

JNM Engineering Limited		Page 0
14-16 High Street Ironbridge Shropshire, TF8 7AD	Drury Lane	
Date 09/11/2021 File drury lane.MDX	Designed by JJM Checked by	
Innovyze	Network 2017.1.2	

STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes DRURY LANE Manhole Sizes DRURY LANE

Designed with Level Soffits

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
1.000	14.439	0.144	100.3	0.040	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	11.763	0.118	100.0	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	11.537	0.115	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.003	24.412	0.244	100.0	0.025	0.00	0.0	0.600	o	150	Pipe/Conduit
1.004	4.000	0.040	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.005	10.076	0.101	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.006	14.714	0.147	100.0	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit
1.007	7.065	0.071	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.008	4.150	0.122	34.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
2.000	15.071	0.332	45.4	0.036	5.00	0.0	0.600	o	100	Pipe/Conduit

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.24	98.800	0.040	0.0	0.0	2.2	1.00	17.7	7.6
1.001	50.00	5.43	98.656	0.053	0.0	0.0	2.9	1.00	17.8	10.0
1.002	50.00	5.63	98.538	0.053	0.0	0.0	2.9	1.00	17.8	10.0
1.003	50.00	6.03	98.423	0.078	0.0	0.0	4.2	1.00	17.8	14.8
1.004	50.00	6.10	98.179	0.078	0.0	0.0	4.2	1.00	17.8	14.8
1.005	50.00	6.26	98.139	0.078	0.0	0.0	4.2	1.00	17.8	14.8
1.006	50.00	6.51	98.038	0.089	0.0	0.0	4.8	1.00	17.8	16.9
1.007	50.00	6.63	97.891	0.089	0.0	0.0	4.8	1.00	17.8	16.9
1.008	50.00	6.67	97.820	0.089	0.0	0.0	4.8	1.73	30.6	16.9
2.000	50.00	5.22	98.161	0.036	0.0	0.0	1.9	1.15	9.0	6.8

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Network Design Table for DRURY LANE.SWS

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
3.000	7.065	0.118	59.9	0.016	5.00	0.0	0.600	o	100	Pipe/Conduit
2.001	4.850	0.081	60.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
4.000	3.665	0.027	135.7	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
1.009	6.179	0.062	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.010	62.524	2.886	21.7	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)	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)
3.000	50.00	5.12	97.947	0.016	0.0	0.0	0.9	1.00	7.8	3.0
2.001	50.00	5.28	97.779	0.052	0.0	0.0	2.8	1.30	23.0	9.9
4.000	50.00	5.05	97.650	0.000	0.0	0.0	0.0	1.12	44.5	0.0
1.009	50.00	6.74	97.623	0.141	0.0	0.0	7.6	1.31	52.0	26.7
1.010	50.00	7.11	97.561	0.141	0.0	0.0	7.6	2.82	112.3	26.7

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Manhole Schedules for DRURY LANE.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	99.850	1.050	Open Manhole	1200	1.000	98.800	150				
2	99.850	1.194	Open Manhole	1200	1.001	98.656	150	1.000	98.656	150	
3	99.850	1.312	Open Manhole	1200	1.002	98.538	150	1.001	98.538	150	
4	99.850	1.427	Open Manhole	1200	1.003	98.423	150	1.002	98.423	150	
5	99.850	1.671	Open Manhole	1200	1.004	98.179	150	1.003	98.179	150	
6	99.850	1.711	Open Manhole	1200	1.005	98.139	150	1.004	98.139	150	
7	99.600	1.562	Open Manhole	1200	1.006	98.038	150	1.005	98.038	150	
8	99.600	1.709	Open Manhole	1200	1.007	97.891	150	1.006	97.891	150	
9	99.600	1.780	Open Manhole	1200	1.008	97.820	150	1.007	97.820	150	
13	99.350	1.189	Open Manhole	1200	2.000	98.161	100				
15	99.350	1.403	Open Manhole	1200	3.000	97.947	100				
14	99.350	1.571	Open Manhole	1200	2.001	97.779	150	2.000	97.829	100	
								3.000	97.829	100	
16	99.500	1.850	Open Manhole	1200	4.000	97.650	225				
10	99.500	1.877	Open Manhole	1200	1.009	97.623	225	1.008	97.698	150	
								2.001	97.698	150	
								4.000	97.623	225	
11	99.500	1.939	Open Manhole	1200	1.010	97.561	225	1.009	97.561	225	
12	95.350	0.675	Open Manhole	0		OUTFALL		1.010	94.675	225	

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PIPELINE SCHEDULES for DRURY LANE.SWS

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	150	1	99.850	98.800	0.900	Open Manhole	1200
1.001	o	150	2	99.850	98.656	1.044	Open Manhole	1200
1.002	o	150	3	99.850	98.538	1.162	Open Manhole	1200
1.003	o	150	4	99.850	98.423	1.277	Open Manhole	1200
1.004	o	150	5	99.850	98.179	1.521	Open Manhole	1200
1.005	o	150	6	99.850	98.139	1.561	Open Manhole	1200
1.006	o	150	7	99.600	98.038	1.412	Open Manhole	1200
1.007	o	150	8	99.600	97.891	1.559	Open Manhole	1200
1.008	o	150	9	99.600	97.820	1.630	Open Manhole	1200
2.000	o	100	13	99.350	98.161	1.089	Open Manhole	1200
3.000	o	100	15	99.350	97.947	1.303	Open Manhole	1200
2.001	o	150	14	99.350	97.779	1.421	Open Manhole	1200
4.000	o	225	16	99.500	97.650	1.625	Open Manhole	1200
1.009	o	225	10	99.500	97.623	1.652	Open Manhole	1200
1.010	o	225	11	99.500	97.561	1.714	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	14.439	100.3	2	99.850	98.656	1.044	Open Manhole	1200
1.001	11.763	100.0	3	99.850	98.538	1.162	Open Manhole	1200
1.002	11.537	100.0	4	99.850	98.423	1.277	Open Manhole	1200
1.003	24.412	100.0	5	99.850	98.179	1.521	Open Manhole	1200
1.004	4.000	100.0	6	99.850	98.139	1.561	Open Manhole	1200
1.005	10.076	100.0	7	99.600	98.038	1.412	Open Manhole	1200
1.006	14.714	100.0	8	99.600	97.891	1.559	Open Manhole	1200
1.007	7.065	100.0	9	99.600	97.820	1.630	Open Manhole	1200
1.008	4.150	34.0	10	99.500	97.698	1.652	Open Manhole	1200
2.000	15.071	45.4	14	99.350	97.829	1.421	Open Manhole	1200
3.000	7.065	59.9	14	99.350	97.829	1.421	Open Manhole	1200
2.001	4.850	60.0	10	99.500	97.698	1.652	Open Manhole	1200
4.000	3.665	135.7	10	99.500	97.623	1.652	Open Manhole	1200
1.009	6.179	100.0	11	99.500	97.561	1.714	Open Manhole	1200
1.010	62.524	21.7	12	95.350	94.675	0.450	Open Manhole	0

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Free Flowing Outfall Details for DRURY LANE.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.010	12	95.350	94.675	0.000	0	0

Simulation Criteria for DRURY LANE.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	480
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	4
Number of Input Hydrographs		0	Number of Storage Structures
Number of Online Controls		1	Number of Time/Area Diagrams
Number of Offline Controls		0	

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	240
Ratio R	0.371		

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Online Controls for DRURY LANE.SWS

Hydro-Brake® Optimum Manhole: 10, DS/PN: 1.009, Volume (m³): 2.3

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	97.623
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)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

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	1.5	1.200	2.0	3.000	3.0	7.000	4.5
0.200	1.7	1.400	2.1	3.500	3.3	7.500	4.7
0.300	1.8	1.600	2.3	4.000	3.5	8.000	4.8
0.400	1.7	1.800	2.4	4.500	3.7	8.500	5.0
0.500	1.6	2.000	2.5	5.000	3.9	9.000	5.1
0.600	1.5	2.200	2.6	5.500	4.0	9.500	5.2
0.800	1.7	2.400	2.7	6.000	4.2		
1.000	1.8	2.600	2.8	6.500	4.4		

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<u>Storage Structures for DRURY LANE.SWS</u> <u>Tank or Pond Manhole: 16, DS/PN: 4.000</u> Invert Level (m) 97.650 <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> </tr> </thead> <tbody> <tr> <td>0.000</td> <td>60.0</td> <td>1.000</td> <td>60.0</td> <td>1.001</td> <td>0.0</td> </tr> </tbody> </table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	60.0	1.000	60.0	1.001	0.0
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)									
0.000	60.0	1.000	60.0	1.001	0.0									
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Summary of Results for 240 minute 100 year Winter (DRURY LANE.SWS)

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

		Water	Surcharged	Flooded		Pipe	
PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s) Status
1.000	1	98.854	-0.096	0.000	0.28	4.6	OK
1.001	2	98.720	-0.086	0.000	0.38	6.1	OK
1.002	3	98.665	-0.023	0.000	0.38	6.1	OK
1.003	4	98.661	0.088	0.000	0.53	8.9	SURCHARGED
1.004	5	98.656	0.328	0.000	0.69	8.6	SURCHARGED
1.005	6	98.661	0.372	0.000	0.53	8.4	SURCHARGED
1.006	7	98.667	0.479	0.000	0.56	9.2	SURCHARGED
1.007	8	98.666	0.625	0.000	0.59	8.9	SURCHARGED
1.008	9	98.652	0.682	0.000	0.40	8.7	SURCHARGED
2.000	13	98.644	0.383	0.000	0.46	4.0	SURCHARGED
3.000	15	98.636	0.589	0.000	0.22	1.5	SURCHARGED
2.001	14	98.644	0.715	0.000	0.29	5.2	SURCHARGED
4.000	16	98.639	0.764	0.000	0.11	3.4	SURCHARGED
1.009	10	98.782	0.934	0.000	0.05	1.9	SURCHARGED
1.010	11	97.580	-0.207	0.000	0.02	1.8	OK