

Wilde Consultants		Page 1
Brindley Lodge Adcroft Street, Stockport Cheshire, SK1 3HS	LSHTM Tavistock Place Existing SW drainage system	
Date 08-Oct-18 9:18 AM File EX_SW_30CC_1M SURCHARGE...	Designed by EMT Checked by RLG	
Innovyze	Network 2018.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	20.600	Add Flow / Climate Change (%)	0
Ratio R	0.437	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.263	4-8	0.007

Total Area Contributing (ha) = 0.270

Total Pipe Volume (m³) = 1.193

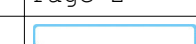
Network Design Table for Storm

« - 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
1.000	5.000	0.050	100.0	0.133	2.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	9.500	0.317	30.0	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	8.000	0.460	17.4	0.103	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	7.500	0.037	202.7	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)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	2.06	21.087	0.133	0.0	0.0	0.0	1.31	52.0	18.0
1.001	50.00	2.13	21.037	0.167	0.0	0.0	0.0	2.40	95.4	22.6
1.002	50.00	2.17	20.720	0.270	0.0	0.0	0.0	3.15	125.4	36.6
1.003	50.00	2.31	20.260	0.270	0.0	0.0	0.0	0.91	36.4«	36.6

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	Pipe Out PN Invert Level (m)	Pipes In Diameter (mm)	Pipes In PN Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
1	23.110	2.023	Open Manhole	1200	1.000	21.087	225		
2	23.110	2.073	Open Manhole	1200	1.001	21.037	225	1.000	21.037
3	21.500	0.780	Open Manhole	1200	1.002	20.720	225	1.001	20.720
4	21.500	1.240	Open Manhole	1200	1.003	20.260	225	1.002	20.260
	24.400	4.177	Open Manhole	1200		OUTFALL		1.003	20.223

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	23.110	21.087	1.798	Open Manhole	1200
1.001	o	225	2	23.110	21.037	1.848	Open Manhole	1200
1.002	o	225	3	21.500	20.720	0.555	Open Manhole	1200
1.003	o	225	4	21.500	20.260	1.015	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	5.000	100.0	2	23.110	21.037	1.848	Open Manhole	1200
1.001	9.500	30.0	3	21.500	20.720	0.555	Open Manhole	1200
1.002	8.000	17.4	4	21.500	20.260	1.015	Open Manhole	1200
1.003	7.500	202.7		24.400	20.223	3.952	Open Manhole	1200

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Network Classifications for Storm

PN	USMH	Pipe	Min Cover	Max Cover	Pipe Type	MH	MH	MH Ring	MH Type
	Name	Dia	Depth	Depth		Dia	Width	Depth	
		(mm)	(m)	(m)		(mm)	(mm)	(m)	
1.000	1	225	1.798	1.848	Unclassified	1200	0	1.798	Unclassified
1.001	2	225	0.555	1.848	Unclassified	1200	0	1.848	Unclassified
1.002	3	225	0.555	1.015	Unclassified	1200	0	0.555	Unclassified
1.003	4	225	1.015	3.952	Unclassified	1200	0	1.015	Unclassified

Surcharged Outfall Details for Storm

Outfall	Outfall C. Level	I. Level	Min	D,L	W
Pipe Number	Name	(m)	(m)	I. Level (mm)	(mm)
				(m)	

1.003 24.400 20.223 21.223 1200 0

Datum (m) 20.223 Offset (mins) 0

Time	Depth	Time	Depth	Time	Depth	Time	Depth	Time	Depth	Time	Depth
(mins)	(m)	(mins)	(m)	(mins)	(m)	(mins)	(m)	(mins)	(m)	(mins)	(m)
60	1.000	1800	1.000	3540	1.000	5280	1.000	7020	1.000	8760	1.000
120	1.000	1860	1.000	3600	1.000	5340	1.000	7080	1.000	8820	1.000
180	1.000	1920	1.000	3660	1.000	5400	1.000	7140	1.000	8880	1.000
240	1.000	1980	1.000	3720	1.000	5460	1.000	7200	1.000	8940	1.000
300	1.000	2040	1.000	3780	1.000	5520	1.000	7260	1.000	9000	1.000
360	1.000	2100	1.000	3840	1.000	5580	1.000	7320	1.000	9060	1.000
420	1.000	2160	1.000	3900	1.000	5640	1.000	7380	1.000	9120	1.000
480	1.000	2220	1.000	3960	1.000	5700	1.000	7440	1.000	9180	1.000
540	1.000	2280	1.000	4020	1.000	5760	1.000	7500	1.000	9240	1.000
600	1.000	2340	1.000	4080	1.000	5820	1.000	7560	1.000	9300	1.000
660	1.000	2400	1.000	4140	1.000	5880	1.000	7620	1.000	9360	1.000
720	1.000	2460	1.000	4200	1.000	5940	1.000	7680	1.000	9420	1.000
780	1.000	2520	1.000	4260	1.000	6000	1.000	7740	1.000	9480	1.000
840	1.000	2580	1.000	4320	1.000	6060	1.000	7800	1.000	9540	1.000
900	1.000	2640	1.000	4380	1.000	6120	1.000	7860	1.000	9600	1.000
960	1.000	2700	1.000	4440	1.000	6180	1.000	7920	1.000	9660	1.000
1020	1.000	2760	1.000	4500	1.000	6240	1.000	7980	1.000	9720	1.000
1080	1.000	2820	1.000	4560	1.000	6300	1.000	8040	1.000	9780	1.000
1140	1.000	2880	1.000	4620	1.000	6360	1.000	8100	1.000	9840	1.000
1200	1.000	2940	1.000	4680	1.000	6420	1.000	8160	1.000	9900	1.000
1260	1.000	3000	1.000	4740	1.000	6480	1.000	8220	1.000	9960	1.000
1320	1.000	3060	1.000	4800	1.000	6540	1.000	8280	1.000	10020	1.000
1380	1.000	3120	1.000	4860	1.000	6600	1.000	8340	1.000	10080	1.000
1440	1.000	3180	1.000	4920	1.000	6660	1.000	8400	1.000	10140	1.000
1500	1.000	3240	1.000	4980	1.000	6720	1.000	8460	1.000	10200	1.000
1560	1.000	3300	1.000	5040	1.000	6780	1.000	8520	1.000	10260	1.000
1620	1.000	3360	1.000	5100	1.000	6840	1.000	8580	1.000	10320	1.000
1680	1.000	3420	1.000	5160	1.000	6900	1.000	8640	1.000	10380	1.000
1740	1.000	3480	1.000	5220	1.000	6960	1.000	8700	1.000	10440	1.000

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Innovyze	Network 2018.1.1	

Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
10500	1.000	12120	1.000	13740	1.000	15360	1.000	16980	1.000	18600	1.000
10560	1.000	12180	1.000	13800	1.000	15420	1.000	17040	1.000	18660	1.000
10620	1.000	12240	1.000	13860	1.000	15480	1.000	17100	1.000	18720	1.000
10680	1.000	12300	1.000	13920	1.000	15540	1.000	17160	1.000	18780	1.000
10740	1.000	12360	1.000	13980	1.000	15600	1.000	17220	1.000	18840	1.000
10800	1.000	12420	1.000	14040	1.000	15660	1.000	17280	1.000	18900	1.000
10860	1.000	12480	1.000	14100	1.000	15720	1.000	17340	1.000	18960	1.000
10920	1.000	12540	1.000	14160	1.000	15780	1.000	17400	1.000	19020	1.000
10980	1.000	12600	1.000	14220	1.000	15840	1.000	17460	1.000	19080	1.000
11040	1.000	12660	1.000	14280	1.000	15900	1.000	17520	1.000	19140	1.000
11100	1.000	12720	1.000	14340	1.000	15960	1.000	17580	1.000	19200	1.000
11160	1.000	12780	1.000	14400	1.000	16020	1.000	17640	1.000	19260	1.000
11220	1.000	12840	1.000	14460	1.000	16080	1.000	17700	1.000	19320	1.000
11280	1.000	12900	1.000	14520	1.000	16140	1.000	17760	1.000	19380	1.000
11340	1.000	12960	1.000	14580	1.000	16200	1.000	17820	1.000	19440	1.000
11400	1.000	13020	1.000	14640	1.000	16260	1.000	17880	1.000	19500	1.000
11460	1.000	13080	1.000	14700	1.000	16320	1.000	17940	1.000	19560	1.000
11520	1.000	13140	1.000	14760	1.000	16380	1.000	18000	1.000	19620	1.000
11580	1.000	13200	1.000	14820	1.000	16440	1.000	18060	1.000	19680	1.000
11640	1.000	13260	1.000	14880	1.000	16500	1.000	18120	1.000	19740	1.000
11700	1.000	13320	1.000	14940	1.000	16560	1.000	18180	1.000	19800	1.000
11760	1.000	13380	1.000	15000	1.000	16620	1.000	18240	1.000	19860	1.000
11820	1.000	13440	1.000	15060	1.000	16680	1.000	18300	1.000	19920	1.000
11880	1.000	13500	1.000	15120	1.000	16740	1.000	18360	1.000	19980	1.000
11940	1.000	13560	1.000	15180	1.000	16800	1.000	18420	1.000	20040	1.000
12000	1.000	13620	1.000	15240	1.000	16860	1.000	18480	1.000	20100	1.000
12060	1.000	13680	1.000	15300	1.000	16920	1.000	18540	1.000	20160	1.000

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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 Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	30
Ratio R	0.437		

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Date 08-Oct-18 9:18 AM File EX_SW_30CC_1M SURCHARGE...	Designed by EMT Checked by RLG																
Innovyze Network 2018.1.1																	
<u>Manhole Headloss for Storm</u> <table> <thead> <tr> <th>PN</th> <th>US/MH Name</th> <th>US/MH Headloss</th> </tr> </thead> <tbody> <tr> <td>1.000</td> <td>1</td> <td>0.500</td> </tr> <tr> <td>1.001</td> <td>2</td> <td>0.500</td> </tr> <tr> <td>1.002</td> <td>3</td> <td>0.500</td> </tr> <tr> <td>1.003</td> <td>4</td> <td>0.500</td> </tr> </tbody> </table>			PN	US/MH Name	US/MH Headloss	1.000	1	0.500	1.001	2	0.500	1.002	3	0.500	1.003	4	0.500
PN	US/MH Name	US/MH Headloss															
1.000	1	0.500															
1.001	2	0.500															
1.002	3	0.500															
1.003	4	0.500															
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Brindley Lodge	LSHTM	
Adcroft Street, Stockport	Tavistock Place	
Cheshire, SK1 3HS	Existing SW drainage system	
Date 08-Oct-18 9:19 AM	Designed by EMT	
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Innovyze	Network 2018.1.1	

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

Simulation Criteria

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

Synthetic Rainfall Details

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	30, 30, 30

									Water
PN	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow
	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.
1.000	1	120	Summer	1	+30%	1/15	Summer		
1.001	2	120	Summer	1	+30%	1/120	Summer		
1.002	3	120	Summer	1	+30%	1/60	Summer	30/15	Summer
1.003	4	120	Summer	1	+30%	1/15	Summer		

PN	US/MH	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level
	Name	Depth (m)	Volume (m³)			Flow (l/s)		Exceeded
1.000	1	0.011	0.000	0.34		10.7	SURCHARGED	
1.001	2	0.053	0.000	0.17		13.1	SURCHARGED	
1.002	3	0.353	0.000	0.22		21.1	FLOOD RISK	11
1.003	4	0.789	0.000	0.73		21.2	FLOOD RISK	

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

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 Coefficient 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 Storage Structures 0
 Number of Online Controls 0 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.438
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 20.800 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 30, 30, 30

								Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Level (m)
1.000	1	15 Summer	30	+30%	1/15 Summer			22.159
1.001	2	15 Summer	30	+30%	1/120 Summer			21.885
1.002	3	15 Winter	30	+30%	1/60 Summer	30/15 Summer		21.504
1.003	4	120 Summer	30	+30%	1/15 Summer			21.352

		Surcharged		Flooded	Pipe		Level	
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Exceeded
1.000	1	0.847	0.000	2.16		68.1	SURCHARGED	
1.001	2	0.623	0.000	1.06		83.6	SURCHARGED	
1.002	3	0.559	3.558	1.08		102.9	FLOOD	11
1.003	4	0.867	0.000	1.75		50.6	FLOOD RISK	

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

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 Coefficient 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 Storage Structures 0
 Number of Online Controls 0 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.438
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 20.800 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 30, 30, 30

										Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	
1.000	1	15 Summer	100	+30%	1/15 Summer				22.723	
1.001	2	15 Summer	100	+30%	1/120 Summer				22.212	
1.002	3	15 Winter	100	+30%	1/60 Summer	30/15 Summer			21.514	
1.003	4	120 Summer	100	+30%	1/15 Summer				21.355	

		<u>Surcharged</u>		<u>Flooded</u>		<u>Pipe</u>			
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded	
1.000	1	1.411	0.000	2.79		87.9	SURCHARGED		
1.001	2	0.950	0.000	1.45		114.6	SURCHARGED		
1.002	3	0.569	13.611	1.08		103.4	FLOOD	11	
1.003	4	0.870	0.000	1.77		51.2	FLOOD RISK		

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Brindley Lodge Adcroft Street, Stockport Cheshire, SK1 3HS	LSHTM Tavistock Place Existing SW drainage system	
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Innovyze	Network 2018.1.1	

Summary Wizard of 360 minute 100 year Summer I+30% for Storm

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 Coefficient 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 Storage Structures 0
 Number of Online Controls 0 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.438
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 20.800 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 30, 30, 30

PN	US/MH Name	Storm Rank	Water		Surcharged		Flooded		Pipe	Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		
1.000	1	21	21.380	0.068	0.000	0.47		14.7	SURCHARGED	
1.001	2	21	21.369	0.107	0.000	0.23		18.5	SURCHARGED	
1.002	3	20	21.345	0.400	0.000	0.31		29.9	FLOOD RISK	
1.003	4	10	21.294	0.809	0.000	1.04		29.9	FLOOD RISK	

Wilde Consultants		Page 1
Brindley Lodge Adcroft Street, Stockport Cheshire, SK1 3HS	LSHTM Tavistock Place Existing SW drainage system	
Date 08-Oct-18 9:20 AM File EX_SW_30CC_1M SURCHARGE...	Designed by EMT Checked by RLG	
Innovyze	Network 2018.1.1	

Summary Wizard of 360 minute 100 year Winter I+30% for Storm

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 Coefficient 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 Storage Structures 0
 Number of Online Controls 0 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.438
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 20.800 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 30, 30, 30

PN	US/MH Name	Storm Rank	Water		Surcharged		Flooded		Pipe	Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		
1.000	1	28	21.324	0.012	0.000	0.34		10.6	SURCHARGED	
1.001	2	27	21.316	0.054	0.000	0.17		13.3	SURCHARGED	
1.002	3	27	21.299	0.354	0.000	0.23		21.5	FLOOD RISK	
1.003	4	16	21.275	0.790	0.000	0.75		21.5	FLOOD RISK	