

Calculated by:	Andy Higgins
Site name:	13258 - Northern Arc
Site location:	WBLR south

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

Site Details

Latitude:	50.96576° N
Longitude:	0.16029° W
Reference:	2842912530
Date:	Jan 03 2020 12:44

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1
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Methodology

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

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	815	815
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is $\text{SPR/SPRHOST} \leq 0.3$?

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

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	5.77	5.77
1 in 1 year (l/s):	4.9	4.9
1 in 30 years (l/s):	13.27	13.27
1 in 100 year (l/s):	18.4	18.4
1 in 200 years (l/s):	21.57	21.57

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

LOCATION	CALCULATIONS	OPTIONS
	Calculations based on: Design and Analysis of urban storm drainage. The Wallingford Procedure, Volume 1 Principles methods and practice.	
	User Input Data	
	Total site area 100 ha	
	SAAR (From FEH) 826	
	Rainfall Intensity (From FEH) 12.31	
	Climate Change allowance 0 %	
	Rainfall Intensity (incl. climate change allowance) 12.31	
	PIMP (% impervious) 100 %	
	Soil Type 0.40	
	Very Low Runoff (well drained sandy, loamy or earthy peat soils) 0.15	
	Low Runoff (Very permeable soils (e.g. gravel, sand) 0.30	
	Moderate (Very fine sands, silts and sedimentary clays) 0.40	
	High Runoff (Clayey or loamy soils) 0.45	
	Very High Runoff (Soils of the wet uplands) 0.50	
Fig. 9.7	UCWI (From Figure 9.7 of Wallingford Method) 90	
Eqn. 13	$Q_p \text{ (peak discharge)} = 2.78 C_v CR i A$	
	Where: Q_p (Peak Discharge) i = rainfall intensity A = Total Area	
	Average rainfall Intensity (i) (including 0% allowance for climate change)	
	M100_60 is: 12.31 mm	
Eqn 7.20	$C_v = PR/100$	
Eqn 7.3	$PR = (0.829 PIMP) + (25.0 SOIL) + (0.078 UCWI) - 20.7$	
	PIMP (Percentage of catchment which is impervious) 100 %	
Page 52	Note: PIMP can not be less than 40% 40 %	
	Thus value of PIMP to be used 100 %	
	Soil: 0.40 UCWI: 90	
	PR = 79.22	
	Thus $C_v = 1.00$	
Sec 7.10	CR (Recommended for simulation and design) 1.3	
	Q_p for 1 in 2 year 60 minute duration = 4,448.8 l/s or 44.49 l/s/ha	

$C_v = 1$ as per
Mid Sussex
request
07/03/2024

LOCATION	CALCULATIONS																				OPTIONS					
	Calculations based on: Design and Analysis of urban storm drainage. The Wallingford Procedure, Volume 1 Principles methods and practice.																									
	User Input Data																									
	Total site area										100										ha					
	SAAR (From FEH)										826															
	Rainfall Intensity (From FEH)										31.75															
	Climate Change allowance										0										%					
	Rainfall Intensity (incl. climate change allowance)										31.75															
	PIMP (% impervious)										100										%					
	Soil Type										0.40															
	Very Low Runoff (well drained sandy, loamy or earthy peat soils)										0.15															
	Low Runoff (Very permeable soils (e.g. gravel, sand)										0.30															
	Moderate (Very fine sands, silts and sedimentary clays)										0.40															
	High Runoff (Clayey or loamy soils)										0.45															
	Very High Runoff (Soils of the wet uplands)										0.50															
Fig. 9.7	UCWI (From Figure 9.7 of Wallingford Method)										90															
Eqn. 13	Qp (peak discharge) = 2.78 Cv CR i A																									
	Where:		Qp (Peak Discharge)					i = rainfall intensity					A = Total Area													
	Average rainfall Intensity (i) (including 0% allowance for climate change)																									
		M100_60 is:					31.75					mm														
Eqn 7.20	Cv = PR/100																									
Eqn 7.3	PR = (0.829 PIMP) + (25.0 SOIL) + (0.078 UCWI) - 20.7																									
		PIMP (Percentage of catchment which is impervious)										100										%				
Page 52		Note: PIMP can not be less than 40%										40										%				
		Thus value of PIMP to be used										100										%				
		Soil:		0.40			UCWI:		90																	
	PR =		79.22																							
	Thus Cv =		1.00																							
Sec 7.10	CR (Recommended for simulation and design)										1.3															
	Qp for 1 in 2 year 60 minute duration =										11,474.5										l/s	or	114.74 l/s/ha			

Cv = 1 as per
Mid Sussex
request
07/03/2024

LOCATION	CALCULATIONS																				OPTIONS							
	Calculations based on: Design and Analysis of urban storm drainage. The Wallingford Procedure, Volume 1 Principles methods and practice.																											
	User Input Data																											
	Total site area										100										ha							
	SAAR (From FEH)										826																	
	Rainfall Intensity (From FEH)										40.47																	
	Climate Change allowance										0										%							
	Rainfall Intensity (incl. climate change allowance)										40.47																	
	PIMP (% impervious)										100										%							
	Soil Type										0.40																	
	Very Low Runoff (well drained sandy, loamy or earthy peat soils)										0.15																	
	Low Runoff (Very permeable soils (e.g. gravel, sand)										0.30																	
	Moderate (Very fine sands, silts and sedimentary clays)										0.40																	
	High Runoff (Clayey or loamy soils)										0.45																	
	Very High Runoff (Soils of the wet uplands)										0.50																	
Fig. 9.7	UCWI (From Figure 9.7 of Wallingford Method)										90																	
Eqn. 13	Qp (peak discharge) = 2.78 Cv CR i A																											
	Where:		Qp (Peak Discharge)					i = rainfall intensity					A = Total Area															
	Average rainfall Intensity (i) (including 0% allowance for climate change)																											
			M100_60 is:					40.47					mm															
Eqn 7.20	Cv = PR/100																											
Eqn 7.3	PR = (0.829 PIMP) + (25.0 SOIL) + (0.078 UCWI) - 20.7																											
	PIMP (Percentage of catchment which is impervious)										100										%							
Page 52	Note: PIMP can not be less than 40%										40										%							
	Thus value of PIMP to be used										100										%							
			Soil:		0.40				UCWI:		90																	
	PR =		79.22																									
	Thus Cv =		1.00																									
Sec 7.10	CR (Recommended for simulation and design)										1.3																	
	Qp for 1 in 2 year 60 minute duration =										14,625.9										l/s	or	146.26		l/s/ha			

Cv = 1 as per
Mid Sussex
request
07/03/2024

CALCULATIONS

Company: WIE

Office: Redhill

Sheet No: 1 of 1

Project No: WIE19442

By J Harshaw

Date 10/10/2024

Checked: S.Pearce

Date 10/10/2024

Project Title = **WBLR Phase 3**

Calculations Title = **Run-off Rate - Impermeable Catchments - 1 in 100 Yr event + 40% Climate Change (Modified Rational Method)**

LOCATION	CALCULATIONS	OPTIONS
	Calculations based on: Design and Analysis of urban storm drainage. The Wallingford Procedure, Volume 1 Principles methods and practice.	
	User Input Data	
	Total site area 100 ha	
	SAAR (From FEH) 826	
	Rainfall Intensity (From FEH) 40.47	
	Climate Change allowance 40 %	
	Rainfall Intensity (incl. climate change allowance) 56.66	
	PIMP (% impervious) 100 %	
	Soil Type 0.40	
	Very Low Runoff (well drained sandy, loamy or earthy peat soils) 0.15	
	Low Runoff (Very permeable soils (e.g. gravel, sand) 0.30	
	Moderate (Very fine sands, silts and sedimentary clays) 0.40	
	High Runoff (Clayey or loamy soils) 0.45	
	Very High Runoff (Soils of the wet uplands) 0.50	
Fig. 9.7	UCWI (From Figure 9.7 of Wallingford Method) 90	
Eqn. 13	Q_p (peak discharge) = $2.78 C_v CR i A$	
	Where: Q_p (Peak Discharge) i = rainfall intensity A = Total Area	
	Average rainfall Intensity (i) (including 40% allowance for climate change)	
	M100_60 is: 56.66 mm	
Eqn 7.20	$C_v = PR/100$	
Eqn 7.3	$PR = (0.829 PIMP) + (25.0 SOIL) + (0.078 UCWI) - 20.7$	
	PIMP (Percentage of catchment which is impervious) 100 %	
Page 52	Note: PIMP can not be less than 40% 40 %	
	Thus value of PIMP to be used 100 %	
	Soil: 0.40 UCWI: 90	
	PR = 79.22	
	Thus C_v = 1.00	
Sec 7.10	CR (Recommended for simulation and design) 1.3	
	Q_p for 1 in 2 year 60 minute duration = 20,476.2 l/s or 204.76 l/s/ha	

**Cv = 1 as per
Mid Sussex
request
07/03/2024**

TECHNICAL NOTE

DATE:	08 August 2024	CONFIDENTIALITY:	Confidential
SUBJECT:	WBLR Phase 3 area reduction for Phase 1 drainage (WBLR-WSP-HDG-00-AN-C-0174 S3-P01)		
PROJECT:	ED/100377 WBLR	AUTHOR:	Alexander Strickland
CHECKED:	Andrew Burrows	APPROVED:	Andrew Burrows

INTRODUCTION

WSP has received a query from JCE following changes to the catchment areas in Phase 3 that are to drain into the Phase 1 network. The proposed change is that only area e), shown in figure 1 (in yellow), will now drain into the Phase 1 southern network. The following component areas were provided for the revised area:

- Verge between carriageway and footway = 161m²
- 3m wide footpath = 395m²
- Filter drain = 82m²
- Verge between filter drain and earthworks = 67m²

This area is significantly reduced from the previously assumed catchment.

The query received asked WSP to review the currently installed Phase 1 hydrobrakes due to the contributing catchment area being reduced and confirm if the southern basin hydrobrake needed re-specifying, and swapping out at some point in the future.

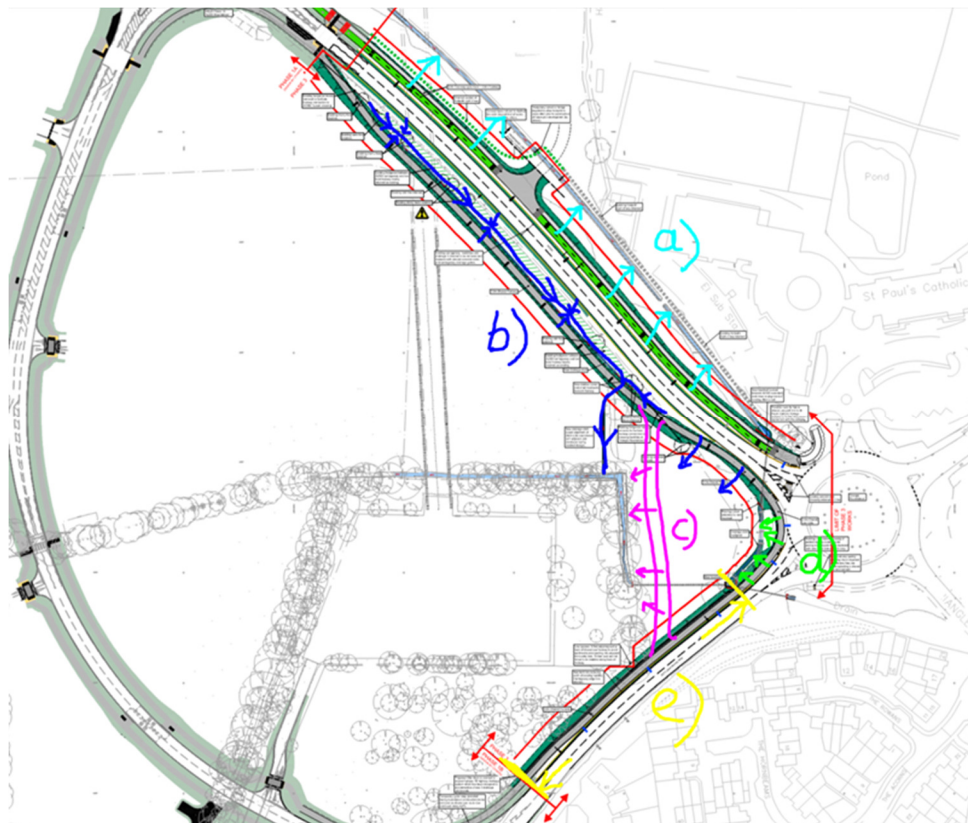


Figure 1 Catchment area markups in query

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PREVIOUS REPORT

Technical note, WBLR-WSP-HSG-00-AN-C-0142, investigated the impact of increasing the catchment area from Phase 3 by 0.065Ha to 0.194Ha. The current design has a catchment area of 0.346Ha from Phase 1 and 0.129Ha from Phase 3. Flows are limited to the green field run off rate of 2.8l/s by a hydrobrake, based on the agreed Qbar of 5.8l/s/Ha. The report concluded that, while the increased catchment could have a permitted discharge rate of 3.2l/s due to the increased catchment area, changing the hydrobrake would not be required. This was due to the analysis showing that the basin had adequate storage capacity to manage the additional volume, and maintaining a reduced flow into the watercourse would provide added benefit in terms of flood risk downstream.

The report also noted that if Phase 3 was not to be constructed for some time, then the installed 2.8l/s hydrobrake would be operating at an unacceptable flow rate for the smaller catchment. Consideration should therefore be given to installing a 2.0l/s hydrobrake until the Phase 3 catchment was connected to the network. 2.0l/s being the maximum permitted discharge for the Phase 1 only catchment.

DRAINAGE CHECKS AND ANALYSIS

Hydrobrake Changes

The contributing area of Phase 3 only drains into the South network for Phase 1, the North basin hydrobrake is therefore unaffected. This review has concluded that the South basin hydrobrake will need to be replaced due to the changes to the Phase 3 areas. The design flow rate for the network outfalls is based on Qbar (5.8l/s/Ha) multiplied by the catchment area.

The current design flow rate is 2.8l/s for a total catchment area of 0.475Ha. As the catchment area is being reduced from 0.475 to 0.402Ha the current hydrobrake would be unacceptable. Figure 2 shows the flow to depth curve for the basin's hydrobrake. It demonstrates two points that the design flow rate of 2.8l/s will be reached. The second is at the design depth which will not be reached as the contributing area has been reduced. The first is at a depth of 0.275m just before the vortex is formed.

The first exceedance of the Phase 1 only permitted discharge (2.0l/s) is however at a much shallower depth (0.083m), which will be reached even during frequent, low return period, storm events.

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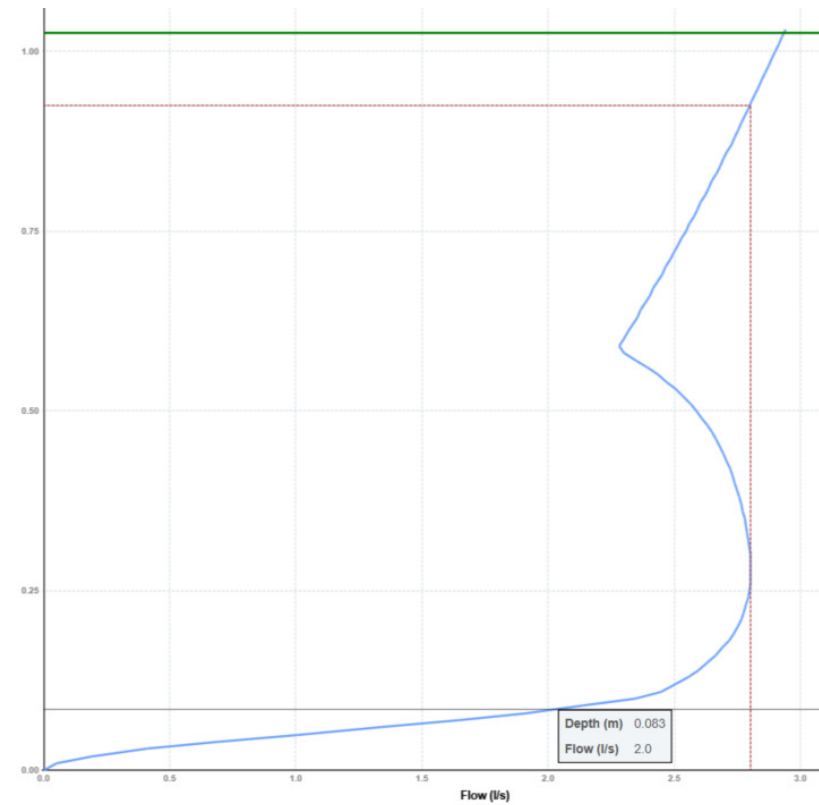


Figure 2 South basin hydrobrake flow to depth curve

Timing of Change

Due to the frequency that the permitted discharge rate of 2.0l/s will be exceeded if the current hydrobrake is retained it is recommended that the hydrobrake is changed during the Phase 1 works.

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CHECKED:	Andrew Burrows	APPROVED:	Andrew Burrows

Final Hydrobrake Selection

Given the reduced catchment/incoming flow but the fixed volume of the basin (that has already been constructed to accommodate the original design), a check has been carried out to review the need to change the 2.0l/s hydrobrake once the Phase 3 catchment is connected.

To analyse this scenario simulations were ran using the current FLOW model for Phase 1 with the following changes:

- The area representing Phase 3 has been reduced from 0.129Ha to 0.056Ha, this area represents the '3m footpath' and 'verge between carriageway and footpath' areas given above. It has been assumed that the verge at the back of the footway will not drain into the new drainage system.
- The hydrobrake was set to having a design depth of 0.85m, based on the as constructed basin depth, and the design flow rate was changed from 2.8l/s to 2.0l/s

The result of this analysis is that the max depth in the South basin will reach 0.768m during a 1 in 100 year +40%CC storm event, below the depth of 0.85m.

Therefore, whilst the southern basin hydrobrake will need to be swapped out in Phase 1, a 2.0l/s hydrobrake will also be sufficient for the final arrangement with Phase 3 connected.