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Studio 313 Scott House The Custard Factory, Gibb St... Birmingham, B9 4AA	Fole Diary CB COLLIER Network D	
Date 28/11/2022 08:43 File Storm D 22.06.22.MDX	Designed by Riaz Alam Checked by	
Innovyze	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	2
FEH Rainfall Version	2013
Site Location GB 404500 337500 SK 04500 37500	
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
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	0.073	4-8	0.050

Total Area Contributing (ha) = 0.123

Total Pipe Volume (m³) = 2.658

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	9.915	0.950	10.4	0.022	6.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	19.965	0.133	150.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	11.858	0.079	150.1	0.012	0.00	0.0	0.600	o	150	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)
1.000	0.00	6.05	110.250	0.022	0.0	0.0	0.0	3.14	55.4	0.0
1.001	0.00	6.46	109.300	0.022	0.0	0.0	0.0	0.82	14.5	0.0
1.002	0.00	6.70	109.167	0.034	0.0	0.0	0.0	0.82	14.5	0.0

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Fole Diary
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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)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
40	110.750	0.500	Open Manhole	475	1.000	110.250	150				
41	110.100	0.800	Open Manhole	475	1.001	109.300	150	1.000	109.300	150	
42	110.650	1.483	Open Manhole	475	1.002	109.167	150	1.001	109.167	150	
43	110.400	1.000	Open Manhole	475	2.000	109.400	150				
44	110.950	1.937	Open Manhole	1200	1.003	109.013	225	1.002	109.088	150	
								2.000	109.088	150	
45	111.400	1.800	Open Manhole	475	3.000	109.600	150				
46	111.150	2.172	Open Manhole	1200	1.004	108.978	225	1.003	108.978	225	
								3.000	109.053	150	
FCC D	111.200	2.271	Open Manhole	1800	1.005	108.929	225	1.004	108.929	225	
47	111.000	2.115	Open Manhole	1200	1.006	108.885	225	1.005	108.885	225	
Outfall	110.600	1.752	Open Manhole	0		OUTFALL		1.006	108.848	225	

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

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	40	110.750	110.250	0.350	Open Manhole	475
1.001	o	150	41	110.100	109.300	0.650	Open Manhole	475
1.002	o	150	42	110.650	109.167	1.333	Open Manhole	475
2.000	o	150	43	110.400	109.400	0.850	Open Manhole	475
1.003	o	225	44	110.950	109.013	1.712	Open Manhole	1200
3.000	o	150	45	111.400	109.600	1.650	Open Manhole	475
1.004	o	225	46	111.150	108.978	1.947	Open Manhole	1200
1.005	o	225	FCC D	111.200	108.929	2.046	Open Manhole	1800
1.006	o	225	47	111.000	108.885	1.890	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	9.915	10.4	41	110.100	109.300	0.650	Open Manhole	475
1.001	19.965	150.1	42	110.650	109.167	1.333	Open Manhole	475
1.002	11.858	150.1	44	110.950	109.088	1.712	Open Manhole	1200
2.000	19.149	61.4	44	110.950	109.088	1.712	Open Manhole	1200
1.003	5.203	148.7	46	111.150	108.978	1.947	Open Manhole	1200
3.000	12.634	23.1	46	111.150	109.053	1.947	Open Manhole	1200
1.004	12.325	251.5	FCC D	111.200	108.929	2.046	Open Manhole	1800
1.005	11.050	251.1	47	111.000	108.885	1.890	Open Manhole	1200
1.006	5.600	151.4	Outfall	110.600	108.848	1.527	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	Outfall	110.600	108.848	0.000	0	0

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<u>Simulation Criteria for Storm</u> Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/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 2 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FSR Profile Type Summer Return Period (years) 100 Cv (Summer) 0.750 Region England and Wales Cv (Winter) 0.840 M5-60 (mm) 19.000 Storm Duration (mins) 30 Ratio R 0.373		
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: FCC D, DS/PN: 1.005, Volume (m³): 6.2

Unit Reference	MD-SHE-0199-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	199
Invert Level (m)	108.929
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	20.0
Flush-Flo™	0.340	20.0
Kick-Flo®	0.721	17.1
Mean Flow over Head Range	-	16.8

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	6.9	1.200	21.8	3.000	33.8	7.000	51.0
0.200	18.7	1.400	23.5	3.500	36.4	7.500	52.7
0.300	19.9	1.600	25.0	4.000	38.9	8.000	54.4
0.400	19.9	1.800	26.5	4.500	41.1	8.500	56.0
0.500	19.5	2.000	27.8	5.000	43.3	9.000	57.6
0.600	19.0	2.200	29.1	5.500	45.3	9.500	59.1
0.800	18.0	2.400	30.4	6.000	47.3		
1.000	20.0	2.600	31.6	6.500	49.2		

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Storage Structures for Storm

Porous Car Park Manhole: 42, DS/PN: 1.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	71.2
Max Percolation (l/s)	118.7	Slope (1:X)	36.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	0
Invert Level (m)	109.090	Cap Volume Depth (m)	0.350

Tank or Pond Manhole: FCC D, DS/PN: 1.005

Invert Level (m) 108.950

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	60.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	60.0	0.800	0.0	1.500	0.0	2.200	0.0
0.200	60.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	60.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	60.0	1.100	0.0	1.800	0.0	2.500	0.0
0.401	0.0	1.200	0.0	1.900	0.0		
0.600	0.0	1.300	0.0	2.000	0.0		

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1 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 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 2

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 0.373

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

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) 1, 2, 30, 100

Climate Change (%) 0, 0, 0, 40

	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water
	PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Level
								Act.	(m)
1.000	40	15	Winter	1	+0%				110.272
1.001	41	15	Winter	1	+0%	100/15	Summer		109.344
1.002	42	15	Winter	1	+0%	100/15	Summer		109.221
2.000	43	15	Winter	1	+0%	100/15	Summer		109.448
1.003	44	15	Winter	1	+0%	30/15	Summer		109.101
3.000	45	15	Winter	1	+0%				109.631
1.004	46	15	Winter	1	+0%	30/15	Summer		109.089
1.005	FCC D	30	Winter	1	+0%	100/15	Summer		109.025
1.006	47	30	Winter	1	+0%				108.948

Surcharged

Flooded

Pipe

US/MH

Depth

Volume

Flow / Overflow

Flow

Level

PN

Name

(m)

(m³)

Cap.

(l/s)

(l/s)

Status

Exceeded

1.000	40	-0.128	0.000	0.05	2.6	OK
1.001	41	-0.106	0.000	0.19	2.6	OK
1.002	42	-0.096	0.000	0.27	3.6	OK
2.000	43	-0.102	0.000	0.22	4.8	OK

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

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Flow		
1.003	44	-0.137	0.000	0.27		8.1		OK	
3.000	45	-0.119	0.000	0.10		3.3		OK	
1.004	46	-0.114	0.000	0.48		13.4		OK	
1.005	FCC D	-0.129	0.000	0.19		5.3		OK	
1.006	47	-0.162	0.000	0.18		5.3		OK	

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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 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 2

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 0.373

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

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)

1, 2, 30, 100

Climate Change (%)

0, 0, 0, 40

US/MH

PN

Name

Storm

Return Period

Climate Change

First (X) Surcharge

First (Y) Flood

First (Z) Overflow

Overflow Act.

Water Level (m)

1.000

40

15 Winter

2

+0%

110.276

1.001

41

15 Winter

2

+0%

100/15 Summer

109.351

1.002

42

15 Winter

2

+0%

100/15 Summer

109.229

2.000

43

15 Winter

2

+0%

100/15 Summer

109.455

1.003

44

15 Winter

2

+0%

30/15 Summer

109.119

3.000

45

15 Winter

2

+0%

109.635

1.004

46

15 Winter

2

+0%

30/15 Summer

109.108

1.005

FCC D

30 Winter

2

+0%

100/15 Summer

109.050

1.006

47

30 Winter

2

+0%

108.956

Surcharged

Flooded

Pipe

US/MH

PN

Name

Depth (m)

Volume (m³)

Flow / Cap.

Overflow (l/s)

Pipe Flow (l/s)

Status

Level Exceeded

1.000

40

-0.124

0.000

0.07

3.4

OK

1.001

41

-0.099

0.000

0.25

3.4

OK

1.002

42

-0.088

0.000

0.36

4.7

OK

2.000

43

-0.095

0.000

0.29

6.2

OK

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
1.003	44	-0.119	0.000	0.35		10.6		OK	
3.000	45	-0.115	0.000	0.13		4.3		OK	
1.004	46	-0.095	0.000	0.62		17.5		OK	
1.005	FCC D	-0.104	0.000	0.24		6.5		OK	
1.006	47	-0.154	0.000	0.22		6.5		OK	

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Micro Drainage

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000
Hot Start (mins) 0
Hot Start Level (mm) 0
Manhole Headloss Coeff (Global) 0.500
Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000
MADD Factor * 10m³/ha Storage 2.000
Inlet Coefficient 0.800
Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0
Number of Online Controls 1
Number of Offline Controls 0

Number of Storage Structures 2
Number of Time/Area Diagrams 0
Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR
Region England and Wales Cv (Summer)
M5-60 (mm)

Ratio R 0.373
0.750
19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status
DVD Status
Inertia Status

300.0
ON
ON
ON

Profile(s)
Duration(s) (mins)
Return Period(s) (years)
Climate Change (%)

Summer and Winter
15, 30, 60, 120, 240, 360, 480, 960, 1440
1, 2, 30, 100
0, 0, 0, 40

US/MH
PN Name Storm

Return
Period

Climate
Change

First (X)
Surcharge

First (Y)
Flood

First (Z)
Overflow

Overflow
Act.

Water
Level
(m)

1.000 40 15 Winter 30 +0% 100/15 Summer 110.286

1.001 41 15 Winter 30 +0% 100/15 Summer 109.372

1.002 42 15 Winter 30 +0% 100/15 Summer 109.282

2.000 43 15 Winter 30 +0% 100/15 Summer 109.479

1.003 44 15 Winter 30 +0% 30/15 Summer 109.250

3.000 45 15 Winter 30 +0% 109.650

1.004 46 15 Winter 30 +0% 30/15 Summer 109.214

1.005 FCC D 30 Winter 30 +0% 100/15 Summer 109.144

1.006 47 30 Winter 30 +0% 108.988

Surcharged Flooded

US/MH
PN Name

Depth
(m)

Volume
(m³)

Flow /
Cap.

Overflow
(l/s)

Pipe
Flow
(l/s)

Status

Level
Exceeded

1.000 40 -0.114 0.000 0.13 6.4 OK

1.001 41 -0.078 0.000 0.47 6.4 OK

1.002 42 -0.035 0.000 0.73 9.5 OK

2.000 43 -0.071 0.000 0.55 11.7 OK

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Cap.	(l/s)	(l/s)		
1.003	44	0.012	0.000	0.66		19.7	SURCHARGED	
3.000	45	-0.100	0.000	0.24		8.2	OK	
1.004	46	0.011	0.000	1.16		32.5	SURCHARGED	
1.005	FCC D	-0.010	0.000	0.47		12.9	OK	
1.006	47	-0.122	0.000	0.43		12.9	OK	

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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 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 2

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 0.373

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

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)

1, 2, 30, 100

Climate Change (%)

0, 0, 0, 40

	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water	
	PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level
										(m)
1.000	40	15	Winter	100	+40%					110.299
1.001	41	15	Winter	100	+40%	100/15	Summer			109.514
1.002	42	15	Winter	100	+40%	100/15	Summer			109.441
2.000	43	15	Winter	100	+40%	100/15	Summer			109.680
1.003	44	15	Winter	100	+40%	30/15	Summer			109.387
3.000	45	15	Winter	100	+40%					109.669
1.004	46	30	Winter	100	+40%	30/15	Summer			109.345
1.005	FCC D	30	Winter	100	+40%	100/15	Summer			109.290
1.006	47	30	Winter	100	+40%					109.016

Surcharged

Flooded

Pipe

US/MH

Depth

Volume

Flow /

Overflow

Flow

Status

Level

PN

Name

(m)

(m³)

Cap.

(l/s)

(l/s)

Exceeded

1.000

40

-0.101

0.000

0.24

11.6

OK

1.001

41

0.064

0.000

0.84

11.4

SURCHARGED

1.002

42

0.124

0.000

1.00

13.1

SURCHARGED

2.000

43

0.130

0.000

0.96

20.5

SURCHARGED

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Innovyze

Mucklow & Harris Ltd		Page 15
Studio 313 Scott House The Custard Factory, Gibb St... Birmingham, B9 4AA	Fole Diary CB COLLIER Network D	
Date 28/11/2022 08:43 File Storm D 22.06.22.MDX	Designed by Riaz Alam Checked by	
Innovyze	Network 2019.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
	Name	Depth (m)	Volume (m³)			Flow (l/s)		
1.003	44	0.149	0.000	0.96		28.8	SURCHARGED	
3.000	45	-0.081	0.000	0.44		14.8	OK	
1.004	46	0.142	0.000	1.57		43.9	SURCHARGED	
1.005	FCC D	0.136	0.000	0.70		19.2	SURCHARGED	
1.006	47	-0.094	0.000	0.64		19.2	OK	