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Unit A, Racecourse Business ... Dovefields, Uttoxeter Staffordshire, ST14 8GB	Brunswick Mill North area sw model o1	
Date 23/09/2023 09:31 File 23178 - HW north area p...	Designed by BD Checked by	
Innovyze	Network 2020.1	

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)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.358	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	0.087	4-8	0.028

Total Area Contributing (ha) = 0.115

Total Pipe Volume (m³) = 1.456

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	10.564	0.100	105.6	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	8.255	0.100	82.6	0.035	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	7.199	0.087	82.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	14.208	0.300	47.4	0.015	5.00	0.0	0.600	o	150	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	45.98	5.18	52.300	0.014	0.0	0.0	0.0	0.98	17.3	1.7
2.000	46.19	5.12	52.300	0.035	0.0	0.0	0.0	1.11	19.6	4.4
1.001	45.58	5.29	52.200	0.049	0.0	0.0	0.0	1.11	19.5	6.0
3.000	46.05	5.16	51.700	0.015	0.0	0.0	0.0	1.47	25.9	1.9

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 4, DS/PN: 1.003, Volume (m³): 2.5

Unit Reference	MD-SHE-0112-6000-1200-6000
Design Head (m)	1.200
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	112
Invert Level (m)	50.900
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.0
Flush-Flo™	0.357	6.0
Kick-Flo®	0.754	4.8
Mean Flow over Head Range	-	5.2

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	3.9	1.200	6.0	3.000	9.2	7.000	13.8
0.200	5.7	1.400	6.4	3.500	9.9	7.500	14.2
0.300	5.9	1.600	6.8	4.000	10.5	8.000	14.7
0.400	6.0	1.800	7.2	4.500	11.1	8.500	15.1
0.500	5.9	2.000	7.6	5.000	11.7	9.000	15.5
0.600	5.7	2.200	7.9	5.500	12.3	9.500	15.9
0.800	5.0	2.400	8.3	6.000	12.8		
1.000	5.5	2.600	8.6	6.500	13.3		

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Storage Structures for Storm Tank or Pond Manhole: 4, DS/PN: 1.003 Invert Level (m) 50.900 <table><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>50.0</td><td>0.700</td><td>50.0</td><td>0.701</td><td>0.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	50.0	0.700	50.0	0.701	0.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)									
0.000	50.0	0.700	50.0	0.701	0.0									
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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 1

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

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, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 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 Winter				52.463
2.000	2	15 Winter	100	+40%	100/15 Summer				52.543
1.001	2	15 Winter	100	+40%	100/15 Summer				52.438
3.000	4	15 Winter	100	+40%	100/15 Summer				52.182
1.002	3	15 Winter	100	+40%	100/15 Summer				52.159
4.000	6	15 Winter	100	+40%					52.040
1.003	4	60 Winter	100	+40%	30/15 Summer				51.552
1.004	5	120 Winter	100	+40%					50.857

PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap.	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.013	0.000	0.44		6.8	SURCHARGED	
2.000	2	0.093	0.000	1.02		17.3	SURCHARGED	
1.001	2	0.088	0.000	1.42		23.8	SURCHARGED	
3.000	4	0.332	0.000	0.31		7.3	SURCHARGED	
1.002	3	0.609	0.000	1.39		43.4	SURCHARGED	
4.000	6	-0.110	0.000	0.16		7.5	OK	

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

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
1.003	4	0.502	0.000	0.39			6.0	SURCHARGED	
1.004	5	-0.093	0.000	0.31			6.0	OK	