

# Annex C

## PROPOSED STORAGE CALCULATIONS Rev B



HyNet Carbon Dioxide Pipeline OUTLINE SURFACE WATER DRAINAGE STRATEGY (Clean)



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Site Details

Calculated by:	Megan Au
Site name:	Ince AGI
Site location:	Ince, England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Latitude:	53.27941° N
Longitude:	2.79829° W
Reference:	3071446808
Date:	Jul 22 2022 16:41

20

0.4

10

0.87

1.38

1.7

2.08

Site characteristics		Methodology				
Total site area (ha):	0.18	Q <sub>MED</sub> estimation method:	Calc	Calculate from BFI and		AR
Significant public open space (ha):	0	BFI and SPR method:	Calc	Calculate from dominant		
Area positively drained (ha):	0.18	Soil characteristics	DURAS	μ, E	dited	
Impermeable area (ha):	0.18	HOST class:				
Percentage of drained area that is impermeable (%):	100	BFI HOST:		0.30	02	
Impervious area drained via infiltration (ha):	0	SPR HOST:		0.6		
Return period for infiltration system design (year):	10	Hydrological		Default	Edi	ted
Impervious area drained to rainwater harvesting (ha):	0	characteristics			1	
Return period for rainwater harvesting system (year):	10	Q <sub>MED</sub> :	-		0.93	
Compliance factor for rainwater harvesting system (%):	66	Q <sub>BAR</sub> / Q <sub>MED</sub> conversion	-		1.075	1
Net site area for storage volume design (ha):	0.18	Bainfall 100 yrs 6 hrs:			62	
Net impermable area for storage volume design (ha):	0.18	Rainfall 100 yrs 12 hrs			79.54	
Pervious area contribution to runoff (%):	30	FEH / FSB conversion fac		1.00	1.00	
* where rainwater harvesting or infiltration has been used	l for managing			1.02	1.02	
surface water runoff such that the effective impermeable	SAAR (MM):		(22	/22		

surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of  $Q_{BAR}$  and other flow rates will have been reduced accordingly.

#### Design criteria

Climate change allowance factor:

Urban creep allowance

Volume control approach

factor:

(mm):

1.4	
1	
Use long te	erm storage



2

Minimum flow rate (l/s):

years: Q<sub>BAR</sub> for total site area (l/s):

M5-60 Rainfall Depth (mm):

'r' Ratio M5-60/M5-2 day:

Growth curve factor 1 year:

Growth curve factor 10 year:

Growth curve factor 30 year:

Growth curve factor 100

Hydological region:

Q <sub>BAR</sub> for	net site	area	(l/s):
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1	1
1	1

20

0.4

10

0.87

1.38

1.7

2.08

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m <sup>3</sup> ):	94	94
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m <sup>3</sup> ):	0	0
1 in 100 year (l/s):	2.1	2.1	Total storage 1/100 years (m <sup>3</sup> ):	94	94



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Calculated by:	Megan Au
Site name:	Rock Bank BVS
Site location:	Rock Bank, England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details	
Latitude:	53.23617° N
Longitude:	2.88363° W
Reference:	2567233292
Date:	Jul 22 2022 16:53

Site characteristics		Methodology				
Total site area (ha):	0.1050	Q <sub>MED</sub> estimation method	d: Calculate from BFI and SA		and SAAR	
Significant public open space (ha):	0	BFI and SPR method:	С	Calculate from dominant		ninant
Area positively drained (ha):	0.105	Soil characteristics		Defailing Edited		ited
Impermeable area (ha):	0.105	HOST class:				
Percentage of drained area that is impermeable (%):	100	BFI HOST:			0.492	2
Impervious area drained via infiltration (ha):	0	SPR HOST:			0.47	
Return period for infiltration system design (year):	10	Hydrological		Default		Edited
Impervious area drained to rainwater harvesting (ha):	0	characteristics				
Return period for rainwater harvesting system (year):	10	Q <sub>MED</sub> :				0.31
Compliance factor for rainwater harvesting system (%):	66	Q <sub>BAR</sub> / Q <sub>MED</sub> conversion factor:				1.075
Net site area for storage volume design (ha):	0.11	Rainfall 100 yrs 6 hrs:				55
Net impermable area for storage volume design (ha):	0.11	Rainfall 100 yrs 12 hrs:				65.52
Pervious area contribution to runoff (%):	30	FEH / FSR conversion factor:		<b>:or:</b> 1.04		1.04
* where rainwater harvesting or infiltration has been used for managing		SAAR (mm):		698		698
surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the		M5-60 Rainfall Depth (m	m):	17		17
estimates of Q <sub>BAR</sub> and other flow rates will have been reduced		'r' Ratio M5-60/M5-2 da	y:	0.4		0.4

#### Design criteria

Climate change allowance factor:

Urban creep allowance

Volume control approach

factor:

(mm):

1.4	
1	
Use long te	erm storage

Interception rainfall depth	5
(mayna) -	

2

Minimum flow rate (l/s):

Q<sub>BAR</sub> for total site area (l/s): Q<sub>BAR</sub> for net site area (l/s):

Hydological region:

Growth curve factor 1 year:

Growth curve factor 10 year:

Growth curve factor 30 year:

Growth curve factor 100

years:

0.34	0.34
0.34	0.34

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m <sup>3</sup> ):	36	36
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m <sup>3</sup> ):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m <sup>3</sup> ):	36	36



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Calculated by:	Megan Au
Site name:	Mollington BVS
Site location:	Mollington, England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details	
Latitude:	53.22534° N
Longitude:	2.92793° W
Reference:	2036154066
Date:	Jul 22 2022 17:01

Site characteristics		Methodology					
Total site area (ha):	0.1050	Q <sub>MED</sub> estimation method	<b>d:</b>	Calculate f	rom BF	I and SAAR	
Significant public open space (ha):	0	BFI and SPR method:	C	Calculate f	rom do	minant	
Area positively drained (ha):	0.105	Soil characteristics	De	<b>PAST</b> E	Ec	dited	
Impermeable area (ha):	0.1050	HOST class:					
Percentage of drained area that is impermeable (%):	100	BFI HOST:			0.68	2	
Impervious area drained via infiltration (ha):	0	SPR HOST:			0.3		
Return period for infiltration system design (year):	10	Hydrological		Defa	ault	Edited	
Impervious area drained to rainwater harvesting (ha):	0	characteristics					
Return period for rainwater harvesting system (year):	10	Q <sub>MED</sub> :				0.16	_
Compliance factor for rainwater harvesting system (%):	66	Q <sub>BAR</sub> / Q <sub>MED</sub> conversion factor:	ľ			1.075	
Net site area for storage volume design (ha):	0.11	Rainfall 100 yrs 6 hrs:				55	
Net impermable area for storage volume design (ha):	0.11	Rainfall 100 yrs 12 hrs:				65.52	-
Pervious area contribution to runoff (%):	30	FEH / FSR conversion fa	actor:	1.04		1.04	-
* where rainwater harvesting or infiltration has been used	for managing	SAAR (mm):		699		699	
than 50% of the 'area positively drained', the 'net site are	earea is less ea' and the	M5-60 Rainfall Depth (m	nm):	17		17	
estimates of $Q_{BAR}$ and other flow rates will have been real	duced	'r' Patio M5-60/M5-2 de		0.4		0.4	

years:

Design	criteria
Design	ontona

accordingly.

factor:

Climate change allowance factor:

Urban creep allowance

Volume control approach

1.4	
1	
Use long terr	n storag

5

2

Interception rainfall depth (mm):

Minimum flow rate (l/s):

e long term	n storage

'r' Ratio M5-60/M5-2 day: 0.4 0.4 Hydological region: 9 9 Growth curve factor 1 year: 0.88 0.88 Growth curve factor 10 year: 1.42 1.42 Growth curve factor 30 year: 1.78 1.78 Growth curve factor 100 2.18 2.18 Q<sub>BAR</sub> for total site area (I/s): 0.17 0.17 Q<sub>BAR</sub> for net site area (I/s): 0.17 0.17

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m <sup>3</sup> ):	36	36
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m <sup>3</sup> ):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m <sup>3</sup> ):	36	36



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Site Details

Calculated by:	Megan Au
Site name:	Aston Hall BVS
Site location:	Aston Hall. England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Latitude:	53.19439° N
Longitude:	3.03233° W
Reference:	75357765
Date:	Jul 22 2022 17:03

Site characteristics		Methodology					
Total site area (ha):	0.1050	Q <sub>MED</sub> estimation method	<b>d:</b>	Calculate <sup>-</sup>	from BF	and SAAR	
Significant public open space (ha):	0	BFI and SPR method:	C	Calculate <sup>-</sup>	from doi	minant	
Area positively drained (ha):	0.105	Soil characteristics	Ъ	<del>l</del> asti	Ec	lited	
Impermeable area (ha):	0.1050	HOST class:					
Percentage of drained area that is impermeable (%):	100	BFI HOST:			0.49	2	
Impervious area drained via infiltration (ha):	0	SPR HOST:	HOST:		0.47	7	
Return period for infiltration system design (year):	10	Hydrological		Def	ault	Edited	
Impervious area drained to rainwater harvesting (ha):	0	characteristics					
Return period for rainwater harvesting system (year):	10	Q <sub>MED</sub> :				0.34	
Compliance factor for rainwater harvesting system (%): 66		Q <sub>BAR</sub> / Q <sub>MED</sub> conversion factor:	1		1.075		
Net site area for storage volume design (ha):	0.11	Rainfall 100 yrs 6 hrs:				61	
Net impermable area for storage volume design (ha):	0.11	Rainfall 100 vrs 12 hrs:				75.92	
Pervious area contribution to runoff (%): 30		FEH / FSR conversion fa	1.04		1.04		
* where rainwater harvesting or infiltration has been used	for managing	SAAR (mm):		719		719	
surface water runoff such that the effective impermeable than 50% of the 'area positively drained', the 'net site are	e area is less ea' and the	M5-60 Rainfall Depth (m	m):	17		17	
estimates of $Q_{BAR}$ and other flow rates will have been reduced		'r' Ratio M5-60/M5-2 da	iv:	0.3		0.3	

Design criteria
Climate change allowance

accordingly.

(mm):

factor: Urban creep allowance factor:

1.4	
1	
Use long terr	n storage

5

2

Minimum flow rate (l/s):

Volume control approach

Interception rainfall depth

years:
Q <sub>BAR</sub> for total site area (l/s):
Q <sub>BAR</sub> for net site area (l/s):

Hydological region:

Growth curve factor 1 year:

Growth curve factor 10 year:

Growth curve factor 30 year:

Growth curve factor 100

	75.92
1.04	1.04
719	719
17	17
0.3	0.3
9	9
0.88	0.88
1.42	1.42
1.78	1.78
2.18	2.18

0.36	0.36
0.36	0.36

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m <sup>3</sup> ):	39	39
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m <sup>3</sup> ):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m <sup>3</sup> ):	39	39



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Calculated by:	Kyra Wilson	S	Site Details	
Site name:	Northop Hall AGI	Ľ	.atitude:	53.20370° N
Site location:	Northop Hall, England	L	.ongitude:	3.11094° W
This is an estimatio normal	n of the storage volume requirement	s that are needed to meet <b>F</b>	Reference:	952990071
best practice criter management	ria in line with Environment Agency gu	uidance "Rainfall runoff D	Date:	Mar 21 2023 12:47
for developments",	SC030219 (2013), the SuDS Manual C7 standards for SuDS (Defra, 2015). It is	53 (Ciria, 2015) and		
design				

of drainage systems. It is recommended that hydraulic modelling software is used to calculate

volume requirements and design details before finalising the design of the drainage scheme.

Site characteristics				Methodology			
Total site area (ha):			0.115	Q <sub>MED</sub> estimation	Calculate from BFI and		
Significant public open s	space (ha):		0	method:	SAAR		
Area positively drained (	(ha):		0.115	BFI and SPR method:	Calculate from dominant		
Impermeable area (ha):			0.115	Soil characteristics	Default	Edited	
Percentage of drained a	area that is im	permeable (%):	100	HOST class:			
Impervious area drainec	l via infiltratio	on (ha):	0	BEI HOST:		0.492	
Return period for infiltra	ation system o	design (year):	10	SPR HOST		0.432	
Impervious area drained	to rainwater	harvesting	0	Hydrological	Default	Edited	
(na).			40	characteristics			
(year):	ater narvestir	ig system	10	Q <sub>MED</sub> :		0.46	
Compliance factor for ra (%):	ainwater harv	esting system	66	Q <sub>BAR</sub> / Q <sub>MED</sub> conversion factor.		1.075	
Net site area for storage	e volume des	ign (ha):	0.12	Rainfall 100 yrs 6 hrs:		61	
Net impermable area for storage volume design		0.12	Rainfall 100 yrs 12 hrs:		77.38		
(ha):	9	9	0.12	FEH / FSR conversion	1.06	1.06	
Pervious area contribut	ion to runoff	(%):	30	factor.			
* where rainwater harve	sting or infilt	ration has been	used for	SAAR (mm):	787	787	
managing surface water impermeable area is les	r runoff such s than 50% of	that the effecti the 'area positiv	ve vely	M5-60 Rainfall Depth (mm):	17	17	
drained', the 'net site ar flow rates will have beer	ea' and the e n reduced ac	stimates of Q <sub>BAR</sub> cordingly.	and other	'r' Ratio M5-60/M5-2 day:	0.3	0.3	
Design criteria				Hydological region:	9	9	
Climate change allowan factor:	ce 1.4			Growth curve factor 1	0.88	0.88	
Urban creep allowance	1.1			year:			
factor.				Growth curve factor	1.42	1.42	
Volume control approac	sh Use	long term storag	ge	Growth curve factor	1.78	1.78	
Interception rainfall dep (mm):	oth 5			30 year.		1	
Minimum flow rate (l/s):	2			Growth curve factor 100 years:	2.18	2.18	
				Q <sub>BAR</sub> for total site area (I/s):	0.5	0.5	
				Q <sub>BAR</sub> for net site area (I/s):	0.5	0.5	
	Defeult	۲-انب- ما			Defeult	F dit a d	
Site discharge rates	Detault	Eaitea	Estimated	storage volumes	verault	Laitea	
1 in 1 year (l/s):	2	2	Attenuation	n storage 1/100 years	54	54	
1 in 30 years (l/s):	2	2	long term o	torage 1/100 vegre	0	0	
1 in 100 year (l/s):	2	2	(m <sup>3</sup> ):	in in seals	U	U	
			Total storag	ge 1/100 years (m³):	54	54	

WSP Group Ltd					Page 1
•	Flir	nt AGI			
					Micco
Date 24/06/2022	Desi	aned h	57 MA		
File Elipt storage CDCV	Choc	und hu	70		Drainage
File Filnt Storage.SRCx	Cnec	скеа ру	AS		
XP Solutions	Sour	ce Cont	trol 2019	.1	
<u>Summary of Results</u>	for 10	<u>)0 year</u>	Return E	<u>eriod (+40%)</u>	
Storm	Max M	lax Ma	x Max	Status	
Event 1	evel De	m) (1/	rol Volume		
	(111)	(, (1)	3) (111)		
15 min Summer 5	1.327 0.	197	2.0 201.6	0 K	
30 min Summer 5	1.390 0.	260	2.0 269.9	Flood Risk	
60 min Summer 5	1.458 0.	328	2.0 346.3	Flood Risk	
120 min Summer 5	1.513 0. 1.544 0	383	2.0 408.6	Flood Risk	
240 min Summer 5	1.564 0.	434	2.0 444.7	Flood Risk	
360 min Summer 5	1.590 0.	460	2.0 500.1	Flood Risk	
480 min Summer 5	1.605 0.	475	2.0 517.9	Flood Risk	
600 min Summer 5	1.614 0.	484	2.0 528.5	Flood Risk	
720 min Summer 5	1.619 0.	489	2.0 534.4	Flood Risk	
960 min Summer 5	1.621 0.	491	2.0 537.4	Flood Risk	
1440 min Summer 5	1.611 0.	481	2.0 524.6	Flood Risk	
2160 min Summer 5	1.5// U. 1.5/8 0	447	2.0 483.8	Flood Risk	
4320 min Summer 5	1.540 0. 1.507 0.	377	2.0 402.1	Flood Risk	
5760 min Summer 5	1.479 0.	349	2.0 369.8	Flood Risk	
7200 min Summer 5	1.462 0.	332	2.0 351.1	Flood Risk	
8640 min Summer 5	1.452 0.	322	2.0 339.5	Flood Risk	
10080 min Summer 5:	1.448 0.	318	2.0 334.3	Flood Risk	
15 min Winter 5	1.327 0.	197	2.0 201.6	OK	
30 min Winter 5.	1.390 0.	260	2.0 270.0	Flood Risk	
Storm	Dain	Floodod	Dischange	Mime-Deels	
Event	(mm/hr)	Volume	Volume	(mins)	
	( /	(m <sup>3</sup> )	(m <sup>3</sup> )	(	
		-			
15 min Summer	154.086	0.0	168.8	27	
30 min Summer	103.378	0.0	163.6	42	
120 min Summer	39,817	0.0	320.7 309.9	130	
180 min Summer	29.225	0.0	305.6	190	
240 min Summer	23.384	0.0	303.6	250	
360 min Summer	16.986	0.0	302.8	370	
480 min Summer	13.480	0.0	303.7	488	
600 min Summer	11.238	0.0	305.4	608	
/20 min Summer	9.6/1	0.0	307.4	/28	
1440 min Summer	5 395	0.0	316.2	900 1444	
2160 min Summer	3.796	0.0	629.7	2144	
2880 min Summer	2.958	0.0	617.0	2452	
4320 min Summer	2.087	0.0	576.3	3168	
5760 min Summer	1.645	0.0	838.8	3984	
7200 min Summer	1.395	0.0	888.9	4832	
8640 min Summer	1.236	0.0	945.1	5704	
15 min Winter	154 086	0.0	168 9	27	
30 min Winter	103.378	0.0	163.6	41	
	982-20	19 Tnnc			
	202-20		V Y Z C		

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•	Flin	nt AGI				
						Micco
Date 24/06/2022	Des	igned b	ov Ma	Α		
File Flint storage.SBCX	Cheo	cked by	7 AS			Drain
XP Solutions	Sour		$\frac{1}{1+ro}$	1 2019	1	
	500			1 2019	• ±	
Summary of Results	for 1	10 vea	r Re	turn F	Period (+40%)	
<u>Building of Rebuilds</u>	101 1	<u>ycu</u>			<u>erroa (+100)</u>	-
Storm M	Max 1	Max M	lax	Max	Status	
Event Le	evel De	epth Con	trol	Volume		
	(m)	(m) (l	/s)	(m³)		
60 min Winter 51	.458 0	.328	2.0	346.4	Flood Risk	
120 min Winter 51	.513 0	.383	2.0	408.9	Flood Risk	
180 min Winter 51	.544 0	.414	2.0	445.2	Flood Risk	
240 min Winter 51	.565 0	.435	2.0	469.8	Flood Risk	
360 min Winter 51 480 min Winter 51	591 0 607 0	.461 477	2.0	501.2	Flood Risk	
600 min Winter 51	616 0	.486	2.0	530.4	Flood Risk	
720 min Winter 51	.621 0	.491	2.0	536.7	Flood Risk	
960 min Winter 51	.624 0	.494	2.0	540.5	Flood Risk	
1440 min Winter 51	.615 0	.485	2.0	530.1	Flood Risk	
2160 min Winter 51		.455	2.0	493.8	Flood Risk	
4320 min Winter 51	.502 0	. 421	2.0	452.9	Flood Risk Flood Risk	
5760 min Winter 51	.462 0	.332	2.0	351.0	Flood Risk	
7200 min Winter 51	.432 0	.302	2.0	316.8	Flood Risk	
8640 min Winter 51	.406 0	.276	2.0	288.3	Flood Risk	
10080 min Winter 51	.388 0	.258	2.0	268.5	Flood Risk	
Storm	Rain	Floode	1 Dis	charge	Time-Peak	
Event	(mm/hr)	Volume	Vc	lume	(mins)	
		(m³)	(	(m³)		
60 min Winter	66.653	0.0	)	320.7	70	
120 min Winter	39.817	0.0	)	309.7	128	
180 min Winter	29.225	0.0	)	305.3	188	
240 min Winter	23.384	0.0	)	303.2	246	
360 min Winter 480 min Winter	13.480	0.0	)	302.2	364 480	
600 min Winter	11.238	0.0	- )	304.4	598	
720 min Winter	9.671	0.0	)	306.3	714	
	7.608	0.0	)	309.9	946	
960 min Winter			)	313.3	1404	
960 min Winter 1440 min Winter 2160 min Winter	5.395	0.0	۰ ۲	621 0	2001	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter	5.395 3.796 2.958	0.0	)	624.0 616.3	2064 2680	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter	5.395 3.796 2.958 2.087	0.0	) ) )	624.0 616.3 580.8	2064 2680 3328	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter 5760 min Winter	5.395 3.796 2.958 2.087 1.645	0.0	) ) )	624.0 616.3 580.8 838.8	2064 2680 3328 4264	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter 5760 min Winter 7200 min Winter	5.395 3.796 2.958 2.087 1.645 1.395	0.0	) ) ) )	624.0 616.3 580.8 838.8 888.8	2064 2680 3328 4264 5192	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter 5760 min Winter 7200 min Winter 8640 min Winter	5.395 3.796 2.958 2.087 1.645 1.395 1.236			624.0 616.3 580.8 838.8 888.8 944.7	2064 2680 3328 4264 5192 6048	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter 5760 min Winter 7200 min Winter 8640 min Winter 10080 min Winter	5.395 3.796 2.958 2.087 1.645 1.395 1.236 1.128			624.0 616.3 580.8 838.8 888.8 944.7 1007.0	2064 2680 3328 4264 5192 6048 6864	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter 5760 min Winter 7200 min Winter 8640 min Winter 10080 min Winter	5.395 3.796 2.958 2.087 1.645 1.395 1.236 1.128		) ) ) )	624.0 616.3 580.8 838.8 888.8 944.7 1007.0	2064 2680 3328 4264 5192 6048 6864	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter 5760 min Winter 7200 min Winter 8640 min Winter 10080 min Winter	5.395 3.796 2.958 2.087 1.645 1.395 1.236 1.128	0.0000000000000000000000000000000000000		624.0 616.3 580.8 838.8 888.8 944.7 1007.0	2064 2680 3328 4264 5192 6048 6864	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter 5760 min Winter 7200 min Winter 8640 min Winter 10080 min Winter	5.395 3.796 2.958 2.087 1.645 1.395 1.236 1.128			624.0 616.3 580.8 838.8 888.8 944.7 1007.0	2064 2680 3328 4264 5192 6048 6864	
960 min Winter 1440 min Winter 2160 min Winter 2880 min Winter 4320 min Winter 5760 min Winter 7200 min Winter 8640 min Winter 10080 min Winter	5.395 3.796 2.958 2.087 1.645 1.395 1.236 1.128			624.0 616.3 580.8 838.8 888.8 944.7 1007.0	2064 2680 3328 4264 5192 6048 6864	

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WSP Group Ltd		Page 3			
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•		Mirm			
Date 24/06/2022	Designed by MA	Drainago			
File Flint storage.SRCX	Checked by AS	Diamage			
XP Solutions	Source Control 2019.1				
_					
<u></u> <u></u>	aintall Details				
Rainfall Mod	del FEH				
Return Period (yea:	rs) 100				
FEH Rainfall Vers	ion 2013				
Data T	vpe Point				
Summer Sto	rms Yes				
Winter Stor	rms Yes				
CV (Summe CV (Winte	er) 0.950				
Shortest Storm (min	ns) 15				
Longest Storm (min	ns) 10080				
Climate Change	e ≈ +40				
Ті	<u>me Area Diagram</u>				
	-				
То	tal Area (ha) 0.559				
Time (mins) Area	Time (mins) Area Time (mins) Area				
From: To: (ha) F	rom: To: (ha) From: To: (ha)				
0 4 0 187	4 8 0 187 8 12 0 186				
©19	82-2019 Innovyze				

WSP Group	Ltd									Pa	ge 4	
• •					Flint	AGI					licro	
Date 24/06	/2022				Desig	gned by M	A				raina	n
File Flint	stor	age.S	RCX		Check	ed by AS						IJе
XP Solutio	ns				Sourc	ce Contro	1 202	19.1		I		
XP Solutions Source Control 2019.1   Model Details   Storage is Online Cover Level (m) 51.630   Tank or Pond Structure   Invert Level (m) 51.130   Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )   0.000 980.2 0.500 1214.8 0.501 1215.3   Unit Reference MD-SHE-0070-2000-0800-2000   Design Head (m) 0.800   Design Flow (1/s) 2.0												
ObjectiveMinimise upstream storage ApplicationSump AvailableYesDiameter (mm)70Invert Level (m)50.930Minimum Outlet Pipe Diameter (mm)100Suggested Manhole Diameter (mm)1200												
Control	Point	S	Head	(m)	Flow (l/s)	Cont	rol P	oints	Head	(m)	Flow (	1/s)
Design Point	(Calcu Flus	lated) h-Flo™	0. ∞ 0.	.800 .240	2.0	Mean Flow	over	Kick- Head H	-Flo® 0 Range	.504		1.6 1.7
The hydrol Hydro-Brak Hydro-Brak invalidate	ogical e® Opti e Optin d	calcul .mum as num® be	lations s speci e utili	hav fied sed	e been base . Should a then these	ed on the H another typ storage rc	lead/D be of b buting	ischar contro calcu	ge relatio l device o lations wi	nship ther ll be	o for tl than a	he
Depth (m)	) Flow	(1/s)	Depth	(m)	Flow (l/s)	Depth (m)	Flow	(1/s)	Depth (m)	Flor	w (l/s)	
0.10	C	1.8	1.	.200	2.4	3.000		3.7	7.000		5.5	
0.20	)	2.0	1.	400	2.6	3.500		3.9	7.500		5.6	
0.30	)	2.0	1.	.600	2.7	4.000		4.2	8.000		5.8	
0.40	J	1.9		.800	2.9	4.500		4.4	8.500		6.0	
0.50	)	1 Q	2.	200	<b>3.</b> 0 マ つ	5.000		4./ 1 0	9.000		6.2 63	
0.00	)	⊥.0 2 ∩	2.	400	 ২ ২	6 000		4.9 5 1	9.000		0.3	
0.001	-	2.0	2.	600	3.4	6.500		5.3				
1.00	C	2.2	۷.		0.1							
1.000	D	2.2				1			I			



#### www.uksuds.com | Storage estimation tool

Calculated by:	Kyra Wilson		Site Details	
Site name:	Cornist Lane BVS		Latitude:	53.24265° N
Site location:	Cornist Lane, Wales		Longitude:	3.17233° W
This is an estimatio normal	n of the storage volume requiremer	its that are needed to meet	Reference:	661935429
best practice crite management	ria in line with Environment Agency g	uidance "Rainfall runoff	Date:	Mar 21 2023 12:53
for developments",	SC030219 (2013), the SuDS Manual C	753 (Ciria, 2015) and		
the non-statutory s	standards for SuDS (Defra, 2015). It is	not to be used for detailed		
design				

of drainage systems. It is recommended that hydraulic modelling software is used to calculate

volume requirements and design details before finalising the design of the drainage scheme.

Site characteristics				Methodology			
Total site area (ha):			0.105 Q <sub>MED</sub> estimation		Calculate from BFI and		
Significant public open space (ha):			0	method:	SAAR		
Area positively drained	(ha):		0.105	BFI and SPR	Calculate from	n dominant	
Impermeable area (ha):			0.105	Soil characteristics	Default	Edited	
Percentage of drained a	area that is ir	npermeable (%):	100	HOST class:			
Impervious area drained	l via infiltratio	on (ha):	0	BELHOST		0.492	
Return period for infiltra	tion system	design (year):	10			0.47	
Impervious area drainec (ha):	l to rainwate	r harvesting	0	Hydrological	Default	Edited	
Return period for rainwa (vear):	ater harvestii	ng system	10	characteristics Q <sub>MED</sub> :		0.48	
Compliance factor for ra	ainwater harv	vesting system	66	Q <sub>BAR</sub> / Q <sub>MED</sub> conversion factor.		1.075	
Net site area for storage	e volume des	sign (ha):	0 11	Rainfall 100 yrs 6 hrs:		61	
Net impermable area fo	r storage vol	ume design	0.11	Rainfall 100 yrs 12 hrs:		77.38	
(ha):			0.11	FEH / FSR conversion	1.06	1.06	
Pervious area contribut	ion to runoff	(%):	30	factor.			
* where rainwater harve	sting or infilt	ration has been	used for	SAAR (mm):	831	831	
managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively				M5-60 Rainfall Depth (mm):	17	17	
drained', the 'net site ar flow rates will have beer	ea' and the e n reduced ac	stimates of Q <sub>BAR</sub> cordingly.	and other	'r' Ratio M5-60/M5-2 day:	0.3	0.3	
Design criteria				Hydological region:	9	9	
Climate change allowan factor:	<b>ce</b> 1.4			Growth curve factor 1 year.	0.88	0.88	
Urban creep allowance factor.	1.1			Growth curve factor	1.42	1.42	
Volume control approac	h Use	long term storag	ge	Growth curve factor	1 70	1 70	
Interception rainfall dep	oth 5			30 year:	1.70	1.70	
(mm): Minimum flow rate (l/s):	2			Growth curve factor 100 years:	2.18	2.18	
				Q <sub>BAR</sub> for total site area (I/s):	0.52	0.52	
				Q <sub>BAR</sub> for net site area (I/s):	0.52	0.52	
Sito discharge rotes	Default	Edited	Estimatad	storago volumos	Default	Edited	
lin 1 yoor (1/o).	0		Attonuction	atorago 1/100 vacro	40	40	
nn i year (i/s):	2	2	Attenuation (m <sup>3</sup> ):	storage I/ IUU years	46	46	
1 in 30 years (l/s):	2	2	Long term s	torage 1/100 vears	0	0	
1 in 100 year (l/s):	2	2	(m³):	<u> </u>	Ŭ	Ŭ	
			Total storag	ge 1/100 years (m³):	46	46	
6							



www.uksuds.com | Storage estimation tool

Site Details

Calculated by:	Megan Au
Site name:	Pentre Halkyn BVS
Site location:	Pentre Halkvn, Wales

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Latitude:	53.25007° N
Longitude:	3.23855° W
Reference:	3469493473
Date:	Jul 22 2022 17:17

Site characteristics		Methodology				
Total site area (ha):	Q <sub>MED</sub> estimation method	d: Calculate from BFI a			l and SAAR	
Significant public open space (ha):	0	BFI and SPR method:	С	alculate f	rom do	minant
Area positively drained (ha):	0.105	Soil characteristics	De	PASTE	Ed	dited
Impermeable area (ha):	0.105	HOST class:				
Percentage of drained area that is impermeable (%):	100	BFI HOST:			0.68	2
Impervious area drained via infiltration (ha):	0	SPR HOST:			0.21	
Return period for infiltration system design (year):	10	Hydrological		Defa	ault	Edited
Impervious area drained to rainwater harvesting (ha):	0	characteristics				
Return period for rainwater harvesting system (year):	10	Q <sub>MED</sub> :				0.27
Compliance factor for rainwater harvesting system (%):	66	Q <sub>BAR</sub> / Q <sub>MED</sub> conversion factor:				1.075
Net site area for storage volume design (ha):	0.11	Rainfall 100 vrs 6 hrs:				61
Net impermable area for storage volume design (ha):	0.11	Rainfall 100 vrs 12 hrs:				76.65
Pervious area contribution to runoff (%):	30	FEH / FSR conversion fa	ictor:	1.05		1.05
* where rainwater harvesting or infiltration has been used	SAAR (mm):		875		875	
than 50% of the 'area positively drained', the 'net site and	M5-60 Rainfall Depth (m	m):	17		17	
estimates of Q <sub>BAR</sub> and other flow rates will have been reaccordingly.	duced	'r' Ratio M5-60/M5-2 da	iy:	0.3		0.3
		Hydological region:		9		9

#### Design criteria

Climate change allowance factor:

Urban creep allowance

Volume control approach

Interception rainfall depth

factor:

(mm):

1.4
1
Use long term storag

5

2

Minimum flow rate (l/s):

	Growt
storage	years:
	Q <sub>BAR</sub> 1

Q<sub>BAR</sub> for net site area (I/s):

factor:		
Rainfall 100 yrs 6 hrs:		61
Rainfall 100 yrs 12 hrs:		76.65
FEH / FSR conversion factor:	1.05	1.05
SAAR (mm):	875	875
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78
Growth curve factor 100	2.18	2.18
years:		
Q <sub>BAR</sub> for total site area (I/s):	0.29	0.29

0.29 0.29

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m <sup>3</sup> ):	40	40
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m <sup>3</sup> ):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m <sup>3</sup> ):	40	40



### Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Site Details

SAAR (mm):

M5-60 Rainfall Depth (mm):

'r' Ratio M5-60/M5-2 day:

Growth curve factor 1 year:

Growth curve factor 10 year:

Growth curve factor 30 year:

Growth curve factor 100

Hydological region:

Calculated by: Megan Au Site name: Babell BVS Site location: Babell, Wales

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Latitude:	53.26070° N
Longitude:	3.27731° W
Reference:	247217570
Date:	Jul 22 2022 17:20

Site characteristics		Methodology		
Total site area (ha):	0.1050	Q <sub>MED</sub> estimation method:	Calculate from	n BFI and SAAR
Significant public open space (ha):	0	BFI and SPR method:	Calculate from	n dominant
Area positively drained (ha):	0.105	Soil characteristics	DEPEST	Edited
Impermeable area (ha):	0.105	HOST class:	-	
Percentage of drained area that is impermeable (%):	100	BFI HOST:	-	0.682
Impervious area drained via infiltration (ha):	0	SPR HOST:	-	0.3
Return period for infiltration system design (year):	10	Hydrological	Default	Edited
Impervious area drained to rainwater harvesting (ha):	0	characteristics		
Return period for rainwater harvesting system (year):	10	Q <sub>MED</sub> :		0.26
Compliance factor for rainwater harvesting system (%):	66	Q <sub>BAR</sub> / Q <sub>MED</sub> conversion		1.075
Net site area for storage volume design (ha):	0.11			
		Rainfall 100 yrs 6 hrs:		61
Net impermable area for storage volume design (na):	0.11	Rainfall 100 yrs 12 hrs:		75.92
Pervious area contribution to runoff (%):	30	FEH / FSR conversion facto	or: 1.04	1.04

\* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of  $\mathsf{Q}_{\mathsf{BAR}}$  and other flow rates will have been reduced accordingly.

#### Design criteria

Climate change allowance factor:

Urban creep allowance

Volume control approach

Interception rainfall depth

1.4	
1	
Use long terr	n storage

5

2

(mm):

factor:

Minimum flow rate (l/s):

years: Q<sub>BAR</sub> for total site area (I/s): Q<sub>BAR</sub> for net site area (I/s):

0.3	0.3
9	9
0.88	0.88
1.42	1.42
1.78	1.78
2.18	2.18

859

17

859

17

0.28	0.28
0.28	0.28

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m <sup>3</sup> ):	39	39
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m <sup>3</sup> ):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m <sup>3</sup> ):	39	39