

The Old Chapel  
Station Road, Hugglescote  
Leicestershire LE67 2GB

Bicester  
Parcel H  
SWS NET 3

Date 01/08/2018  
File 23431 parcel H3.mdx

Designed by as  
Checked by



XP Solutions

Network 2015.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	1
Site Location GB 457850 220300 SP 57850 20300	
C (1km)	-0.023
D1 (1km)	0.309
D2 (1km)	0.343
D3 (1km)	0.255
E (1km)	0.288
F (1km)	2.462
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
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 Surface Network 3

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.227	4-8	0.094

Total Area Contributing (ha) = 0.321

Total Pipe Volume (m<sup>3</sup>) = 5.851

Network Design Table for Surface Network 3

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.000	23.670	0.237	99.9	0.121	5.00	0.0	0.600	o	150	
1.001	8.095	0.135	60.0	0.000	0.00	0.0	0.600	o	150	
1.002	37.304	2.528	14.8	0.000	0.00	0.0	0.600	o	300	
2.000	11.664	0.117	99.7	0.124	5.00	0.0	0.600	o	150	

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	50.00	5.39	79.200	0.121	0.0	0.0	0.0	1.01	17.8	16.4
1.001	50.00	5.50	78.963	0.121	0.0	0.0	0.0	1.30	23.0	16.4
1.002	50.00	5.65	78.678	0.121	0.0	0.0	0.0	4.11	290.8	16.4
2.000	50.00	5.19	79.500	0.124	0.0	0.0	0.0	1.01	17.8	16.8

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Network Design Table for Surface Network 3

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
2.001	21.278	0.593	35.9	0.000	0.00	0.0	0.600	o	150	
2.002	9.257	0.930	10.0	0.000	0.00	0.0	0.600	o	150	
3.000	22.117	0.221	100.1	0.032	5.00	0.0	0.600	o	150	
3.001	4.662	0.047	100.0	0.000	0.00	0.0	0.600	o	150	
3.002	5.574	0.557	10.0	0.023	0.00	0.0	0.600	o	150	
1.003	12.095	0.094	128.7	0.021	0.00	0.0	0.600	o	375	

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)
2.001	50.00	5.40	79.383	0.124	0.0	0.0	0.0	1.69	29.8	16.8
2.002	50.00	5.45	77.230	0.124	0.0	0.0	0.0	3.21	56.8	16.8
3.000	50.00	5.37	78.300	0.032	0.0	0.0	0.0	1.00	17.7	4.3
3.001	50.00	5.44	78.079	0.032	0.0	0.0	0.0	1.00	17.8	4.3
3.002	50.00	5.47	76.640	0.055	0.0	0.0	0.0	3.20	56.6	7.4
1.003	50.00	5.77	76.075	0.321	0.0	0.0	0.0	1.60	176.3	43.5

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Area Summary for Surface Network 3

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.121	0.121	0.121
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.124	0.124	0.124
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.032	0.032	0.032
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.023	0.023	0.023
1.003	-	-	100	0.021	0.021	0.021
				Total	Total	Total
				0.321	0.321	0.321

Free Flowing Outfall Details for Surface Network 3

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003	SH3	80.747	75.981	0.000	1800	0

Simulation Criteria for Surface Network 3

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /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 Offline Controls 0    Number of Time/Area Diagrams 0  
 Number of Online Controls 4    Number of Storage Structures 3    Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	E (1km)	0.288
Return Period (years)	1	F (1km)	2.462
Site Location	GB 457850 220300 SP 57850 20300	Summer Storms	Yes
C (1km)	-0.023	Winter Storms	Yes
D1 (1km)	0.309	Cv (Summer)	0.750
D2 (1km)	0.343	Cv (Winter)	0.840
D3 (1km)	0.255	Storm Duration (mins)	30

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Online Controls for Surface Network 3

Garastor Manhole: S302, DS/PN: 1.001, Volume (m³): 0.9

Invert Level (m) 78.963 Model 400mm Overflow

Garastor Manhole: S306, DS/PN: 2.002, Volume (m³): 4.6

Invert Level (m) 77.230 Model 400mm Overflow

Garastor Manhole: S308, DS/PN: 3.001, Volume (m³): 1.1

Invert Level (m) 78.079 Model 400mm Overflow

Complex Manhole: S310HB, DS/PN: 1.003, Volume (m³): 35.7

Hydro-Brake Optimum®

Unit Reference MD-SHE-0070-3500-2800-3500  
 Design Head (m) 2.800  
 Design Flow (l/s) 3.5  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Diameter (mm) 70  
 Invert Level (m) 76.075  
 Minimum Outlet Pipe Diameter (mm) 100  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.800	3.5	Kick-Flo®	0.629	1.8
Flush-Flo™	0.308	2.2	Mean Flow over Head Range	-	2.5

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)	Depth (m)	Flow (l/s)
0.100	1.8	0.800	2.0	2.000	3.0	4.000	4.1	7.000	5.4
0.200	2.1	1.000	2.2	2.200	3.1	4.500	4.4	7.500	5.5
0.300	2.2	1.200	2.4	2.400	3.3	5.000	4.6	8.000	5.7
0.400	2.2	1.400	2.5	2.600	3.4	5.500	4.8	8.500	5.9
0.500	2.1	1.600	2.7	3.000	3.6	6.000	5.0	9.000	6.0
0.600	1.9	1.800	2.8	3.500	3.9	6.500	5.2	9.500	6.2

Weir

Discharge Coef 0.544 Width (m) 0.150 Invert Level (m) 79.700

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Storage Structures for Surface Network 3

Tank or Pond Manhole: S301, DS/PN: 1.000

Invert Level (m) 79.200

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	60.0	1.200	0.0	2.400	0.0	3.600	0.0	4.800	0.0
0.200	60.0	1.400	0.0	2.600	0.0	3.800	0.0	5.000	0.0
0.400	60.0	1.600	0.0	2.800	0.0	4.000	0.0		
0.600	60.0	1.800	0.0	3.000	0.0	4.200	0.0		
0.800	60.0	2.000	0.0	3.200	0.0	4.400	0.0		
1.000	0.0	2.200	0.0	3.400	0.0	4.600	0.0		

Tank or Pond Manhole: S304, DS/PN: 2.000

Invert Level (m) 79.500

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	60.0	1.200	0.0	2.400	0.0	3.600	0.0	4.800	0.0
0.200	60.0	1.400	0.0	2.600	0.0	3.800	0.0	5.000	0.0
0.400	60.0	1.600	0.0	2.800	0.0	4.000	0.0		
0.600	60.0	1.800	0.0	3.000	0.0	4.200	0.0		
0.800	60.0	2.000	0.0	3.200	0.0	4.400	0.0		
1.000	0.0	2.200	0.0	3.400	0.0	4.600	0.0		

Tank or Pond Manhole: S307, DS/PN: 3.000

Invert Level (m) 78.300

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	110.0	1.200	110.0	2.400	0.0	3.600	0.0	4.800	0.0
0.200	110.0	1.400	0.0	2.600	0.0	3.800	0.0	5.000	0.0
0.400	110.0	1.600	0.0	2.800	0.0	4.000	0.0		
0.600	110.0	1.800	0.0	3.000	0.0	4.200	0.0		
0.800	110.0	2.000	0.0	3.200	0.0	4.400	0.0		
1.000	110.0	2.200	0.0	3.400	0.0	4.600	0.0		

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10 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m<sup>3</sup>/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 Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 4 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.255  
 Site Location GB 457850 220300 SP 57850 20300 E (1km) 0.288  
 C (1km) -0.023 F (1km) 2.462  
 D1 (1km) 0.309 Cv (Summer) 0.750  
 D2 (1km) 0.343 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, 240, 360, 480, 960, 1440  
 Return Period(s) (years) 10, 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 Surcharged	
									Level (m)	Depth (m)
1.000	S301	60 Winter	10	+0%	10/15 Summer				79.438	0.088
1.001	S302	60 Winter	10	+0%	10/15 Summer				79.410	0.297
1.002	S303	60 Winter	10	+0%	30/30 Winter				78.706	-0.272
2.000	S304	15 Winter	10	+0%	30/15 Summer				79.649	-0.001
2.001	S305	30 Summer	10	+0%	100/15 Summer				79.464	-0.069
2.002	S306	120 Winter	10	+0%	10/15 Summer				78.663	1.283
3.000	S307	120 Winter	10	+0%	10/120 Winter				78.468	0.018
3.001	S308	120 Winter	10	+0%	10/15 Summer				78.521	0.292
3.002	S309	120 Winter	10	+0%	10/15 Summer				78.598	1.808
1.003	S310HB	120 Winter	10	+0%	10/15 Summer				78.644	2.194

PN	US/MH Name	Flooded		Pipe		Level Exceeded
		Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)	Status	
1.000	S301	0.000	0.32	5.4	SURCHARGED	
1.001	S302	0.000	0.27	5.4	SURCHARGED	
1.002	S303	0.000	0.02	5.4	OK	
2.000	S304	0.000	1.00	16.1	OK	
2.001	S305	0.000	0.57	16.1	OK	
2.002	S306	0.000	0.18	9.0	SURCHARGED	
3.000	S307	0.000	0.09	1.4	SURCHARGED	
3.001	S308	0.000	0.10	1.3	SURCHARGED	
3.002	S309	0.000	0.03	1.6	SURCHARGED	
1.003	S310HB	0.000	0.03	3.4	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m<sup>3</sup>/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 Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 4 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.255  
 Site Location GB 457850 220300 SP 57850 20300 E (1km) 0.288  
 C (1km) -0.023 F (1km) 2.462  
 D1 (1km) 0.309 Cv (Summer) 0.750  
 D2 (1km) 0.343 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, 240, 360, 480, 960, 1440  
 Return Period(s) (years) 10, 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 Surcharged	
									Level (m)	Depth (m)
1.000	S301	30 Winter	30	+0%	10/15 Summer				79.518	0.168
1.001	S302	30 Winter	30	+0%	10/15 Summer				79.464	0.351
1.002	S303	60 Winter	30	+0%	30/30 Winter				79.064	0.086
2.000	S304	15 Winter	30	+0%	30/15 Summer				79.722	0.072
2.001	S305	15 Winter	30	+0%	100/15 Summer				79.480	-0.053
2.002	S306	60 Winter	30	+0%	10/15 Summer				79.097	1.717
3.000	S307	240 Winter	30	+0%	10/120 Winter				78.673	0.223
3.001	S308	120 Winter	30	+0%	10/15 Summer				78.690	0.461
3.002	S309	60 Winter	30	+0%	10/15 Summer				78.963	2.173
1.003	S310HB	60 Winter	30	+0%	10/15 Summer				79.053	2.603

PN	US/MH Name	Flooded		Pipe		Level Exceeded
		Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)	Status	
1.000	S301	0.000	0.48	8.0	SURCHARGED	
1.001	S302	0.000	0.40	8.0	SURCHARGED	
1.002	S303	0.000	0.03	8.0	SURCHARGED	
2.000	S304	0.000	1.30	20.8	SURCHARGED	
2.001	S305	0.000	0.74	20.8	OK	
2.002	S306	0.000	0.32	16.0	SURCHARGED	
3.000	S307	0.000	0.16	2.8	SURCHARGED	
3.001	S308	0.000	0.15	2.0	SURCHARGED	
3.002	S309	0.000	0.06	3.0	SURCHARGED	
1.003	S310HB	0.000	0.03	3.6	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m<sup>3</sup>/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 Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 4 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.255  
 Site Location GB 457850 220300 SP 57850 20300 E (1km) 0.288  
 C (1km) -0.023 F (1km) 2.462  
 D1 (1km) 0.309 Cv (Summer) 0.750  
 D2 (1km) 0.343 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, 240, 360, 480, 960, 1440  
 Return Period(s) (years) 10, 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 Surcharged	
									Level (m)	Depth (m)
1.000	S301	30 Winter	100	+40%	10/15 Summer				79.858	0.508
1.001	S302	60 Winter	100	+40%	10/15 Summer				79.754	0.641
1.002	S303	60 Winter	100	+40%	30/30 Winter				79.714	0.736
2.000	S304	15 Winter	100	+40%	30/15 Summer				80.018	0.368
2.001	S305	30 Winter	100	+40%	100/15 Summer				79.900	0.367
2.002	S306	60 Winter	100	+40%	10/15 Summer				79.758	2.378
3.000	S307	360 Winter	100	+40%	10/120 Winter				79.420	0.970
3.001	S308	240 Winter	100	+40%	10/15 Summer				79.427	1.198
3.002	S309	60 Winter	100	+40%	10/15 Summer				79.575	2.785
1.003	S310HB	60 Winter	100	+40%	10/15 Summer				79.700	3.250

PN	US/MH Name	Flooded		Pipe		Level Exceeded
		Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)	Status	
1.000	S301	0.000	0.81	13.6	SURCHARGED	
1.001	S302	0.000	0.63	12.5	SURCHARGED	
1.002	S303	0.000	0.05	12.3	SURCHARGED	
2.000	S304	0.000	1.86	29.9	SURCHARGED	
2.001	S305	0.000	0.97	27.1	SURCHARGED	
2.002	S306	0.000	0.37	18.4	SURCHARGED	
3.000	S307	0.000	0.19	3.2	SURCHARGED	
3.001	S308	0.000	0.23	3.1	SURCHARGED	
3.002	S309	0.000	0.08	3.5	SURCHARGED	
1.003	S310HB	0.000	0.03	3.9	SURCHARGED	