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Lone Barn Studios Stanbridge Lane Romsey SO51 0HE	Burndell Road Drainage Simulation Rev B	
Date 15/03/2019 File Network.mdx	Designed by Hoa Nguyen Checked by KM	
Micro Drainage	Network 2013.1.1	

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	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.100
Ratio R	0.350	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)	0.81
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	1000
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.418	4-8	0.439	8-12	0.009

Total Area Contributing (ha) = 0.866

Total Pipe Volume (m³) = 34.035

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)
1.000	13.255	0.185	71.6	0.091	4.00	0.0	0.600	o	300
2.000	16.220	0.059	274.9	0.135	4.00	0.0	0.600	o	300
2.001	34.635	0.126	274.9	0.011	0.00	0.0	0.600	o	300
3.000	12.672	0.068	185.0	0.065	4.00	0.0	0.600	o	225
3.001	17.800	0.096	185.2	0.000	0.00	0.0	0.600	o	225

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	4.12	5.285	0.091	0.0	0.0	0.0	1.86	131.5	12.3
2.000	50.00	4.29	5.285	0.135	0.0	0.0	0.0	0.94	66.7	18.3
2.001	49.07	4.90	5.226	0.146	0.0	0.0	0.0	0.94	66.7	19.4
3.000	50.00	4.22	5.340	0.065	0.0	0.0	0.0	0.96	38.1	8.8
3.001	50.00	4.53	5.272	0.065	0.0	0.0	0.0	0.96	38.1	8.8

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1.001	27.833	0.104	267.5	0.020	0.00	0.0	0.600	o	375		
1.002	42.454	0.159	267.5	0.111	0.00	0.0	0.600	o	375		
1.003	19.943	0.074	269.1	0.043	0.00	0.0	0.600	o	375		
4.000	36.943	0.246	150.2	0.028	4.00	0.0	0.600	o	150		
4.001	13.000	0.087	150.0	0.015	0.00	0.0	0.600	o	150		
4.002	14.564	0.097	150.1	0.000	0.00	0.0	0.600	o	150		
4.003	12.060	0.080	150.0	0.000	0.00	0.0	0.600	o	150		
4.004	7.366	0.049	150.3	0.045	0.00	0.0	0.600	o	150		
4.005	11.834	0.079	149.8	0.000	0.00	0.0	0.600	o	150		
4.006	6.666	0.044	151.5	0.000	0.00	0.0	0.600	o	150		
4.007	7.884	0.053	148.8	0.015	0.00	0.0	0.600	o	150		
4.008	14.886	0.066	225.5	0.000	0.00	0.0	0.600	o	225		
4.009	18.196	0.081	224.6	0.011	0.00	0.0	0.600	o	225		
4.010	11.580	0.051	227.1	0.012	0.00	0.0	0.600	o	225		
4.011	14.596	0.029	500.0	0.000	0.00	0.0	0.600	o	375		
4.012	14.000	0.028	500.0	0.010	0.00	0.0	0.600	o	375		
4.013	28.000	0.057	494.7	0.053	0.00	0.0	0.600	o	375		
1.004	37.000	0.081	456.8	0.031	0.00	0.0	0.600	o	375		
<u>Network Results Table</u>											
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	47.40	5.32	5.025	0.322	0.0	0.0	0.0	1.10	121.8	41.3	
1.002	45.10	5.96	4.921	0.433	0.0	0.0	0.0	1.10	121.8	52.9	
1.003	44.10	6.26	4.762	0.476	0.0	0.0	0.0	1.10	121.4	56.9	
4.000	49.68	4.75	5.960	0.028	0.0	0.0	0.0	0.82	14.5	3.8	
4.001	48.58	5.02	5.714	0.043	0.0	0.0	0.0	0.82	14.5	5.7	
4.002	47.42	5.31	5.627	0.043	0.0	0.0	0.0	0.82	14.5	5.7	
4.003	46.50	5.56	5.530	0.043	0.0	0.0	0.0	0.82	14.5	5.7	
4.004	45.96	5.71	5.450	0.088	0.0	0.0	0.0	0.82	14.4	11.0	
4.005	45.13	5.95	5.401	0.088	0.0	0.0	0.0	0.82	14.5	11.0	
4.006	44.67	6.09	5.322	0.088	0.0	0.0	0.0	0.81	14.4	11.0	
4.007	44.15	6.25	5.278	0.103	0.0	0.0	0.0	0.82	14.5	12.3	
4.008	43.25	6.53	5.150	0.103	0.0	0.0	0.0	0.87	34.5	12.3	
4.009	42.21	6.88	5.084	0.114	0.0	0.0	0.0	0.87	34.5	13.0	
4.010	41.57	7.11	5.003	0.126	0.0	0.0	0.0	0.86	34.3	14.2	
4.011	40.74	7.41	4.802	0.126	0.0	0.0	0.0	0.80	88.7	14.2	
4.012	39.98	7.70	4.773	0.136	0.0	0.0	0.0	0.80	88.7	14.7	
4.013	38.57	8.28	4.745	0.189	0.0	0.0	0.0	0.81	89.2	19.7	
1.004	36.93	9.01	4.688	0.696	0.0	0.0	0.0	0.84	92.9	69.6	
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Storage Structures for Storm

Cellular Storage Manhole: S1, DS/PN: 1.000

Invert Level (m) 5.600 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 ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	60.0	60.0	0.900	0.0	85.6
0.800	60.0	85.6			

Cellular Storage Manhole: S7, DS/PN: 2.000

Invert Level (m) 5.300 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 ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	133.0	133.0	0.900	0.0	174.6
0.800	133.0	174.6			

Cellular Storage Manhole: S15, DS/PN: 5.000

Invert Level (m) 4.650 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 ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	187.5	187.5	1.700	0.0	291.5
1.600	187.5	291.5			

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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	3
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	0.300
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	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%	30/120 Winter				
2.000	60 Winter	1	0%	30/360 Winter				
2.001	30 Winter	1	0%	30/120 Winter				
3.000	15 Winter	1	0%	30/120 Winter				
3.001	15 Summer	1	0%	30/120 Summer				
1.001	15 Winter	1	0%	30/30 Winter				
1.002	15 Winter	1	0%	30/15 Winter				
1.003	240 Winter	1	0%	30/15 Summer				
4.000	15 Winter	1	0%	100/15 Summer				
4.001	15 Winter	1	0%	30/15 Summer				
4.002	15 Winter	1	0%	30/15 Summer				
4.003	15 Winter	1	0%	30/15 Summer				
4.004	15 Winter	1	0%	30/15 Summer				
4.005	15 Winter	1	0%	30/15 Summer				
4.006	15 Winter	1	0%	30/15 Summer				
4.007	15 Winter	1	0%	30/15 Summer				
4.008	15 Winter	1	0%	30/15 Winter				
4.009	15 Winter	1	0%	30/15 Winter				
4.010	15 Winter	1	0%	30/15 Summer				
4.011	240 Winter	1	0%	30/15 Summer				

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<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>							
PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Lvl Act. Exc.
4.012	240 Winter	1	0%	30/15 Summer			
4.013	240 Winter	1	0%	30/15 Summer			
1.004	240 Winter	1	0%	1/240 Winter			
5.000	240 Winter	1	0%	1/240 Winter			
1.005	240 Winter	1	0%	1/15 Winter			
</							

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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 ³ /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	3
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	0.300
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	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	360 Winter	30	0%	30/120 Winter				
2.000	480 Winter	30	0%	30/360 Winter				
2.001	360 Winter	30	0%	30/120 Winter				
3.000	480 Winter	30	0%	30/120 Winter				
3.001	960 Winter	30	0%	30/120 Summer				
1.001	480 Winter	30	0%	30/30 Winter				
1.002	480 Winter	30	0%	30/15 Winter				
1.003	360 Winter	30	0%	30/15 Summer				
4.000	15 Winter	30	0%	100/15 Summer				
4.001	15 Winter	30	0%	30/15 Summer				
4.002	15 Winter	30	0%	30/15 Summer				
4.003	15 Winter	30	0%	30/15 Summer				
4.004	15 Winter	30	0%	30/15 Summer				
4.005	15 Winter	30	0%	30/15 Summer				
4.006	360 Winter	30	0%	30/15 Summer				
4.007	480 Winter	30	0%	30/15 Summer				
4.008	480 Winter	30	0%	30/15 Winter				
4.009	360 Winter	30	0%	30/15 Winter				
4.010	480 Winter	30	0%	30/15 Summer				
4.011	480 Winter	30	0%	30/15 Summer				

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<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>								
PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Lvl Act. Exc.	
4.012	480 Winter	30	0%	30/15 Summer				
4.013	480 Winter	30	0%	30/15 Summer				
1.004	480 Winter	30	0%	1/240 Winter				
5.000	480 Winter	30	0%	1/240 Winter				
1.005	480 Winter	30	0%	1/15 Winter				
PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	S1	5.618	0.033	0.000	0.05	0.0	5.7	SURCHARGED
2.000	S7	5.594	0.009	0.000	0.09	0.0	5.4	SURCHARGED
2.001	S8	5.758	0.232	0.000	0.11	0.0	6.6	SURCHARGED
3.000	S10	5.711	0.146	0.000	0.08	0.0	2.7	SURCHARGED
3.001	S11	5.718	0.221	0.000	0.06	0.0	2.1	SURCHARGED
1.001	S2	5.777	0.377	0.000	0.12	0.0	12.7	SURCHARGED
1.002	S3	5.828	0.532	0.000	0.15	0.0	16.4	SURCHARGED
1.003	S4	5.836	0.699	0.000	0.20	0.0	20.7	SURCHARGED
4.000	S16	6.046	-0.064	0.000	0.61	0.0	8.5	OK
4.001	S17	5.968	0.104	0.000	0.83	0.0	11.0	SURCHARGED
4.002	S18	5.926	0.149	0.000	0.71	0.0	9.4	SURCHARGED
4.003	S19	5.879	0.199	0.000	0.76	0.0	10.0	SURCHARGED
4.004	S20	5.840	0.241	0.000	1.42	0.0	17.7	SURCHARGED
4.005	S21	5.741	0.190	0.000	1.32	0.0	17.3	SURCHARGED
4.006	S22	5.628	0.156	0.000	0.37	0.0	4.5	SURCHARGED
4.007	S23	5.650	0.222	0.000	0.34	0.0	4.3	SURCHARGED
4.008	S24	5.705	0.330	0.000	0.14	0.0	4.3	SURCHARGED
4.009	S25	5.729	0.420	0.000	0.18	0.0	5.7	SURCHARGED
4.010	S26	5.763	0.535	0.000	0.18	0.0	5.2	SURCHARGED
4.011	S27	5.790	0.614	0.000	0.09	0.0	5.0	SURCHARGED
4.012	S28	5.809	0.661	0.000	0.10	0.0	5.5	SURCHARGED
4.013	S29	5.821	0.701	0.000	0.10	0.0	7.5	SURCHARGED
1.004	S5	5.847	0.784	0.000	0.30	0.0	25.3	SURCHARGED
5.000	S15	5.634	0.599	0.000	0.12	0.0	8.7	SURCHARGED
1.005	S6	5.884	0.902	0.000	0.07	0.0	7.1	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	3
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	0.300
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	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	480 Winter	100	+30%	30/120 Winter				
2.000	480 Winter	100	+30%	30/360 Winter				
2.001	480 Winter	100	+30%	30/120 Winter				
3.000	480 Winter	100	+30%	30/120 Winter				
3.001	480 Winter	100	+30%	30/120 Summer				
1.001	480 Winter	100	+30%	30/30 Winter				
1.002	480 Winter	100	+30%	30/15 Winter				
1.003	480 Winter	100	+30%	30/15 Summer				
4.000	15 Winter	100	+30%	100/15 Summer				
4.001	15 Winter	100	+30%	30/15 Summer				
4.002	15 Winter	100	+30%	30/15 Summer				
4.003	15 Winter	100	+30%	30/15 Summer				
4.004	30 Winter	100	+30%	30/15 Summer				
4.005	30 Winter	100	+30%	30/15 Summer				
4.006	480 Winter	100	+30%	30/15 Summer				
4.007	480 Winter	100	+30%	30/15 Summer				
4.008	480 Winter	100	+30%	30/15 Winter				
4.009	480 Winter	100	+30%	30/15 Winter				
4.010	480 Winter	100	+30%	30/15 Summer				
4.011	480 Winter	100	+30%	30/15 Summer				

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<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>							
PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act. Lvl Exc.
4.012	480 Winter	100	+30%	30/15 Summer			
4.013	480 Winter	100	+30%	30/15 Summer			
1.004	480 Winter	100	+30%	1/240 Winter			
5.000	480 Winter	100	+30%	1/240 Winter			
1.005	480 Winter	100	+30%	1/15 Winter			