WML CONSULTING
Civil, Structural and Geotechnical Engineers

Surface Water Drainage Calculations

For a site referred to as

Glendene, Wythenshawe

Undertaken on behalf of

Garden City Design & Build Ltd.

Job No: 9003

Document No: 9003-WML-00-XX-CA-C-0001

Date: October 2022

Project No. & Name:	9003 – Glendene, Wythenshawe	Status:	Prepared by:	Rev:	Date:
Document Ref:	9003-WML-00-XX-CA-C-0001	Preliminary	Daniel Baker	P04	October 2022

General Notes

1. The calculations within this document have been undertaken using MicroDrainage Software version 2020.

2. This document is to be read in conjunction with the following documents;

    a. 9003-WML-ZZ-XX-DR-C-1001 - 1005 – Proposed Drainage GAs
    b. 9003-WML-ZZ-XX-RP-C-1001 – Drainage Strategy Document

Summary of Results

3. The following summary demonstrates that the outgoing flow rates for the new development works are less than or equal to those of the pre-development site.

4. The existing site comprises a combination of Greenfield and Brownfield areas as shown within appendix 01 below.

5. Greenfield Areas have been calculated using MicoDrainage Software version 2020 whilst the existing Brownfield flow rate has been calculated using a 50mm/Hr rainfall intensity as noted within the drainage strategy.

Existing		
Greenfield Runoff Rate (l/s)	Brownfield Runoff Rate (l/s)	Proposed Site Runoff Rate - Total (l/s)
Q1: 4.3 Q30: 8.3 Q100: 10.2	72.9 36.4 - Allowable (50% reduction)	4.3 +36.4 = 40.7

Proposed				
Proposed Site Runoff Rate - South (l/s)	Proposed Site Runoff Rate - North (l/s)	Actual Site Runoff Rate - South (l/s)	Actual Site Runoff Rate - North (l/s)	Actual Site Runoff Rate - Total (l/s)
7.5	32.5	7.6	32.4	40.0

6. The following calculations are associated with the adoptable drainage only and don't take into account the extensive private drainage network which will provide an additional storage volume and further reduce the risk of flooding.

Existing Site Area Plan

LEGEND

EXISTING BROWNFIELD AREA: 5,249m²

EXISTING GREENFIELD AREA: 8,909m²

Greenfield Runoff Assessment

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.891	Urban	0.000
SAAR (mm)	849	Region Number	Region 10

Results	**l/s**
QBAR Rural	4.9
QBAR Urban	4.9
Q100 years	10.2
Q1 year	4.3
Q30 years	8.3
Q100 years	10.2

©1982-2020 Innovyze

Proposed Surface Water Network
(South)

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)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	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

Network Design Table for Storm

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	25.500	0.085	300.0	0.041	5.00	0.0	0.600	o	600	Pipe/Conduit	
S2.000	7.000	0.030	233.3	0.056	5.00	0.0	0.600	o	600	Pipe/Conduit	
S1.001	42.000	0.140	300.0	0.034	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.002	2.981	0.035	85.2	0.061	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	6.009	0.560	10.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

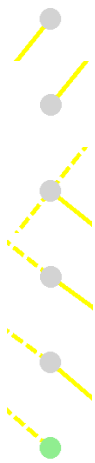
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.30	48.560	0.041	0.0	0.0	0.0	1.40	396.0	5.6
S2.000	50.00	5.07	48.510	0.056	0.0	0.0	0.0	1.59	449.5	7.6
S1.001	50.00	5.80	48.475	0.131	0.0	0.0	0.0	1.40	396.0	17.7
S1.002	50.00	5.83	48.335	0.192	0.0	0.0	0.0	1.70	120.5	26.0
S1.003	50.00	5.85	48.300	0.192	0.0	0.0	0.0	4.83	341.1	26.0

©1982-2020 Innovyze

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	50.760	2.200	Open Manhole	2400	S1.000	48.560	600				
S2	51.710	3.200	Open Manhole	2400	S2.000	48.510	600				
S3	51.510	3.035	Open Manhole	2400	S1.001	48.475	600	S1.000	48.475	600	
								S2.000	48.480	600	5
S4	52.230	3.895	Open Manhole	2400	S1.002	48.335	300	S1.001	48.335	600	
S-C1	52.330	4.030	Open Manhole	1350	S1.003	48.300	300	S1.002	48.300	300	
S	52.390	4.650	Open Manhole	0		OUTFALL		S1.003	47.740	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	381041.161	387651.001	381041.161	387651.001	Required	
S2	381020.730	387625.726	381020.730	387625.726	Required	
S3	381025.130	387631.170	381025.130	387631.170	Required	
S4	381058.049	387605.086	381058.049	387605.086	Required	
S-C1	381060.462	387603.335	381060.462	387603.335	Required	
S	381065.026	387599.426			No Entry	



©1982-2020 Innovyze

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)
S1.000	o	600	S1	50.760	48.560	1.600	Open Manhole	2400
S2.000	o	600	S2	51.710	48.510	2.600	Open Manhole	2400
S1.001	o	600	S3	51.510	48.475	2.435	Open Manhole	2400
S1.002	o	300	S4	52.230	48.335	3.595	Open Manhole	2400
S1.003	o	300	S-C1	52.330	48.300	3.730	Open Manhole	1350

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)
S1.000	25.500	300.0	S3	51.510	48.475	2.435	Open Manhole	2400
S2.000	7.000	233.3	S3	51.510	48.480	2.430	Open Manhole	2400
S1.001	42.000	300.0	S4	52.230	48.335	3.295	Open Manhole	2400
S1.002	2.981	85.2	S-C1	52.330	48.300	3.730	Open Manhole	1350
S1.003	6.009	10.7	S	52.390	47.740	4.350	Open Manhole	0

©1982-2020 Innovyze

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.041	0.041	0.041
2.000	-	-	100	0.056	0.056	0.056
1.001	-	-	100	0.034	0.034	0.034
1.002	-	-	100	0.061	0.061	0.061
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.192	0.192	0.192

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	52.390	47.740	0.000	0	0

Simulation Criteria for Storm

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 Storage Structures	0
Number of Online Controls	1	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)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

©1982-2020 Innovyze

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S4, DS/PN: S1.002, Volume (m³): 28.8

Unit Reference	MD-SHE-0110-7500-2200-7500
Design Head (m)	2.200
Design Flow (l/s)	7.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	48.335
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.200	7.5
Flush-Flo™	0.486	6.5
Kick-Flo®	0.988	5.2
Mean Flow over Head Range	-	6.0

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	3.8	1.200	5.6	3.000	8.7	7.000	13.0
0.200	5.7	1.400	6.1	3.500	9.3	7.500	13.4
0.300	6.2	1.600	6.5	4.000	9.9	8.000	13.8
0.400	6.4	1.800	6.8	4.500	10.5	8.500	14.2
0.500	6.5	2.000	7.2	5.000	11.1	9.000	14.6
0.600	6.4	2.200	7.5	5.500	11.6	9.500	15.0
0.800	6.1	2.400	7.8	6.000	12.1		
1.000	5.2	2.600	8.1	6.500	12.5		

©1982-2020 Innovyze

2 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 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 Storage Structures 0
Number of Online Controls 1 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 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 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) 2, 30, 100
Climate Change (%) 0, 0, 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	30 Winter	2	+0%	100/15 Summer				48.686
S2.000	S2	30 Winter	2	+0%	100/15 Summer				48.686
S1.001	S3	30 Winter	2	+0%	100/15 Summer				48.685
S1.002	S4	30 Winter	2	+0%	2/15 Summer				48.684
S1.003	S-C1	30 Winter	2	+0%					48.336

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	-0.474	0.000	0.01			4.6	OK	
S2.000	S2	-0.424	0.000	0.02			5.8	OK	
S1.001	S3	-0.390	0.000	0.03			10.5	OK	
S1.002	S4	0.049	0.000	0.10			6.3	SURCHARGED	
S1.003	S-C1	-0.264	0.000	0.03			6.3	OK	

©1982-2020 Innovyze

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 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 Storage Structures 0
Number of Online Controls 1 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 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 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) 2, 30, 100
Climate Change (%) 0, 0, 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	60 Winter	30	+0%	100/15 Summer				48.977
S2.000	S2	60 Winter	30	+0%	100/15 Summer				48.977
S1.001	S3	60 Winter	30	+0%	100/15 Summer				48.977
S1.002	S4	60 Winter	30	+0%	2/15 Summer				48.974
S1.003	S-C1	60 Winter	30	+0%					48.336

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	-0.183	0.000	0.01			4.4	OK	
S2.000	S2	-0.133	0.000	0.03			6.8	OK	
S1.001	S3	-0.098	0.000	0.02			8.2	OK	
S1.002	S4	0.339	0.000	0.11			6.5	SURCHARGED	
S1.003	S-C1	-0.264	0.000	0.03			6.5	OK	

©1982-2020 Innovyze

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 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 Storage Structures 0
Number of Online Controls 1 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 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

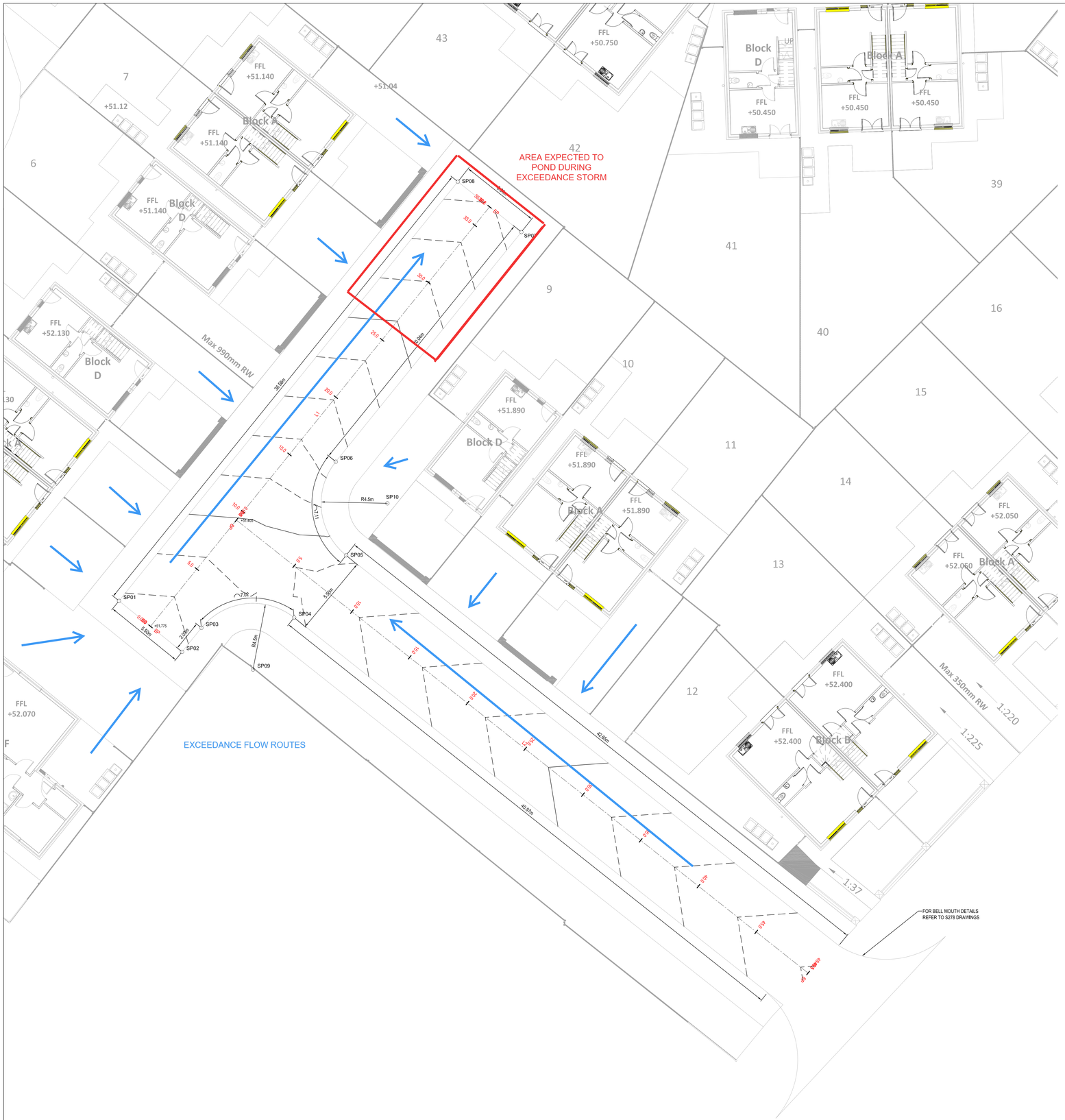
Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

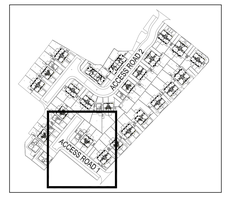
Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

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	120 Winter	100	+40%	100/15 Summer				50.608
S2.000	S2	120 Winter	100	+40%	100/15 Summer				50.608
S1.001	S3	120 Winter	100	+40%	100/15 Summer				50.608
S1.002	S4	120 Winter	100	+40%	2/15 Summer				50.607
S1.003	S-C1	120 Winter	100	+40%					48.339

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	1.448	0.000	0.01			4.4	FLOOD RISK	
S2.000	S2	1.498	0.000	0.03			7.0	SURCHARGED	
S1.001	S3	1.533	0.000	0.02			7.6	SURCHARGED	
S1.002	S4	1.972	0.000	0.12			7.6	SURCHARGED	
S1.003	S-C1	-0.261	0.000	0.04			7.6	OK	

©1982-2020 Innovyze





LOCATION PLAN

[SCALE 1:2000]

EXCEEDANCE FLOW ROUTES
SHEET 1

Proposed Surface Water Network
(North)

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)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	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

Network Design Table for Storm

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	10.000	0.100	100.0	0.132	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	9.000	0.025	360.0	0.042	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.002	9.000	0.025	360.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.003	36.000	0.080	450.0	0.039	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.004	11.601	0.030	386.7	0.142	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.005	10.396	0.020	519.8	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S2.000	46.000	0.225	204.4	0.050	5.00	0.0	0.600	o	600	Pipe/Conduit	
S2.001	8.139	0.040	203.5	0.059	0.00	0.0	0.600	o	750	Pipe/Conduit	
S2.002	22.530	0.075	300.4	0.011	0.00	0.0	0.600	o	750	Pipe/Conduit	
S2.003	5.004	0.020	250.2	0.039	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.006	8.991	0.020	449.6	0.028	0.00	0.0	0.600	o	900	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	46.31	5.13	47.400	0.132	0.0	0.0	0.0	1.31	52.0	16.6
S1.001	45.96	5.22	45.800	0.174	0.0	0.0	0.0	1.65	1046.8	21.7
S1.002	45.62	5.31	45.775	0.174	0.0	0.0	0.0	1.65	1046.8	21.7
S1.003	44.17	5.72	45.750	0.213	0.0	0.0	0.0	1.47	935.5	25.5
S1.004	43.76	5.84	45.670	0.355	0.0	0.0	0.0	1.59	1009.8	42.1
S1.005	43.34	5.97	45.640	0.355	0.0	0.0	0.0	1.37	869.9	42.1
S2.000	45.11	5.45	47.280	0.050	0.0	0.0	0.0	1.70	480.5	6.1
S2.001	44.86	5.52	46.055	0.109	0.0	0.0	0.0	1.96	865.1	13.2
S2.002	44.05	5.75	46.015	0.120	0.0	0.0	0.0	1.61	711.0	14.3
S2.003	43.86	5.81	45.940	0.159	0.0	0.0	0.0	1.53	434.0	18.9
S1.006	43.01	6.07	45.620	0.542	0.0	0.0	0.0	1.47	935.9	63.1

©1982-2020 Innovyze

Network Design Table for Storm

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
S1.007	3.417	0.050	68.3	0.009	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	4.992	0.330	15.1	0.000	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)
S1.007	42.91	6.10	45.600	0.551	0.0	0.0	0.0	1.90	134.6	64.0
S1.008	42.84	6.12	44.050	0.551	0.0	0.0	0.0	4.06	287.2	64.0

©1982-2020 Innovyze

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S5	50.235	2.835	Open Manhole	1200	S1.000	47.400	225				
S6	50.060	4.260	Open Manhole	2400	S1.001	45.800	900	S1.000	47.300	225	825
S7	49.905	4.130	Open Manhole	2400	S1.002	45.775	900	S1.001	45.775	900	
S8	49.750	4.000	Open Manhole	2400	S1.003	45.750	900	S1.002	45.750	900	
S9	48.970	3.300	Open Manhole	2400	S1.004	45.670	900	S1.003	45.670	900	
S10	48.620	2.980	Open Manhole	2400	S1.005	45.640	900	S1.004	45.640	900	
S11.7	50.200	2.920	Open Manhole	1500	S2.000	47.280	600				
S11.17	49.210	3.155	Open Manhole	1800	S2.001	46.055	750	S2.000	47.055	600	850
S11.21	47.860	1.845	Open Manhole	1800	S2.002	46.015	750	S2.001	46.015	750	
S11.29	47.860	1.920	Open Manhole	1800	S2.003	45.940	600	S2.002	45.940	750	
S11	48.200	2.580	Open Manhole	2400	S1.006	45.620	900	S1.005	45.620	900	
								S2.003	45.920	600	
S12	47.800	2.200	Open Manhole	2400	S1.007	45.600	300	S1.006	45.600	900	
S-C3	47.580	3.530	Open Manhole	1500	S1.008	44.050	300	S1.007	45.550	300	1500
S	47.395	3.675	Open Manhole	0		OUTFALL		S1.008	43.720	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S5	381049.420	387684.928	381049.420	387684.928	Required	
S6	381057.203	387678.650	381057.203	387678.650	Required	
S7	381065.859	387676.184	381065.859	387676.184	Required	
S8	381073.723	387680.560	381073.723	387680.560	Required	
S9	381096.322	387708.583	381096.322	387708.583	Required	
S10	381102.579	387718.352	381102.579	387718.352	Required	
S11.7	381104.901	387665.919	381104.901	387665.919	Required	

©1982-2020 Innovyze

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S11.17	381133.549	387701.909	381133.549	387701.909	Required	
S11.21	381131.880	387709.874	381131.880	387709.874	Required	
S11.29	381113.864	387723.403	381113.864	387723.403	Required	
S11	381109.599	387726.020	381109.599	387726.020	Required	
S12	381112.078	387734.662	381112.078	387734.662	Required	
S-C3	381113.196	387737.891	381113.196	387737.891	Required	
S	381116.024	387742.005			No Entry	

©1982-2020 Innovyze

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)
S1.000	o	225	S5	50.235	47.400	2.610	Open Manhole	1200
S1.001	o	900	S6	50.060	45.800	3.360	Open Manhole	2400
S1.002	o	900	S7	49.905	45.775	3.230	Open Manhole	2400
S1.003	o	900	S8	49.750	45.750	3.100	Open Manhole	2400
S1.004	o	900	S9	48.970	45.670	2.400	Open Manhole	2400
S1.005	o	900	S10	48.620	45.640	2.080	Open Manhole	2400
S2.000	o	600	S11.7	50.200	47.280	2.320	Open Manhole	1500
S2.001	o	750	S11.17	49.210	46.055	2.405	Open Manhole	1800
S2.002	o	750	S11.21	47.860	46.015	1.095	Open Manhole	1800
S2.003	o	600	S11.29	47.860	45.940	1.320	Open Manhole	1800
S1.006	o	900	S11	48.200	45.620	1.680	Open Manhole	2400
S1.007	o	300	S12	47.800	45.600	1.900	Open Manhole	2400
S1.008	o	300	S-C3	47.580	44.050	3.230	Open Manhole	1500

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)
S1.000	10.000	100.0	S6	50.060	47.300	2.535	Open Manhole	2400
S1.001	9.000	360.0	S7	49.905	45.775	3.230	Open Manhole	2400
S1.002	9.000	360.0	S8	49.750	45.750	3.100	Open Manhole	2400
S1.003	36.000	450.0	S9	48.970	45.670	2.400	Open Manhole	2400
S1.004	11.601	386.7	S10	48.620	45.640	2.080	Open Manhole	2400
S1.005	10.396	519.8	S11	48.200	45.620	1.680	Open Manhole	2400
S2.000	46.000	204.4	S11.17	49.210	47.055	1.555	Open Manhole	1800
S2.001	8.139	203.5	S11.21	47.860	46.015	1.095	Open Manhole	1800
S2.002	22.530	300.4	S11.29	47.860	45.940	1.170	Open Manhole	1800
S2.003	5.004	250.2	S11	48.200	45.920	1.680	Open Manhole	2400
S1.006	8.991	449.6	S12	47.800	45.600	1.300	Open Manhole	2400
S1.007	3.417	68.3	S-C3	47.580	45.550	1.730	Open Manhole	1500
S1.008	4.992	15.1	S	47.395	43.720	3.375	Open Manhole	0

©1982-2020 Innovyze

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.132	0.132	0.132
1.001	-	-	100	0.042	0.042	0.042
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.039	0.039	0.039
1.004	-	-	100	0.142	0.142	0.142
1.005	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.050	0.050	0.050
2.001	-	-	100	0.059	0.059	0.059
2.002	-	-	100	0.011	0.011	0.011
2.003	-	-	100	0.039	0.039	0.039
1.006	-	-	100	0.028	0.028	0.028
1.007	-	-	100	0.009	0.009	0.009
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.551	0.551	0.551

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	47.395	43.720	0.000	0	0

Simulation Criteria for Storm

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 Storage Structures	0
Number of Online Controls	2	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)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

©1982-2020 Innovyze

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S11.29, DS/PN: S2.003, Volume (m³): 14.0

Unit Reference	MD-SHE-0134-1000-1800-1000
Design Head (m)	1.800
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	134
Invert Level (m)	45.940
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	10.0
Flush-Flo™	0.525	10.0
Kick-Flo®	1.089	7.9
Mean Flow over Head Range	-	8.7

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	4.8	1.200	8.3	3.000	12.7	7.000	19.1
0.200	8.6	1.400	8.9	3.500	13.7	7.500	19.7
0.300	9.5	1.600	9.5	4.000	14.6	8.000	20.3
0.400	9.8	1.800	10.0	4.500	15.4	8.500	20.9
0.500	10.0	2.000	10.5	5.000	16.2	9.000	21.5
0.600	9.9	2.200	11.0	5.500	17.0	9.500	22.1
0.800	9.6	2.400	11.5	6.000	17.7		
1.000	8.7	2.600	11.9	6.500	18.4		

Hydro-Brake® Optimum Manhole: S12, DS/PN: S1.007, Volume (m³): 14.1

Unit Reference	MD-SHE-0231-3250-2000-3250
Design Head (m)	2.000
Design Flow (l/s)	32.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	231
Invert Level (m)	45.600
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

©1982-2020 Innovyze

Hydro-Brake® Optimum Manhole: S12, DS/PN: S1.007, Volume (m³): 14.1

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	32.5
Flush-Flo™	0.589	32.4
Kick-Flo®	1.275	26.2
Mean Flow over Head Range	-	28.1

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	7.7	1.200	28.0	3.000	39.5	7.000	59.5
0.200	23.2	1.400	27.4	3.500	42.5	7.500	61.5
0.300	30.1	1.600	29.2	4.000	45.4	8.000	63.5
0.400	31.6	1.800	30.9	4.500	48.0	8.500	65.4
0.500	32.3	2.000	32.5	5.000	50.5	9.000	67.2
0.600	32.4	2.200	34.0	5.500	52.9	9.500	69.0
0.800	31.9	2.400	35.5	6.000	55.2		
1.000	30.8	2.600	36.9	6.500	57.4		

©1982-2020 Innovyze

1 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 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 Storage Structures 0
Number of Online Controls 2 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 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 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 (%) 0, 0, 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	S5	15 Winter	1	+0%	100/15 Summer				47.495
S1.001	S6	15 Winter	1	+0%	100/15 Winter				45.927
S1.002	S7	15 Winter	1	+0%	100/15 Winter				45.912
S1.003	S8	15 Winter	1	+0%	100/15 Winter				45.908
S1.004	S9	15 Winter	1	+0%	100/15 Winter				45.903
S1.005	S10	15 Winter	1	+0%	100/15 Winter				45.901
S2.000	S11.7	15 Winter	1	+0%					47.322
S2.001	S11.17	15 Winter	1	+0%	100/15 Summer				46.194
S2.002	S11.21	15 Winter	1	+0%	100/15 Summer				46.194
S2.003	S11.29	15 Winter	1	+0%	30/15 Winter				46.193
S1.006	S11	15 Winter	1	+0%	100/15 Winter				45.898
S1.007	S12	15 Winter	1	+0%	30/15 Summer				45.894
S1.008	S-C3	15 Winter	1	+0%					44.142

©1982-2020 Innovyze

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

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	S5	-0.130	0.000	0.37			15.9	OK	
S1.001	S6	-0.773	0.000	0.04			19.6	OK	
S1.002	S7	-0.763	0.000	0.04			18.8	OK	
S1.003	S8	-0.742	0.000	0.03			20.9	OK	
S1.004	S9	-0.667	0.000	0.06			27.8	OK	
S1.005	S10	-0.639	0.000	0.07			24.4	OK	
S2.000	S11.7	-0.558	0.000	0.01			6.0	OK	
S2.001	S11.17	-0.611	0.000	0.02			11.2	OK	
S2.002	S11.21	-0.571	0.000	0.02			10.4	OK	
S2.003	S11.29	-0.347	0.000	0.04			9.1	OK	
S1.006	S11	-0.622	0.000	0.08			31.8	OK	
S1.007	S12	-0.006	0.000	0.49			30.0	OK	
S1.008	S-C3	-0.208	0.000	0.21			30.0	OK	

©1982-2020 Innovyze

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 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 Storage Structures 0
Number of Online Controls 2 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 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 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 (%) 0, 0, 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	S5	15 Winter	30	+0%	100/15 Summer				47.568
S1.001	S6	30 Winter	30	+0%	100/15 Winter				46.257
S1.002	S7	30 Winter	30	+0%	100/15 Winter				46.256
S1.003	S8	30 Winter	30	+0%	100/15 Winter				46.255
S1.004	S9	30 Winter	30	+0%	100/15 Winter				46.249
S1.005	S10	30 Winter	30	+0%	100/15 Winter				46.242
S2.000	S11.7	15 Winter	30	+0%					47.353
S2.001	S11.17	30 Winter	30	+0%	100/15 Summer				46.647
S2.002	S11.21	30 Winter	30	+0%	100/15 Summer				46.646
S2.003	S11.29	30 Winter	30	+0%	30/15 Winter				46.642
S1.006	S11	30 Winter	30	+0%	100/15 Winter				46.240
S1.007	S12	30 Winter	30	+0%	30/15 Summer				46.235
S1.008	S-C3	30 Winter	30	+0%					44.146

©1982-2020 Innovyze

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

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	S5	-0.057	0.000	0.90			38.8	OK	
S1.001	S6	-0.443	0.000	0.08			37.2	OK	
S1.002	S7	-0.419	0.000	0.06			29.8	OK	
S1.003	S8	-0.395	0.000	0.04			31.2	OK	
S1.004	S9	-0.321	0.000	0.08			40.3	OK	
S1.005	S10	-0.298	0.000	0.09			30.9	OK	
S2.000	S11.7	-0.527	0.000	0.03			14.5	OK	
S2.001	S11.17	-0.158	0.000	0.05			22.6	OK	
S2.002	S11.21	-0.119	0.000	0.04			18.1	OK	
S2.003	S11.29	0.102	0.000	0.05			9.8	SURCHARGED	
S1.006	S11	-0.280	0.000	0.10			37.5	OK	
S1.007	S12	0.335	0.000	0.53			32.4	SURCHARGED	
S1.008	S-C3	-0.204	0.000	0.23			32.4	OK	

©1982-2020 Innovyze

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 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 Storage Structures 0
Number of Online Controls 2 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 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 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 (%) 0, 0, 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	S5	15 Winter	100	+40%	100/15 Summer				47.788
S1.001	S6	60 Winter	100	+40%	100/15 Winter				47.439
S1.002	S7	60 Winter	100	+40%	100/15 Winter				47.439
S1.003	S8	60 Winter	100	+40%	100/15 Winter				47.438
S1.004	S9	60 Winter	100	+40%	100/15 Winter				47.437
S1.005	S10	60 Winter	100	+40%	100/15 Winter				47.436
S2.000	S11.7	60 Winter	100	+40%					47.711
S2.001	S11.17	60 Winter	100	+40%	100/15 Summer				47.709
S2.002	S11.21	60 Winter	100	+40%	100/15 Summer				47.708
S2.003	S11.29	60 Winter	100	+40%	30/15 Winter				47.709
S1.006	S11	60 Winter	100	+40%	100/15 Winter				47.435
S1.007	S12	60 Winter	100	+40%	30/15 Summer				47.433
S1.008	S-C3	60 Winter	100	+40%					44.146

©1982-2020 Innovyze

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

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	S5	0.163	0.000	1.61			69.7	SURCHARGED	
S1.001	S6	0.739	0.000	0.09			45.5	SURCHARGED	
S1.002	S7	0.764	0.000	0.07			36.3	SURCHARGED	
S1.003	S8	0.788	0.000	0.06			42.7	SURCHARGED	
S1.004	S9	0.867	0.000	0.10			49.8	SURCHARGED	
S1.005	S10	0.896	0.000	0.10			37.4	SURCHARGED	
S2.000	S11.7	-0.169	0.000	0.03			14.5	OK	
S2.001	S11.17	0.904	0.000	0.05			25.3	SURCHARGED	
S2.002	S11.21	0.943	0.000	0.04			18.7	FLOOD RISK	
S2.003	S11.29	1.169	0.000	0.05			10.0	FLOOD RISK	
S1.006	S11	0.915	0.000	0.11			42.1	SURCHARGED	
S1.007	S12	1.533	0.000	0.53			32.4	SURCHARGED	
S1.008	S-C3	-0.204	0.000	0.23			32.4	OK	

©1982-2020 Innovyze

GENERAL NOTES

1. DO NOT SCALE FROM THIS DRAWING WORK TO FIGURED DIMENSIONS ONLY.
2. NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS ALLOWED WITHOUT PRIOR PERMISSION IN WRITING.
3. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
4. THE CONTRACTOR SHALL INCORPORATE ALL THE REQUIREMENTS OF THE PRE-TENDER STAGE HEALTH & SAFETY PLAN.
5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH WML DRAWINGS;
   - 9003-WML-ZZ-XX-DR-C-1052
   - 9003-WML-ZZ-XX-DR-C-1054
   - 9003-WML-ZZ-XX-DR-C-1055
   - 9003-WML-ZZ-XX-DR-C-1056

EXCEEDANCE FLOW ROUTES SHEET 2