

Civil Engineers & Transport Planners

South Worple Way, East Sheen

Drainage Strategy

August 2023 231721/DS/AG/KL/01 Rev B



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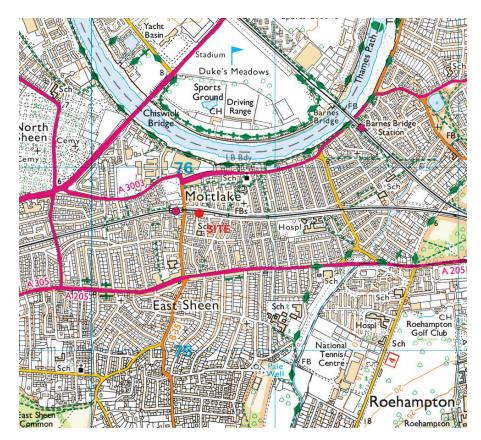
SuDS Proforma

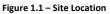


1 INTRODUCTION

1.1 Scope

1.1.1 Lanmor Consulting has been appointed to prepare a drainage strategy for the proposed development at the site of South Worple Way, East Sheen, London. This report has been commissioned to advise on the technical feasibility of providing drainage for the proposed development. Figure 1.1 below shows the location of the site.





1.1.2 This report will consider the proposed drainage strategy for the site, it will assess the site's current Greenfield and Brownfield runoff rates, suitable methods of discharging the runoff from the development and set the drainage strategy for the proposed development, including discharge rates and any requirements for attenuation.

- 1.1.3 The information and details within this report will be refined, modified and updated as the detailed design is progressed, post planning. The scope of works for this drainage strategy report is outlined below:
 - Review available data relating to existing on-site drainage and other drainage networks in the vicinity of the site.
 - Review of the site's ground conditions for suitability of SuDS.
 - Consider the use of Sustainable Drainage Systems as an option for disposal of surface water runoff from the proposed development.
 - Undertake drainage assessments of proposed buildings to establish discharge rates and attenuation requirements to deal with any increased surface water runoff.

2 SITE LOCATION AND DESCRIPTION

2.1 Location

- 2.1.1 The land use in the area surrounding the site is heavily developed with residential properties with some commercial uses to the east and north. The site is occupied by a number of garages with parking to the front. The nearest water courses is the River Thames to the north of the site.
- 2.1.2 The application site covers an area of 0.05, the proposed application seeks approval to construct 5 residential dwellings.

2.2 Proposed Development

2.2.1 The proposed redevelopment will involve the construction of 5 residential properties with parking to the front of the site along South Worple Way. The proposed development is shown on Drawing 1332/03 and is included within Appendix A.

2.3 Regional Geology

- 2.3.1 The British Geological Survey indicates that the site has an underlying bedrock of London Clay Formation - Clay and silt. Sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period.
- 2.3.2 Superficial deposits of the Kempton Park Gravel Member are indicated overlaying the bedrock, these consist of Sand and gravel. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.



3 EXISTING DRAINAGE

3.1 Existing Foul Drainage

3.1.1 The site is occupied by a series of garages so there is no foul connection from the site. Thames Water sewer records were obtained. Their asset records show there is a foul sewer running along South Worple Way, it is indicated to be a 225mm diameter sewer.

3.2 Existing Surface Water Drainage

- 3.2.1 The site is currently drained via a dished channel and gullies, which are assumed to discharge surface water directly into the public sewer network located within South Worple Way. No SuDS have been identified on site so it is assumed that the drainage discharges direct to the adopted sewer with no control.
- 3.2.2 The Thames Water records also show there is an existing surface water sewer running in South Worple Way. The sewer is shown as a 225mm in diameter. The nearest surface water manhole is 5717, the depth of the sewer is indicated to be 2.5m. The Thames Water asset records are included in Appendix B of this report.

4 PROPOSED DRAINAGE REGIME

4.1 Proposed Foul Water Drainage

4.1.1 A new network of foul drainage pipes will be provided to serve the 5 new properties. Foul water will be collected through a series of pipes from the units and discharge into the existing Thames Water foul sewer towards the south of the site in South Worple Way.

4.2 Proposed Surface Water Drainage

- 4.2.1 Sustainable Drainage Systems (SuDS) were considered as part of this assessment for disposal of surface water runoff from the development. The residential units will have pitched roofs, so incorporating a green roof is not possible.
- 4.2.2 Next on the Sustainable Drainage Hierarchy is the use of ground infiltration techniques such as soakaways and infiltration basins etc. The underlaying ground consist of London clay with superficial deposits of the Kempton Park Gravel. The site is located directly south of the railway line, network rail has a requirements that no infiltration should be allowed within the 10-20m of their asset boundary, therefore, the use of infiltration techniques such as soakaways have been discounted on these grounds.
- 4.2.3 Next is discharge to watercourse, there are none in the vicinity of the site, so this has been discounted. A connection to a surface water sewer is next on the hierarchy so the preferred option for discharge of runoff is to attenuate runoff and discharge to the adopted surface water sewer.
- 4.2.4 There is a Thames Water surface water sewer located in South Worple Way, the proposed drainage strategy will provide a new connection to the public sewer at manhole 5717. The surface water sewer is 2.5m deep so a gravity connection can be provided from the site to the adopted sewer network.

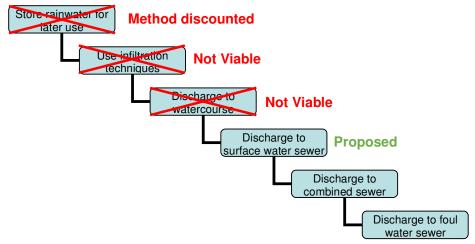


Figure 4.1 – Sustainable Drainage Hierarchy

- 4.2.5 The proposed drainage strategy has adopted the approach to use a rainwater garden and attenuate runoff on site in the subbase of the permeable paving to the front of the site and cascade into a cellular crate system beneath the paving area to attenuate the runoff from the development. A flood risk assessment has been prepared for the development this has identified the current discharge rate from site and that infiltration is unlikely to be viable. They estimated that existing discharge rate from the site to be 6.3 I/s and suggest that the proposed discharge rate should be restricted to 3I/s, 50% of the existing.
- 4.2.6 As part of this assessment the greenfield runoff rates have been assessed, the full calculations are included in Appendix C, this shows a very low discharge rate, which is not achievable so the discharge rate will be restricted to 2 l/s.
- 4.2.7 The attenuation will be designed to accommodate a 1 in 100 year storm plus an allowance for climate change. The climate change allowance to be included are based on the river management catchment area and lifetime for the development, for developments with a lifetime beyond 2100 the PPG recommends that the upper end allowance be used for assessing surface water flood risk. The site located in London Management Catchment area. The upper end allowance of the catchment is 40% so this will be used for the surface water design.

- 4.2.8 The rainwater garden will receive the runoff from half the site and cascade into the underground attenuation tank, the remainder of the roof drainage from the buildings will flow to the permeable paving to the front of the properties before entering the attenuation crates below. Infiltration is not possible so the paving will act as storage only. The sub-base has been designed with a 350mm thick granular subbase to accommodate runoff from the roofs and hardstandings for a rainfall event with a probability of 1in 100 plus a 40% allowance for climate change.
- 4.2.9 The discharge from the paving to the attenuation crates will be controlled via a 40mm orifice. The attenuation crates have also been designed at 2m x 14m x 0.4m deep to accommodate the runoff from an event with a probability of 1 in 100 years +40% allowance. The discharge from the crates the adopted sewer in South Worple Way will be restricted to 2 l/s controlled via a hydrobrake. The sewer in South Worple Way is 2.5m deep so a gravity connection can be provided from the development.
- 4.2.10 Water butts have been provided to the rear of the property at the request of the Local Planning Authority, they have no SuDS benefit as they cannot be accounted for in the attenuation calculations as there is no guarantee they will empty to receive an incoming rainfall. None have been provided to front as the RWP's discharge to the raingarden which needs the runoff from the roof to feed the plants.
- 4.2.11 Drawing 231666/DS/01 included in Appendix C, shows an indicative drainage layout for the development. The full calculations for each return period are included in Appendix C. The London SuDS proforma for the development is included in Appendix D.

4.3 Flood Exceedance

The site will be largely developed with buildings, so the only open area at risk is the parking area to front of the site. This area will fall to South Worple Road so the development will not be at risk of flooding as exceedance flooding will be directed away from the site and down South Worple Road.

5 SUDS TREATMENT & MANAGEMENT

5.1 SuDS Treatment

TA 2

- 5.1.1 Section 26 of the CIRIA SuDS Manual C753, provides guidance regarding methods for managing pollution risks from surface water runoff. Part of the assessment is to determine which land use classification the proposed development falls under, Table 26.1 of the CIRIA Report C753 sets the approaches to water quality risk management. For this site the Simple Index Approach will be used.
- 5.1.2 Table 26.2 in C753 reproduced as Table 5.1, show the potential hazard associated with different land uses the hazard indices. The development will consist of residential houses, it is concluded that the site should be classed within the sections shown in Table 5.1 below. The roofs of the residential buildings is considered to have a "very low" pollution hazard, generating 0.2 total suspended solids, 0.2 metals and 0.05 hydro-carbons. The access and parking area is considered to have a "low" pollution hazard, generating 0.5 total suspended solids, 0.4 metals and 0.4 hydro-carbons.

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydr carbo
Residential roofs	Very low	0.2	0.2	0.0
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non- residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8²	0.82	0.9

Table 5.1 – CIRIA SuDS Manual C753 Extract (Land use classifications)

5.1.3 The proposed development will incorporate permeable paving for storage.
 Suitable treatment measures offered by SuDS features are set out in CIRA report.
 Table 26.3 of C753 reproduced below as Table 5.2 sets out the mitigation indices provided by SuDS features for discharge to surface waters.

26.3			Mitigation indices ¹	
	Type of SuDS component	TSS	Metals	Hydrocarbons
	Filter strip	0.4	0.4	0.5
	Filter drain	0.4 ²	0.4	0.4
	Swale	0.5	0.6	0.6
	Bioretention system	0.8	0.8	0.8
	Permeable pavement	0.7	0.6	0.7
•	Detention basin	0.5	0.5	0.6
	Pond ⁴	0.73	0.7	0.5
	Wetland	0.8 ³	0.8	0.8
	Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Table 5.2 – SuDS Manual C753 Extract (Mitigation Indices to Surface Water)

5.1.4 The permeable paving will provide mitigation of 0.7 for total suspended solids,0.6 for metals and 0.7 for hydrocarbons. These are all greater than the pollution hazard indices identified in table 5.1 above.

5.2 SuDS Maintenance

- 5.2.1 Regular inspection of the surface water drainage network for blockages and clearing unwanted debris/silt from the system should improve the performance of the surface water network and decrease the need for future repairs. In the event of blockages, high pressure water jets can be used to clear the gullies and pipes to ensure they are functioning correctly, this should be undertaken by certified trained professionals.
- 5.2.2 The level and frequency of maintenance required on site is dependent on the type of facility. The type of maintenance will fall into one of three categories "regular maintenance", "occasional maintenance", and "remedial maintenance".

- 5.2.3 Regular Maintenance of the drainage and SuDS features will include, inspections, removal of litter/debris and sweeping of the surfaces. Occasional maintenance will include removal of sediment etc. and remedial maintenance may include structural repairs and infiltration reconditioning if required.
- 5.2.4 The drainage and SuDS elements after an initial inspection following construction should be inspected on a monthly basis for the first 12 months and after large storms, thereafter the following maintenance regime should be applied and adjusted if the 12-month monitoring process has identified any issues. Following completion of the development, a Management Company will be set up to maintain all the communal areas, including the drainage. It will be their responsibility to maintain the drainage network, including the SuDS elements
- 5.2.5 For the Inspection, Manhole, Catchpit Chambers and Pipes, the following maintenance will be required.

Manhole / Pipe Maintenance Schedule			
	Required Action	Typical Frequency	
Regular maintenance	Inspect for evidence of poor operation via water level in chambers. If required, take remedial action.	3-monthly, 48 hours after large storms.	
	Check and remove large vegetation growth near pipe runs.	Monthly or as required	
	Remove sediment from structures.	Annually or as required	
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required	
	If continued poor performance jet and CCTV survey poorly performing runs.	As required	
Monitoring	Inspect/check all inlets, outlets, to ensure that they are in good condition and operating as designed.	Annually	
	Survey inside of pipe manholes for sediment build-up and remove if necessary	Every 5 years or as required	

Table 5.3 – Manhole and Pipe Maintenance Schedule



Permeable Paving

5.2.6	For permeable paving areas, the following maintenance is recommended.
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Permeable Paving Maintenance Schedule			
	Required Action	Typical Frequency	
Regular maintenance	Remove debris and leaves etc.	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surfaces from adjacent impermeable areas as this area is most likely to collect the most sediment.	
Occasional Stabilise and mow contributing and adjacent areas		As required	
maintenance	Removal of weeds	As required- once per year on less frequently used pavements	
Remedial	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required	
Actions	Remedial work to any depressions, rutting etc	As required	
	Rehabilitation of surface and upper substructure	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)	
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action.	Three-monthly, 48 hours after large storms in the first six months	
Monitoring	Inspect silt accumulation rates and establish appropriate frequencies for rehabilitation	Annually	
	Monitor inspection chambers	Annually	

Table 5.4 – Permeable Paving Maintenance Schedule



Attenuation Tanks

5.2.1 For the attenuation tanks, the following maintenance will be required.

Attenuation Tank Maintenance Schedule				
	Required Action	Typical Frequency		
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Annually		
	Remove debris from the catchment surface (where it may cause risk to performance).	Monthly		
	For systems where rainfall infiltrates in the tank from above, check surface of filter for blockage by sediment, algae or other matter, remove and replace surface infiltration medium as necessary	Annually		
	Remove sediment from pre-treatment structures.	Annually or as required		
Remedial Actions	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		
	Survey inside of tanks for sediment build-up and remove if necessary	Every 5 years or as required		

Table 5.5 – Attenuation Tank Maintenance

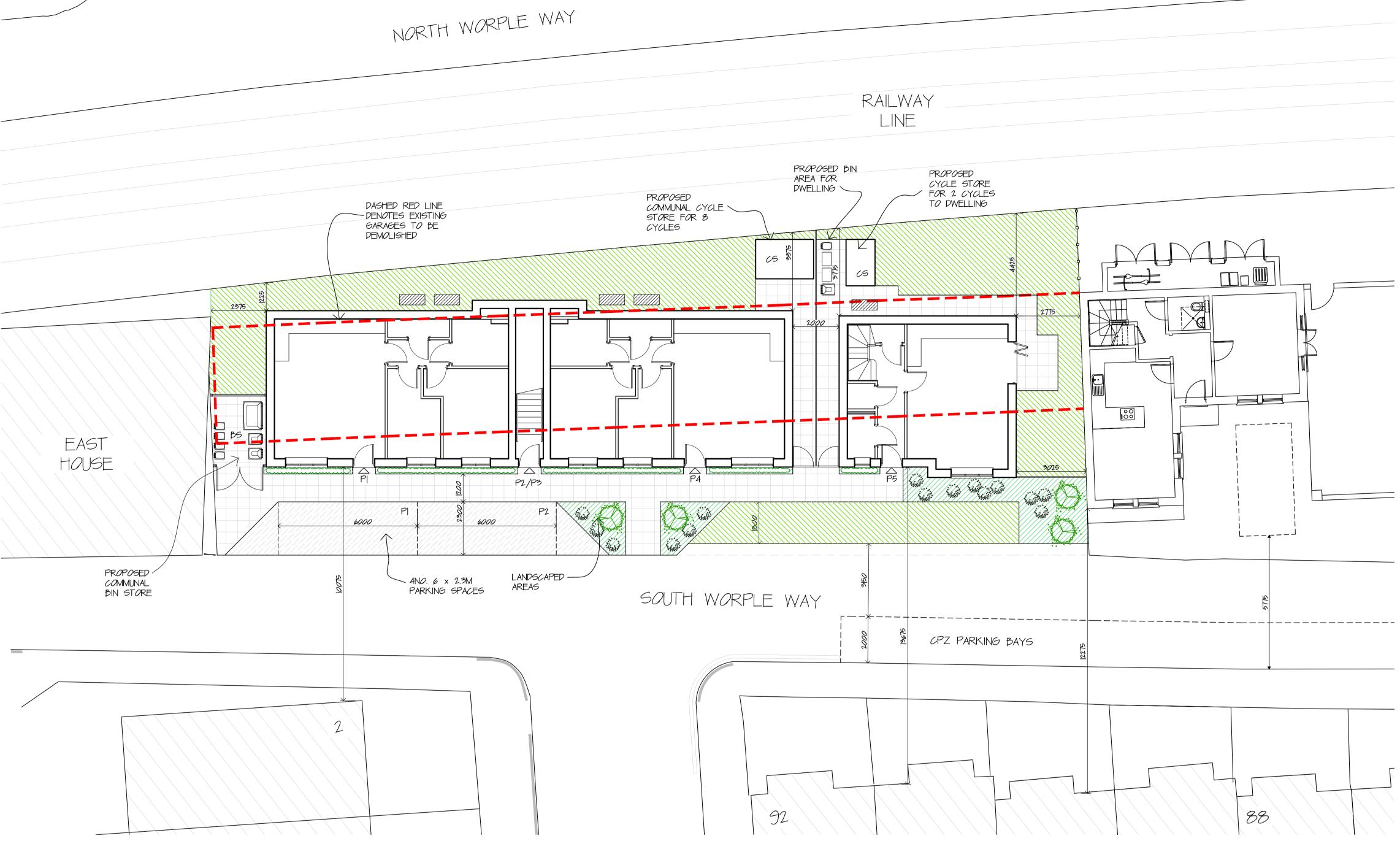
6 SUMMARY AND CONCLUSION

- 6.1.1 This Drainage Strategy has been prepared to identify how the proposed development will discharge surface water runoff from the proposed development.
- 6.1.2 The proposed application site is located off South Worple Way and will consist of a development of 5 residential properties, following demolition of the existing garages on site.
- 6.1.3 As part of the assessment, SuDS was considered for the discharge of surface water runoff from the proposed buildings and parking areas. The proposals will implement permeable paving and attenuation storage, that has been sized to ensure the storage in the subbase and crates caters for all events up to and including the 1 in 100 year storm plus 40% climate change allowance. The discharge from the attenuation crates will be restricted by a hyrodbrake to 2 l/s which is less than 50% of the existing discharge rate.
- 6.1.4 This statement clearly demonstrates that the proposed development can be served in terms of discharge of foul and surface water runoff from the site without increasing the risk of flooding in the area. Given the above we can see no reason to preclude development on this site on the grounds of there being insufficient capacity to deal with the runoff from the proposed development.



APPENDIX A

Drawing 1332/03 – Proposed Site Layout





INDICATIVE IMAGE OF PROPOSED COMMUNAL CYCLE STORE

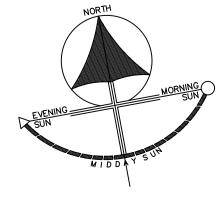
WASTE CALCULATIONS

IN ACCORDANCE WITH LONDON BOROUGH OF RICHMOND REFUSE AND RECYCLING STORAGE REQUIREMENTS' FOR ONE 2 BEDROOM HOUSE THE FOLLOWING SHOULD BE PROVIDED;

240L REFUSE IIOL DRY RECYCLING (2 NO 55 LITRE RECYCLING BOXES) 23L FOOD PER UNIT

FOR FOUR 2 BEDROOM FLATS THE FOLLOWING SHOULD BE PROVIDED; 560L REFUSE (BASED ON 70 LITRES PER BEDROOM) 480L DRY RECYCLING (I NO 240 LITRE BIN FOR MIXED PAPER AND I NO 240 LITRE BIN FOR MIXED

CONTAINERS) 23L FOOD PER UNIT





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DESIGN



APPENDIX B

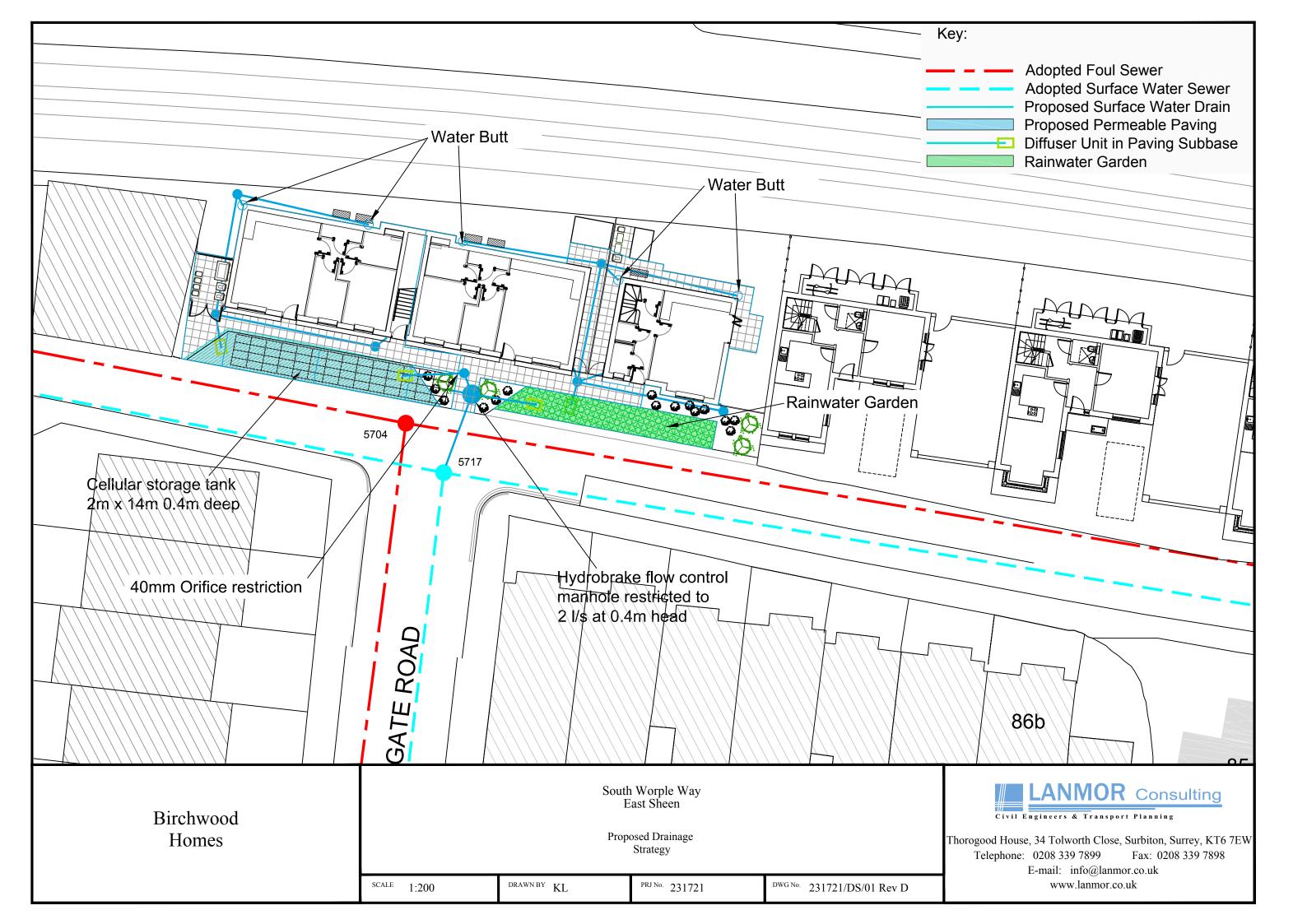
Thames Water Sewer Records





APPENDIX C

Drawing 231271/DS/01 – Proposed Drainage Strategy





Micro Drainage – Greenfield Runoff

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	Micco
Designed by Kunal	
Checked by	Drainage
Source Control 2015.1	
<u>S Mean Annual Flood</u>	
Input	
rs) 1 Soil 0.300 ha) 0.050 Urban 0.000 nm) 600 Region Number Region 6	
	Checked by Source Control 2015.1 S Mean Annual Flood Input rs) 1 Soil 0.300 ha) 0.050 Urban 0.000

Results 1/s

QBAR Rural 0.1 QBAR Urban 0.1 Q1 year 0.1

Q1 year 0.1 Q30 years 0.2 Q100 years 0.2

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Micro Drainage – Permeable Paving

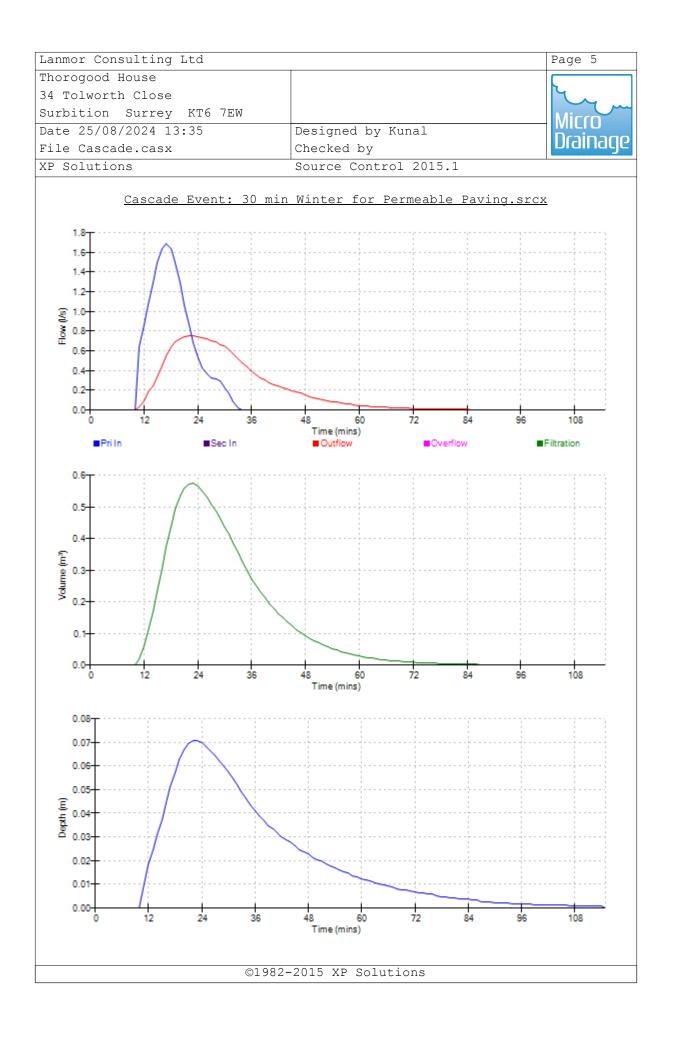
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			6.066 0			0.0	0.7	0.7	0.5	
60	min	Summer	6.066 0	.066		0.0	0.7	0.7	0.5	ОК
			6.057 0			0.0	0.6	0.6	0.4	
			6.051 0			0.0	0.5	0.5	0.4	
			6.046 0			0.0	0.5	0.5	0.3	
			6.040 0			0.0	0.4 0.3	0.4	0.3	
			6.036 0 6.033 0			0.0 0.0	0.3	0.3	0.2	
			6.031 0			0.0	0.3	0.3	0.2	
			6.027 0			0.0	0.2	0.2	0.1	
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			6.018 0			0.0	0.1	0.1	0.1	
			6.016 0 6.014 0			0.0	0.1	0.1	0.0	
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	min Summe:				0.0	0.0	0.0	0.0	0 K
	min Winte				0.0	0.0	0.0	0.0	0 K
	min Winte				0.0	0.8	0.8	0.5	O K
	min Winte				0.0	0.7	0.7		O K
	min Winte				0.0	0.6	0.6		
	min Winte				0.0	0.5	0.5		
	min Winte				0.0	0.3	0.3		0 K
	min Winte				0.0	0.3	0.4		0 K
	min Winte				0.0	0.3	0.3		0 K
	min Winte				0.0	0.2	0.2		0 K
	min Winte				0.0	0.2	0.2		0 K
	min Winte				0.0	0.2	0.2		
	min Winte				0.0	0.2	0.2		
	min Winte				0.0	0.1	0.1		0 K
	min Winte				0.0	0.1	0.1	0.0	0 K
	min Winte				0.0	0.1	0.1		0 K
	min Winte				0.0	0.0	0.0		0 K
	min Winte				0.0	0.0	0.0		
	min Winte				0.0	0.0	0.0		0 K
	min Winte				0.0	0.0	0.0		ОК
			-		and a ded	Discharg	o Timo-D	ook	
		Storm						ean	
		Storm Event				-		•)	
		Storm Event			Volume	Volume		;)	
		Event	(m	m/hr) '	Volume (m³)	Volume (m ³)	(mins		
		Event	(m mer	m/hr) ' 0.349	Volume (m³) 0.0	Volume (m ³) 4.	(mins	304	
	10080	Event	(m mer mer	m/hr) ' 0.349 0.312	Volume (m ³) 0.0 0.0	Volume (m ³) 4. 5.	(mins 9 4 0 5	304 040	
	10080	Event	(m mer mer iter 3	m/hr) 0.349 0.312 1.195	Volume (m ³) 0.0 0.0 0.0	Volume (m ³) 4. 5. 0.	(mins 9 4 0 5 8	304 040 14	
	10080 15 30	Event) min Sum) min Sum ; min Win) min Win	(m mer mer ater 3 ater 2	m/hr) v 0.349 0.312 1.195 0.288	Volume (m ³) 0.0 0.0 0.0 0.0	Volume (m ³) 4. 5. 0. 1.	(mins 9 4. 0 5 8 1	304 040 14 23	
	10080 15 30 60	Event) min Sum) min Sum 5 min Win) min Win) min Win) min Win	(m mer ater 3 ater 2 ater 1	m/hr) v 0.349 0.312 1.195 0.288 2.800	Volume (m ³) 0.0 0.0 0.0 0.0 0.0	Volume (m ³) 4. 5. 0. 1.	(mins 9 4. 0 5. 8 1 4	304 040 14 23 40	
	10080 15 30 60 120	Event) min Sum) min Sum ; min Wir) min Wir) min Wir) min Wir	(m mer ater 3 ater 2 ater 1 ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0	Volume (m ³) 4. 5. 0. 1. 1.	(mins 9 4. 0 5. 8 1 4 8	304 040 14 23 40 70	
	10080 15 30 60 120 180	Event) min Sum) min Sum i min Wir) min Wir) min Wir) min Wir) min Wir	(m mer ater 3 ater 2 ater 1 ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Volume (m ³) 4. 5. 0. 1. 1. 1. 2.	(mins 9 4 0 5 8 1 4 8 1	304 040 14 23 40 70 100	
	10080 15 30 60 120 180 240	Event) min Sum) min Sum) min Sum i min Wir) min Wir	(m mer ater 3 ater 2 ater 1 ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2.	(mins 9 4 0 5 8 1 4 8 1 3	304 040 14 23 40 70 100 132	
	10080 15 30 60 120 180 240 360	Event) min Sum) min Sum i min Sum i min Wir) min Wir	(m mer mer ater 3 ater 2 ater 1 ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2.	(mins 9 4 0 5 8 1 4 8 1 3 5	304 040 14 23 40 70 100 132 190	
	10080 15 30 60 120 180 240 360 480	Event) min Sum) min Sum i min Wir) min Wir	(m umer uter 3 uter 2 uter 1 uter uter uter uter uter	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2.	(mins 9 4 0 5 8 1 4 8 1 3 5 7	304 040 14 23 40 70 100 132 190 254	
	10080 15 30 60 120 180 240 360 480 600	Event) min Sum) min Sum) min Sum i min Wir) min Wir	(m umer uter 3 uter 2 uter 1 uter uter uter uter uter uter	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 2.	(mins 9 4 0 5 8 1 4 8 1 3 5 7 9	304 040 14 23 40 70 100 132 190 254 314	
	10080 15 30 60 120 180 240 360 480 600 720	Event) min Sum) min Sum i min Wir) min Wir	(m umer ater 3 ater 2 ater 1 ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 3.	(mins 9 4 0 5 8 1 4 8 1 3 5 7 7 1	304 040 14 23 40 70 100 132 190 254 314 376	
	10080 15 30 60 120 180 240 360 480 600 720 960	Event) min Sum) min Sum i min Sum i min Wir) min Wir	(m mer ater 3 ater 2 ater 1 ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168 1.754	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 3. 3.	(mins 9 4 0 5 8 1 4 8 1 3 5 7 9 1 3	304 040 14 23 40 70 100 132 190 254 314 376 490	
	10080 15 30 60 120 180 240 360 480 600 720 960 1440	Event) min Sum) min Sum i min Wir) min Wir	(m mer ater 3 ater 2 ater 1 ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168 1.754 1.302	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 3. 3. 3.	(mins 9 4 0 5 8 1 4 8 1 3 5 7 9 1 3 7	304 040 14 23 40 70 100 132 190 254 314 376 490 710	
	10080 15 30 60 120 180 240 360 480 600 720 960 1440 2160	Event) min Sum) min Sum i min Wir) min Wir	(m mer ater 3 ater 2 ater 1 ater 1 ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168 1.754 1.302 0.967	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 3. 3. 3. 4.	(mins 9 4 0 5 8 1 4 8 1 3 5 7 9 1 3 7 1 1	304 040 14 23 40 70 100 132 190 254 314 376 490 710 072	
	10080 15 30 60 120 180 240 360 480 600 720 960 1440 2160 2880	Event) min Sum) min Sum) min Sum i min Wir) min Wir	(m mer ater 3 ater 2 ater 1 ater 1 ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168 1.754 1.302 0.967 0.783	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 3. 3. 3. 4. 4.	(mins 9 4 0 5 8 1 4 8 1 3 5 5 7 1 1 3 7 1 1 1 4 1	304 040 14 23 40 70 100 132 190 254 314 376 490 710 072 448	
	10080 15 30 60 120 180 240 360 480 600 720 960 1440 2160 2880 4320	Event) min Sum) min Sum i min Wir) min Wir	(m mer mer ater 3 ater 1 ater 1 ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168 1.754 1.302 0.967 0.783 0.581	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 2. 3. 3. 3. 4. 4. 4.	(mins 9 4 0 5 8 1 4 8 1 3 5 5 7 1 1 3 7 1 1 1 4 1 8 2	304 040 14 23 40 70 100 132 190 254 314 376 490 710 072 448 272	
	10080 15 30 60 120 180 240 360 480 600 720 960 1440 2160 2880 4320 5760	Event) min Sum) min Sum ; min Wir) min Wir	(m mer mer ater 3 ater 1 ater 1 ater ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168 1.754 1.302 0.967 0.783 0.581 0.470	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 2. 3. 3. 3. 4. 4. 5.	(mins 9 4 0 5 8 1 4 8 1 3 5 7 9 1 3 7 1 1 1 4 1 8 2 1 2	304 040 14 23 40 70 100 132 190 254 314 376 490 710 072 448 272 864	
	10080 15 30 60 120 180 240 360 480 600 720 960 1440 2160 2880 4320 5760 7200	Event) min Sum) min Sum) min Sum i min Wir) min Wir	(m mer mer ater 3 ater 1 ater 1 ater 1 ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168 1.754 1.302 0.967 0.783 0.581 0.470 0.399	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 2. 3. 3. 3. 4. 4. 4. 5. 5.	(mins 9 4 0 5 8 1 4 8 1 3 5 5 7 1 1 1 4 1 8 2 1 2 4 3	304 040 14 23 40 70 100 132 190 254 314 376 490 710 072 448 272 864 672	
	10080 15 30 60 120 180 240 360 480 600 720 960 1440 2160 2880 4320 5760 7200 8640	Event) min Sum) min Sum ; min Wir) min Wir	(m mer mer ater 3 ater 1 ater 1 ater 1 ater ater ater ater ater ater ater ater	m/hr) 0.349 0.312 1.195 0.288 2.800 7.911 5.941 4.843 3.610 2.922 2.479 2.168 1.754 1.302 0.967 0.783 0.581 0.470 0.399	Volume (m ³) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Volume (m ³) 4. 5. 0. 1. 1. 1. 2. 2. 2. 2. 2. 2. 2. 3. 3. 3. 3. 4. 4. 4. 5. 5. 5.	(mins 9 4 0 5 8 1 4 8 1 3 5 5 7 4 1 1 3 7 7 1 1 1 4 1 8 2 1 2 4 3 6 4	304 040 14 23 40 70 100 132 190 254 314 376 490 710 072 448 272 864	

Lanmor Consulting Ltd		Page 3
Thorogood House		rage 5
34 Tolworth Close		1 m
Surbition Surrey KT6 7EW		Micro
Date 25/08/2024 13:35	Designed by Kunal	Drainage
File Cascade.casx	Checked by	Diamage
XP Solutions	Source Control 2015.1	
Rainfall Model Return Period (vears)	tails for Permeable Paving.srcx FSR Winter Storms Y 1 Cv (Summer) 0.7	50
M5-60 (mm) Ratio R Summer Storms	and and Wales Cv (Winter) 0.8 20.000 Shortest Storm (mins) 0.408 Longest Storm (mins) 100 Yes Climate Change %	15 80
Tir	<u>ne Area Diagram</u>	
Tot.	al Area (ha) 0.015	
	ime (mins) Area om: To: (ha)	
	0 4 0.015	
©1982-	-2015 XP Solutions	

Thorogood House 34 Tolworth Close Surbition Surrey KT6 7EW Date 25/08/2024 13:35 Pile Cascade.Casx XP Solutions Storage is Online Cover Level (m) 6.500 <u>Porous Car Park Structure</u> Infiltration Coefficient Base (m/hr) 0.0000 Midth (m) 2.4 Membrane Percolation (m/hr) 1000 Safety Pactor 2.0 Pepression Storage (m) 14.0 Max Percolation (1/s) 5.3 Stope (1:X) 500.0 <u>Orifice Outflow Control</u> Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 6.000	Lanmor Consulting Ltd		Page 4
Surbition Surrey KT6 7EW Micropolysis Date 25/08/2024 13:35 Designed by Kunal Checked by Designed by Kunal Checked by Designed by Kunal Checked by XP Solutions Source Control 2015.1 Source Control 2015.1 Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (1/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350	Thorogood House		
Date 25/08/2024 13:35 File Cascade.casx XP Solutions Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Max Percolation (mm/hr) 1000 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Porosity 0.30 Orifice Outflow Control	34 Tolworth Close		<u> </u>
File Cascade.casx Checked by XP Solutions Source Control 2015.1 Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (1/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350 Orifice Outflow Control	Surbition Surrey KT6 7EW		Micco
XP Solutions Source Control 2015.1 Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (1/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Volume Depth (m) 0.350 Orifice Outflow Control	Date 25/08/2024 13:35	Designed by Kunal	
Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) Max Percolation (1/s) 9.3 Slope (1:X) Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Car Volume Depth (m) 0.350	File Cascade.casx	Checked by	Digiliada
Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.0000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (l/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350 Orifice Outflow Control	XP Solutions	Source Control 2015.1	
Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (l/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350 Orifice Outflow Control			
Membrane Percolation (mm/hr)1000Length (m)14.0Max Percolation (l/s)9.3Slope (1:X)500.0Safety Factor2.0 Depression Storage (mm)5Porosity0.30Evaporation (mm/day)3Invert Level (m)6.000Cap Volume Depth (m)0.350Orifice Outflow Control	Porous	<u>Car Park Structure</u>	
	Membrane Percolation (m Max Percolation Safety F Por	nm/hr) 1000 Length (m) (1/s) 9.3 Slope (1:X) Factor 2.0 Depression Storage (mm) cosity 0.30 Evaporation (mm/day)	14.0 500.0 5 3
Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 6.000	Orific	e Outflow Control	
	Diameter (m) 0.040 Discharge	Coefficient 0.600 Invert Level (m) 6.	000

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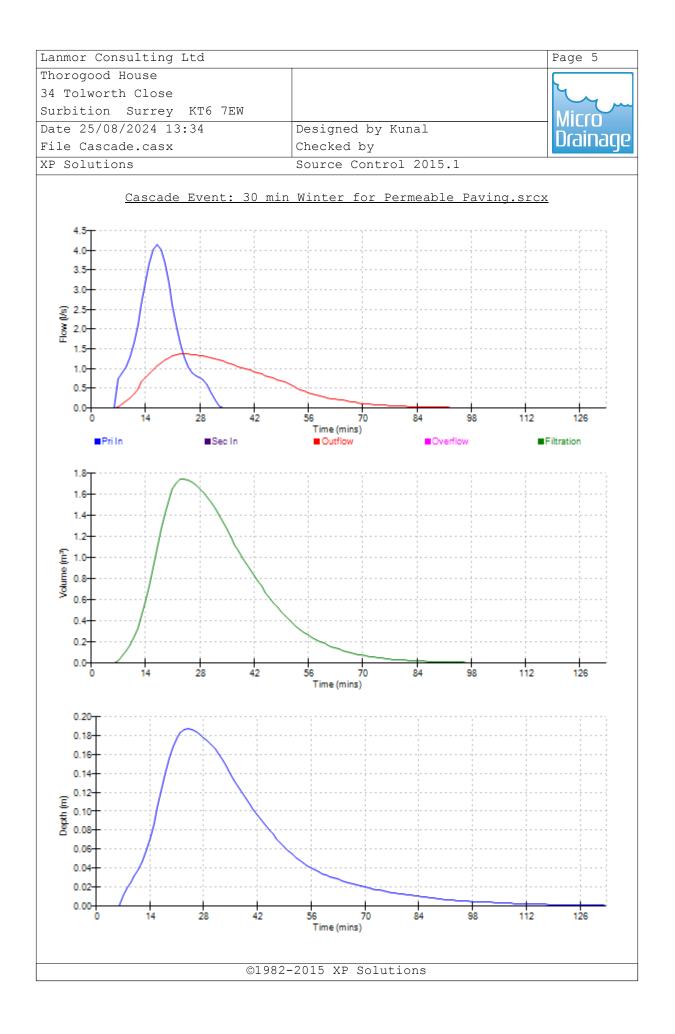
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4 Tolworth	Close	9								4	-
urbition	Surrey	у КІ	C6 7EW							Mice	6
ate 25/08/	2024 1	13:34	1		Desi	.gned b	y Kunal				U
File Cascad						ked by	-			Draii	10
XP Solution							trol 20	15.1			
	-					22 0011	20				
	Casca	ade S	Summary	of Re	esult	ts for	Permeab	le Pavi	ng.src	x	
									-		
			Up	stream	Outi	low To	Overflow	То			
			Str	uctures	:						
				(None)	Tar	nk.srcx	(Nor	ne)			
			Н	alf Dra	ain Ti	lme : 15	minutes.				
	Storm		Max	Max	Ma	x	Max	Max	Max	Status	
	Event		Level D	epth I	nfilt	ration (Control D	Outflow	Volume		
			(m)	(m)	(1/		(l/s)	(l/s)	(m³)		
1 ⊏	min C	mmo~	6.152 0	150		0.0	1.2	1.2	1.4	ОК	
			6.152 0			0.0	1.2	1.2			
			6.166 0			0.0	1.3	1.3			
			6.139 0			0.0	1.2	1.2	1.3		
			6.116 0			0.0	1.0	1.0	1.0		
			6.099 0			0.0	0.9	0.9	0.9		
			6.076 0			0.0	0.8	0.8	0.6		
			6.063 0			0.0	0.7	0.7	0.5		
			6.055 0 6.050 0			0.0	0.6 0.5	0.6 0.5	0.4		
			6.044 0			0.0	0.3	0.3	0.4		
			6.036 0			0.0	0.3	0.3	0.2		
			6.030 0			0.0	0.2	0.2	0.2		
			6.025 0			0.0	0.2	0.2	0.1		
			6.021 0			0.0	0.1	0.1	0.1		
			6.020 0 6.018 0			0.0 0.0	0.1	0.1	0.1		
7200	III Ju	IIIIIIE I	0.010 0	.010		0.0	0.1	0.1	0.1	0 K	
			Storm Event		ain (hr)	Flooded Volume	Discharg	ge Time-P (mins			
			Lvenc	(1101	., ,	(m ³)	(m ³)	(11111	>/		
		1 -	min C	nor 7	515	0 0	0	0	1 /		
			min Sumr min Sumr		6.545 6.669	0.0		.0 .6	14 22		
			min Sum min Sumr		.811	0.0		.3	40		
			min Sumr		.553	0.0		.0	72		
		180 ı	min Sumr	mer 13	.645	0.0	4	. 4	102		
			min Sumr		.926	0.0			132		
			min Sumr		.968	0.0			192		
			min Sumr		.367	0.0			252		
			min Sumr min Sumr		.347	0.0			308 370		
			min Sum min Sumr		.696	0.0			370 492		
			min Sumr		.684	0.0			734		
			min Sumr		.947	0.0			100		
	2	2880 1	min Sumr		.550	0.0		.0 1	468		
			min Sumr		.122	0.0			200		
			min Sumr		.892	0.0			880		
		/200 1	min Sumr	ner O	.746	0.0	9	.4 3	672		

Lanmor Cons	ulti	ng Lto	ł							Page 2
horogood H	ouse									
4 Tolworth	Clo	se								4
urbition	Surr	ev Kl	76 7EW	r						
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ile Cascad			E			ked by	-			Drainag
						-				J
XP Solution	S				Sour	ce Con	trol 20	15.1		
	Cas	cade s	lummar	vof	Regult	s for	Pormoah	le Pavir	a srci	v
	<u>cus</u>	<u>cauc</u> s	annar	<u>y or</u>	ICSUIC	,5 101	reriicat	<u>, 10 10/11</u>	<u>ig.5102</u>	<u>n</u>
	Stor	m	Max	Max	Ма	ax	Max	Max	Max	Status
	Even	t		-				E Outflow		
			(m)	(m)	(1/	/s)	(1/s)	(1/s)	(m³)	
8640	min	Summer	6.017	0.017		0.0	0.1	0.1	0.0	O K
		Summer				0.0	0.1	0.1		
		Winter				0.0	1.3	1.3		
30	min	Winter	6.187	0.187		0.0	1.4	1.4	1.7	ОК
60	min	Winter	6.175	0.175		0.0	1.3	1.3	1.6	O K
120	min	Winter	6.134	0.134		0.0	1.1	1.1	1.2	O K
180	min	Winter	6.104	0.104		0.0	1.0	1.0	0.9	O K
240	min	Winter	6.084	0.084		0.0	0.8	0.8	0.7	O K
		Winter				0.0	0.7	0.7		
		Winter				0.0	0.6	0.6	0.4	
		Winter				0.0	0.5	0.5		
		Winter				0.0	0.4	0.4		
		Winter				0.0	0.3	0.3		
		Winter				0.0	0.2	0.2		
		Winter				0.0	0.2	0.2		
		Winter				0.0	0.1	0.1		
		Winter				0.0	0.1	0.1		
		Winter				0.0	0.1	0.1		
		Winter				0.0	0.1	0.1		
		Winter Winter				0.0 0.0	0.1	0.1		
10000		WINCCI	0.013	0.013		0.0	0.1	0.1	0.0	0 1
			Storm		Rain	Floodor	Dischar	ge Time-Po	ook	
						Volume		-		
			Event		(1111)	(m ³)	(m ³)	e (miiis	•)	
		0.640			0 645			-	~ ~ 4	
			min Su		0.645	0.0			384	
			min Su		0.570	0.0			056	
			min Wi		76.545	0.0		.2	15 24	
			min Wi min Wi		49.669	0.0		.0 .7	24 42	
			min Wi min Wi		30.811 18.553	0.0		.5	42 76	
			min Wi		13.645	0.0			106	
			min Wi		10.926	0.0			136	
			min Wi		7.968	0.0			194	
			min Wi		6.367	0.0			250	
			min Wi		5.347	0.0			308	
			min Wi		4.634	0.0			370	
			min Wi		3.696	0.0			492	
			min Wi		2.684	0.0			736	
			min Wi		1.947	0.0			100	
		2880	min Wi	nter	1.550	0.0			488	
		4000	min Wi	nter	1.122	0.0) 9	.7 2	168	
		4320					10	.2 2	936	
			min Wi	nter	0.892	0.0	10			
		5760			0.892 0.746	0.0			536	
		5760 7200 8640	min Wi min Wi min Wi	nter nter	0.746 0.645	0.0) 10) 10	.6 3 .9 4	536 408	
		5760 7200 8640	min Wi min Wi	nter nter	0.746	0.0) 10) 10	.6 3 .9 4	536	

Lanmor Consulting Ltd		Page 3
Thorogood House		raye 5
		L
34 Tolworth Close		M m
Surbition Surrey KT6 7EW		Micro
Date 25/08/2024 13:34	Designed by Kunal	Drainage
File Cascade.casx	Checked by	Diamage
XP Solutions	Source Control 2015.1	
Rainfall Model Return Period (years)	30Cv (Summer) 0.7and and WalesCv (Winter) 0.820.000Shortest Storm (mins)0.408Longest Storm (mins) 100	40 15
Tir	ne Area Diagram	
Tota	al Area (ha) 0.015	
	ime (mins) Area om: To: (ha)	
	0 4 0.015	
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Thorogood House		
34 Tolworth Close		Ly I
Surbition Surrey KT6 7EW		Mirro
Date 25/08/2024 13:34	Designed by Kunal	Drainage
File Cascade.casx	Checked by	Diamaye
XP Solutions	Source Control 2015.1	
	ails for Permeable Paving.srcx nline Cover Level (m) 6.500	
Porous	Car Park Structure	
	(/) > 0 00000	0.4
Po	mm/hr) 1000 Length (m)	14.0 500.0 5 3
	ce Outflow Control	
Diameter (m) 0.040 Discharge	e Coefficient 0.600 Invert Level (m) 6	.000

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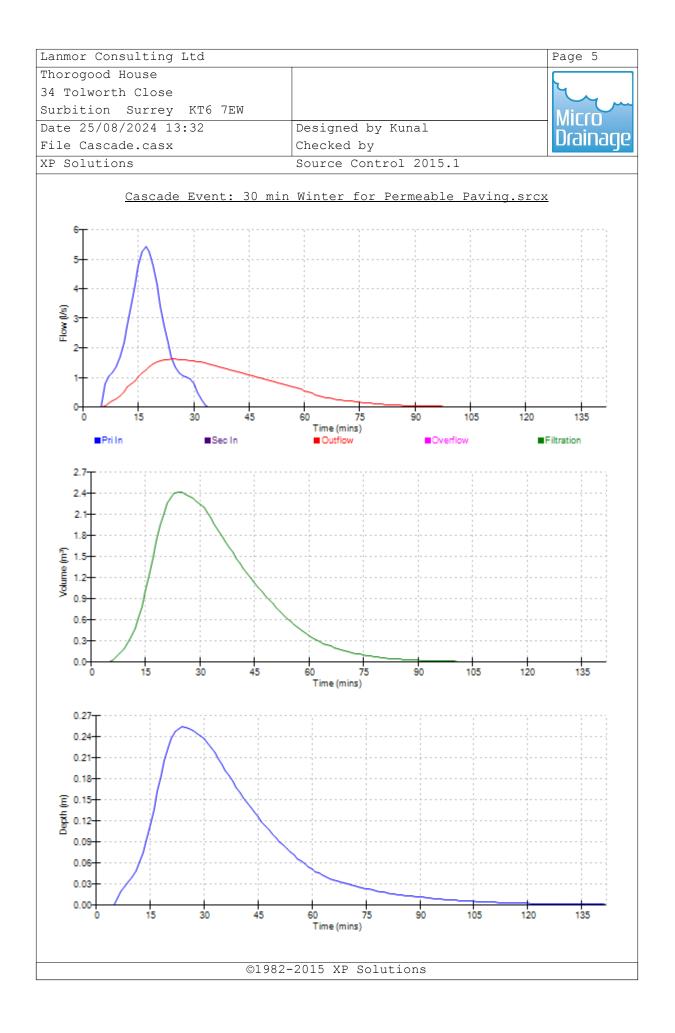


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Thorogood House												
34 Tolworth Close	4											
Surbition Surrey H		Micco										
Date 25/08/2024 13:3	32	Desi	laned k	y Kuna	1							
File Cascade.casx	Drainage											
File Cascade.casxChecked byXP SolutionsSource Control 2015.1												
	AF SOLUCIONS Source Control 2015.1											
Cascade	Summary of	E Resul	ts for	Permea	ble Pav	ing.s:	rcx					
	<u>-</u>											
	Upstre	am Out	Elow To	Overflow	и То							
	Structu	ires										
	(Nc	one) Tai	nk.srcx	(No	one)							
	(110	/iic) 101	IR. DICA	(1)(5110)							
	Half	Drain T:	ime : 18	minutes	5.							
Storm	Max Max	Max	1	Max	Max	Max	Status					
Event 1	Level Depth											
	(m) (m)	(l/s)	(1/s)	(l/s)	(m³)						
15 min Summer 6	6.202 0.202		0.0	1.4	1.4	1.9	Flood Risk					
30 min Summer 6	6.228 0.228		0.0	1.5	1.5	2.2	Flood Risk					
60 min Summer 6	6.227 0.227		0.0	1.5	1.5	2.1	Flood Risk					
120 min Summer 0			0.0	1.4	1.4							
180 min Summer 6			0.0	1.3	1.3	1.5						
240 min Summer 6			0.0	1.1	1.1	1.2						
360 min Summer (0.0	1.0	1.0	0.9						
480 min Summer 6			0.0	0.8	0.8	0.7	O K					
600 min Summer 6 720 min Summer 6			0.0 0.0	0.7 0.7	0.7 0.7	0.6 0.5	ок ок					
960 min Summer 6			0.0	0.6	0.6	0.3						
1440 min Summer 6			0.0	0.4	0.4	0.3						
2160 min Summer 6			0.0	0.3	0.3	0.2						
2880 min Summer @	6.030 0.030		0.0	0.2	0.2	0.2	ΟK					
4320 min Summer 6	6.024 0.024		0.0	0.2	0.2	0.1	O K					
5760 min Summer 6			0.0	0.1	0.1	0.1	0 K					
7200 min Summer 0	6.020 0.020		0.0	0.1	0.1	0.1	ОК					
	Storm	Rain	Flooded	l Dischar	rge Time [.]	-Peak						
	Event	(mm/hr)			-	ns)						
			(m³)	(m³)								
15	min Summer	99.366	0.0		2.6	14						
	min Summer	65.019	0.0		3.5	23						
60	min Summer	40.510	0.0	4	4.4	40						
	min Summer	24.381	0.0		5.3	72						
	min Summer	17.876	0.0		5.9	104						
	min Summer	14.259	0.0		6.2	134						
	min Summer	10.337	0.0		6.8	194						
	min Summer	8.228 6.888	0.0 0.0		7.2 7.5	254 314						
	min Summer	5.954	0.0		7.8	314						
	min Summer	4.728	0.0		8.3	492						
	min Summer	3.411	0.0		8.9	734						
	min Summer	2.457	0.0		9.6	1100						
2880	min Summer	1.945	0.0	10	0.1	1468						
	min Summer	1.397	0.0		0.8	2160						
	min Summer	1.104	0.0		1.4	2888						
7200) min Summer	0.919	0.0	11	1.7	3600						
	©19	82-2015	XP So	lutions	5							
L												

Lanmor Consulting L	td						Page 2
Thorogood House							
34 Tolworth Close							4
Surbition Surrey	KT6 7FW						1 mm
					7		— Micro
Date 25/08/2024 13:	32		-	oy Kuna	ι⊥		Drainage
File Cascade.casx		Chec	ked by	1			Diamage
XP Solutions		Sour	ce Cor	ntrol 2	2015.1		
Concerning and the second seco	G	. D		D			
	Summary of	<u>Result</u>	<u>is ior</u>	Permea	adle Pa	ving.si	<u>rcx</u>
Storm	Max Max	Max		Max	Max	Max	Status
Event	Level Depth	Infiltra	tion Co	ontrol Σ	Outflow	Volume	
	(m) (m)	(l/s))	(1/s)	(1/s)	(m³)	
8640 min Summor	6 010 0 010		0 0	0 1	0 1	0 1	O K
8640 min Summer 10080 min Summer			0.0 0.0	0.1	0.1		
15 min Winter			0.0	1.5	1.5		Flood Risk
30 min Winter			0.0	1.5	1.5		Flood Risk
60 min Winter			0.0	1.6			Flood Risk
120 min Winter			0.0	1.0	1.4		O K
120 min Winter 180 min Winter			0.0	1.4	1.4		
240 min Winter			0.0	1.2	1.2		
360 min Winter			0.0	0.8	1.1 0.8		
480 min Winter			0.0	0.8	0.8		0 K
480 min Winter 600 min Winter			0.0	0.7	0.0		0 K
720 min Winter			0.0	0.5	0.0		0 K
960 min Winter			0.0	0.3	0.4		
1440 min Winter			0.0	0.4	0.4		0 K
2160 min Winter			0.0	0.2	0.2		
2880 min Winter			0.0	0.2	0.2		
4320 min Winter			0.0	0.2	0.2		
5760 min Winter			0.0	0.1	0.1		
7200 min Winter			0.0	0.1	0.1		0 K
8640 min Winter			0.0	0.1	0.1		0 K
10080 min Winter			0.0	0.1	0.1		0 K
	Storm	Rain	Floode	d Discha	arge Tim	e-Peak	
	Event	(mm/hr)	Volume	e Volu	me (n	nins)	
			(m³)	(m³)		
864	10 min Summer	0.791	0.	0 2	12.0	4376	
1008	30 min Summer	0.696	Ο.	0	12.3	5064	
1	15 min Winter	99.366	0.	0	3.0	15	
	30 min Winter		0.		3.9	24	
6	60 min Winter	40.510	0.	0	4.9	42	
12	20 min Winter	24.381	0.	0	6.0	76	
18	30 min Winter	17.876	0.	0	6.6	108	
24	10 min Winter	14.259	0.	0	7.0	138	
36	60 min Winter	10.337	0.	0	7.6	198	
48	30 min Winter	8.228	0.	0	8.1	256	
60	00 min Winter	6.888	0.	0	8.5	312	
72	20 min Winter	5.954	Ο.	0	8.8	370	
96	50 min Winter	4.728	Ο.	0	9.3	492	
144	10 min Winter	3.411	Ο.	0 2	10.0	716	
216	60 min Winter	2.457	0.	0 2	10.8	1088	
288	30 min Winter	1.945	0.	0 2	11.4	1468	
432	20 min Winter	1.397	0.	0 2	12.2	2188	
576	60 min Winter	1.104	0.	0 2	12.8	2840	
720	00 min Winter	0.919	Ο.	0 2	13.2	3616	
864	10 min Winter	0.791	0.	0 2	13.6	4352	
1008	30 min Winter	0.696	0.	0 2	13.9	5064	

Lanmor Consulting Ltd		Page 3
Thorogood House		
34 Tolworth Close		4
Surbition Surrey KT6 7EW		1 mm
Date 25/08/2024 13:32	Designed by Kunal	Micro
File Cascade.casx	Checked by	Drainage
XP Solutions	Source Control 2015.1	
<u>Cascade Rainfall De</u>	tails for Permeable Paving.srcx	
Rainfall Model		es
Return Period (years)	100 Cv (Summer) 0.7	
Region Engl M5-60 (mm)	and and Wales Cv (Winter) 0.8 20.000 Shortest Storm (mins)	40 15
Ratio R	0.408 Longest Storm (mins) 100	
Summer Storms		+0
<u></u>	<u>me Area Diagram</u>	
Tot	al Area (ha) 0.015	
	ime (mins) Area com: To: (ha)	
	0 4 0.015	
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Therogood House 34 Tolworth Close Surbition Surrey KT6 75W Date 25/08/2024 13:32 File Cascade.casx XP Solutions Source Control 2015.1 Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.0000 Midth (m) 2.4 Membrane Percolation (mm/hr) 1000 Safety Factor 2.0 Depression Storage (m) 5 Porosity 0.30 Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 6.000 Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 6.000	Lanmor Consulting Ltd		Page 4
Surbition Surrey KT6 7EW Date 25/08/2024 13:32 Designed by Kunal Checked by Designed by Kunal Checked by KP Solutions Source Control 2015.1 Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (1/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350	Thorogood House		
Date 25/08/2024 13:32 File Cascade.casx XP Solutions Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Max Percolation (mm/hr) 1000 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Porosity 0.30 Orifice Outflow Control	34 Tolworth Close		<u>u</u>
File Cascade.casx Checked by XP Solutions Source Control 2015.1 Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (1/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350 Orifice Outflow Control	Surbition Surrey KT6 7EW		Micco
XP Solutions Source Control 2015.1 Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (1/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Volume Depth (m) 0.350 Orifice Outflow Control	Date 25/08/2024 13:32	Designed by Kunal	
Cascade Model Details for Permeable Paving.srcx Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) Max Percolation (1/s) 9.3 Slope (1:X) Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Car Volume Depth (m) 0.350	File Cascade.casx	Checked by	Diamaye
Storage is Online Cover Level (m) 6.500 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.0000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (l/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350 Orifice Outflow Control	XP Solutions	Source Control 2015.1	
Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 2.4 Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (l/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350 Orifice Outflow Control			
Membrane Percolation (mm/hr) 1000 Length (m) 14.0 Max Percolation (l/s) 9.3 Slope (1:X) 500.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 6.000 Cap Volume Depth (m) 0.350 <u>Orifice Outflow Control</u>	Porous	Car Park Structure	
	Membrane Percolation (n Max Percolation Safety F Por	nm/hr)1000Length (m)(1/s)9.3Slope (1:X)Factor2.0Depression Storage (mm)rosity0.30Evaporation (mm/day)	14.0 500.0 5 3
Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 6.000	Orific	e Outflow Control	
	Diameter (m) 0.040 Discharge	Coefficient 0.600 Invert Level (m) 6.	000



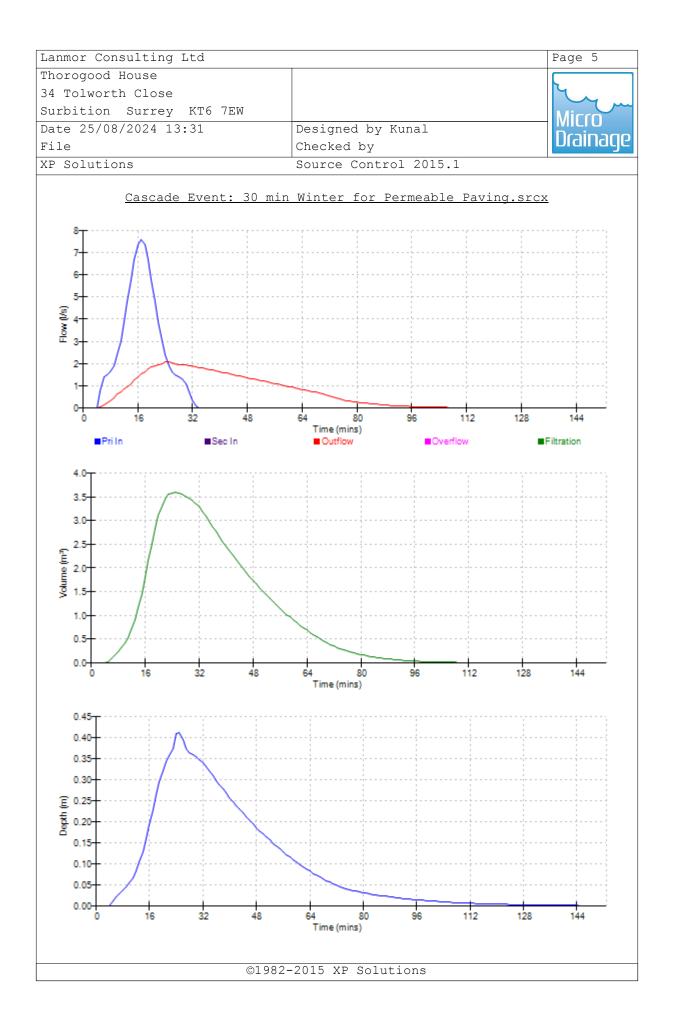
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Thorogood House							
34 Tolworth Close							4
Surbition Surrey	KT6 7EW						Micco
Date 25/08/2024 13:	y Kunal						
File			cked by	-			Drainage
XP Solutions			-	trol 2015	5.1		
				0101 101			
Cascade	Summary o	f Resul	ts for	Permeabl	e Pav	ving.s:	rcx
	<u> </u>						
	Upstr	eam Out:	flow To	Overflow T	0		
	Struct	ures					
	()	ione) Tai	nk.srcx	(None)		
	(1)	101107 101	IK. DICK	(100110	/		
	Half	Drain T	ime : 21	minutes.			
Storm	Max Max	Max	M	lax Ma	x	Max	Status
Event	Level Depth	Infiltra	tion Cor	trol Σ Out	flow	Volume	
	(m) (m)	(1/s)) (1	./s) (1/	's)	(m³)	
15 min Summer	6.292 0 292		0.0	1.7	1.7	2 R	Flood Risk
30 min Summer			0.0	1.9	1.9		Flood Risk
60 min Summer	6.333 0.333		0.0	1.9	1.9	3.2	Flood Risk
120 min Summer	6.292 0.292		0.0	1.7	1.7	2.8	Flood Risk
180 min Summer	6.249 0.249		0.0	1.6	1.6		Flood Risk
240 min Summer			0.0	1.5	1.5		Flood Risk
360 min Summer			0.0	1.3	1.3		
480 min Summer			0.0	1.1	1.1		
600 min Summer			0.0	1.0	1.0		
720 min Summer 960 min Summer			0.0	0.9 0.8	0.9 0.8	0.8 0.6	
1440 min Summer			0.0	0.8	0.8	0.8	
2160 min Summer			0.0	0.8	0.0	0.4	
2880 min Summer			0.0	0.4	0.4		
4320 min Summer			0.0	0.2	0.2	0.2	
5760 min Summer			0.0	0.2	0.2		
7200 min Summer			0.0	0.2	0.2		
	a 1	_ .	_1 -		_ .	. .	
	Storm Event	Rain (mm/hr)	Flooded Volume	Discharge Volume		-Peak .ns)	
	Evenc	(1111)	(m ³)	(m ³)	(111		
1	5 min Summer	139.112	0.0	3.7		15	
	0 min Summer		0.0	4.9		23	
	0 min Summer		0.0	6.2		40	
	0 min Summer		0.0	7.5		74	
18	0 min Summer		0.0	8.3		106	
24	0 min Summer	19.963	0.0	8.8		136	
	0 min Summer		0.0	9.6		198	
	0 min Summer		0.0	10.2		258	
	0 min Summer		0.0	10.6		316	
	0 min Summer		0.0	11.0		376	
	0 min Summer		0.0	11.7		494	
	0 min Summer		0.0	12.6		734	
	0 min Summer 0 min Summer		0.0	13.6		1092 1468	
	0 min Summer 0 min Summer		0.0	14.3 15.4		1468 2176	
	0 min Summer		0.0	15.4		2928	
	0 min Summer		0.0	16.7		3624	
		. = . /				-	
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Thorogood	House							
34 Tolworth Close								Y a
Surbition	Surrey	KT6 7	EW					Micco
Date 25/08	3/2024 13	:31		Designed	l by Kur	nal		
File				Checked	by			Drainage
XP Solutio	ons			Source C	Control	2015.1		
	Casado	C.I.mm	arrit of	Dogulta fo	n Dormo	able Dav	ing or	
		<u>s summ</u>	ary oi	Results fo	<u>or perme</u>	eadle Pav	ing.si	<u>. Cx</u>
	Storm	Max	Max	Max	Max	Max	Max	Status
	Event	Level	-	Infiltration				
		(m)	(m)	(1/s)	(1/s)	(1/s)	(m³)	
8640	min Summer	6.021	0.021	0.0	0.1	0.1	0.1	O K
10080	min Summer	6.020	0.020	0.0	0.1	0.1	0.1	O K
15	min Winter	6.331	0.331	0.0	1.9	1.9	3.2	Flood Risk
30	min Winter	6.413	0.413	0.0	2.1	2.1	3.6	Flood Risk
60	min Winter	6.367	0.367	0.0	2.0	2.0	3.5	Flood Risk
120	min Winter	6.297	0.297	0.0	1.8	1.8	2.9	Flood Risk
180	min Winter	6.237	0.237	0.0	1.6	1.6	2.2	Flood Risk
240	min Winter	6.192	0.192	0.0	1.4	1.4	1.8	O K
360	min Winter	6.134	0.134	0.0	1.1	1.1	1.2	O K
480	min Winter	6.100	0.100	0.0	0.9	0.9	0.9	O K
600	min Winter	6.080	0.080	0.0	0.8	0.8	0.7	O K
720	min Winter	6.066	0.066	0.0	0.7	0.7	0.5	O K
	min Winter			0.0	0.6	0.6	0.4	
	min Winter			0.0	0.4	0.4		
	min Winter			0.0	0.3	0.3		
	min Winter			0.0	0.2	0.2	0.2	
	min Winter			0.0	0.2	0.2	0.1	
	min Winter			0.0	0.1	0.1	0.1	
							0 1	0.77
7200	min Winter			0.0	0.1	0.1	0.1	
7200 8640	min Winter min Winter min Winter	6.019	0.019	0.0 0.0 0.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	

	Stor Even		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m ³)	Time-Peak (mins)
8640	min	Summer	1.107	0.0	17.2	4368
10080	min	Summer	0.975	0.0	17.6	5032
15	min	Winter	139.112	0.0	4.2	15
30	min	Winter	91.026	0.0	5.6	25
60	min	Winter	56.713	0.0	7.0	44
120	min	Winter	34.134	0.0	8.4	78
180	min	Winter	25.027	0.0	9.3	110
240	min	Winter	19.963	0.0	9.9	142
360	min	Winter	14.472	0.0	10.7	202
480	min	Winter	11.519	0.0	11.4	262
600	min	Winter	9.643	0.0	11.9	320
720	min	Winter	8.336	0.0	12.4	376
960	min	Winter	6.619	0.0	13.1	490
1440	min	Winter	4.775	0.0	14.2	734
2160	min	Winter	3.440	0.0	15.3	1092
2880	min	Winter	2.723	0.0	16.1	1428
4320	min	Winter	1.956	0.0	17.3	2196
5760	min	Winter	1.545	0.0	18.1	2824
7200	min	Winter	1.287	0.0	18.8	3608
8640	min	Winter	1.107	0.0	19.3	4240
10080	min	Winter	0.975	0.0	19.8	4976
		©198	82-2015	XP Sol	utions	

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Thorogood House		
34 Tolworth Close		4
		1 mm
Surbition Surrey KT6 7EW		Micro
Date 25/08/2024 13:31	Designed by Kunal	Drainage
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XP Solutions	Source Control 2015.1	
	tails for Permeable Paving.srcx	
Rainfall Model	FSR Winter Storms Y	
Return Period (years)	100Cv (Summer) 0.7and and WalesCv (Winter) 0.8	50 40
M5-60 (mm)		15
Ratio R	0.408 Longest Storm (mins) 100	
Summer Storms	Yes Climate Change % +	40
<u> </u>	ne Area Diagram	
Tota	al Area (ha) 0.015	
	ime (mins) Area om: To: (ha)	
	0 4 0.015	
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Thorogood House		
34 Tolworth Close		4
Surbition Surrey KT6 7EW		- Com
Date 25/08/2024 13:31	Designed by Kunal	MICLO
File	Checked by	Drainage
XP Solutions	Source Control 2015.1	
<u>Cascade Model Deta</u>	ails for Permeable Paving.srcx	
Storage is Or	nline Cover Level (m) 6.500	
Porous	<u>Car Park Structure</u>	
Infiltration Coefficient Base	(m/hr) 0.00000 Width (m)	2.4
Membrane Percolation (mm/hr) 1000 Length (m)	
Max Percolation	1 1 1	
	Factor 2.0 Depression Storage (mm)	5
	rosity 0.30 Evaporation (mm/day) el (m) 6.000 Cap Volume Depth (m)	
		0.000
Orific	ce Outflow Control	
Diameter (m) 0 040 Discharge	e Coefficient 0.600 Invert Level (m) 6.	000





Micro Drainage – Attenuation Crates

anmor Consulting Lto horogood House	<i>.</i>						Page 1
4 Tolworth Close							7
	06 200						1 cm
Surbition Surrey K							— Micro
Date 25/08/2024 13:35	5		-	y Kunal			Draina
File Cascade.casx		Chec	cked by				Dialita
XP Solutions		Soui	cce Con	trol 201	5.1		
Cas	scade Summa	ary of	Result	<u>s for Ta</u>	nk.srcz	<u>x</u>	
	Upstrea		0+51	w To Over	flow To		
	Structu		Outlit	W IO OVEL	110w 10		
Pe	ermeable Pav	ing.src	x (N	lone)	(None)		
	Half	Drain T:	ime : 19	minutes.			
Storm	Max Max	Ma		Max	Max	Max	Status
Event	Level Depth						
	(m) (m)	(1)	s)	(1/s)	(l/s)	(m³)	
15 min Summer	5.041 0.041		0.0	0.7	0.7	1.1	ОК
30 min Summer			0.0	0.9	0.9	1.3	
60 min Summer			0.0	1.0	1.0	1.4	
120 min Summer			0.0	1.0	1.0	1.4	
180 min Summer			0.0	1.0	1.0	1.3	
240 min Summer			0.0	0.9	0.9	1.3	
360 min Summer			0.0	0.7	0.7	1.1	
480 min Summer			0.0	0.6	0.6	1.1	
600 min Summer			0.0	0.6	0.6	1.0	
720 min Summer			0.0	0.5	0.5	0.9	
960 min Summer			0.0	0.4	0.4	0.8	ОК
1440 min Summer			0.0	0.3	0.3	0.7	
2160 min Summer 2880 min Summer			0.0	0.3 0.2	0.3	0.6 0.6	
4320 min Summer			0.0	0.2	0.2		
5760 min Summer			0.0	0.2	0.1		
7200 min Summer			0.0	0.1	0.1	0.4	
	Storm Event	Rain (mm/hr)		Discharge Volume	a Time-Pe (mins		
			(m³)	(m³)			
15	min Summer	31.195	0.0	1.7	7	18	
	min Summer	20.288	0.0	2.3		28	
60	min Summer	12.800	0.0	3.0		42	
120	min Summer	7.911	0.0	3.7	7	74	
180	min Summer	5.941	0.0	4.2	2	106	
240	min Summer	4.843	0.0	4.6	5	136	
360	min Summer	3.610	0.0	5.2	2	198	
480	min Summer	2.922	0.0	5.6	5	258	
	min Summer	2.479	0.0	5.9		320	
	min Summer	2.168	0.0	6.2		378	
	min Summer	1.754	0.0	6.7		500	
	min Summer	1.302	0.0	7.5		740	
	min Summer	0.967	0.0	8.3		100	
	min Summer	0.783	0.0	8.9		468	
	min Summer	0.581	0.0	9.9		196	
	min Summer	0.470	0.0			936	
7200	min Summer	0.399	0.0	11.2	2 31	632	

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Thorogood House		
34 Tolworth Close		L.
Surbition Surrey KT6 7EW		Micco
Date 25/08/2024 13:35	Designed by Kunal	
File Cascade.casx	Checked by	Drainage
XP Solutions	Source Control 2015.1	

Cascade	Summary	of	Results	for	Tank.srcx
	_				

	Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
8640	min Su	ummer	5.014	0.014	0.0	0.1	0.1	0.4	ОК
10080	min Su	ummer	5.013	0.013	0.0	0.1	0.1	0.3	ОК
15	min Wi	nter	5.045	0.045	0.0	0.8	0.8	1.2	ОК
30	min Wi	nter	5.053	0.053	0.0	1.0	1.0	1.4	ОК
60	min Wi	nter	5.057	0.057	0.0	1.1	1.1	1.5	ОК
120	min Wi	nter	5.054	0.054	0.0	1.1	1.1	1.4	ОК
180	min Wi	nter	5.049	0.049	0.0	0.9	0.9	1.3	ОК
240	min Wi	nter	5.045	0.045	0.0	0.8	0.8	1.2	ОК
360	min Wi	nter	5.040	0.040	0.0	0.6	0.6	1.1	ОК
480	min Wi	nter	5.036	0.036	0.0	0.5	0.5	0.9	ОК
600	min Wi	nter	5.033	0.033	0.0	0.5	0.5	0.9	ΟK
720	min Wi	nter	5.031	0.031	0.0	0.4	0.4	0.8	ОК
960	min Wi	nter	5.027	0.027	0.0	0.3	0.3	0.7	ОК
1440	min Wi	nter	5.024	0.024	0.0	0.3	0.3	0.6	ОК
2160	min Wi	nter	5.020	0.020	0.0	0.2	0.2	0.5	ОК
2880	min Wi	nter	5.018	0.018	0.0	0.2	0.2	0.5	ОК
4320	min Wi	nter	5.015	0.015	0.0	0.1	0.1	0.4	ОК
5760	min Wi	nter	5.014	0.014	0.0	0.1	0.1	0.4	ОК
7200	min Wi	nter	5.013	0.013	0.0	0.1	0.1	0.3	ОК
8640	min Wi	nter	5.012	0.012	0.0	0.1	0.1	0.3	ОК
10080	min Wi	nter	5.011	0.011	0.0	0.1	0.1	0.3	O K

	Stor Even		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640	min	Summer	0.349	0.0	11.7	4360
10080	min	Summer	0.312	0.0	12.1	5048
15	min	Winter	31.195	0.0	2.0	18
30	min	Winter	20.288	0.0	2.6	29
60	min	Winter	12.800	0.0	3.4	44
120	min	Winter	7.911	0.0	4.2	78
180	min	Winter	5.941	0.0	4.7	108
240	min	Winter	4.843	0.0	5.2	140
360	min	Winter	3.610	0.0	5.8	200
480	min	Winter	2.922	0.0	6.3	266
600	min	Winter	2.479	0.0	6.6	322
720	min	Winter	2.168	0.0	7.0	378
960	min	Winter	1.754	0.0	7.5	510
1440	min	Winter	1.302	0.0	8.4	748
2160	min	Winter	0.967	0.0	9.3	1096
2880	min	Winter	0.783	0.0	10.0	1456
4320	min	Winter	0.581	0.0	11.1	2244
5760	min	Winter	0.470	0.0	11.9	2928
7200	min	Winter	0.399	0.0	12.6	3632
8640	min	Winter	0.349	0.0	13.2	4400
10080	min	Winter	0.312	0.0	13.6	5128
		©198	82-2015	XP Sol	utions	

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Thorogood House		
34 Tolworth Close		L.
Surbition Surrey KT6 7EW		Micco
Date 25/08/2024 13:35	Designed by Kunal	
File Cascade.casx	Checked by	Drainage
XP Solutions	Source Control 2015.1	1

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)	20.000	Shortest Storm (mins) 15
Ratio R	0.408	Longest Storm (mins) 10080
Summer Storms	Yes	Climate Change % +0

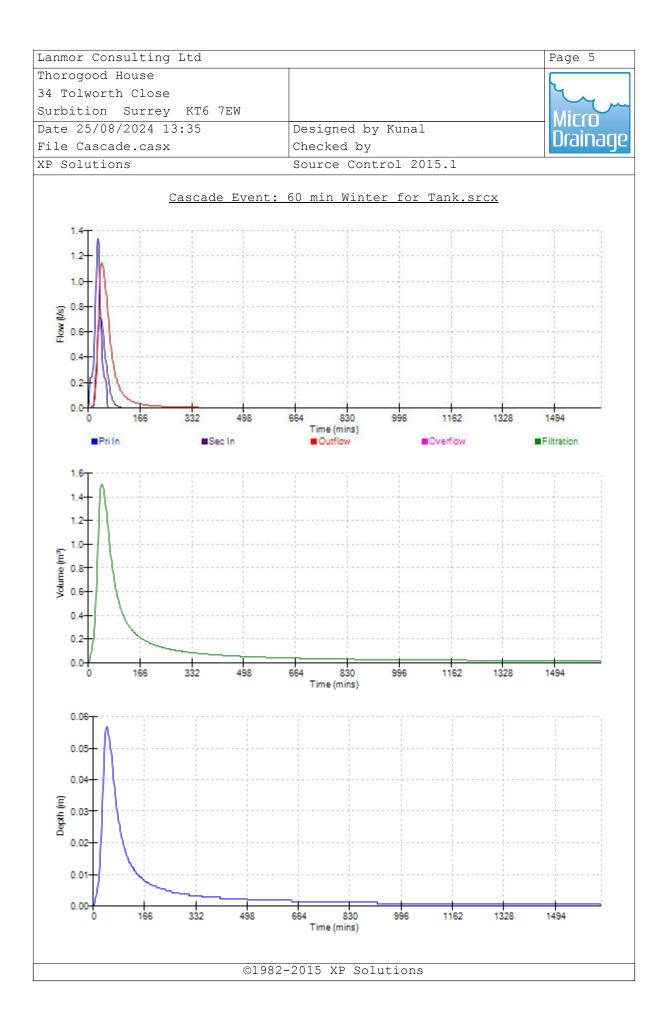
<u>Time Area Diagram</u>

Total Area (ha) 0.018

Time (mins) Area From: To: (ha)

0 4 0.018

Thorogood House 34 Tolworth Close									
34 Tolworth Close									
Surbition Surrey KT6 7EW									
	ned by Kunal								
File Cascade.casx Check									
XP Solutions Sourc	e Control 2015.1								
<u>Cascade Model Det</u>	ails for Tank.srcx								
Storage is Online C	Storage is Online Cover Level (m) 6.500								
<u>Cellular Stor</u>	age Structure								
Infiltration Coefficient Base (r	Invert Level (m) 5.000 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000								
Depth (m) Area (m²) Inf. Area (m²)	Depth (m) Area (m ²) Inf. Area (m ²)								
0.000 28.0 28.0 0.400 28.0 40.8									
<u>Hydro-Brake Optimu</u>	m® Outflow Control								
Unit Refere	nce MD-SHE-0075-2000-0400-2000								
Design Head									
Design Flow (1 Flush-F									
	ive Minimise upstream storage								
Diameter (mm) 75								
Invert Level									
Minimum Outlet Pipe Diameter (Suggested Manhole Diameter (
Control Points	Control Points Head (m) Flow (1/s)								
Design Point (Calculate	ed) 0.400 2.0								
	lo™ 0.124 2.0								
Kick-F Mean Flow over Head Ra									
	190 I.U								
Hydro-Brake Optimum® as specified. Should	ed on the Head/Discharge relationship for the another type of control device other than a								
Hydro-Brake Optimum® be utilised then these invalidated	e storage routing calculations will be								
Depth (m) Flow (l/s) Depth (m) Flow (l/s)	Depth (m) Flow (l/s) Depth (m) Flow (l/s)								
0.100 2.0 1.200 3.3									
0.200 1.9 1.400 3.5 0.300 1.7 1.600 3.7	3.500 5.4 7.500 7.8 4.000 5.7 8.000 8.1								
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$									
0.500 2.2 2.000 4.1									
0.600 2.4 2.200 4.3	5.500 6.7 9.500 8.8								
0.800 2.7 2.400 4.5									
1.000 3.0 2.600 4.7	6.500 7.3								
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anmor Consulting L horogood House							Page 1
34 Tolworth Close							4
Surbition Surrey							- Micro
Date 25/08/2024 13:	33		-	y Kunal			Drainac
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XP Solutions		Sou	rce Con	trol 201	5.1		
<u>C</u> .	ascade Summ	<u>ary of</u>	Result	<u>s for Ta</u>	ank.srcz	<u>x</u>	
	Upstre Structu		Outflo	w To Over	flow To		
	Structu	ires					
	Permeable Pa	ving.src	x (N	lone)	(None)		
			. 10	· .			
	Hali	Drain T	ıme : 19	minutes.			
Storm	Max Max	M	ax	Max	Max	Max	Status
Event	Level Dept	h Infilt	ration C	Control S	Outflow	Volume	
	(m) (m)	(1	/s)	(1/s)	(l/s)	(m³)	
15 min Summe	r 5.088 0.08	8	0.0	1.9	1.9	2.3	ОК
	r 5.105 0.10		0.0	2.0	2.0	2.8	
	r 5.115 0.11		0.0	2.0	2.0	3.1	
120 min Summe			0.0	2.0	2.0		
180 min Summe	r 5.098 0.09	8	0.0	1.9	1.9	2.6	ОК
240 min Summe	r 5.088 0.08	8	0.0	1.9	1.9	2.3	ОК
360 min Summe	r 5.075 0.07	5	0.0	1.6	1.6	2.0	O K
480 min Summe	r 5.067 0.06	7	0.0	1.4	1.4	1.8	O K
600 min Summe			0.0	1.3	1.3	1.6	
720 min Summe			0.0	1.1	1.1	1.5	
960 min Summe			0.0	0.9	0.9	1.3	
1440 min Summe			0.0	0.7	0.7	1.1	
2160 min Summe			0.0	0.5	0.5	0.9	
2880 min Summe 4320 min Summe			0.0	0.4 0.3	0.4		
5760 min Summe			0.0	0.3	0.3	0.7	
7200 min Summe			0.0	0.2	0.2	0.6	
	Storm Event	Rain (mm/hr)		Discharge Volume	e Time-Pe (mins		
	lvenc	(,	(m ³)	(m ³)	(1115	·,	
1	5 min Summer	76.545	0.0	4.6	5	16	
) min Summer	49.669	0.0	4.0		28	
) min Summer	30.811	0.0	7.4		44	
) min Summer	18.553	0.0	9.0		78	
18) min Summer	13.645	0.0	9.9		108	
24) min Summer	10.926	0.0	10.0	6	138	
36) min Summer	7.968	0.0	11.0	6	198	
) min Summer	6.367	0.0	12.4		258	
) min Summer	5.347	0.0	13.0		316	
) min Summer	4.634	0.0	13.5		376	
) min Summer	3.696	0.0			498	
) min Summer	2.684	0.0	15.		738	
) min Summer	1.947	0.0	17.0		104	
) min Summer	1.550	0.0	18.0		468	
) min Summer) min Summer	1.122 0.892	0.0			196 896	
) min Summer	0.892	0.0	20.0		696 672	
7201		0./40	0.0	21.V	, ., ., ., ., ., ., ., ., ., ., ., ., .,	012	

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Thorogood House		
34 Tolworth Close		L.
Surbition Surrey KT6 7EW		Micco
Date 25/08/2024 13:33	Designed by Kunal	
File Cascade.casx	Checked by	Drainage
XP Solutions	Source Control 2015.1	

Cascade Summary of Results for Tank.srcx
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	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
8640	min Summe	r 5.019	0.019	0.0	0.2	0.2	0.5	ОК
10080	min Summe	r 5.018	0.018	0.0	0.2	0.2	0.5	ОК
15	min Winte	r 5.099	0.099	0.0	2.0	2.0	2.6	ОК
30	min Winte	r 5.121	0.121	0.0	2.0	2.0	3.2	ОК
60	min Winte	r 5.129	0.129	0.0	2.0	2.0	3.4	ОК
120	min Winte	r 5.115	0.115	0.0	2.0	2.0	3.1	ОК
180	min Winte	r 5.094	0.094	0.0	1.9	1.9	2.5	ОК
240	min Winte	r 5.082	0.082	0.0	1.8	1.8	2.2	ОК
360	min Winte	r 5.067	0.067	0.0	1.4	1.4	1.8	ОК
480	min Winte	r 5.058	0.058	0.0	1.2	1.2	1.5	ОК
600	min Winte	r 5.052	0.052	0.0	1.0	1.0	1.4	O K
720	min Winte	r 5.048	0.048	0.0	0.9	0.9	1.3	ОК
960	min Winte	r 5.042	0.042	0.0	0.7	0.7	1.1	ОК
1440	min Winte	r 5.035	0.035	0.0	0.5	0.5	0.9	ОК
2160	min Winte	r 5.029	0.029	0.0	0.4	0.4	0.8	ОК
2880	min Winte	r 5.026	0.026	0.0	0.3	0.3	0.7	ОК
4320	min Winte	r 5.022	0.022	0.0	0.2	0.2	0.6	ОК
5760	min Winte	r 5.019	0.019	0.0	0.2	0.2	0.5	ОК
7200	min Winte	r 5.018	0.018	0.0	0.1	0.1	0.5	ОК
8640	min Winte	r 5.016	0.016	0.0	0.1	0.1	0.4	ОК
10080	min Winte	r 5.015	0.015	0.0	0.1	0.1	0.4	O K

	Stor Even		Rain (mm/hr)		Discharge Volume (m³)	Time-Peak (mins)
8640	min	Summer	0.645	0.0	22.2	4400
10080	min	Summer	0.570	0.0	22.8	5016
15	min	Winter	76.545	0.0	5.1	17
30	min	Winter	49.669	0.0	6.7	30
60	min	Winter	30.811	0.0	8.4	48
120	min	Winter	18.553	0.0	10.1	82
180	min	Winter	13.645	0.0	11.2	112
240	min	Winter	10.926	0.0	11.9	142
360	min	Winter	7.968	0.0	13.0	200
480	min	Winter	6.367	0.0	13.9	260
600	min	Winter	5.347	0.0	14.6	320
720	min	Winter	4.634	0.0	15.2	378
960	min	Winter	3.696	0.0	16.1	504
1440	min	Winter	2.684	0.0	17.6	746
2160	min	Winter	1.947	0.0	19.1	1108
2880	min	Winter	1.550	0.0	20.2	1472
4320	min	Winter	1.122	0.0	21.9	2200
5760	min	Winter	0.892	0.0	23.2	2944
7200	min	Winter	0.746	0.0	24.1	3552
8640	min	Winter	0.645	0.0	25.0	4392
10080	min	Winter	0.570	0.0	25.7	4968
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Thorogood House		
34 Tolworth Close		<u>Y</u>
Surbition Surrey KT6 7EW		Micco
Date 25/08/2024 13:33	Designed by Kunal	
File Cascade.casx	Checked by	Drainage
XP Solutions	Source Control 2015.1	1

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)	20.000	Shortest Storm (mins) 15
Ratio R	0.408	Longest Storm (mins) 10080
Summer Storms	Yes	Climate Change % +0

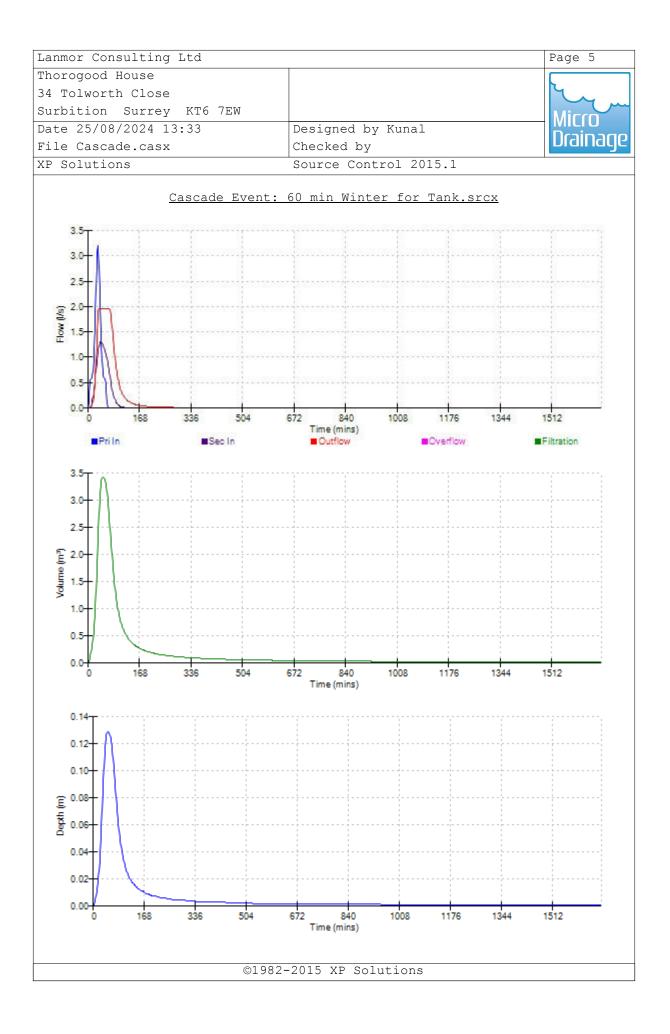
<u>Time Area Diagram</u>

Total Area (ha) 0.018

Time (mins) Area From: To: (ha)

0 4 0.018

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Thorogood House		F T
34 Tolworth Close		
Surbition Surrey KT6 7EW		Mirro
Date 25/08/2024 13:33	Designed by Kunal	Drainage
File Cascade.casx	Checked by	Diamage
XP Solutions	Source Control 2015	.1
Cascade Mode	el Details for Tank.s	srcx
Storage is O	nline Cover Level (m) 6.	500
<u>Cellula</u>	<u>r Storage Structure</u>	
Inve Infiltration Coefficient Infiltration Coefficient		-
Depth (m) Area (m²) Inf. Ar	ea (m²) Depth (m) Area (m	m²) Inf. Area (m²)
0.000 28.0 0.400 28.0	28.0 0.401 40.8	0.0 40.8
<u>Hydro-Brake</u>	Optimum® Outflow Con	trol
	Reference MD-SHE-0075-2	
	n Head (m) Flow (l/s)	0.400 2.0
Design	Flow (1/S) Flush-Flo™	Calculated
	Objective Minimise ups	
	umeter (mm)	75
Invert Minimum Outlet Pipe Dia	: Level (m)	5.000 100
Suggested Manhole Dia		1200
Control Pc	ints Head (m) Flow	(1/s)
	alculated) 0.400	2.0
	Flush-Flo™ 0.124 Kick-Flo® 0.285	2.0
Mean Flow over 1		1.7 1.6
	-	
The hydrological calculations have & Hydro-Brake Optimum® as specified.		5 1
Hydro-Brake Optimum® be utilised the invalidated		
Depth (m) Flow (1/s) Depth (m) Flor	w (l/s) Depth (m) Flow (l/s) Depth (m) Flow (l/s)
0.100 2.0 1.200	3.3 3.000	5.0 7.000 7.5
0.200 1.9 1.400	3.5 3.500	5.4 7.500 7.8
0.300 1.7 1.600 0.400 2.0 1.800	3.7 4.000 3.9 4.500	5.7 8.000 8.1 6.0 8.500 8.3
0.500 2.2 2.000	3.9 4.500 4.1 5.000	6.0 8.500 8.3 6.4 9.000 8.6
0.600 2.4 2.200	4.3 5.500	6.7 9.500 8.8
0.800 2.7 2.400	4.5 6.000	7.0
1.000 3.0 2.600	4.7 6.500	7.3
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anmor Consulting Lto norogood House	<i>.</i>						Page 1
4 Tolworth Close							4
Surbition Surrey K				- 77 - 7			-Micro
Date 25/08/2024 13:32	2		-	y Kunal			Draina
File Cascade.casx			cked by				Diama
XP Solutions		Sour	rce Con	trol 201	5.1		
	_	-	_	_			
Cas	scade Summ	<u>ary of</u>	Result	<u>s for Ta</u>	nk.srcz	X	
	Upstre		0.1+ f1	w To Over	flow To		
	Structu		OULLIC	W 10 OVEL	110w 10		
P	ermeable Par	/ing.src	x (N	lone)	(None)		
	Half	Drain T	ime : 23	minutes.			
	narr	Diain i	. 20	initinacco.			
Storm	Max Max		ах	Max	Max	Max	Status
Event	Level Depth						
	(m) (m)	(1,	/s)	(1/s)	(l/s)	(m³)	
15 min Summer			0.0	2.0	2.0	3.1	
30 min Summer			0.0	2.0	2.0	3.9	
60 min Summer			0.0	2.0	2.0	4.4	
120 min Summer			0.0	2.0	2.0	4.2	
180 min Summer			0.0	2.0	2.0	3.8	
240 min Summer			0.0	2.0	2.0	3.3	
360 min Summer			0.0	1.9	1.9	2.5	
480 min Summer			0.0	1.7	1.7	2.2	
600 min Summer 720 min Summer			0.0	1.6	1.6	1.9	
960 min Summer			0.0	1.4	1.4	1.8 1.5	
960 min Summer 1440 min Summer			0.0	0.9	1.2	1.5	
2160 min Summer			0.0	0.9	0.9	1.3	
2880 min Summer			0.0	0.5	0.0	0.9	
4320 min Summer			0.0	0.4	0.4		
5760 min Summer			0.0	0.3	0.3	0.7	
7200 min Summer			0.0	0.2	0.2	0.6	
	Storm Event	Rain (mm/hr)		Discharge Volume	• Time-Pe (mins		
		,	(m ³)	(m ³)	, .		
15	min Summer	99.366	0.0	6.0)	17	
	min Summer	65.019	0.0	7.9		31	
	min Summer	40.510	0.0	9.8		52	
	min Summer	24.381	0.0	11.9		84	
	min Summer	17.876	0.0	13.1		116	
240	min Summer	14.259	0.0	13.9) [146	
360	min Summer	10.337	0.0	15.1	L 2	200	
480	min Summer	8.228	0.0	16.1	L 2	260	
600	min Summer	6.888	0.0	16.8	3 3	320	
	min Summer	5.954	0.0	17.5		378	
	min Summer	4.728	0.0	18.5		496	
	min Summer	3.411	0.0	20.0		736	
	min Summer	2.457	0.0	21.6		104	
	min Summer	1.945	0.0	22.7		468	
	min Summer	1.397	0.0	24.4		196	
	min Summer	1.104	0.0	25.0		912	
/200	min Summer	0.919	0.0	26.6	o 30	672	

Lanmor Consulting Ltd		Page 2
Thorogood House		
34 Tolworth Close		L.
Surbition Surrey KT6 7EW		Micco
Date 25/08/2024 13:32	Designed by Kunal	
File Cascade.casx	Checked by	Drainage
XP Solutions	Source Control 2015.1	

Cascade	Summary	of	Results	for	Tank.srcx
	-				

	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
8640	min Summe	r 5.022	0.022	0.0	0.2	0.2	0.6	ОК
10080	min Summe	r 5.020	0.020	0.0	0.2	0.2	0.5	ОК
15	min Winte	r 5.132	0.132	0.0	2.0	2.0	3.5	ОК
30	min Winte	r 5.169	0.169	0.0	2.0	2.0	4.5	ОК
60	min Winte	r 5.191	0.191	0.0	2.0	2.0	5.1	ОК
120	min Winte	r 5.176	0.176	0.0	2.0	2.0	4.7	ОК
180	min Winte	r 5.145	0.145	0.0	2.0	2.0	3.9	ОК
240	min Winte	r 5.115	0.115	0.0	2.0	2.0	3.1	ОК
360	min Winte	r 5.084	0.084	0.0	1.8	1.8	2.2	ОК
480	min Winte	r 5.070	0.070	0.0	1.5	1.5	1.9	ОК
600	min Winte	r 5.062	0.062	0.0	1.3	1.3	1.6	ОК
720	min Winte	r 5.056	0.056	0.0	1.1	1.1	1.5	ОК
960	min Winte	r 5.049	0.049	0.0	0.9	0.9	1.3	ОК
1440	min Winte	r 5.040	0.040	0.0	0.7	0.7	1.1	ОК
2160	min Winte	r 5.033	0.033	0.0	0.5	0.5	0.9	ОК
2880	min Winte	r 5.029	0.029	0.0	0.4	0.4	0.8	ОК
4320	min Winte	r 5.025	0.025	0.0	0.3	0.3	0.7	ОК
5760	min Winte	r 5.022	0.022	0.0	0.2	0.2	0.6	ОК
7200	min Winte	r 5.020	0.020	0.0	0.2	0.2	0.5	ОК
8640	min Winte	r 5.018	0.018	0.0	0.2	0.2	0.5	ОК
10080	min Winte	r 5.017	0.017	0.0	0.1	0.1	0.5	O K

	torm vent			Discharge Volume (m³)	Time-Peak (mins)	
8640 n	min Summer	0.791	0.0	27.4	4384	
10080 n	min Summer	0.696	0.0	28.1	5032	
15 n	min Winter	99.366	0.0	6.7	18	
30 n	min Winter	65.019	0.0	8.8	32	
60 n	min Winter	40.510	0.0	11.0	58	
120 n	min Winter	24.381	0.0	13.3	90	
180 n	min Winter	17.876	0.0	14.7	124	
240 n	min Winter	14.259	0.0	15.6	152	
360 n	min Winter	10.337	0.0	17.0	204	
480 n	min Winter	8.228	0.0	18.0	262	
600 n	min Winter	6.888	0.0	18.9	320	
720 n	min Winter	5.954	0.0	19.6	378	
960 n	min Winter	4.728	0.0	20.7	498	
1440 n	min Winter	3.411	0.0	22.4	736	
2160 n	min Winter	2.457	0.0	24.2	1104	
	min Winter			25.5	1472	
	min Winter			27.4	2192	
	min Winter					
	min Winter			29.9	3624	
	min Winter				4360	
10080 n	min Winter	0.696	0.0	31.6	4992	
	©198	32-2015	XP Sol	utions		

Lanmor Consulting Ltd		Page 3
Thorogood House		
34 Tolworth Close		L.
Surbition Surrey KT6 7EW		Micco
Date 25/08/2024 13:32	Designed by Kunal	
File Cascade.casx	Checked by	Digitigh
XP Solutions	Source Control 2015.1	

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)	20.000	Shortest Storm (mins) 15
Ratio R	0.408	Longest Storm (mins) 10080
Summer Storms	Yes	Climate Change % +0

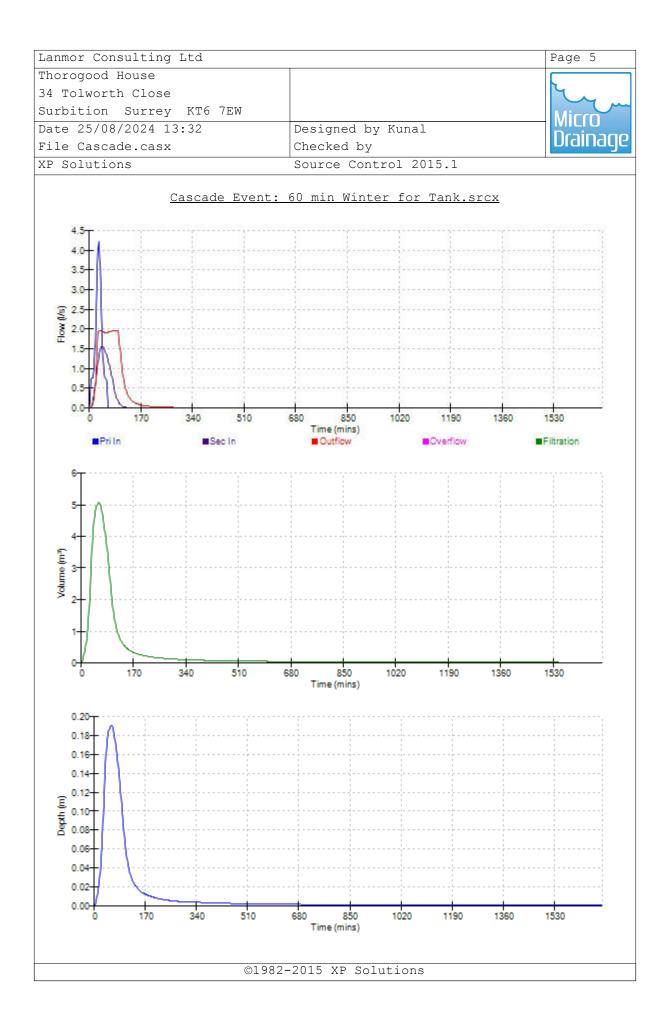
<u>Time Area Diagram</u>

Total Area (ha) 0.018

Time (mins) Area From: To: (ha)

0 4 0.018

Lanmor Consulting Ltd		Page 4
Thorogood House		
34 Tolworth Close		
Surbition Surrey KT6 7EW		Mirro
Date 25/08/2024 13:32	Designed by Kunal	Drainage
File Cascade.casx	Checked by	Drainage
XP Solutions	Source Control 2015.1	
<u>Cascade Mode</u>	el Details for Tank.src	<u>:x</u>
Storage is Or	line Cover Level (m) 6.500)
<u>Cellula</u>	<u>r Storage Structure</u>	
	t Level (m) 5.000 Safety Base (m/hr) 0.00000 F Side (m/hr) 0.00000	
Depth (m) Area (m²) Inf. Are	a (m ²) Depth (m) Area (m ²)	Inf. Area (m²)
0.000 28.0 0.400 28.0	28.0 0.401 0.0 40.8	40.8
<u>Hydro-Brake</u>	Optimum® Outflow Contro	<u>ol</u>
Unit	Reference MD-SHE-0075-200	0-0400-2000
-	n Head (m)	0.400
_	Flow (l/s) Flush-Flo™	2.0 Calculated
	Objective Minimise upstre	
	meter (mm)	75
Invert Minimum Outlet Pipe Dia	Level (m)	5.000 100
Suggested Manhole Dia		1200
Control Po	ints Head (m) Flow (1	./s)
Design Point (Ca	lculated) 0.400	2.0
F		2.0
Mean Flow over H		1.7 1.6
	-	
The hydrological calculations have b		
Hydro-Brake Optimum® as specified. Hydro-Brake Optimum® be utilised the invalidated		
Depth (m) Flow (l/s) Depth (m) Flow	7 (l/s) Depth (m) Flow (l/s) Depth (m) Flow (l/s)
0.100 2.0 1.200		.0 7.000 7.5
0.200 1.9 1.400		.4 7.500 7.8
0.300 1.7 1.600 0.400 2.0 1.800		.7 8.000 8.1 .0 8.500 8.3
0.500 2.2 2.000		.4 9.000 8.6
0.600 2.4 2.200		.7 9.500 8.8
0.800 2.7 2.400		.0
1.000 3.0 2.600	4.7 6.500 7.	.3
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horogood H		ING LT	-							Page 1
	House	9								
4 Tolworth	n Clo	ose								4
Surbition	Sur	rey K	T6 7EV	v						
Date 25/08,					Desi	aned b	oy Kunal			- Micro
File	202		-			cked by	-			Drainac
-							-	E 1		
XP Solution	IS				Sour	cce Cor	ntrol 201	J.L		
			-	~				,		
		<u>Ca</u>	scade	Summa	ary of	Resul	ts for Ta	ank.src	X	
							-	£1 =		
				pstrea		Outfl	ow To Over	TTOM LO		
		P	ermeab	le Pav	ing.src	х (None)	(None)		
				Half I	Drain Ti	ime : 30	5 minutes.			
	Stor	rm	Max	Max	Ма	ax	Max	Max	Max	Status
	Ever	nt		-			Control S			
			(m)	(m)	(1/	s)	(1/s)	(l/s)	(m³)	
1 5	min	Summer	5.171	0.171		0.0	2.0	2.0	4.5	0 K
		Summer				0.0	2.0	2.0		
		Summer				0.0	2.0	2.0		
		Summer				0.0	2.0	2.0	7.2	
		Summer				0.0	2.0	2.0	6.5	O K
240) min	Summer	5.220	0.220		0.0	2.0	2.0	5.8	ОК
360) min	Summer	5.170	0.170		0.0	2.0	2.0	4.5	ОК
480) min	Summer	5.131	0.131		0.0	2.0	2.0	3.5	ОК
600) min	Summer	5.104	0.104		0.0	2.0	2.0	2.8	O K
720) min	Summer	5.089	0.089		0.0	1.9	1.9	2.4	O K
		Summer				0.0	1.6	1.6	2.0	O K
		Summer				0.0	1.2	1.2		
		Summer				0.0	0.9	0.9		
		Summer				0.0	0.7	0.7		
		Summer				0.0	0.5	0.5		
		Summer				0.0	0.4	0.4		
7200	min	Summer	5.028	0.028		0.0	0.4	0.4	0.7	ОК
			Storm		Rain	Flooder	l Discharge	e Time-P	eak	
			Event			Volume		(mins		
						(m ³)		,		
		1 –	min C-	mmo 1	20 110	0 0		4	10	
					L39.112	0.0			18 33	
		30	min Su	mmer	91.026	0.0) 11.	1	33	
		30 60	min Su min Su	mmer mmer	91.026 56.713	0.0) 11.) 13.	1 9	33 62	
		30 60 120	min Su min Su min Su	mmer mmer mmer	91.026 56.713 34.134	0.0 0.0 0.0) 11.3) 13.9) 16.7	1 9 7	33 62 104	
		30 60 120 180	min Su min Su min Su min Su	mmer mmer mmer mmer	91.026 56.713 34.134 25.027	0.0 0.0 0.0	11.1 13.1 13.1 16.1 18.4	1 9 7 4	33 62 104 130	
		30 60 120 180 240	min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer	91.026 56.713 34.134 25.027 19.963	0.0 0.0 0.0 0.0	11.1 13.1 13.1 16.1 18.2 19.1	1 9 7 4 6	33 62 104 130 160	
		30 60 120 180 240 360	min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer	91.026 56.713 34.134 25.027 19.963 14.472	0.0 0.0 0.0 0.0 0.0	11.3 13.4 16.3 18.4 19.4 19.4 11.5	1 9 7 4 6 3	33 62 104 130 160 220	
		30 60 120 180 240 360 480	min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer	91.026 56.713 34.134 25.027 19.963 14.472 11.519	0.0 0.0 0.0 0.0 0.0 0.0) 11.) 13.) 16.) 18.) 19.) 21.) 22.	1 9 7 4 6 3 6	33 62 104 130 160 220 276	
		30 60 120 180 240 360 480 600	min Su min Su min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer mmer	91.026 56.713 34.134 25.027 19.963 14.472 11.519 9.643) 11.) 13.) 16.) 18.) 19.) 21.) 22.) 23.	1 9 7 4 6 3 6 6	33 62 104 130 160 220 276 328	
		30 60 120 180 240 360 480 600 720	min Su min Su min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer mmer mmer	91.026 56.713 34.134 25.027 19.963 14.472 11.519 9.643 8.336) 11.) 13.) 16.) 18.) 19.) 21.) 22.) 23.) 24.	1 9 7 4 6 3 6 6 5	33 62 104 130 160 220 276 328 382	
		30 60 120 180 240 360 480 600 720 960	min Su min Su min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer mmer mmer	91.026 56.713 34.134 25.027 19.963 14.472 11.519 9.643) 11.) 13.) 16.) 16.) 19.) 21.) 22.) 23.) 24.) 24.) 26.	1 9 7 4 6 3 6 6 5 5 0	33 62 104 130 160 220 276 328	
		30 60 120 240 360 480 600 720 960 1440	min Su min Su min Su min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer mmer mmer	91.026 56.713 34.134 25.027 19.963 14.472 11.519 9.643 8.336 6.619) 11.) 13.) 16.) 18.) 19.) 21.) 22.) 23.) 24.) 26.) 28.	1 9 7 4 6 3 6 6 5 5 0 1	33 62 104 130 220 276 328 382 500	
		30 60 120 180 240 360 480 600 720 960 1440 2160	min Su min Su min Su min Su min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer mmer mmer	91.026 56.713 34.134 25.027 19.963 14.472 11.519 9.643 8.336 6.619 4.775) 11.) 13.) 16.) 18.) 19.) 21.) 22.) 23.) 24.) 26.) 28.) 30.	1 9 7 4 6 3 6 6 5 5 0 1 3 1 1	33 62 104 130 220 276 328 382 500 736	
		30 60 120 180 240 360 480 600 720 960 1440 2160 2880	min Su min Su min Su min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer mmer mmer	$\begin{array}{c} 91.026\\ 56.713\\ 34.134\\ 25.027\\ 19.963\\ 14.472\\ 11.519\\ 9.643\\ 8.336\\ 6.619\\ 4.775\\ 3.440 \end{array}$) 11.) 13.) 16.) 18.) 19.) 21.) 22.) 23.) 24.) 26.) 28.) 30.) 32.	1 9 7 4 6 3 6 6 5 5 0 1 3 1 1 0 1 1 0 1	33 62 104 130 220 276 328 382 500 736 104	
		30 60 120 180 240 360 480 600 720 960 1440 2160 2880 4320	min Su min Su min Su min Su min Su min Su min Su min Su min Su min Su	mmer mmer mmer mmer mmer mmer mmer mmer	$\begin{array}{c} 91.026\\ 56.713\\ 34.134\\ 25.027\\ 19.963\\ 14.472\\ 11.519\\ 9.643\\ 8.336\\ 6.619\\ 4.775\\ 3.440\\ 2.723\\ \end{array}$) 11.) 13.) 16.) 18.) 19.) 21.) 22.) 23.) 24.) 26.) 28.) 30.) 32.) 34.	1 9 7 4 6 3 6 6 5 5 0 1 3 1 1 3 1 1 0 1 1 4 2	33 62 104 130 220 276 328 382 500 736 104 460	
		30 60 120 180 240 360 480 600 720 960 1440 2160 2880 4320 5760	min Su min Su	mmer mmer mmer mmer mmer mmer mmer mmer	$\begin{array}{c} 91.026\\ 56.713\\ 34.134\\ 25.027\\ 19.963\\ 14.472\\ 11.519\\ 9.643\\ 8.336\\ 6.619\\ 4.775\\ 3.440\\ 2.723\\ 1.956\end{array}$) 11.) 13.) 16.) 18.) 19.) 21.) 22.) 23.) 24.) 26.) 28.) 30.) 32.) 34.) 36.	1 9 7 4 6 3 6 6 5 5 0 1 3 1 1 0 1 1 4 2 2 1 2 2	33 62 104 130 220 276 328 382 500 736 104 460 200	
		30 60 120 180 240 360 480 600 720 960 1440 2160 2880 4320 5760	min Su min Su	mmer mmer mmer mmer mmer mmer mmer mmer	$\begin{array}{c} 91.026\\ 56.713\\ 34.134\\ 25.027\\ 19.963\\ 14.472\\ 11.519\\ 9.643\\ 8.336\\ 6.619\\ 4.775\\ 3.440\\ 2.723\\ 1.956\\ 1.545\end{array}$) 11.) 13.) 16.) 18.) 19.) 21.) 22.) 23.) 24.) 26.) 28.) 30.) 32.) 34.) 36.	1 9 7 4 6 3 6 6 5 5 0 1 3 1 1 0 1 1 4 2 2 1 2 2	33 62 104 130 220 276 328 382 500 736 104 460 200 936	

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Thorogood House		
34 Tolworth Close		L.
Surbition Surrey KT6 7EW		Micco
Date 25/08/2024 13:30	Designed by Kunal	Drainage
File	Checked by	Diamaye
XP Solutions	Source Control 2015.1	

	Stor		Max	Max	Max	Max	Max	Max	Statu
	Even	t	Level (m)	Depth (m)	Infiltration (1/s)	Control (l/s)		Volume (m³)	
8640	min	Summer	5.026	0.026	0.0	0.3	0.3	0.7	0
10080	min	Summer	5.024	0.024	0.0	0.3	0.3	0.6	0
15	min	Winter	5.194	0.194	0.0	2.0	2.0	5.2	0
30	min	Winter	5.257	0.257	0.0	2.0	2.0	6.8	0
60	min	Winter	5.313	0.313	0.0	2.0	2.0	8.3	0
120	min	Winter	5.317	0.317	0.0	2.0	2.0	8.4	0
180	min	Winter	5.280	0.280	0.0	2.0	2.0	7.4	0
240	min	Winter	5.233	0.233	0.0	2.0	2.0	6.2	0
360	min	Winter	5.151	0.151	0.0	2.0	2.0	4.0	0
480	min	Winter	5.100	0.100	0.0	2.0	2.0	2.7	0
600	min	Winter	5.083	0.083	0.0	1.8	1.8	2.2	0
720	min	Winter	5.073	0.073	0.0	1.6	1.6	1.9	0
960	min	Winter	5.061	0.061	0.0	1.3	1.3	1.6	0
1440	min	Winter	5.049	0.049	0.0	0.9	0.9	1.3	0
2160	min	Winter	5.041	0.041	0.0	0.7	0.7	1.1	0
2880	min	Winter	5.035	0.035	0.0	0.5	0.5	0.9	0
4320	min	Winter	5.030	0.030	0.0	0.4	0.4	0.8	0
5760	min	Winter	5.026	0.026	0.0	0.3	0.3	0.7	0
7200	min	Winter	5.024	0.024	0.0	0.3	0.3	0.6	0
8640	min	Winter	5.022	0.022	0.0	0.2	0.2	0.6	0
10080	min	Winter	5.020	0.020	0.0	0.2	0.2	0.5	0

	Stor Even		Rain (mm/hr)		Discharge Volume (m³)	Time-Peak (mins)	
8640	min	Summer	1.107	0.0	38.7	4400	
10080	min	Summer	0.975	0.0	39.7	5096	
15	min	Winter	139.112	0.0	9.5	19	
30	min	Winter	91.026	0.0	12.4	34	
60	min	Winter	56.713	0.0	15.5	62	
120	min	Winter	34.134	0.0	18.7	114	
180	min	Winter	25.027	0.0	20.6	142	
240	min	Winter	19.963	0.0	21.9	172	
360	min	Winter	14.472	0.0	23.9	228	
480	min	Winter	11.519	0.0	25.3	276	
600	min	Winter	9.643	0.0	26.5	326	
720	min	Winter	8.336	0.0	27.5	384	
960	min	Winter	6.619	0.0	29.1	498	
1440	min	Winter	4.775	0.0	31.5	738	
2160	min	Winter	3.440	0.0	34.0	1112	
2880	min	Winter	2.723	0.0	35.8	1472	
4320	min	Winter	1.956	0.0	38.6	2172	
5760	min	Winter	1.545	0.0	40.5	2928	
7200	min	Winter	1.287	0.0	42.1	3680	
8640	min	Winter	1.107	0.0	43.4	4352	
10080	min	Winter	0.975	0.0	44.5	5096	
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Thorogood House		
34 Tolworth Close		L.
Surbition Surrey KT6 7EW		Micco
Date 25/08/2024 13:30	Designed by Kunal	
File	Checked by	Diamaye
XP Solutions	Source Control 2015.1	

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)	20.000	Shortest Storm (mins) 15
Ratio R	0.408	Longest Storm (mins) 10080
Summer Storms	Yes	Climate Change % +40

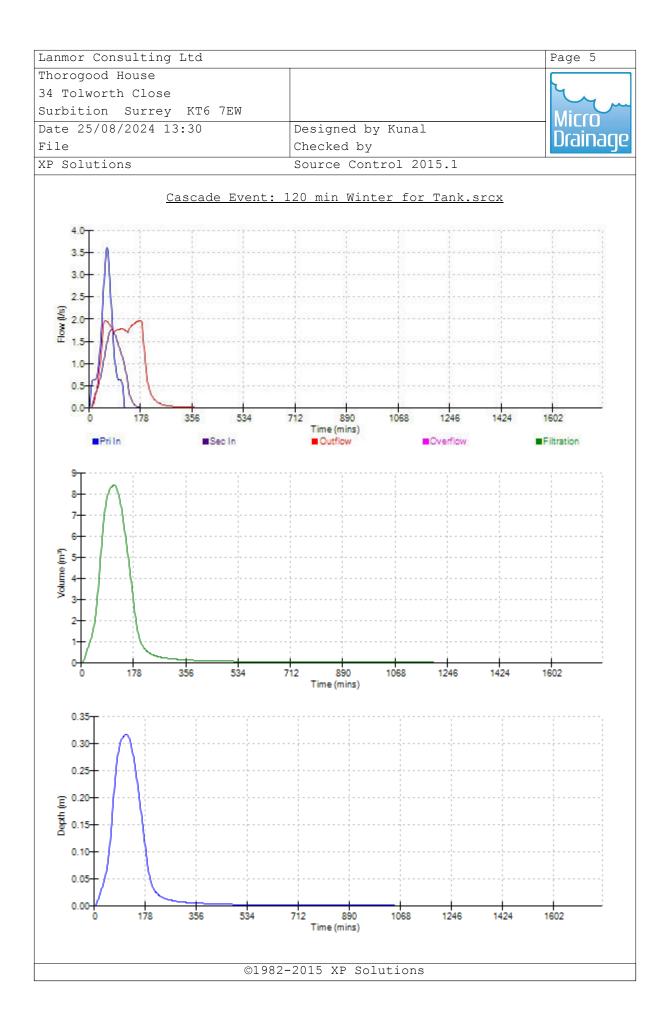
<u>Time Area Diagram</u>

Total Area (ha) 0.018

Time (mins) Area From: To: (ha)

0 4 0.018

Lanmor Consulting Ltd			Page 4		
Thorogood House					
34 Tolworth Close			Y.		
Surbition Surrey KT6 7EW			Micco		
Date 25/08/2024 13:30	Designed by Kun	al			
File	Checked by		Digingda		
XP Solutions	Source Control :	2015.1			
<u>Cascade Mode</u>	el Details for Ta	ank.srcx			
Storage is On	nline Cover Level (r	n) 6.500			
<u>Cellula</u>	<u>r Storage Struct</u>	ure			
Inver Infiltration Coefficient Infiltration Coefficient) Porosity 0.			
Depth (m) Area (m²) Inf. Are	ea (m²) Depth (m) A	rea (m²) Inf. Area	a (m²)		
0.000 28.0 0.400 28.0	28.0 40.8	0.0	40.8		
<u>Hydro-Brake</u>	Optimum® Outflow	Control			
Unit	Reference MD-SHE-0	075 2000 0400 200	0		
	n Head (m)	0.40			
_	Flow (l/s)	2.			
	Flush-Flo™ Objective Minimis	Calculate			
Dia	umeter (mm)	e upstream storage 7.			
	Level (m)	5.00			
Minimum Outlet Pipe Dia Suggested Manhole Dia		10 120	-		
Control Po	ints Head (m)	Flow (l/s)			
	alculated) 0.400				
I	Flush-Flo™ 0.124 Kick-Flo® 0.285				
Mean Flow over H		1.6			
		. /			
The hydrological calculations have be Hydro-Brake Optimum® as specified.		-	-		
Hydro-Brake Optimum® be utilised the invalidated					
Depth (m) Flow (1/s) Depth (m) Flow	w (1/s) Depth (m) F	low (1/s) Depth (1	m) Flow (1/s)		
0.100 2.0 1.200 0.200 1.9 1.400	3.3 3.000 3.5 3.500	5.0 7.0 5.4 7.5			
0.300 1.7 1.600	3.7 4.000	5.7 8.0			
0.400 2.0 1.800	3.9 4.500	6.0 8.5			
0.500 2.2 2.000	4.1 5.000	6.4 9.0			
0.600 2.4 2.200	4.3 5.500	6.7 9.5	00 8.8		
0.800 2.7 2.400 1.000 3.0 2.600	4.5 6.000 4.7 6.500	7.0 7.3			
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01902		-			





APPENDIX D

SuDS Proforma





	Project / Site Name (including sub- catchment / stage / phase where appropriate)	South Worple Way	
	Address & post code	South Worple Way. East Sheen	
	OS Grid ref. (Easting, Northing)	E 520584	
s		N 175756	
etail	LPA reference (if applicable)		
1. Project & Site Details	Brief description of proposed work	Construction of 5 new residential properties	
	Total site Area	500 m ²	
	Total existing impervious area	420 m ²	
	Total proposed impervious area	350 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	Sewer	
	Designer Name		
	Designer Position		
	Designer Company		

	2a. Infiltration Feasibility					
	Superficial geology classification	mton Park Gravels				
	Bedrock geology classification	London Clay				
	Site infiltration rate	n/a	m/s			
	Depth to groundwater level	n/a				
	Is infiltration feasible?		No			
	2b. Drainage Hierarchy					
ements		Feasible (Y/N)	Proposed (Y/N)			
ang	1 store rainwater for later use		Ν	Ν		
arge Arr	2 use infiltration techniques, such surfaces in non-clay areas	Ν	N			
d Discha	3 attenuate rainwater in ponds or features for gradual release	Ν	N			
2. Proposed Discharge Arrangements	4 attenuate rainwater by storing in sealed water features for gradual r	Y	Y			
2. P	5 discharge rainwater direct to a v	N	N			
	6 discharge rainwater to a surface sewer/drain	Y	Y			
	7 discharge rainwater to the comb	N	Ν			
	2c. Proposed Discharge Details					
	Proposed discharge location	ater Surface V	Vater Sewer			
	Has the owner/regulator of the discharge location been consulted?		No			



GREATER **LONDON** AUTHORITY



	3a. Discharge Rates & Required Storage					
		Greenfield (GF) runoff rate (l/s)	Existing discharge rate (I/s)	Required storage for GF rate (m ³)	Proposed discharge rate (l/s)	
	Qbar	0.1	\langle	\searrow	\ge	
	1 in 1	0.1	6.3	n/a	1.3	
	1 in 30	0.2	n/a	n/a	2	
	1 in 100	0.2	n/a	n/a	2	
	1 in 100 + CC		\ge	n/a	2	
	Climate change allowance used		40%			
3. Drainage Strategy	3b. Principal Method of Flow Control		Hydrobrake			
e St	3c. Proposed SuDS Measures					
nag			Catchment	Plan area	Storage	
Drai			area (m²)	(m²)	vol. (m ³)	
З.	Rainwater harves	-	0	\geq	0	
	Infiltration syster	ns	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		0 350	0 150	15	
	Pervious pavements Swales		350	150	15 0	
	Basins/ponds		0	0	0	
	Attenuation tank	c	0		10	
	Total	5	350	150	25	

	4a. Discharge & Drainage Strategy	Page/section of drainage report	
	Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	section 2 &4	
	Drainage hierarchy (2b)	Section 4	
4. Supporting Information	Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Appendix C	
	Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Appendix C	
	Proposed SuDS measures & specifications (3b)	Section 5	
por	4b. Other Supporting Details	Page/section of drainage report	
Sup	Detailed Development Layout	Appendix A	
	Detailed drainage design drawings, including exceedance flow routes	Appendix C	
	Detailed landscaping plans	-	
	Maintenance strategy	Section 5	
	Demonstration of how the proposed SuDS measures improve:		
	a) water quality of the runoff?	Section 5	
	b) biodiversity?	Section 5	
	c) amenity?	-	