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Unit A, Racecourse Business ... Dovefields, Uttoxeter Staffordshire, ST14 8GB	Brunswick Mill courtyard SW model 01	
Date 23/09/2023 13:37	Designed by BD	
File 23178 - HW courtyard ar...	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

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.050	0.050	0.050
1.001	-	-	100	0.024	0.024	0.024
2.000	-	-	100	0.032	0.032	0.032
2.001	-	-	100	0.020	0.020	0.020
3.000	-	-	100	0.032	0.032	0.032
3.001	-	-	100	0.043	0.043	0.043
3.002	-	-	100	0.045	0.045	0.045
1.002	-	-	100	0.010	0.010	0.010
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.256	0.256	0.256

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
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	6
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)	18.000	Storm Duration (mins)	30
Ratio R	0.357		

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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		

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<div>Storage Structures for Storm</div> <div>Tank or Pond Manhole: 1, DS/PN: 1.000</div> <div>Invert Level (m) 52.300</div> <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>15.0</td><td>0.600</td><td>15.0</td><td>0.601</td><td>0.0</td></tr></table> <div>Tank or Pond Manhole: 2, DS/PN: 1.001</div> <div>Invert Level (m) 52.250</div> <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>15.0</td><td>0.600</td><td>15.0</td><td>0.601</td><td>0.0</td></tr></table> <div>Tank or Pond Manhole: 3, DS/PN: 2.000</div> <div>Invert Level (m) 52.300</div> <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>10.0</td><td>0.600</td><td>10.0</td><td>0.601</td><td>0.0</td></tr></table> <div>Tank or Pond Manhole: 5, DS/PN: 3.000</div> <div>Invert Level (m) 52.300</div> <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>10.0</td><td>0.600</td><td>10.0</td><td>0.601</td><td>0.0</td></tr></table> <div>Tank or Pond Manhole: 6, DS/PN: 3.001</div> <div>Invert Level (m) 52.250</div> <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>10.0</td><td>0.600</td><td>10.0</td><td>0.601</td><td>0.0</td></tr></table> <div>Tank or Pond Manhole: 7, DS/PN: 3.002</div> <div>Invert Level (m) 52.800</div> <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>13.5</td><td>0.150</td><td>13.5</td><td>0.151</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	10.0	0.600	10.0	0.601	0.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	13.5	0.150	13.5	0.151	0.0
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0.000	10.0	0.600	10.0	0.601	0.0																																																																					
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0.000	13.5	0.150	13.5	0.151	0.0																																																																					
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Staffordshire, ST14 8GB

Brunswick Mill
courtyard
SW model 01

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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 6

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

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status OFF

Inertia Status OFF

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

									Water
	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)
1.000	1	30 Winter	100	+40%	100/15 Summer				52.843
1.001	2	30 Winter	100	+40%	100/15 Summer				52.838
2.000	3	30 Winter	100	+40%	100/15 Summer				52.837
2.001	4	30 Winter	100	+40%	100/15 Summer				52.843
3.000	5	30 Winter	100	+40%	100/15 Summer				52.851
3.001	6	30 Winter	100	+40%	100/15 Summer				52.849
3.002	7	30 Winter	100	+40%	100/15 Summer				52.846
1.002	3	30 Winter	100	+40%	1/15 Winter				52.841
1.003	4	30 Winter	100	+40%					51.620

Surcharged Flooded

Half Drain Pipe

US/MH

Depth

Volume

Flow / Overflow

Time

Flow

Level

PN

Name

(m)

(m³)

Cap.

(l/s)

(mins)

(l/s)

Status

Exceeded

1.000

1

0.243

0.000

0.18

8.9

FLOOD RISK

1.001

2

0.288

0.000

0.18

10.8

FLOOD RISK

2.000

3

0.237

0.000

0.10

6.0

FLOOD RISK

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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	0.293	0.000	0.16			10.1	FLOOD RISK	
3.000	5	0.251	0.000	0.08			5.1	FLOOD RISK	
3.001	6	0.299	0.000	0.17			10.7	FLOOD RISK	
3.002	7	0.346	0.000	0.43			21.9	FLOOD RISK	
1.002	3	1.016	0.000	0.76			25.0	FLOOD RISK	
1.003	4	-0.105	0.000	0.56			25.0	OK	