

Shaun Tonge Engineering		Page 1
11 Broomhead Road Wombell Barnsley S73 0SA		
Date 25/09/2025 16:15 File Drainage.MDX	Designed by shaun Checked by	
CADS		Network 2020.1.3

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)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.354	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	0.010	4-8	0.002

Total Area Contributing (ha) = 0.012

Total Pipe Volume (m³) = 0.306

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
1.000	8.500	0.150	56.7	0.004	4.00	0.0	0.600	o	100	Pipe/Conduit		
1.001	12.800	0.160	80.0	0.004	0.00	0.0	0.600	o	100	Pipe/Conduit		
1.002	9.900	0.190	52.1	0.004	0.00	0.0	0.600	o	100	Pipe/Conduit		
1.003	7.750	0.100	77.5	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL E (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.14	9.400	0.004	0.0	0.0	0.0	1.03	8.1	0.5
1.001	50.00	4.39	9.250	0.008	0.0	0.0	0.0	0.86	6.8	1.1
1.002	50.00	4.54	9.090	0.012	0.0	0.0	0.0	1.07	8.4	1.6
1.003	50.00	4.69	8.900	0.012	0.0	0.0	0.0	0.88	6.9	1.6

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
1	10.000	0.600	Open Manhole	450	1.000	9.400	100				
2	10.000	0.750	Open Manhole	450	1.001	9.250	100	1.000	9.250	100	
3	10.000	0.910	Open Manhole	450	1.002	9.090	100	1.001	9.090	100	
4	10.000	1.100	Open Manhole	1200	1.003	8.900	100	1.002	8.900	100	
	10.000	1.200	Open Manhole	0		OUTFALL		1.003	8.800	100	

No coordinates have been specified, layout information cannot be produced.

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 0.000
 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 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) 1 Cv (Summer) 0.750
 Region England and Wales Cv (Winter) 0.840
 M5-60 (mm) 19.000 Storm Duration (mins) 30
 Ratio R 0.354

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 4, DS/PN: 1.003, Volume (m³): 1.3

Unit Reference	MD-SHE-0084-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	84
Invert Level (m)	8.900
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	3.0
Flush-Flo™	0.267	3.0
Kick-Flo®	0.570	2.4
Mean Flow over Head Range	-	2.6

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)						
0.100	2.5	1.200	3.4	3.000	5.2	7.000	7.8
0.200	3.0	1.400	3.7	3.500	5.6	7.500	8.1
0.300	3.0	1.600	3.9	4.000	6.0	8.000	8.3
0.400	2.9	1.800	4.1	4.500	6.3	8.500	8.6
0.500	2.7	2.000	4.3	5.000	6.7	9.000	8.8
0.600	2.5	2.200	4.5	5.500	7.0	9.500	9.0
0.800	2.8	2.400	4.7	6.000	7.3		
1.000	3.1	2.600	4.9	6.500	7.5		

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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 0.000
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 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 0.354
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)

Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600
Return Period(s) (years) 2, 100
Climate Change (%) 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	2	+0%	100/15 Summer				9.421
1.001	2	15 Winter	2	+0%	100/15 Summer				9.280
1.002	3	15 Winter	2	+0%	100/15 Summer				9.123
1.003	4	15 Winter	2	+0%	100/15 Summer				8.972

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Time (mins)	Pipe Flow (l/s)	
1.000	1	-0.079	0.000	0.09		0.7	OK
1.001	2	-0.070	0.000	0.20		1.3	OK
1.002	3	-0.067	0.000	0.23		1.8	OK
1.003	4	-0.028	0.000	0.28		1.8	OK

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 0.000
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 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 0.354
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M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)

Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600
Return Period(s) (years) 2, 100
Climate Change (%) 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+40%	100/15	Summer			9.710
1.001	2	15 Winter	100	+40%	100/15	Summer			9.702
1.002	3	15 Winter	100	+40%	100/15	Summer			9.684
1.003	4	15 Winter	100	+40%	100/15	Summer			9.658

PN	US/MH Name	Surcharged Flooded			Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Overflow (l/s)					
1.000	1	0.210	0.000	0.32		2.3	FLOOD RISK		
1.001	2	0.352	0.000	0.64		4.1	FLOOD RISK		
1.002	3	0.494	0.000	0.71		5.5	SURCHARGED		
1.003	4	0.658	0.000	0.47		3.0	SURCHARGED		