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Queens House 123-129 Queens Road Norwich NR1 3PS	30 a Thurlow Road London	
Date 09/01/17 File BASIC NETWORK.MDX	Designed by Mehmet Ozdemir Checked by Greg Scott	
Micro Drainage		Network 2016.1

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)	2	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.700	Minimum Backdrop Height (m)	0.200
Ratio R	0.439	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm




Time Area
(mins) (ha)

0-4 0.023

Total Area Contributing (ha) = 0.023

Total Pipe Volume (m³) = 0.158

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
S1.000	3.198	0.032	99.9	0.014	3.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	4.285	0.043	99.7	0.009	3.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	1.436	0.025	57.4	0.000	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)
S1.000	50.00	3.05	83.400	0.014	0.0	0.0	0.0	1.01	17.8	1.9
S2.000	50.00	3.07	83.400	0.009	0.0	0.0	0.0	1.01	17.8	1.2
S1.001	50.00	3.09	82.270	0.023	0.0	0.0	0.0	1.33	23.5	3.1

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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	0.014	0.014	0.014
2.000	-	-	100	0.009	0.009	0.009
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.023	0.023	0.023

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)
S1.001	S	84.770	82.245	0.000	0	0

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Online Controls for Storm


Hydro-Brake Optimum® Manhole: S2, DS/PN: S1.001, Volume (m³): 2.9

Unit Reference	MD-SHE-0089-5000-2200-5000
Design Head (m)	2.200
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	82.270
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.200	5.0
Flush-Flo™	0.391	3.9
Kick-Flo®	0.801	3.1
Mean Flow over Head Range	-	3.9

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	2.8	1.200	3.8	3.000	5.8	7.000	8.6
0.200	3.6	1.400	4.0	3.500	6.2	7.500	8.9
0.300	3.9	1.600	4.3	4.000	6.6	8.000	9.2
0.400	3.9	1.800	4.5	4.500	7.0	8.500	9.4
0.500	3.9	2.000	4.8	5.000	7.3	9.000	9.7
0.600	3.8	2.200	5.0	5.500	7.7	9.500	10.0
0.800	3.1	2.400	5.2	6.000	8.0		
1.000	3.5	2.600	5.4	6.500	8.3		

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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 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 0.438
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.800 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
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	1	+0%	100/15 Summer				83.449
S2.000	S3	15 Summer	1	+0%	100/15 Summer				83.436
S1.001	S2	15 Summer	1	+0%	1/15 Summer				82.458

PN	US/MH Name	Surcharged		Flooded		Pipe		Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Flow (l/s)	Status	
S1.000	S1	-0.101	0.000	0.23		2.5	OK	
S2.000	S3	-0.114	0.000	0.13		1.6	OK	
S1.001	S2	0.038	0.000	0.32		3.5	SURCHARGED	

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30 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 0
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

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720, 960, 1440, 2160, 2880
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	100/15	Summer			83.531
S2.000	S3	15 Winter	30	+0%	100/15	Summer			83.530
S1.001	S2	15 Winter	30	+0%	1/15	Summer			83.527

PN	US/MH Name	Surcharged		Flooded		Pipe		Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Flow (l/s)	Status	
S1.000	S1	-0.019	0.000	0.53		5.9	OK	
S2.000	S3	-0.020	0.000	0.29		3.8	OK	
S1.001	S2	1.107	0.000	0.36		3.9	SURCHARGED	

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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 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 0.438
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.800 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
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+30%	100/15	Summer			84.437
S2.000	S3	15 Winter	100	+30%	100/15	Summer			84.436
S1.001	S2	15 Winter	100	+30%	1/15	Summer			84.432

PN	US/MH Name	Surcharged Flooded			Pipe		Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Flow (l/s)	Status	
S1.000	S1	0.887	0.000	0.78	8.7	SURCHARGED	
S2.000	S3	0.886	0.000	0.43	5.6	SURCHARGED	
S1.001	S2	2.012	0.000	0.46	4.9	SURCHARGED	