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Ground Floor, 24 High Street Whittlesford Cambs, CB22 4LT	Station Road, Cuffley Southern SWS 30yr + 40%	
Date 14/09/2023 10:39 File 2592- SWS.MDX	Designed by JWF Checked by	
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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 530772 202663 TL 30772 02663
Data Type	Point
Maximum Rainfall (mm/hr)	50
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)	0.200
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 Storm


Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.056	4-8	0.013

Total Area Contributing (ha) = 0.069

Total Pipe Volume (m³) = 0.570


Network Design Table for Storm

« - Indicates pipe capacity < flow

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	9.150	0.305	30.0	0.010	5.00	0.0	0.600	o	100	Pipe/Conduit	







Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.11	58.365	0.010	0.0	0.0	0.0	1.41	11.1	1.4

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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
1.001	20.600	0.824	25.0	0.010	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	6.000	0.040	150.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	1.000	0.010	100.0	0.030	5.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	18.938	0.829	22.8	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
2.002	7.790	0.260	30.0	0.010	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	1.630	0.020	81.5	0.000	0.00	0.0	0.600	o	100	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)
1.001	50.00	5.33	58.060	0.020	0.0	0.0	0.0	1.55	12.2	2.7
1.002	50.00	5.45	57.236	0.029	0.0	0.0	0.0	0.82	14.5	3.9
2.000	50.00	5.02	58.295	0.030	0.0	0.0	0.0	0.77	6.0	4.1
2.001	50.00	5.22	58.285	0.030	0.0	0.0	0.0	1.62	12.7	4.1
2.002	50.00	5.31	57.456	0.040	0.0	0.0	0.0	1.41	11.1	5.4
1.003	50.00	5.48	57.196	0.069	0.0	0.0	0.0	0.85	6.7«	9.3

Ground Floor, 24 High Street  
Whittlesford  
Cambs, CB22 4LT

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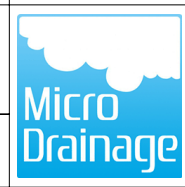
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Manhole Schedules for Storm

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)
SIC2	59.000	0.635	Open Manhole	1200	1.000	58.365	100				
SIC3	59.000	0.940	Open Manhole	1200	1.001	58.060	100	1.000	58.060		100
SIC4	58.300	1.064	Open Manhole	1200	1.002	57.236	150	1.001	57.236		100
SIC 1	59.000	0.705	Open Manhole	1200	2.000	58.295	100				
SIC5	59.000	0.715	Open Manhole	1200	2.001	58.285	100	2.000	58.285		100
SIC6	58.500	1.044	Open Manhole	1200	2.002	57.456	100	2.001	57.456		100
6	58.150	0.954	Open Manhole	1200	1.003	57.196	100	1.002	57.196		150
	58.100	0.924	Open Manhole	0		OUTFALL		2.002	57.196		100
								1.003	57.176		100

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	100	SIC2	59.000	58.365	0.535	Open Manhole	1200
1.001	o	100	SIC3	59.000	58.060	0.840	Open Manhole	1200
1.002	o	150	SIC4	58.300	57.236	0.914	Open Manhole	1200
2.000	o	100	SIC 1	59.000	58.295	0.605	Open Manhole	1200
2.001	o	100	SIC5	59.000	58.285	0.615	Open Manhole	1200
2.002	o	100	SIC6	58.500	57.456	0.944	Open Manhole	1200
1.003	o	100	6	58.150	57.196	0.854	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	9.150	30.0	SIC3	59.000	58.060	0.840	Open Manhole	1200
1.001	20.600	25.0	SIC4	58.300	57.236	0.964	Open Manhole	1200
1.002	6.000	150.0	6	58.150	57.196	0.804	Open Manhole	1200
2.000	1.000	100.0	SIC5	59.000	58.285	0.615	Open Manhole	1200
2.001	18.938	22.8	SIC6	58.500	57.456	0.944	Open Manhole	1200
2.002	7.790	30.0	6	58.150	57.196	0.854	Open Manhole	1200
1.003	1.630	81.5		58.100	57.176	0.824	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)
1.003		58.100	57.176	0.000	0	0

Simulation Criteria for Storm

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	0.000
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	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

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Simulation Criteria for Storm

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.200	Storm Duration (mins)	30
Ratio R	0.433		

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<p><u>Online Controls for Storm</u></p> <p><u>Orifice Manhole: SIC5, DS/PN: 2.001, Volume (m<sup>3</sup>): 0.8</u></p> <p>Diameter (m) 0.028 Discharge Coefficient 0.600 Invert Level (m) 58.285</p> <p><u>Orifice Manhole: 6, DS/PN: 1.003, Volume (m<sup>3</sup>): 1.2</u></p> <p>Diameter (m) 0.037 Discharge Coefficient 0.600 Invert Level (m) 57.196</p>		
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Storage Structures for Storm


Cellular Storage Manhole: SIC4, DS/PN: 1.002

Invert Level (m) 57.236 Safety Factor 2.0  
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	18.0	18.0	0.900	0.0	32.4
0.800	18.0	31.6			

Porous Car Park Manhole: SIC 1, DS/PN: 2.000

Infiltration Coefficient Base (m/hr) 0.00000	Width (m) 5.0
Membrane Percolation (mm/hr) 1000	Length (m) 55.0
Max Percolation (l/s) 76.4	Slope (1:X) 0.0
Safety Factor 2.0	Depression Storage (mm) 5
Porosity 0.30	Evaporation (mm/day) 3
Invert Level (m) 58.295	Membrane Depth (mm) 0

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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 \* 10m<sup>3</sup>/ha Storage 0.000  
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 2 Number of Time/Area Diagrams 0  
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 530772 202663 TL 30772 02663  
Data Type Point  
Cv (Summer) 0.750  
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, 4320, 5760,  
7200, 8640, 10080  
Return Period(s) (years) 2, 30, 100  
Climate Change (%) 0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Water Level
1.000	SIC2	15 Winter	2	+0%	100/15 Winter			58.391
1.001	SIC3	15 Winter	2	+0%	100/15 Summer			58.094
1.002	SIC4	120 Winter	2	+0%	30/15 Summer			57.370
2.000	SIC 1	360 Winter	2	+0%	30/60 Winter			58.334
2.001	SIC5	360 Winter	2	+0%	30/30 Winter			58.340
2.002	SIC6	15 Winter	2	+0%	30/15 Summer			57.480
1.003	6	180 Winter	2	+0%	2/15 Summer			57.369

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SIC2	-0.074	0.000	0.15		1.6	OK	
1.001	SIC3	-0.066	0.000	0.25		2.9	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			Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow						
1.002	SIC4	-0.016	0.000	0.06		56	0.7	OK		
2.000	SIC 1	-0.061	0.000	0.10		192	0.4	OK		
2.001	SIC5	-0.045	0.000	0.03			0.3	OK		
2.002	SIC6	-0.076	0.000	0.13			1.3	OK		
1.003	6	0.073	0.000	0.28			1.1	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 \* 10m<sup>3</sup>/ha Storage 0.000  
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 2 Number of Time/Area Diagrams 0  
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 530772 202663 TL 30772 02663  
Data Type Point  
Cv (Summer) 0.750  
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, 4320, 5760,  
7200, 8640, 10080  
Return Period(s) (years) 2, 30, 100  
Climate Change (%) 0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Water Level
1.000	SIC2	15 Winter	30	+40%	100/15 Winter			58.416
1.001	SIC3	15 Winter	30	+40%	100/15 Summer			58.139
1.002	SIC4	180 Winter	30	+40%	30/15 Summer			57.792
2.000	SIC 1	240 Winter	30	+40%	30/60 Winter			58.432
2.001	SIC5	360 Summer	30	+40%	30/30 Winter			58.452
2.002	SIC6	180 Winter	30	+40%	30/15 Summer			57.823
1.003	6	1440 Summer	30	+40%	2/15 Summer			58.007


PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SIC2	-0.049	0.000	0.50		5.2	OK	
1.001	SIC3	-0.021	0.000	0.90		10.6	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 / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )						
1.002	SIC4	0.406	0.000	0.19		105	2.3	SURCHARGED	
2.000	SIC 1	0.037	0.000	0.16		240	0.6	SURCHARGED	
2.001	SIC5	0.067	0.000	0.05			0.6	SURCHARGED	
2.002	SIC6	0.267	0.000	0.16			1.6	SURCHARGED	
1.003	6	0.611	0.000	0.39			1.6	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 \* 10m<sup>3</sup>/ha Storage 0.000  
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 2    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model    FEH  
FEH Rainfall Version    2013  
Site Location GB 530772 202663 TL 30772 02663  
Data Type    Point  
Cv (Summer)    0.750  
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, 4320, 5760,  
7200, 8640, 10080  
Return Period(s) (years)    2, 30, 100  
Climate Change (%)    0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SIC2	15 Winter	100	+40%	100/15 Winter				58.471
1.001	SIC3	15 Winter	100	+40%	100/15 Summer				58.372
1.002	SIC4	180 Winter	100	+40%	30/15 Summer				58.017
2.000	SIC 1	360 Winter	100	+40%	30/60 Winter				58.489
2.001	SIC5	480 Winter	100	+40%	30/30 Winter				58.547
2.002	SIC6	180 Winter	100	+40%	30/15 Summer				58.058
1.003	6	480 Winter	100	+40%	2/15 Summer				58.146

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Pipe Level Exceeded
1.000	SIC2	0.006	0.000	0.64		6.5	SURCHARGED	
1.001	SIC3	0.212	0.000	0.98		11.5	SURCHARGED	

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

PN	US/MH Name	Surcharged Flooded			Flow / Overflow Cap.	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.					
1.002	SIC4	0.631	0.000	0.21		123	2.6	SURCHARGED	
2.000	SIC 1	0.094	0.000	0.15		324	0.6	SURCHARGED	
2.001	SIC5	0.162	0.000	0.06			0.7	SURCHARGED	
2.002	SIC6	0.502	0.000	0.22			2.0	SURCHARGED	
1.003	6	0.750	0.000	0.57			2.0	SURCHARGED	