

ABA Consulting		Page 1
Unit A, Racecourse Business ... Dovefields, Uttoxeter Staffordshire, ST14 8GB	Brunswick Mill courtyard SW model 01	
Date 19/03/2024 11:11 File 23178 - HW COURTYARD AR...	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	0.357	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	0.210	4-8	0.046

Total Area Contributing (ha) = 0.256

Total Pipe Volume (m³) = 5.354

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	17.053	0.050	341.1	0.050	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	9.717	0.050	194.3	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	5.354	0.050	107.1	0.032	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	5.437	0.050	108.7	0.020	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	9.094	0.050	181.9	0.032	5.00	0.0	0.600	o	300	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	45.34	5.34	52.300	0.050	0.0	0.0	0.0	0.85	59.8	6.1
1.001	44.82	5.48	52.250	0.074	0.0	0.0	0.0	1.12	79.5	9.0
2.000	46.38	5.06	52.300	0.032	0.0	0.0	0.0	1.52	107.4	4.0
2.001	46.15	5.12	52.250	0.052	0.0	0.0	0.0	1.51	106.5	6.5
3.000	46.10	5.13	52.300	0.032	0.0	0.0	0.0	1.16	82.2	4.0

ABA Consulting		Page 3
Unit A, Racecourse Business ... Dovefields, Uttoxeter Staffordshire, ST14 8GB	Brunswick Mill courtyard SW model 01	
Date 19/03/2024 11:11 File 23178 - HW COURTYARD AR...	Designed by BD Checked by	
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 3, DS/PN: 1.002, Volume (m³): 4.4

Unit Reference	MD-SHE-0215-2500-1300-2500
Design Head (m)	1.300
Design Flow (l/s)	25.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	215
Invert Level (m)	51.600
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	25.0
Flush-Flo™	0.413	25.0
Kick-Flo®	0.901	21.0
Mean Flow over Head Range	-	21.3

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	7.3	1.200	24.1	3.000	37.3	7.000	56.2
0.200	21.0	1.400	25.9	3.500	40.2	7.500	58.2
0.300	24.6	1.600	27.6	4.000	42.9	8.000	60.0
0.400	25.0	1.800	29.2	4.500	45.4	8.500	61.8
0.500	24.9	2.000	30.7	5.000	47.8	9.000	63.6
0.600	24.5	2.200	32.2	5.500	50.0	9.500	65.2
0.800	23.0	2.400	33.5	6.000	52.2		
1.000	22.1	2.600	34.9	6.500	54.3		

ABA Consulting		Page 4																																																																								
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Storage Structures for Storm Tank or Pond Manhole: 1, DS/PN: 1.000 Invert Level (m) 52.300 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>15.0</td><td>0.600</td><td>15.0</td><td>0.601</td><td>0.0</td></tr></table> Tank or Pond Manhole: 2, DS/PN: 1.001 Invert Level (m) 52.250 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>15.0</td><td>0.600</td><td>15.0</td><td>0.601</td><td>0.0</td></tr></table> Tank or Pond Manhole: 3, DS/PN: 2.000 Invert Level (m) 52.300 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>10.0</td><td>0.600</td><td>10.0</td><td>0.601</td><td>0.0</td></tr></table> Tank or Pond Manhole: 5, DS/PN: 3.000 Invert Level (m) 52.300 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>10.0</td><td>0.600</td><td>10.0</td><td>0.601</td><td>0.0</td></tr></table> Tank or Pond Manhole: 6, DS/PN: 3.001 Invert Level (m) 52.250 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>7.0</td><td>0.600</td><td>7.0</td><td>0.601</td><td>0.0</td></tr></table> Tank or Pond Manhole: 7, DS/PN: 3.002 Invert Level (m) 52.250 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>7.0</td><td>0.600</td><td>7.0</td><td>0.601</td><td>0.0</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	15.0	0.600	15.0	0.601	0.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	15.0	0.600	15.0	0.601	0.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	10.0	0.600	10.0	0.601	0.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	10.0	0.600	10.0	0.601	0.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	7.0	0.600	7.0	0.601	0.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	7.0	0.600	7.0	0.601	0.0
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ABA Consulting		Page 6
Unit A, Racecourse Business ... Dovefields, Uttoxeter Staffordshire, ST14 8GB	Brunswick Mill courtyard SW model 01	
Date 19/03/2024 11:11 File 23178 - HW COURTYARD AR...	Designed by BD Checked by	
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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)				
2.001	4	0.269	0.000	0.17			10.4	FLOOD RISK	
3.000	5	0.232	0.000	0.09			5.3	FLOOD RISK	
3.001	6	0.280	0.000	0.22			13.2	FLOOD RISK	
3.002	7	0.327	0.000	0.38			19.7	FLOOD RISK	
1.002	3	0.992	0.000	0.76			24.9	FLOOD RISK	
1.003	4	-0.105	0.000	0.55			25.0	OK	