98.016	0.016	0.8	0.0	O K
5760 min Winter	98.014	0.014	0.7	0.0	O K
7200 min Winter	98.012	0.012	0.6	0.0	O K
8640 min Winter	98.011	0.011	0.5	0.0	O K
10080 min Winter	98.009	0.009	0.4	0.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	12.227	0.0	19.5	34	
120 min Winter	7.783	0.0	24.8	66	
180 min Winter	5.952	0.0	28.5	96	
240 min Winter	4.917	0.0	31.4	116	
360 min Winter	3.727	0.0	35.7	182	
480 min Winter	3.055	0.0	39.0	240	
600 min Winter	2.619	0.0	41.8	296	
720 min Winter	2.309	0.0	44.2	372	
960 min Winter	1.894	0.0	48.3	498	
1440 min Winter	1.433	0.0	54.9	738	
2160 min Winter	1.083	0.0	62.2	1096	
2880 min Winter	0.888	0.0	67.9	1428	
4320 min Winter	0.672	0.0	77.0	2176	
5760 min Winter	0.552	0.0	84.3	5480	
7200 min Winter	0.474	0.0	90.3	368	
8640 min Winter	0.417	0.0	95.0	816	
10080 min Winter	0.374	0.0	101.6	9848	
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Scott-White & Hookins		Page 3																																	
42 West Street London House Carshalton SM5 2PR																																			
Date 12/06/2017 16:58 File EXISTING 1900M2 1 IN 1 ...	Designed by I Llewellyn Checked by																																		
Micro Drainage Source Control 2017.1																																			
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>1</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.200</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.190 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.190</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	1	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.200	Shortest Storm (mins)	15	Ratio R	0.350	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.190
Rainfall Model	FSR	Winter Storms	Yes																																
Return Period (years)	1	Cv (Summer)	0.750																																
Region	England and Wales	Cv (Winter)	0.840																																
M5-60 (mm)	19.200	Shortest Storm (mins)	15																																
Ratio R	0.350	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.190																																	
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42 West Street London House Carshalton SM5 2PR		
Date 12/06/2017 16:58 File EXISTING 1900M2 1 IN 1 ...	Designed by I Llewellyn Checked by	
Micro Drainage Source Control 2017.1		
<u>Model Details</u> Storage is Online Cover Level (m) 100.000 <u>Pipe Structure</u> Diameter (m) 1.000 Length (m) 10.000 Slope (1:X) 10.000 Invert Level (m) 98.000 <u>Pipe Outflow Control</u> Diameter (m) 1.000 Entry Loss Coefficient 0.500 Slope (1:X) 10.0 Coefficient of Contraction 0.600 Length (m) 10.000 Upstream Invert Level (m) 98.000 Roughness k (mm) 0.600		
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42 West Street London House Carshalton SM5 2PR					
Date 12/06/2017 17:01 File EXISTING 450M2 1 IN 1 Y...		Designed by I Llewellyn Checked by			
Micro Drainage		Source Control 2017.1			
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	98.062	0.062	6.2	0.1	O K
30 min Summer	98.060	0.060	5.4	0.1	O K
60 min Summer	98.049	0.049	4.0	0.0	O K
120 min Summer	98.040	0.040	2.8	0.0	O K
180 min Summer	98.036	0.036	2.3	0.0	O K
240 min Summer	98.033	0.033	1.8	0.0	O K
360 min Summer	98.028	0.028	1.4	0.0	O K
480 min Summer	98.023	0.023	1.1	0.0	O K
600 min Summer	98.020	0.020	1.0	0.0	O K
720 min Summer	98.018	0.018	0.9	0.0	O K
960 min Summer	98.015	0.015	0.7	0.0	O K
1440 min Summer	98.011	0.011	0.5	0.0	O K
2160 min Summer	98.008	0.008	0.4	0.0	O K
2880 min Summer	98.007	0.007	0.4	0.0	O K
4320 min Summer	98.006	0.006	0.3	0.0	O K
5760 min Summer	98.005	0.005	0.2	0.0	O K
7200 min Summer	98.004	0.004	0.2	0.0	O K
8640 min Summer	98.004	0.004	0.2	0.0	O K
10080 min Summer	98.004	0.004	0.2	0.0	O K
15 min Winter	98.062	0.062	6.2	0.1	O K
30 min Winter	98.054	0.054	4.7	0.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	28.417	0.0	2.4	9	
30 min Summer	18.860	0.0	3.2	17	
60 min Summer	12.227	0.0	4.1	32	
120 min Summer	7.783	0.0	5.3	62	
180 min Summer	5.952	0.0	6.0	96	
240 min Summer	4.917	0.0	6.6	124	
360 min Summer	3.727	0.0	7.5	182	
480 min Summer	3.055	0.0	8.2	244	
600 min Summer	2.619	0.0	8.8	302	
720 min Summer	2.309	0.0	9.4	362	
960 min Summer	1.894	0.0	9.9	474	
1440 min Summer	1.433	0.0	11.0	726	
2160 min Summer	1.083	0.0	12.0	1428	
2880 min Summer	0.888	0.0	13.0	2876	
4320 min Summer	0.672	0.0	14.8	740	
5760 min Summer	0.552	0.0	16.1	4512	
7200 min Summer	0.474	0.0	17.1	1952	
8640 min Summer	0.417	0.0	18.5	6120	
10080 min Summer	0.374	0.0	19.7	8320	
15 min Winter	28.417	0.0	2.7	10	
30 min Winter	18.860	0.0	3.6	17	
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42 West Street London House Carshalton SM5 2PR					
Date 12/06/2017 17:01 File EXISTING 450M2 1 IN 1 Y...			Designed by I Llewellyn Checked by		
Micro Drainage			Source Control 2017.1		
Summary of Results for 1 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	98.043	0.043	3.2	0.0	O K
120 min Winter	98.035	0.035	2.2	0.0	O K
180 min Winter	98.031	0.031	1.6	0.0	O K
240 min Winter	98.027	0.027	1.3	0.0	O K
360 min Winter	98.021	0.021	1.0	0.0	O K
480 min Winter	98.017	0.017	0.8	0.0	O K
600 min Winter	98.015	0.015	0.7	0.0	O K
720 min Winter	98.013	0.013	0.6	0.0	O K
960 min Winter	98.011	0.011	0.5	0.0	O K
1440 min Winter	98.008	0.008	0.4	0.0	O K
2160 min Winter	98.007	0.007	0.3	0.0	O K
2880 min Winter	98.006	0.006	0.3	0.0	O K
4320 min Winter	98.004	0.004	0.2	0.0	O K
5760 min Winter	98.004	0.004	0.2	0.0	O K
7200 min Winter	98.004	0.004	0.2	0.0	O K
8640 min Winter	98.004	0.004	0.2	0.0	O K
10080 min Winter	98.004	0.004	0.2	0.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	12.227	0.0	4.6	32	
120 min Winter	7.783	0.0	5.9	64	
180 min Winter	5.952	0.0	6.7	100	
240 min Winter	4.917	0.0	7.4	122	
360 min Winter	3.727	0.0	8.4	186	
480 min Winter	3.055	0.0	9.2	234	
600 min Winter	2.619	0.0	9.9	308	
720 min Winter	2.309	0.0	10.4	370	
960 min Winter	1.894	0.0	11.4	468	
1440 min Winter	1.433	0.0	12.5	732	
2160 min Winter	1.083	0.0	13.7	104	
2880 min Winter	0.888	0.0	14.8	308	
4320 min Winter	0.672	0.0	16.4	132	
5760 min Winter	0.552	0.0	18.7	5632	
7200 min Winter	0.474	0.0	19.3	6640	
8640 min Winter	0.417	0.0	20.7	7912	
10080 min Winter	0.374	0.0	21.6	7824	
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42 West Street London House Carshalton SM5 2PR																																			
Date 12/06/2017 17:01 File EXISTING 450M2 1 IN 1 Y...	Designed by I Llewellyn Checked by																																		
Micro Drainage Source Control 2017.1																																			
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>1</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.200</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.045 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.045</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	1	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.200	Shortest Storm (mins)	15	Ratio R	0.350	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.045
Rainfall Model	FSR	Winter Storms	Yes																																
Return Period (years)	1	Cv (Summer)	0.750																																
Region	England and Wales	Cv (Winter)	0.840																																
M5-60 (mm)	19.200	Shortest Storm (mins)	15																																
Ratio R	0.350	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.045																																	
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42 West Street London House Carshalton SM5 2PR		
Date 12/06/2017 17:01 File EXISTING 450M2 1 IN 1 Y...	Designed by I Llewellyn Checked by	
Micro Drainage Source Control 2017.1		
<u>Model Details</u> Storage is Online Cover Level (m) 100.000 <u>Pipe Structure</u> Diameter (m) 1.000 Length (m) 10.000 Slope (1:X) 10.000 Invert Level (m) 98.000 <u>Pipe Outflow Control</u> Diameter (m) 1.000 Entry Loss Coefficient 0.500 Slope (1:X) 10.0 Coefficient of Contraction 0.600 Length (m) 10.000 Upstream Invert Level (m) 98.000 Roughness k (mm) 0.600		
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42 West Street London House Carshalton SM5 2PR					
Date 12/06/2017 16:59 File EXISTING 1900M2 1 IN 30...			Designed by I Llewellyn Checked by		
Micro Drainage			Source Control 2017.1		
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	98.205	0.205	63.6	0.3	O K
30 min Summer	98.191	0.191	56.1	0.3	O K
60 min Summer	98.163	0.163	41.4	0.2	O K
120 min Summer	98.128	0.128	27.5	0.2	O K
180 min Summer	98.108	0.108	21.0	0.1	O K
240 min Summer	98.096	0.096	17.0	0.1	O K
360 min Summer	98.082	0.082	12.7	0.1	O K
480 min Summer	98.075	0.075	10.4	0.1	O K
600 min Summer	98.071	0.071	8.9	0.1	O K
720 min Summer	98.067	0.067	7.7	0.1	O K
960 min Summer	98.063	0.063	6.4	0.1	O K
1440 min Summer	98.053	0.053	4.6	0.1	O K
2160 min Summer	98.044	0.044	3.4	0.0	O K
2880 min Summer	98.040	0.040	2.8	0.0	O K
4320 min Summer	98.034	0.034	2.0	0.0	O K
5760 min Summer	98.031	0.031	1.6	0.0	O K
7200 min Summer	98.028	0.028	1.4	0.0	O K
8640 min Summer	98.025	0.025	1.2	0.0	O K
10080 min Summer	98.021	0.021	1.0	0.0	O K
15 min Winter	98.205	0.205	63.9	0.3	O K
30 min Winter	98.177	0.177	48.9	0.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	69.605	0.0	24.8	10	
30 min Summer	46.335	0.0	33.0	17	
60 min Summer	29.553	0.0	42.1	32	
120 min Summer	18.298	0.0	52.2	62	
180 min Summer	13.667	0.0	58.4	90	
240 min Summer	11.055	0.0	63.0	124	
360 min Summer	8.183	0.0	70.0	180	
480 min Summer	6.606	0.0	75.3	242	
600 min Summer	5.592	0.0	79.7	298	
720 min Summer	4.877	0.0	83.4	358	
960 min Summer	3.929	0.0	89.6	488	
1440 min Summer	2.893	0.0	98.9	728	
2160 min Summer	2.127	0.0	109.1	1088	
2880 min Summer	1.708	0.0	116.9	1420	
4320 min Summer	1.253	0.0	128.6	2160	
5760 min Summer	1.005	0.0	137.4	2872	
7200 min Summer	0.846	0.0	144.7	3632	
8640 min Summer	0.736	0.0	151.1	4248	
10080 min Summer	0.654	0.0	156.2	5080	
15 min Winter	69.605	0.0	27.8	10	
30 min Winter	46.335	0.0	37.0	17	
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42 West Street London House Carshalton SM5 2PR					
Date 12/06/2017 16:59			Designed by I Llewellyn		
File EXISTING 1900M2 1 IN 30...			Checked by		
Micro Drainage			Source Control 2017.1		
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	98.143	0.143	32.3	0.2	O K
120 min Winter	98.106	0.106	20.4	0.1	O K
180 min Winter	98.090	0.090	15.2	0.1	O K
240 min Winter	98.082	0.082	12.7	0.1	O K
360 min Winter	98.072	0.072	9.3	0.1	O K
480 min Winter	98.066	0.066	7.5	0.1	O K
600 min Winter	98.063	0.063	6.4	0.1	O K
720 min Winter	98.060	0.060	5.6	0.1	O K
960 min Winter	98.052	0.052	4.4	0.1	O K
1440 min Winter	98.044	0.044	3.3	0.0	O K
2160 min Winter	98.038	0.038	2.5	0.0	O K
2880 min Winter	98.034	0.034	2.0	0.0	O K
4320 min Winter	98.030	0.030	1.4	0.0	O K
5760 min Winter	98.024	0.024	1.2	0.0	O K
7200 min Winter	98.021	0.021	1.0	0.0	O K
8640 min Winter	98.017	0.017	0.8	0.0	O K
10080 min Winter	98.016	0.016	0.8	0.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	29.553	0.0	47.2	32	
120 min Winter	18.298	0.0	58.4	60	
180 min Winter	13.667	0.0	65.4	88	
240 min Winter	11.055	0.0	70.6	120	
360 min Winter	8.183	0.0	78.4	194	
480 min Winter	6.606	0.0	84.3	242	
600 min Winter	5.592	0.0	89.2	306	
720 min Winter	4.877	0.0	93.4	374	
960 min Winter	3.929	0.0	100.3	486	
1440 min Winter	2.893	0.0	110.8	726	
2160 min Winter	2.127	0.0	122.2	1060	
2880 min Winter	1.708	0.0	130.8	1424	
4320 min Winter	1.253	0.0	144.1	2180	
5760 min Winter	1.005	0.0	153.9	2928	
7200 min Winter	0.846	0.0	162.1	3568	
8640 min Winter	0.736	0.0	168.9	4208	
10080 min Winter	0.654	0.0	175.2	5096	
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42 West Street London House Carshalton SM5 2PR																																			
Date 12/06/2017 16:59 File EXISTING 1900M2 1 IN 30...	Designed by I Llewellyn Checked by																																		
Micro Drainage Source Control 2017.1																																			
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.200</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.190 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.190</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.200	Shortest Storm (mins)	15	Ratio R	0.350	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.190
Rainfall Model	FSR	Winter Storms	Yes																																
Return Period (years)	30	Cv (Summer)	0.750																																
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Ratio R	0.350	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.190																																	
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42 West Street London House Carshalton SM5 2PR		
Date 12/06/2017 16:59 File EXISTING 1900M2 1 IN 30...	Designed by I Llewellyn Checked by	
Micro Drainage Source Control 2017.1		
<u>Model Details</u> Storage is Online Cover Level (m) 100.000 <u>Pipe Structure</u> Diameter (m) 1.000 Length (m) 10.000 Slope (1:X) 10.000 Invert Level (m) 98.000 <u>Pipe Outflow Control</u> Diameter (m) 1.000 Entry Loss Coefficient 0.500 Slope (1:X) 10.0 Coefficient of Contraction 0.600 Length (m) 10.000 Upstream Invert Level (m) 98.000 Roughness k (mm) 0.600		
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42 West Street London House Carshalton SM5 2PR					
Date 12/06/2017 17:00 File EXISTING 1900M2 1 IN 10...		Designed by I Llewellyn Checked by			
Micro Drainage		Source Control 2017.1			
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	98.232	0.232	82.6	0.4	O K
30 min Summer	98.221	0.221	74.4	0.3	O K
60 min Summer	98.188	0.188	54.5	0.3	O K
120 min Summer	98.154	0.154	36.3	0.2	O K
180 min Summer	98.128	0.128	27.5	0.2	O K
240 min Summer	98.113	0.113	22.5	0.1	O K
360 min Summer	98.095	0.095	16.8	0.1	O K
480 min Summer	98.084	0.084	13.3	0.1	O K
600 min Summer	98.078	0.078	11.4	0.1	O K
720 min Summer	98.073	0.073	9.8	0.1	O K
960 min Summer	98.068	0.068	8.0	0.1	O K
1440 min Summer	98.061	0.061	5.7	0.1	O K
2160 min Summer	98.051	0.051	4.2	0.1	O K
2880 min Summer	98.044	0.044	3.4	0.1	O K
4320 min Summer	98.037	0.037	2.4	0.0	O K
5760 min Summer	98.036	0.036	2.3	0.0	O K
7200 min Summer	98.032	0.032	1.7	0.0	O K
8640 min Summer	98.029	0.029	1.4	0.0	O K
10080 min Summer	98.026	0.026	1.3	0.0	O K
15 min Winter	98.232	0.232	82.6	0.4	O K
30 min Winter	98.206	0.206	64.2	0.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	90.053	0.0	32.1	9	
30 min Summer	60.532	0.0	43.1	17	
60 min Summer	38.834	0.0	55.4	32	
120 min Summer	24.053	0.0	68.6	62	
180 min Summer	17.903	0.0	76.5	92	
240 min Summer	14.414	0.0	82.2	122	
360 min Summer	10.599	0.0	90.6	182	
480 min Summer	8.517	0.0	97.1	240	
600 min Summer	7.181	0.0	102.3	302	
720 min Summer	6.244	0.0	106.8	364	
960 min Summer	5.002	0.0	114.1	480	
1440 min Summer	3.653	0.0	124.9	732	
2160 min Summer	2.662	0.0	136.6	1064	
2880 min Summer	2.124	0.0	145.3	1452	
4320 min Summer	1.542	0.0	158.2	2188	
5760 min Summer	1.227	0.0	167.8	2904	
7200 min Summer	1.027	0.0	175.6	3576	
8640 min Summer	0.889	0.0	182.5	4392	
10080 min Summer	0.787	0.0	188.4	4952	
15 min Winter	90.053	0.0	35.9	9	
30 min Winter	60.532	0.0	48.3	17	
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42 West Street London House Carshalton SM5 2PR					
Date 12/06/2017 17:00 File EXISTING 1900M2 1 IN 10...			Designed by I Llewellyn Checked by		
Micro Drainage			Source Control 2017.1		
Summary of Results for 100 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	98.166	0.166	42.7	0.2	O K
120 min Winter	98.126	0.126	26.8	0.2	O K
180 min Winter	98.105	0.105	20.1	0.1	O K
240 min Winter	98.094	0.094	16.4	0.1	O K
360 min Winter	98.080	0.080	12.0	0.1	O K
480 min Winter	98.073	0.073	9.8	0.1	O K
600 min Winter	98.069	0.069	8.3	0.1	O K
720 min Winter	98.065	0.065	7.2	0.1	O K
960 min Winter	98.061	0.061	5.7	0.1	O K
1440 min Winter	98.050	0.050	4.2	0.1	O K
2160 min Winter	98.042	0.042	3.1	0.0	O K
2880 min Winter	98.038	0.038	2.5	0.0	O K
4320 min Winter	98.033	0.033	1.9	0.0	O K
5760 min Winter	98.029	0.029	1.4	0.0	O K
7200 min Winter	98.024	0.024	1.2	0.0	O K
8640 min Winter	98.022	0.022	1.1	0.0	O K
10080 min Winter	98.019	0.019	0.9	0.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	38.834	0.0	62.0	34	
120 min Winter	24.053	0.0	76.8	60	
180 min Winter	17.903	0.0	85.7	90	
240 min Winter	14.414	0.0	92.0	126	
360 min Winter	10.599	0.0	101.5	176	
480 min Winter	8.517	0.0	108.7	244	
600 min Winter	7.181	0.0	114.6	296	
720 min Winter	6.244	0.0	119.6	390	
960 min Winter	5.002	0.0	127.7	480	
1440 min Winter	3.653	0.0	139.9	716	
2160 min Winter	2.662	0.0	152.9	1128	
2880 min Winter	2.124	0.0	162.7	1460	
4320 min Winter	1.542	0.0	177.3	2328	
5760 min Winter	1.227	0.0	188.0	2784	
7200 min Winter	1.027	0.0	196.5	3664	
8640 min Winter	0.889	0.0	204.1	4440	
10080 min Winter	0.787	0.0	211.0	4944	
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Date 12/06/2017 17:00 File EXISTING 1900M2 1 IN 10...	Designed by I Llewellyn Checked by	
Micro Drainage Source Control 2017.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.190

Time (mins)	Area
From:	To: (ha)
0	4 0.190

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42 West Street London House Carshalton SM5 2PR		
Date 12/06/2017 17:00 File EXISTING 1900M2 1 IN 10...	Designed by I Llewellyn Checked by	
Micro Drainage Source Control 2017.1		
<u>Model Details</u> Storage is Online Cover Level (m) 100.000 <u>Pipe Structure</u> Diameter (m) 1.000 Length (m) 10.000 Slope (1:X) 10.000 Invert Level (m) 98.000 <u>Pipe Outflow Control</u> Diameter (m) 1.000 Entry Loss Coefficient 0.500 Slope (1:X) 10.0 Coefficient of Contraction 0.600 Length (m) 10.000 Upstream Invert Level (m) 98.000 Roughness k (mm) 0.600		
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42 West Street London House Carshalton SM5 2PR					
Date 12/06/2017 17:06 File 1200M2 PERMEABLE PAVING...		Designed by I Llewellyn Checked by			
Micro Drainage		Source Control 2017.1			
Summary of Results for 100 year Return Period (+30%)					
Half Drain Time : 451 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.648	0.148	0.9	19.8	O K
30 min Summer	99.677	0.177	1.1	28.2	O K
60 min Summer	99.702	0.202	1.2	36.8	O K
120 min Summer	99.725	0.225	1.2	44.9	O K
180 min Summer	99.735	0.235	1.2	48.6	O K
240 min Summer	99.740	0.240	1.2	50.3	O K
360 min Summer	99.743	0.243	1.2	51.6	O K
480 min Summer	99.745	0.245	1.2	52.1	O K
600 min Summer	99.745	0.245	1.2	52.1	O K
720 min Summer	99.744	0.244	1.2	51.9	O K
960 min Summer	99.741	0.241	1.2	50.9	O K
1440 min Summer	99.732	0.232	1.2	47.7	O K
2160 min Summer	99.717	0.217	1.2	42.1	O K
2880 min Summer	99.703	0.203	1.2	37.0	O K
4320 min Summer	99.681	0.181	1.1	29.6	O K
5760 min Summer	99.664	0.164	1.0	24.3	O K
7200 min Summer	99.650	0.150	0.9	20.2	O K
8640 min Summer	99.638	0.138	0.8	17.1	O K
10080 min Summer	99.628	0.128	0.8	14.7	O K
15 min Winter	99.660	0.160	1.0	22.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	117.069	0.0	19		
30 min Summer	78.692	0.0	33		
60 min Summer	50.485	0.0	62		
120 min Summer	31.269	0.0	122		
180 min Summer	23.274	0.0	182		
240 min Summer	18.738	0.0	240		
360 min Summer	13.779	0.0	332		
480 min Summer	11.072	0.0	388		
600 min Summer	9.336	0.0	452		
720 min Summer	8.117	0.0	516		
960 min Summer	6.503	0.0	654		
1440 min Summer	4.749	0.0	924		
2160 min Summer	3.461	0.0	1320		
2880 min Summer	2.761	0.0	1700		
4320 min Summer	2.005	0.0	2460		
5760 min Summer	1.595	0.0	3176		
7200 min Summer	1.335	0.0	3896		
8640 min Summer	1.156	0.0	4592		
10080 min Summer	1.023	0.0	5344		
15 min Winter	117.069	0.0	18		
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Date 12/06/2017 17:06		Designed by I Llewellyn			
File 1200M2 PERMEABLE PAVING...		Checked by			
Micro Drainage		Source Control 2017.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.690	0.190	1.1	32.4	O K
60 min Winter	99.717	0.217	1.2	42.2	O K
120 min Winter	99.743	0.243	1.2	51.5	O K
180 min Winter	99.755	0.255	1.2	55.9	O K
240 min Winter	99.762	0.262	1.2	58.2	O K
360 min Winter	99.767	0.267	1.2	60.2	O K
480 min Winter	99.768	0.268	1.2	60.4	O K
600 min Winter	99.767	0.267	1.2	60.0	O K
720 min Winter	99.765	0.265	1.2	59.5	O K
960 min Winter	99.760	0.260	1.2	57.7	O K
1440 min Winter	99.746	0.246	1.2	52.5	O K
2160 min Winter	99.722	0.222	1.2	43.9	O K
2880 min Winter	99.701	0.201	1.2	36.5	O K
4320 min Winter	99.673	0.173	1.0	26.8	O K
5760 min Winter	99.650	0.150	0.9	20.3	O K
7200 min Winter	99.632	0.132	0.8	15.8	O K
8640 min Winter	99.618	0.118	0.7	12.5	O K
10080 min Winter	99.606	0.106	0.6	10.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	78.692	0.0	33		
60 min Winter	50.485	0.0	62		
120 min Winter	31.269	0.0	120		
180 min Winter	23.274	0.0	178		
240 min Winter	18.738	0.0	234		
360 min Winter	13.779	0.0	346		
480 min Winter	11.072	0.0	448		
600 min Winter	9.336	0.0	484		
720 min Winter	8.117	0.0	558		
960 min Winter	6.503	0.0	712		
1440 min Winter	4.749	0.0	1010		
2160 min Winter	3.461	0.0	1424		
2880 min Winter	2.761	0.0	1788		
4320 min Winter	2.005	0.0	2552		
5760 min Winter	1.595	0.0	3288		
7200 min Winter	1.335	0.0	4032		
8640 min Winter	1.156	0.0	4680		
10080 min Winter	1.023	0.0	5440		
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42 West Street London House Carshalton SM5 2PR																																			
Date 12/06/2017 17:06 File 1200M2 PERMEABLE PAVING...	Designed by I Llewellyn Checked by																																		
Micro Drainage		Source Control 2017.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.200</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.120 <table> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> <tr> <td>0</td> <td>4</td> <td>0.120</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.200	Shortest Storm (mins)	15	Ratio R	0.350	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+30	Time (mins)		Area	From:	To:	(ha)	0	4	0.120
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Micro Drainage Source Control 2017.1																										
<u>Model Details</u> Storage is Online Cover Level (m) 100.000 <u>Porous Car Park Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.00360</td> <td>Width (m)</td> <td>30.0</td> </tr> <tr> <td>Membrane Percolation (mm/hr)</td> <td>1000</td> <td>Length (m)</td> <td>40.0</td> </tr> <tr> <td>Max Percolation (l/s)</td> <td>333.3</td> <td>Slope (1:X)</td> <td>200.0</td> </tr> <tr> <td>Safety Factor</td> <td>1.0</td> <td>Depression Storage (mm)</td> <td>5</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Evaporation (mm/day)</td> <td>3</td> </tr> <tr> <td>Invert Level (m)</td> <td>99.500</td> <td>Membrane Depth (m)</td> <td>0</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.00360	Width (m)	30.0	Membrane Percolation (mm/hr)	1000	Length (m)	40.0	Max Percolation (l/s)	333.3	Slope (1:X)	200.0	Safety Factor	1.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	99.500	Membrane Depth (m)	0
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Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 26 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	98.718	0.718	0.0	6.0	6.0	12.3	O K
30 min Summer	98.832	0.832	0.0	6.0	6.0	14.2	O K
60 min Summer	98.855	0.855	0.0	6.0	6.0	14.6	O K
120 min Summer	98.769	0.769	0.0	6.0	6.0	13.1	O K
180 min Summer	98.629	0.629	0.0	6.0	6.0	10.8	O K
240 min Summer	98.478	0.478	0.0	6.0	6.0	8.2	O K
360 min Summer	98.282	0.282	0.0	6.0	6.0	4.8	O K
480 min Summer	98.182	0.182	0.0	5.7	5.7	3.1	O K
600 min Summer	98.135	0.135	0.0	5.4	5.4	2.3	O K
720 min Summer	98.118	0.118	0.0	4.8	4.8	2.0	O K
960 min Summer	98.098	0.098	0.0	3.9	3.9	1.7	O K
1440 min Summer	98.079	0.079	0.0	2.9	2.9	1.3	O K
2160 min Summer	98.065	0.065	0.0	2.1	2.1	1.1	O K
2880 min Summer	98.057	0.057	0.0	1.7	1.7	1.0	O K
4320 min Summer	98.048	0.048	0.0	1.2	1.2	0.8	O K
5760 min Summer	98.042	0.042	0.0	1.0	1.0	0.7	O K
7200 min Summer	98.038	0.038	0.0	0.8	0.8	0.7	O K
8640 min Summer	98.035	0.035	0.0	0.7	0.7	0.6	O K
10080 min Summer	98.033	0.033	0.0	0.6	0.6	0.6	O K
15 min Winter	98.822	0.822	0.0	6.0	6.0	14.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.069	0.0	16.2	16
30 min Summer	78.692	0.0	21.8	26
60 min Summer	50.485	0.0	28.0	44
120 min Summer	31.269	0.0	34.7	78
180 min Summer	23.274	0.0	38.7	112
240 min Summer	18.738	0.0	41.6	142
360 min Summer	13.779	0.0	45.9	198
480 min Summer	11.072	0.0	49.1	252
600 min Summer	9.336	0.0	51.8	308
720 min Summer	8.117	0.0	54.0	368
960 min Summer	6.503	0.0	57.7	490
1440 min Summer	4.749	0.0	63.2	730
2160 min Summer	3.461	0.0	69.1	1100
2880 min Summer	2.761	0.0	73.5	1464
4320 min Summer	2.005	0.0	80.1	2188
5760 min Summer	1.595	0.0	85.0	2936
7200 min Summer	1.335	0.0	88.9	3608
8640 min Summer	1.156	0.0	92.4	4288
10080 min Summer	1.023	0.0	95.4	5120
15 min Winter	117.069	0.0	18.2	16

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<u>Summary of Results for 100 year Return Period (+30%)</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	98.957	0.957	0.0	6.0	6.0	16.4	O K
60 min Winter	98.972	0.972	0.0	6.0	6.0	16.6	O K
120 min Winter	98.820	0.820	0.0	6.0	6.0	14.0	O K
180 min Winter	98.585	0.585	0.0	6.0	6.0	10.0	O K
240 min Winter	98.371	0.371	0.0	6.0	6.0	6.3	O K
360 min Winter	98.163	0.163	0.0	5.6	5.6	2.8	O K
480 min Winter	98.117	0.117	0.0	4.8	4.8	2.0	O K
600 min Winter	98.101	0.101	0.0	4.1	4.1	1.7	O K
720 min Winter	98.090	0.090	0.0	3.5	3.5	1.5	O K
960 min Winter	98.078	0.078	0.0	2.8	2.8	1.3	O K
1440 min Winter	98.064	0.064	0.0	2.1	2.1	1.1	O K
2160 min Winter	98.054	0.054	0.0	1.5	1.5	0.9	O K
2880 min Winter	98.047	0.047	0.0	1.2	1.2	0.8	O K
4320 min Winter	98.040	0.040	0.0	0.9	0.9	0.7	O K
5760 min Winter	98.035	0.035	0.0	0.7	0.7	0.6	O K
7200 min Winter	98.032	0.032	0.0	0.6	0.6	0.5	O K
8640 min Winter	98.030	0.030	0.0	0.5	0.5	0.5	O K
10080 min Winter	98.028	0.028	0.0	0.4	0.4	0.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	78.692	0.0	24.4	28			
60 min Winter	50.485	0.0	31.4	46			
120 min Winter	31.269	0.0	38.9	84			
180 min Winter	23.274	0.0	43.4	120			
240 min Winter	18.738	0.0	46.6	146			
360 min Winter	13.779	0.0	51.4	196			
480 min Winter	11.072	0.0	55.0	248			
600 min Winter	9.336	0.0	58.0	306			
720 min Winter	8.117	0.0	60.5	368			
960 min Winter	6.503	0.0	64.7	490			
1440 min Winter	4.749	0.0	70.8	734			
2160 min Winter	3.461	0.0	77.4	1080			
2880 min Winter	2.761	0.0	82.4	1456			
4320 min Winter	2.005	0.0	89.7	2124			
5760 min Winter	1.595	0.0	95.2	2840			
7200 min Winter	1.335	0.0	99.6	3632			
8640 min Winter	1.156	0.0	103.5	4312			
10080 min Winter	1.023	0.0	106.9	5120			
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.074

Time (mins)	Area
From:	To: (ha)
0	4 0.074

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Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.000 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	18.0	18.0	1.100	0.0	36.0
1.000	18.0	36.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0115-6000-1000-6000
Design Head (m) 1.000
Design Flow (l/s) 6.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 115
Invert Level (m) 98.000
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	6.0
Flush-Flo™	0.298	6.0
Kick-Flo®	0.647	4.9
Mean Flow over Head Range	-	5.2

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)
0.100	4.0	1.200	6.5	3.000	10.0	7.000	15.0
0.200	5.8	1.400	7.0	3.500	10.8	7.500	15.5
0.300	6.0	1.600	7.5	4.000	11.5	8.000	16.0
0.400	5.9	1.800	7.9	4.500	12.2	8.500	16.5
0.500	5.7	2.000	8.3	5.000	12.8	9.000	17.0
0.600	5.3	2.200	8.7	5.500	13.4	9.500	17.4
0.800	5.4	2.400	9.0	6.000	14.0		
1.000	6.0	2.600	9.4	6.500	14.5		

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