

The Alan Johnston Partnership		Page 0
1 Dale Street Liverpool L2 2ET	Queens Road Manchester 223-151	
Date 21/11/2023 14:15 File 223-151 INITIAL S.W CALC...	Designed by JPR Checked by JCM	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	10
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Network Design Table for 223-151 S.W NETWORK.SWS

Network Results Table

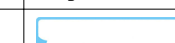
The Alan Johnston Partnership		Page 1
1 Dale Street Liverpool L2 2ET	Queens Road Manchester 223-151	
Date 21/11/2023 14:15	Designed by JPR	
File 223-151 INITIAL S.W CALC...	Checked by JCM	
XP Solutions	Network 2019.1	

Network Design Table for 223-151 S.W NETWORK.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	Auto Design
1.006	3.273	0.033	99.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	4.306	0.043	100.0	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)
1.006	50.00	6.07	60.108	0.129	0.0	0.0	1.7	1.31	52.2	19.2
1.007	50.00	6.12	60.075	0.129	0.0	0.0	1.7	1.31	52.0	19.2

The Alan Johnston Partnership		Page 2
1 Dale Street Liverpool L2 2ET	Queens Road Manchester 223-151	
Date 21/11/2023 14:15 File 223-151 INITIAL S.W CALC...	Designed by JPR Checked by JCM	
XP Solutions	Network 2019.1	

Manhole Schedules for 223-151 S.W NETWORK.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	62.205	0.905	Open Manhole	1200	1.000	61.300	150				
2	62.180	1.404	Open Manhole	1200	1.001	60.776	150	1.000	60.776	150	
3	62.016	1.413	Open Manhole	1200	1.002	60.603	150	1.001	60.603	150	
10	62.641	1.341	Open Manhole	1200	2.000	61.300	150				
11	63.496	2.727	Open Manhole	1200	2.001	60.769	150	2.000	60.769	150	
4	63.527	3.099	Open Manhole	1200	1.003	60.428	150	1.002	60.428	150	
								2.001	60.428	150	
5	63.848	3.531	Open Manhole	1200	1.004	60.317	225	1.003	60.392	150	
6	63.658	3.375	Open Manhole	1200	1.005	60.283	225	1.004	60.283	225	
7	62.978	2.870	Open Manhole	1200	1.006	60.108	225	1.005	60.108	225	
8	62.554	2.479	Open Manhole	1200	1.007	60.075	225	1.006	60.075	225	
9	62.218	2.186	Open Manhole	0		OUTFALL		1.007	60.032	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	385932.881	400161.933	385932.881	400161.933	Required	
2	385950.876	400136.159	385950.876	400136.159	Required	
3	385960.794	400121.954	385960.794	400121.954	Required	
10	385942.402	400168.498	385942.402	400168.498	Required	
11	385960.630	400142.390	385960.630	400142.390	Required	
4	385970.320	400128.534	385970.320	400128.534	Required	
5	385973.477	400130.202	385973.477	400130.202	Required	



The Alan Johnston Partnership					Page 3	
1 Dale Street Liverpool L2 2ET			Queens Road Manchester 223-151			
Date 21/11/2023 14:15			Designed by JPR			
File 223-151 INITIAL S.W CALC...			Checked by JCM			
XP Solutions			Network 2019.1			

Manhole Schedules for 223-151 S.W NETWORK.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
6	385974.922	400127.174	385974.922	400127.174	Required	
7	385980.770	400120.640	385980.770	400120.640	Required	
8	385982.330	400117.763	385982.330	400117.763	Required	
9	385980.066	400114.100			No Entry	

Free Flowing Outfall Details for 223-151 S.W NETWORK.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.007	9	62.218	60.032	59.005	0	0

Simulation Criteria for 223-151 S.W NETWORK.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
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	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

©1982-2019 Innovyze

The Alan Johnston Partnership		Page 4
1 Dale Street Liverpool L2 2ET	Queens Road Manchester 223-151	
Date 21/11/2023 14:15 File 223-151 INITIAL S.W CALC...	Designed by JPR Checked by JCM	
XP Solutions	Network 2019.1	

Online Controls for 223-151 S.W NETWORK.SWS

Hydro-Brake® Optimum Manhole: 8, DS/PN: 1.007, Volume (m³): 2.9

Unit Reference	MD-SHE-0100-5000-1350-5000
Design Head (m)	1.350
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	60.075
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	5.0	Kick-Flo®	0.829	4.0
Flush-Flo™	0.400	5.0	Mean Flow over Head Range	-	4.4

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	3.3	1.200	4.7	3.000	7.3	7.000	10.9
0.200	4.6	1.400	5.1	3.500	7.8	7.500	11.2
0.300	4.9	1.600	5.4	4.000	8.3	8.000	11.6
0.400	5.0	1.800	5.7	4.500	8.8	8.500	11.9
0.500	5.0	2.000	6.0	5.000	9.2	9.000	12.2
0.600	4.8	2.200	6.3	5.500	9.7	9.500	12.6
0.800	4.2	2.400	6.5	6.000	10.1		
1.000	4.4	2.600	6.8	6.500	10.5		

The Alan Johnston Partnership		Page 5																																													
1 Dale Street Liverpool L2 2ET	Queens Road Manchester 223-151																																														
Date 21/11/2023 14:15 File 223-151 INITIAL S.W CALC...	Designed by JPR Checked by JCM																																														
XP Solutions Network 2019.1																																															
<u>Storage Structures for 223-151 S.W NETWORK.SWS</u> <u>Tank or Pond Manhole: 7, DS/PN: 1.006</u> Invert Level (m) 60.108 <table><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><tr><td>0.000</td><td>100.0</td><td>0.400</td><td>100.0</td><td>0.401</td><td>0.0</td></tr></table> <u>Manhole Headloss for 223-151 S.W NETWORK.SWS</u> <table><tr><th>PN</th><th>US/MH Name</th><th>US/MH Headloss</th></tr><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>2.000</td><td>10</td><td>0.500</td></tr><tr><td>2.001</td><td>11</td><td>0.500</td></tr><tr><td>1.003</td><td>4</td><td>0.500</td></tr><tr><td>1.004</td><td>5</td><td>0.500</td></tr><tr><td>1.005</td><td>6</td><td>0.500</td></tr><tr><td>1.006</td><td>7</td><td>0.500</td></tr><tr><td>1.007</td><td>8</td><td>0.500</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	100.0	0.400	100.0	0.401	0.0	PN	US/MH Name	US/MH Headloss	1.000	1	0.500	1.001	2	0.500	1.002	3	0.500	2.000	10	0.500	2.001	11	0.500	1.003	4	0.500	1.004	5	0.500	1.005	6	0.500	1.006	7	0.500	1.007	8	0.500
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)																																										
0.000	100.0	0.400	100.0	0.401	0.0																																										
PN	US/MH Name	US/MH Headloss																																													
1.000	1	0.500																																													
1.001	2	0.500																																													
1.002	3	0.500																																													
2.000	10	0.500																																													
2.001	11	0.500																																													
1.003	4	0.500																																													
1.004	5	0.500																																													
1.005	6	0.500																																													
1.006	7	0.500																																													
1.007	8	0.500																																													
©1982-2019 Innovyze																																															



Micro
Drainage

Simulation Criteria

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

Rainfall Model	FSR	Ratio R	0.354
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.200	Cv (Winter)	0.840

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, 0, 45

©1982-2019 Innovyze

The Alan Johnston Partnership		Page 7
1 Dale Street Liverpool L2 2ET	Queens Road Manchester 223-151	
Date 21/11/2023 14:15 File 223-151 INITIAL S.W CALC...	Designed by JPR Checked by JCM	
XP Solutions	Network 2019.1	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for
223-151 S.W NETWORK.SWS

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow		
1.000	1	-0.103	0.000	0.21		4.6		OK
1.001	2	-0.083	0.000	0.41		6.8		OK
1.002	3	-0.089	0.000	0.34		6.8		OK
2.000	10	-0.103	0.000	0.21		4.6		OK
2.001	11	-0.095	0.000	0.29		6.8		OK
1.003	4	0.005	0.000	1.12		13.3	SURCHARGED	
1.004	5	-0.089	0.000	0.65		19.6		OK
1.005	6	-0.135	0.000	0.33		19.6		OK
1.006	7	-0.123	0.000	0.15		4.5		OK
1.007	8	-0.081	0.000	0.13		3.9		OK

The Alan Johnston Partnership		Page 9
1 Dale Street Liverpool L2 2ET	Queens Road Manchester 223-151	
Date 21/11/2023 14:15 File 223-151 INITIAL S.W CALC...	Designed by JPR Checked by JCM	
XP Solutions	Network 2019.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for 223-151 S.W NETWORK.SWS

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (1/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow		
1.000	1	-0.084	0.000	0.39		8.6		OK
1.001	2	-0.015	0.000	0.80		13.2		OK
1.002	3	0.057	0.000	0.66		13.0	SURCHARGED	
2.000	10	-0.084	0.000	0.39		8.6		OK
2.001	11	-0.066	0.000	0.58		13.7		OK
1.003	4	0.159	0.000	2.14		25.3	SURCHARGED	
1.004	5	0.041	0.000	1.26		37.6	SURCHARGED	
1.005	6	-0.091	0.000	0.65		38.6		OK
1.006	7	-0.006	0.000	0.17		5.1		OK
1.007	8	0.040	0.000	0.16		4.8	SURCHARGED	

The Alan Johnston Partnership								Page 10																																																																																																			
1 Dale Street Liverpool L2 2ET				Queens Road Manchester 223-151																																																																																																							
Date 21/11/2023 14:15				Designed by JPR																																																																																																							
File 223-151 INITIAL S.W CALC...				Checked by JCM																																																																																																							
XP Solutions				Network 2019.1																																																																																																							
<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for 223-151 S.W NETWORK.SWS</u>																																																																																																											
<u>Simulation Criteria</u>																																																																																																											
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 10.000																																																																																																											
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 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																																																																																																											
<u>Synthetic Rainfall Details</u>																																																																																																											
Rainfall Model FSR Ratio R 0.354																																																																																																											
Region England and Wales Cv (Summer) 0.750																																																																																																											
M5-60 (mm) 18.200 Cv (Winter) 0.840																																																																																																											
Margin for Flood Risk Warning (mm) 300.0																																																																																																											
Analysis Timestep 2.5 Second Increment (Extended)																																																																																																											
DTS Status ON																																																																																																											
DVD Status ON																																																																																																											
Inertia Status ON																																																																																																											
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, 0, 45																																																																																																											
<table><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Water Level (m)</th></tr><tr><td>1.000</td><td>1</td><td>15 Winter</td><td>100</td><td>+45%</td><td>100/15 Summer</td><td></td><td></td><td>61.621</td></tr><tr><td>1.001</td><td>2</td><td>15 Winter</td><td>100</td><td>+45%</td><td>100/15 Summer</td><td></td><td></td><td>61.445</td></tr><tr><td>1.002</td><td>3</td><td>120 Winter</td><td>100</td><td>+45%</td><td>30/15 Summer</td><td></td><td></td><td>61.420</td></tr><tr><td>2.000</td><td>10</td><td>15 Winter</td><td>100</td><td>+45%</td><td>100/15 Summer</td><td></td><td></td><td>61.542</td></tr><tr><td>2.001</td><td>11</td><td>120 Winter</td><td>100</td><td>+45%</td><td>100/15 Summer</td><td></td><td></td><td>61.421</td></tr><tr><td>1.003</td><td>4</td><td>120 Winter</td><td>100</td><td>+45%</td><td>2/15 Summer</td><td></td><td></td><td>61.414</td></tr><tr><td>1.004</td><td>5</td><td>120 Winter</td><td>100</td><td>+45%</td><td>30/15 Summer</td><td></td><td></td><td>61.409</td></tr><tr><td>1.005</td><td>6</td><td>120 Winter</td><td>100</td><td>+45%</td><td>100/15 Winter</td><td></td><td></td><td>61.406</td></tr><tr><td>1.006</td><td>7</td><td>120 Winter</td><td>100</td><td>+45%</td><td>100/15 Summer</td><td></td><td></td><td>61.400</td></tr><tr><td>1.007</td><td>8</td><td>120 Winter</td><td>100</td><td>+45%</td><td>30/30 Winter</td><td></td><td></td><td>61.398</td></tr></table>									PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Water Level (m)	1.000	1	15 Winter	100	+45%	100/15 Summer			61.621	1.001	2	15 Winter	100	+45%	100/15 Summer			61.445	1.002	3	120 Winter	100	+45%	30/15 Summer			61.420	2.000	10	15 Winter	100	+45%	100/15 Summer			61.542	2.001	11	120 Winter	100	+45%	100/15 Summer			61.421	1.003	4	120 Winter	100	+45%	2/15 Summer			61.414	1.004	5	120 Winter	100	+45%	30/15 Summer			61.409	1.005	6	120 Winter	100	+45%	100/15 Winter			61.406	1.006	7	120 Winter	100	+45%	100/15 Summer			61.400	1.007	8	120 Winter	100	+45%	30/30 Winter			61.398
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Water Level (m)																																																																																																			
1.000	1	15 Winter	100	+45%	100/15 Summer			61.621																																																																																																			
1.001	2	15 Winter	100	+45%	100/15 Summer			61.445																																																																																																			
1.002	3	120 Winter	100	+45%	30/15 Summer			61.420																																																																																																			
2.000	10	15 Winter	100	+45%	100/15 Summer			61.542																																																																																																			
2.001	11	120 Winter	100	+45%	100/15 Summer			61.421																																																																																																			
1.003	4	120 Winter	100	+45%	2/15 Summer			61.414																																																																																																			
1.004	5	120 Winter	100	+45%	30/15 Summer			61.409																																																																																																			
1.005	6	120 Winter	100	+45%	100/15 Winter			61.406																																																																																																			
1.006	7	120 Winter	100	+45%	100/15 Summer			61.400																																																																																																			
1.007	8	120 Winter	100	+45%	30/30 Winter			61.398																																																																																																			
©1982-2019 Innovyze																																																																																																											

The Alan Johnston Partnership		Page 11
1 Dale Street Liverpool L2 2ET	Queens Road Manchester 223-151	
Date 21/11/2023 14:15 File 223-151 INITIAL S.W CALC...	Designed by JPR Checked by JCM	
XP Solutions	Network 2019.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for 223-151 S.W NETWORK.SWS

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
1.000	1	0.171	0.000	0.64		14.2	SURCHARGED	
1.001	2	0.519	0.000	1.13		18.7	SURCHARGED	
1.002	3	0.667	0.000	0.45		8.9	SURCHARGED	
2.000	10	0.092	0.000	0.67		14.9	SURCHARGED	
2.001	11	0.502	0.000	0.38		8.9	SURCHARGED	
1.003	4	0.836	0.000	1.51		17.8	SURCHARGED	
1.004	5	0.867	0.000	0.92		27.4	SURCHARGED	
1.005	6	0.898	0.000	0.46		27.0	SURCHARGED	
1.006	7	1.067	0.000	0.28		8.3	SURCHARGED	
1.007	8	1.098	0.000	0.17		5.0	SURCHARGED	