ARUP

File Note

Project title Hereford Bus Interchange
Document title Drainage Strategy Addendum
File reference 964-ARP-HDG-ZZ-RP-C-000002
Status S2 | SUITABLE FOR INFORMATION

Revision	Role	Name	Date
P02	Author	Katie Amos	01/02/24
	Checker	Katie Amos	01/02/24
	Approver	Katie Amos	01/02/24
	Authoriser	---	---
	Client	---	---

Revision History

Revision	Author	Date	Description
P02	KA	01/02/24	ISSUED FOR INFORMATION
P01	SS	19/01/24	ISSUED FOR INFORMATION

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1. Drainage Strategy Addendum

Following the submission of the planning application for Hereford Station Transport Hub (HSTH) (Ref: 233009), the Hereford Council Drainage Officer provided comments on the proposed drainage strategy (Ref: 964-ARP-HDG-ZZ-RP-C-000001) submitted with the application. The comments included the following:

1. Flow control device for the bus overlay area is upsized to a minimum of 75mm to avoid the risk of blockage.
2. Main area of site discharging to the surface water sewer. If this area is proposed for adoption, then two attenuation crates will be required. One to accommodate a 1 in 30-year storm event and the other a 1 in 100-year storm event. Currently only one 220m2 area is proposed, with a discharge rate of 16l/s via a 169mm flow control device.
3. A weir manhole will be required.
4. Applicant should confirm the level of the receiving public surface water sewer.

Following the receipt of the drainage comments, a meeting was held to discuss the proposals with HC and their drainage officer on 15th November 2023. The comments above were discussed and the HC Drainage officer added that as the ultimate outfall destination is the same watercourse for both the bus overlay area and the main site, the total maximum run-off rate should remain the same. If increasing the size of the flow control device to 75mm which serves the bus layover area increases the discharge flow rate, then the flow from the main site area should be further restricted.

Since the above comments and subsequent meetings, a review of the drainage proposals has been completed to address the above comments. These are summarised below.

The design team held a meeting with Welsh Water (DCWW) on 28th November 2023 to discuss the project proposed drainage strategy including adoption of the network. The DCWW adoptions engineer confirmed that DCWW would not adopt any of the surface water drainage network within the site boundary as it would be from one curtilage. They will only adopt from the demarcation manhole chamber onwards as the pipe leaves the site boundary. This was confirmed in email, see extract included in Appendix AA1. As such, only one attenuation crate is required.

The proposed surface water network models have been updated to incorporate the requested changes to the flow control devices and weir manholes. The calculations are included in Appendix BB1.

The design team have requested a survey to be carried out of the DCWW surface water sewer and combined sewer adjacent to the proposed connection point on City Link Road. This is to confirm the route, size and invert level of the sewer to fully inform the design. This survey is yet to be undertaken and results are awaited.

It should be noted that the surface water connection has always been the preferred solution as this follows the drainage destination hierarchy. However, if the results of the survey show a connection to the surface water sewer is not possible then the proposals would need to revert to a connection to the DCWW combined sewer within the site. DCWW have not dismissed this solution, they have stated they are open to discuss options or possible alternatives but only once the sewer survey information has been received. They are not currently in a position to explore a connection to the combined public sewer, see extract included in Appendix AA1. DCWW are endeavouring to reduce the surface water flows which discharge to their combined sewer networks and therefore they request the connection to the DCWW surface water sewer is fully explored before discussing any alternative.

Appendix AA1: Correspondence from DCWW

RE: RE: Hereford Station - DCWW Pre Planning Response (Ref: PPA0007171)

Reply | Reply All | Forward

PL Phillip Little <Phillip.Little@dwrcymru.com>
To Katie Amos
Cc Sion Simpson-Williams; Luqmaan Kholwadia
Wed 31/01/2024 15:00

General

This sender Phillip.Little@dwrcymru.com is from outside your organization.

Hi Katie,

Thank you for your email.

Once you have had the survey carried out on the surface water line and have explored the connection to the surface water sewer, if there are concerns with the design at this stage please get In touch to and we can discuss options or possible alternatives. However, we are currently not in a position to explore the possibility of connecting to the combined public sewer.

Kind regards,

Phillip Little
Development Planning Officer| Developer Services
Dŵr Cymru Welsh Water

W: dwrcymru.com
E: developer.services@dwrcymru.com
T: 0800 917 2652
A: PO Box 3146, Cardiff, CF30 0EH

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If we've gone the extra mile to provide you with excellent service, let us know. You can nominate an individual or team for a Diolch award through our website.

From: Katie Amos <katie.amos@arup.com>
Sent: Tuesday, January 30, 2024 5:21 PM
To: Phillip Little <Phillip.Little@dwrcymru.com>
Cc: Sion Simpson-Williams <Sion.Simpson-Williams@arup.com>; Luqmaan Kholwadia <Luqmaan.Kholwadia@arup.com>
Subject: RE: RE: Hereford Station - DCWW Pre Planning Response (Ref: PPA0007171)

******** External Mail ********

Good afternoon Phillip,

We are in the process of responding to comments on the Hereford Bus Station planning application, one of which relates to the discharge destination for the surface water from Welsh Water.

We have requested a survey to be carried out of the DCWW surface water sewer and combined sewer adjacent to the proposed connection point on City Link Road. This is to confirm the routes, sizes and invert levels of the sewers to fully inform the design. We are still awaiting this survey to be undertaken by your Plan and Protect team however, we need to issue our response to the comments.

It should be noted that the surface water connection is the preferred solution as this follows the drainage destination hierarchy. However, if the results of the survey show a connection to the surface water sewer is not possible, then the proposals would need to revert to a connection to the DCWW combined sewer within the site.

The Planning Officer for the application has asked if it can be confirmed that Welsh Water will consider this option should the results of the survey show a connection to the surface water sewer cannot be achieved?

Kind regards

Katie Amos
Senior Engineer | Infrastructure West

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RE: RE: Hereford Station - DCWW Pre Planning Response (Ref: PPA0007171) [Filed 28 Nov 2023 23:24]

Reply | Reply All | Forward

PL Phillip Little <Phillip.Little@dwrcymru.com>
To Katie Amos
Tue 28/11/2023 16:30

Filed by Mail Manager

General

This sender Phillip.Little@dwrcymru.com is from outside your organization.

This is the most recent version, but you made changes to another copy. Click here to see the other versions.

Hi Katie,

Thank you for your time on the call this afternoon with myself and my colleague Mohammad running through the proposed drainage layout with us.

As Mohammad confirmed, we would not adopt any on site drainage as this will be remaining under one curtilage. We will therefore only adopt from the demarcation chamber onwards as the pipe leaves the sites boundary.

If we can be of any further assistance, please do not hesitate to contact us.

Kind regards,

Phillip Little
Development Planning Officer| Developer Services
Dŵr Cymru Welsh Water

W: dwrcymru.com
E: developer.services@dwrcymru.com
T: 0800 917 2652
A: PO Box 3146, Cardiff, CF30 0EH

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Appendix BB1: Proposed Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm - Bus Parking

Pipe Sizes Storm Pl Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	2
FEH Rainfall Version	1999
Site Location	GB 351500 240400 SO 51500 40400
C (1km)	-0.028
D1 (1km)	0.360
D2 (1km)	0.354
D3 (1km)	0.312
E (1km)	0.301
F (1km)	2.294
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm - Bus Parking

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	13.790	0.138	100.0	0.028	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	7.918	0.201	39.4	0.112	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	15.127	0.115	131.5	0.053	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	19.457	0.097	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	9.293	0.066	140.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	12.355	0.062	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.18	52.693	0.028	0.0	0.0	0.0	1.31	52.0	3.7
S2.000	50.00	5.06	52.756	0.112	0.0	0.0	0.0	2.09	83.1	15.1
S1.001	50.00	5.36	52.480	0.192	0.0	0.0	0.0	1.37	96.8	26.0
S1.002	50.00	5.65	52.315	0.192	0.0	0.0	0.0	1.11	78.3	26.0
S1.003	50.00	5.79	52.218	0.192	0.0	0.0	0.0	1.10	43.7	26.0
S1.004	50.00	6.02	52.152	0.192	0.0	0.0	0.0	0.92	36.6	26.0

Free Flowing Outfall Details for Storm - Bus Parking

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	SOutfall 3	53.100	52.090	0.000	0	0

Simulation Criteria for Storm - Bus Parking

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm - Bus Parking

Hydro-Brake® Optimum Manhole: S33, DS/PN: S1.003, Volume (m³): 8.7

Unit Reference	MD-SHE-0076-2300-0700-2300
Design Head (m)	0.700
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	52.218
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	2.3	Kick-Flo®	0.454	1.9
Flush-Flo™	0.207	2.3	Mean Flow over Head Range	-	2.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	1.200	2.9	3.000	4.5	7.000	6.7
0.200	2.3	1.400	3.2	3.500	4.8	7.500	6.9
0.300	2.2	1.600	3.4	4.000	5.1	8.000	7.1
0.400	2.1	1.800	3.5	4.500	5.4	8.500	7.4
0.500	2.0	2.000	3.7	5.000	5.7	9.000	7.6
0.600	2.1	2.200	3.9	5.500	6.0	9.500	7.8
0.800	2.4	2.400	4.1	6.000	6.2		
1.000	2.7	2.600	4.2	6.500	6.5		

Storage Structures for Storm - Bus Parking

Cellular Storage Manhole: S33, DS/PN: S1.003

Invert Level (m) 52.218 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 (m²)	Inf. Area (m²)
0.000	150.0	0.0	0.751	0.0	0.0
0.750	150.0	0.0			

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Bus Parking

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S29	15 Winter	2	+0%	100/15 Summer				52.738
S2.000	S30	15 Winter	2	+0%	100/15 Summer				52.833
S1.001	S31	15 Winter	2	+0%	30/15 Summer				52.598
S1.002	S32	15 Winter	2	+0%	30/15 Summer				52.444
S1.003	S33	240 Winter	2	+0%	30/15 Summer				52.359
S1.004	S34	240 Winter	2	+0%					52.191

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S29	-0.180	0.000	0.09			3.9	OK	
S2.000	S30	-0.148	0.000	0.25			15.9	OK	
S1.001	S31	-0.182	0.000	0.32			26.0	OK	
S1.002	S32	-0.171	0.000	0.39			26.3	OK	
S1.003	S33	-0.084	0.000	0.06		127	2.2	OK	
S1.004	S34	-0.186	0.000	0.07			2.2	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Bus Parking

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S29	15 Winter	30	+40%	100/15 Summer				52.853
S2.000	S30	15 Winter	30	+40%	100/15 Summer				52.978
S1.001	S31	15 Winter	30	+40%	30/15 Summer				52.830
S1.002	S32	240 Winter	30	+40%	30/15 Summer				52.744
S1.003	S33	240 Winter	30	+40%	30/15 Summer				52.742
S1.004	S34	15 Winter	30	+40%					52.192

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S29	-0.065	0.000	0.29			13.2	OK	
S2.000	S30	-0.003	0.000	0.85			53.5	OK	
S1.001	S31	0.050	0.000	1.13			91.6	SURCHARGED	
S1.002	S32	0.129	0.000	0.26			17.7	SURCHARGED	
S1.003	S33	0.299	0.000	0.06			2.3	SURCHARGED	
S1.004	S34	-0.185	0.000	0.07			2.3	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Bus Parking

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S29	15 Winter	100	+40%	100/15 Summer				53.138
S2.000	S30	15 Winter	100	+40%	100/15 Summer				53.378
S1.001	S31	15 Winter	100	+40%	30/15 Summer				53.108
S1.002	S32	240 Winter	100	+40%	30/15 Summer				52.959
S1.003	S33	240 Winter	100	+40%	30/15 Summer				52.956
S1.004	S34	240 Winter	100	+40%					52.192

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S29	0.220	0.000	0.40			18.2	SURCHARGED	
S2.000	S30	0.397	0.000	1.16			73.5	SURCHARGED	
S1.001	S31	0.328	0.000	1.54			125.2	SURCHARGED	
S1.002	S32	0.344	0.000	0.34			23.3	SURCHARGED	
S1.003	S33	0.513	0.000	0.07			2.4	SURCHARGED	
S1.004	S34	-0.185	0.000	0.07			2.4	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm - Surface Water Main Site

Pipe Sizes Storm Pl Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Maximum Rainfall (mm/hr)	100
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.950
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.500
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	0.75
Min Slope for Optimisation (1:X)	1000

Designed with Level Soffits

Network Design Table for Storm - Surface Water Main Site

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	17.420	0.145	120.1	0.028	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	13.926	0.116	120.1	0.046	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	15.918	0.119	134.2	0.022	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	20.219	0.148	136.6	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	16.523	0.396	41.7	0.067	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	13.932	0.396	35.2	0.061	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	3.801	0.025	150.0	0.016	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	56.21	5.24	52.488	0.028	0.0	0.0	0.0	1.19	47.4	5.4
S1.001	55.29	5.44	52.343	0.074	0.0	0.0	0.0	1.19	47.4	14.1
S1.002	54.22	5.67	52.227	0.096	0.0	0.0	0.0	1.13	44.8	17.9
S1.003	53.13	5.92	52.033	0.101	0.0	0.0	0.0	1.34	95.0	18.5
S2.000	56.73	5.14	52.753	0.067	0.0	0.0	0.0	2.03	80.8	13.1
S2.001	56.22	5.24	52.357	0.128	0.0	0.0	0.0	2.21	88.0	24.7
S1.004	52.92	5.97	51.886	0.245	0.0	0.0	0.0	1.28	90.6	44.6

Network Design Table for Storm - Surface Water Main Site

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.005	14.112	0.094	150.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	22.125	0.148	149.5	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	9.398	0.064	148.0	0.028	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	29.836	0.298	100.1	0.036	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	15.902	0.159	100.0	0.040	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	16.324	0.148	110.3	0.002	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.003	5.993	0.054	110.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	5.624	0.112	50.0	0.003	5.00	0.0	0.600	o	150	Pipe/Conduit	
S4.001	10.571	0.211	50.0	0.047	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.004	27.283	0.400	68.2	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	11.329	0.076	149.1	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	4.976	0.058	85.8	0.018	5.00	0.0	0.600	o	150	Pipe/Conduit	
S6.000	4.521	0.108	41.9	0.016	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.009	6.307	0.261	24.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.000	32.290	0.269	120.0	0.037	5.00	0.0	0.600	o	300	Pipe/Conduit	
S7.001	8.329	0.069	120.0	0.073	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.005	52.15	6.16	51.811	0.245	0.0	0.0	0.0	1.28	90.5	44.6
S1.006	51.00	6.44	51.717	0.250	0.0	0.0	0.0	1.28	90.7	44.6
S1.007	50.53	6.57	51.569	0.278	0.0	0.0	0.0	1.29	91.2	48.3
S3.000	55.56	5.38	52.640	0.036	0.0	0.0	0.0	1.31	52.0	6.9
S3.001	54.63	5.58	52.342	0.076	0.0	0.0	0.0	1.31	52.0	14.3
S3.002	53.66	5.80	52.183	0.078	0.0	0.0	0.0	1.24	49.5	14.4
S3.003	53.31	5.88	52.035	0.078	0.0	0.0	0.0	1.25	49.5	14.4
S4.000	57.07	5.07	52.919	0.003	0.0	0.0	0.0	1.43	25.2	0.5
S4.001	56.47	5.19	52.807	0.049	0.0	0.0	0.0	1.43	25.2	9.5
S3.004	52.10	6.17	51.980	0.163	0.0	0.0	0.0	1.59	63.1	29.1
S1.008	49.97	6.71	51.505	0.458	0.0	0.0	0.0	1.29	90.9	78.6
S5.000	57.02	5.08	52.584	0.018	0.0	0.0	0.0	1.09	19.2	3.5
S6.000	57.16	5.05	52.513	0.016	0.0	0.0	0.0	1.56	27.6	3.2
S1.009	49.85	6.75	51.429	0.493	0.0	0.0	0.0	3.21	227.0	84.3
S7.000	55.59	5.38	52.345	0.037	0.0	0.0	0.0	1.43	101.4	7.0
S7.001	55.14	5.47	52.076	0.110	0.0	0.0	0.0	1.43	101.4	20.8

Network Design Table for Storm - Surface Water Main Site

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.002	29.004	0.789	36.8	0.039	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	20.761	0.104	200.0	0.027	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.000	9.306	0.186	50.0	0.062	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.011	6.347	0.032	198.3	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	19.160	0.096	199.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.013	28.013	0.140	200.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	3.536	0.018	196.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.002	54.29	5.66	51.957	0.149	0.0	0.0	0.0	2.60	183.9	27.7
S1.010	48.87	7.02	51.093	0.668	0.0	0.0	0.0	1.28	141.1	112.1
S8.000	56.86	5.11	51.900	0.062	0.0	0.0	0.0	1.43	25.2	12.2
S1.011	48.47	7.13	50.989	0.752	0.0	0.0	0.0	0.92	36.8«	125.0
S1.012	47.29	7.48	50.957	0.752	0.0	0.0	0.0	0.92	36.7«	125.0
S1.013	45.69	7.98	50.861	0.752	0.0	0.0	0.0	0.92	36.6«	125.0
S1.014	45.49	8.05	50.724	0.752	0.0	0.0	0.0	0.93	36.9«	125.0

Free Flowing Outfall Details for Storm - Surface Water Main Site

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.014	SOutfall A	53.570	50.706	0.000	0	0

Simulation Criteria for Storm - Surface Water Main Site

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013

Synthetic Rainfall Details

Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm - Surface Water Main Site

Hydro-Brake® Optimum Manhole: S26, DS/PN: S1.011, Volume (m³): 12.1

Unit Reference	MD-SHE-0165-1560-1850-1560
Design Head (m)	1.850
Design Flow (l/s)	15.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	165
Invert Level (m)	50.989
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.850	15.6	Kick-Flo®	1.139	12.4
Flush-Flo™	0.535	15.6	Mean Flow over Head Range	-	13.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.9	1.200	12.7	3.000	19.6	7.000	29.5
0.200	13.4	1.400	13.7	3.500	21.1	7.500	30.5
0.300	14.7	1.600	14.5	4.000	22.5	8.000	31.4
0.400	15.4	1.800	15.4	4.500	23.8	8.500	32.4
0.500	15.6	2.000	16.2	5.000	25.1	9.000	33.3
0.600	15.6	2.200	16.9	5.500	26.2	9.500	34.1
0.800	15.1	2.400	17.6	6.000	27.3		
1.000	14.0	2.600	18.3	6.500	28.4		

Storage Structures for Storm - Surface Water Main Site

Cellular Storage Manhole: S24, DS/PN: S1.010

Invert Level (m) 51.093 Safety Factor 10.0
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 (m²)	Inf. Area (m²)
0.000	200.0	0.0	1.876	0.0	0.0
1.875	200.0	0.0			

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	2	+0%	30/15 Summer	100/15 Winter			52.534
S1.001	S2	15 Winter	2	+0%	30/15 Summer				52.417
S1.002	S3	15 Winter	2	+0%	30/15 Summer				52.313
S1.003	S4	15 Winter	2	+0%	30/15 Summer				52.112
S2.000	S5	15 Winter	2	+0%	30/15 Summer				52.808
S2.001	S6	15 Winter	2	+0%	30/15 Summer				52.429
S1.004	S7	15 Winter	2	+0%	30/15 Summer				52.048
S1.005	S7A	15 Winter	2	+0%	30/15 Summer				51.946
S1.006	S8	15 Winter	2	+0%	30/15 Summer				51.849
S1.007	S9	15 Winter	2	+0%	30/15 Summer				51.738
S3.000	S10	15 Winter	2	+0%	30/15 Winter				52.689
S3.001	S11	15 Winter	2	+0%	30/15 Summer				52.413
S3.002	S12	15 Winter	2	+0%	30/15 Summer				52.257
S3.003	S13	15 Winter	2	+0%	30/15 Summer				52.121
S4.000	S14	15 Winter	2	+0%	100/15 Summer				52.932
S4.001	S15	15 Winter	2	+0%	30/15 Summer				52.859
S3.004	S16	15 Winter	2	+0%	30/15 Summer				52.072
S1.008	S17	15 Winter	2	+0%	30/15 Summer				51.712
S5.000	S18	15 Winter	2	+0%	100/120 Winter				52.626
S6.000	S19	15 Winter	2	+0%	100/60 Winter				52.547
S1.009	S20	15 Winter	2	+0%	30/15 Summer				51.574

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.179	0.000	0.09			3.9	OK	1
S1.001	S2	-0.151	0.000	0.23			9.5	OK	
S1.002	S3	-0.139	0.000	0.31			12.2	OK	
S1.003	S4	-0.221	0.000	0.16			12.8	OK	
S2.000	S5	-0.170	0.000	0.13			9.6	OK	
S2.001	S6	-0.153	0.000	0.22			16.8	OK	
S1.004	S7	-0.138	0.000	0.57			31.5	OK	
S1.005	S7A	-0.165	0.000	0.42			31.4	OK	
S1.006	S8	-0.168	0.000	0.40			32.0	OK	
S1.007	S9	-0.131	0.000	0.55			34.9	OK	
S3.000	S10	-0.176	0.000	0.10			5.1	OK	
S3.001	S11	-0.154	0.000	0.22			9.9	OK	
S3.002	S12	-0.151	0.000	0.23			10.3	OK	
S3.003	S13	-0.139	0.000	0.31			10.3	OK	
S4.000	S14	-0.137	0.000	0.02			0.4	OK	
S4.001	S15	-0.097	0.000	0.26			6.0	OK	
S3.004	S16	-0.133	0.000	0.35			20.3	OK	
S1.008	S17	-0.093	0.000	0.82			56.4	OK	
S5.000	S18	-0.108	0.000	0.17			2.6	OK	
S6.000	S19	-0.116	0.000	0.11			2.3	OK	
S1.009	S20	-0.155	0.000	0.47			60.3	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S7.000	S21	15 Winter	2	+0%	100/60 Winter				52.391
S7.001	S22	15 Winter	2	+0%	100/15 Summer				52.170
S7.002	S23	15 Winter	2	+0%	30/120 Winter				52.024
S1.010	S24	120 Winter	2	+0%	30/15 Summer				51.358
S8.000	S25	15 Winter	2	+0%	30/15 Summer				51.966
S1.011	S26	120 Winter	2	+0%	2/15 Summer				51.352
S1.012	S27	120 Winter	2	+0%					51.061
S1.013	S28	120 Winter	2	+0%					50.963
S1.014	S29	120 Winter	2	+0%					50.844

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S7.000	S21	-0.254	0.000	0.06			5.2	OK	
S7.001	S22	-0.206	0.000	0.21			14.0	OK	
S7.002	S23	-0.233	0.000	0.11			18.7	OK	
S1.010	S24	-0.110	0.000	0.11		55	13.7	OK	
S8.000	S25	-0.084	0.000	0.40			8.9	OK	
S1.011	S26	0.138	0.000	0.51			14.5	SURCHARGED	
S1.012	S27	-0.121	0.000	0.44			14.5	OK	
S1.013	S28	-0.123	0.000	0.43			14.5	OK	
S1.014	S29	-0.105	0.000	0.56			14.5	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+40%	30/15 Summer	100/15 Winter			53.072
S1.001	S2	15 Winter	30	+40%	30/15 Summer				53.052
S1.002	S3	15 Winter	30	+40%	30/15 Summer				53.009
S1.003	S4	15 Winter	30	+40%	30/15 Summer				52.935
S2.000	S5	15 Winter	30	+40%	30/15 Summer				53.090
S2.001	S6	15 Winter	30	+40%	30/15 Summer				53.037
S1.004	S7	15 Winter	30	+40%	30/15 Summer				52.902
S1.005	S7A	15 Winter	30	+40%	30/15 Summer				52.794
S1.006	S8	15 Winter	30	+40%	30/15 Summer				52.682
S1.007	S9	15 Winter	30	+40%	30/15 Summer				52.519
S3.000	S10	15 Winter	30	+40%	30/15 Winter				52.933
S3.001	S11	15 Winter	30	+40%	30/15 Summer				52.898
S3.002	S12	15 Winter	30	+40%	30/15 Summer				52.842
S3.003	S13	15 Winter	30	+40%	30/15 Summer				52.782
S4.000	S14	15 Winter	30	+40%	100/15 Summer				53.001
S4.001	S15	15 Winter	30	+40%	30/15 Summer				52.999
S3.004	S16	15 Winter	30	+40%	30/15 Summer				52.752
S1.008	S17	15 Winter	30	+40%	30/15 Summer				52.383

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.359	0.000	0.27			11.3	SURCHARGED	1
S1.001	S2	0.484	0.000	0.66			27.2	SURCHARGED	
S1.002	S3	0.557	0.000	0.83			32.9	SURCHARGED	
S1.003	S4	0.602	0.000	0.41			33.6	SURCHARGED	
S2.000	S5	0.112	0.000	0.42			30.4	SURCHARGED	
S2.001	S6	0.455	0.000	0.68			51.9	SURCHARGED	
S1.004	S7	0.716	0.000	1.54			85.0	SURCHARGED	
S1.005	S7A	0.683	0.000	1.12			84.3	SURCHARGED	
S1.006	S8	0.665	0.000	1.06			84.4	SURCHARGED	
S1.007	S9	0.650	0.000	1.46			92.3	SURCHARGED	
S3.000	S10	0.068	0.000	0.36			17.5	SURCHARGED	
S3.001	S11	0.331	0.000	0.71			32.5	SURCHARGED	
S3.002	S12	0.434	0.000	0.63			27.8	SURCHARGED	
S3.003	S13	0.522	0.000	0.91			30.0	SURCHARGED	
S4.000	S14	-0.068	0.000	0.09			1.8	OK	
S4.001	S15	0.043	0.000	1.08			24.4	SURCHARGED	
S3.004	S16	0.547	0.000	1.00			58.5	SURCHARGED	
S1.008	S17	0.578	0.000	2.25			155.5	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S5.000	S18	15 Winter	30	+40%	100/120 Winter				52.668
S6.000	S19	15 Winter	30	+40%	100/60 Winter				52.578
S1.009	S20	120 Winter	30	+40%	30/15 Summer				52.313
S7.000	S21	15 Winter	30	+40%	100/60 Winter				52.435
S7.001	S22	120 Winter	30	+40%	100/15 Summer				52.312
S7.002	S23	120 Winter	30	+40%	30/120 Winter				52.311
S1.010	S24	120 Winter	30	+40%	30/15 Summer				52.308
S8.000	S25	120 Winter	30	+40%	30/15 Summer				52.308
S1.011	S26	120 Winter	30	+40%	2/15 Summer				52.314
S1.012	S27	240 Summer	30	+40%					51.065
S1.013	S28	240 Summer	30	+40%					50.968
S1.014	S29	360 Summer	30	+40%					50.850

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S5.000	S18	-0.066	0.000	0.59			8.9	OK	
S6.000	S19	-0.085	0.000	0.39			8.1	OK	
S1.009	S20	0.584	0.000	0.55			70.3	SURCHARGED	
S7.000	S21	-0.210	0.000	0.19			17.8	OK	
S7.001	S22	-0.064	0.000	0.27			17.5	OK	
S7.002	S23	0.054	0.000	0.14			23.7	SURCHARGED	
S1.010	S24	0.840	0.000	0.15			18.2	SURCHARGED	
S8.000	S25	0.258	0.000	0.44			9.9	SURCHARGED	
S1.011	S26	1.100	0.000	0.55			15.6	SURCHARGED	
S1.012	S27	-0.117	0.000	0.47			15.6	OK	
S1.013	S28	-0.118	0.000	0.46			15.6	OK	
S1.014	S29	-0.099	0.000	0.60			15.6	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 351500 240400 SO 51500 40400
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+40%	30/15 Summer	100/15 Winter			53.913
S1.001	S2	15 Winter	100	+40%	30/15 Summer				53.909
S1.002	S3	15 Winter	100	+40%	30/15 Summer				53.864
S1.003	S4	15 Winter	100	+40%	30/15 Summer				53.757
S2.000	S5	15 Winter	100	+40%	30/15 Summer				54.038
S2.001	S6	15 Winter	100	+40%	30/15 Summer				53.951
S1.004	S7	15 Winter	100	+40%	30/15 Summer				53.717
S1.005	S7A	15 Winter	100	+40%	30/15 Summer				53.547
S1.006	S8	15 Winter	100	+40%	30/15 Summer				53.375
S1.007	S9	15 Winter	100	+40%	30/15 Summer				53.135
S3.000	S10	15 Winter	100	+40%	30/15 Winter				53.772
S3.001	S11	15 Winter	100	+40%	30/15 Summer				53.724
S3.002	S12	15 Winter	100	+40%	30/15 Summer				53.629
S3.003	S13	15 Winter	100	+40%	30/15 Summer				53.532
S4.000	S14	15 Winter	100	+40%	100/15 Summer				53.623
S4.001	S15	15 Winter	100	+40%	30/15 Summer				53.623
S3.004	S16	15 Winter	100	+40%	30/15 Summer				53.473
S1.008	S17	15 Winter	100	+40%	30/15 Summer				52.940

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.200	0.321	0.33			14.1	FLOOD	1
S1.001	S2	1.341	0.000	0.76			31.5	FLOOD RISK	
S1.002	S3	1.412	0.000	0.98			39.0	SURCHARGED	
S1.003	S4	1.424	0.000	0.48			39.6	SURCHARGED	
S2.000	S5	1.060	0.000	0.48			34.5	FLOOD RISK	
S2.001	S6	1.369	0.000	0.84			64.2	FLOOD RISK	
S1.004	S7	1.531	0.000	1.90			104.9	SURCHARGED	
S1.005	S7A	1.436	0.000	1.36			102.4	SURCHARGED	
S1.006	S8	1.358	0.000	1.29			103.3	SURCHARGED	
S1.007	S9	1.266	0.000	1.78			112.2	SURCHARGED	
S3.000	S10	0.907	0.000	0.41			20.0	SURCHARGED	
S3.001	S11	1.157	0.000	0.85			38.9	SURCHARGED	
S3.002	S12	1.221	0.000	0.83			36.5	SURCHARGED	
S3.003	S13	1.272	0.000	1.09			35.9	SURCHARGED	
S4.000	S14	0.554	0.000	0.20			4.1	SURCHARGED	
S4.001	S15	0.667	0.000	1.28			28.8	SURCHARGED	
S3.004	S16	1.268	0.000	1.18			69.0	SURCHARGED	
S1.008	S17	1.135	0.000	2.69			185.7	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - Surface Water Main Site

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S5.000	S18	120 Winter	100	+40%	100/120 Winter				52.850
S6.000	S19	120 Winter	100	+40%	100/60 Winter				52.850
S1.009	S20	120 Winter	100	+40%	30/15 Summer				52.849
S7.000	S21	120 Winter	100	+40%	100/60 Winter				52.850
S7.001	S22	120 Winter	100	+40%	100/15 Summer				52.849
S7.002	S23	120 Winter	100	+40%	30/120 Winter				52.847
S1.010	S24	120 Winter	100	+40%	30/15 Summer				52.844
S8.000	S25	120 Winter	100	+40%	30/15 Summer				52.842
S1.011	S26	120 Winter	100	+40%	2/15 Summer				52.850
S1.012	S27	120 Winter	100	+40%					51.065
S1.013	S28	240 Summer	100	+40%					50.968
S1.014	S29	360 Summer	100	+40%					50.850

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S5.000	S18	0.116	0.000	0.26			4.0	SURCHARGED	
S6.000	S19	0.187	0.000	0.18			3.6	SURCHARGED	
S1.009	S20	1.120	0.000	0.72			91.6	SURCHARGED	
S7.000	S21	0.205	0.000	0.09			8.1	SURCHARGED	
S7.001	S22	0.473	0.000	0.37			24.4	SURCHARGED	
S7.002	S23	0.590	0.000	0.20			32.8	SURCHARGED	
S1.010	S24	1.376	0.000	0.15			17.3	SURCHARGED	
S8.000	S25	0.792	0.000	0.60			13.4	SURCHARGED	
S1.011	S26	1.636	0.000	0.55			15.6	SURCHARGED	
S1.012	S27	-0.117	0.000	0.47			15.6	OK	
S1.013	S28	-0.118	0.000	0.46			15.6	OK	
S1.014	S29	-0.099	0.000	0.60			15.6	OK	