

Mike Stranks  
Team Leader  
Development Management  
Rochford District Council  
Council Offices,  
South Street,  
Rochford,  
Essex  
SS4 1BW

Our Ref: TS/ss12206/J661



01 May 2012

Dear Mr Stranks,

**Planning Applications reference 11/00689/FUL: EON Site, 190 London Road, Rayleigh, Updated Drainage Strategy**

Further to the submission of the Flood Risk Assessment for the Eon Site on London Road and the detailed hydraulic flood modelling in December 2011, please find enclosed the updated drainage strategy drawing with associated updated hydraulic calculations in support of the amendments to the revised site layout proposals.

The updates to the drainage layout still maintain the principles of the drainage strategy and flood risk assessment as outlined in the previously submitted Flood Risk Assessment (ref: J661-003).

This information is therefore submitted to support the Planning Application and should be considered to be an Addendum to the Flood Risk Assessment J661-003.

Yours sincerely

A handwritten signature in blue ink, appearing to read "Terry Seymour".


**Terry Seymour**  
**Principle Engineer**

CC: Ed Hanson, Barton Willmore  
Emma Wilson, Bellway

Encl:

4 x Drawing J661-007 Drainage Strategy  
4 x Hydraulic calculations for the updated surface water networks



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Micro Drainage	Network W.12.6	


Existing Network Details 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	57.013	0.450	126.7	0.095	5.00	0.0	0.600	o	225
2.000	30.729	0.450	68.3	0.054	5.00	0.0	0.600	o	225
1.001	21.846	0.525	41.6	0.082	5.00	0.0	0.600	o	225
1.002	24.466	0.909	26.9	0.000	0.00	0.0	0.600	o	225
3.000	12.626	0.050	252.5	0.023	5.00	0.0	0.600	o	150
3.001	6.620	0.050	132.4	0.053	0.00	0.0	0.600	o	150
3.002	43.421	0.259	167.6	0.052	0.00	0.0	0.600	o	225
1.003	5.088	0.338	15.1	0.000	0.00	0.0	0.600	o	300
4.000	26.628	0.200	133.1	0.060	5.00	0.0	0.600	o	225
1.004	45.193	0.915	49.4	0.092	0.00	0.0	0.600	o	300
5.000	23.892	0.262	91.2	0.074	5.00	0.0	0.600	o	150
6.000	28.773	0.200	143.9	0.069	5.00	0.0	0.600	o	450
1.005	7.088	0.090	78.8	0.000	0.00	0.0	0.600	oo	450

**RECEIVED**  
02.05.2012  
Support Services

Network Results Table

PN	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	18.957	0.095	0.0	1.16	46.1
2.000	18.950	0.054	0.0	1.58	63.0
1.001	18.500	0.231	0.0	2.03	80.9
1.002	17.975	0.231	0.0	2.53	100.7
3.000	17.500	0.023	0.0	0.63	11.1
3.001	17.450	0.076	0.0	0.87	15.4
3.002	17.400	0.128	0.0	1.01	40.0
1.003	16.991	0.359	0.0	4.07	287.9
4.000	17.000	0.060	0.0	1.13	45.0
1.004	16.653	0.511	0.0	2.24	158.5
5.000	16.150	0.074	0.0	1.05	18.6
6.000	14.800	0.069	0.0	1.69	269.3
1.005	14.600	0.654	0.0	2.29	729.3


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Existing Network Details 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)
1.006	18.375	0.050	367.5	0.088	0.00	0.0	0.600	∞	450
1.007	21.407	0.060	356.8	0.000	0.00	0.0	0.600	∞	450
7.000	5.000	0.100	50.0	0.039	5.00	0.0	0.600	∞	450
1.008	34.957	0.100	349.6	0.000	0.00	0.0	0.600	∞	450
8.000	45.900	0.180	255.0	0.085	5.00	0.0	0.600	∞	450
8.001	25.200	0.070	360.0	0.183	0.00	0.0	0.600	∞	450
9.000	30.000	0.075	400.0	0.000	5.00	0.0	0.600	∞	450
9.001	5.000	0.017	294.1	0.000	0.00	0.0	0.600	∞	450
8.002	26.689	0.068	392.5	0.000	0.00	0.0	0.600	∞	450
8.003	8.221	0.020	411.1	0.083	0.00	0.0	0.600	∞	450
8.004	22.000	0.055	400.0	0.000	0.00	0.0	0.600	∞	450
8.005	23.000	0.057	403.5	0.038	0.00	0.0	0.600	∞	450
8.006	7.372	0.018	409.6	0.042	0.00	0.0	0.600	∞	450
10.000	30.000	0.060	500.0	0.000	5.00	0.0	0.600	∞	450
10.001	1.000	0.008	125.0	0.000	0.00	0.0	0.600	∞	450

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.006	14.510	0.742	0.0	1.05	335.4
1.007	14.460	0.742	0.0	1.07	340.5
7.000	14.500	0.039	0.0	2.88	916.3
1.008	14.300	0.781	0.0	1.08	344.0
8.000	14.600	0.085	0.0	1.27	403.5
8.001	14.420	0.268	0.0	1.07	339.0
9.000	14.410	0.000	0.0	1.01	321.4
9.001	14.335	0.000	0.0	1.18	375.4
8.002	14.318	0.268	0.0	1.02	324.5
8.003	14.250	0.351	0.0	1.00	317.0
8.004	14.230	0.351	0.0	1.01	321.4
8.005	14.175	0.389	0.0	1.01	320.0
8.006	14.118	0.431	0.0	1.00	317.6
10.000	14.168	0.000	0.0	0.90	287.0
10.001	14.108	0.000	0.0	1.82	578.0

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Existing Network Details 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)
1.009	30.961	0.077	402.1	0.068	0.00	0.0	0.600	∞	450
1.010	4.835	0.000	0.0	0.023	0.00	0.0	0.600	∞	450
1.011	16.431	0.004	4107.8	0.000	0.00	0.0	0.600	o	450

Network Results Table

PN	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.009	14.100	1.280	0.0	1.01	320.5
1.010	14.085	1.303	0.0	0.00	0.0
1.011	14.035	1.303	0.0	0.31	48.9


Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	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 Storage Structures	2
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		



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Online Controls for Storm


Non Return Valve Manhole: SWM9.1, DS/PN: 9.001, Volume (m<sup>3</sup>): 10.9

Non Return Valve Manhole: SWMH10.1, DS/PN: 10.001, Volume (m<sup>3</sup>): 11.5

Hydro-Brake<sup>®</sup> Manhole: SW MH 1.11, DS/PN: 1.011, Volume (m<sup>3</sup>): 5.5

Design Head (m) 1.000 Hydro-Brake<sup>®</sup> Type Md4 Invert Level (m) 14.035  
Design Flow (l/s) 220.0 Diameter (mm) 418

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.2	1.200	201.3	3.000	235.9	7.000	360.2
0.200	25.0	1.400	188.8	3.500	254.7	7.500	372.9
0.300	58.0	1.600	185.8	4.000	272.3	8.000	385.1
0.400	99.2	1.800	189.1	4.500	288.8	8.500	397.0
0.500	142.1	2.000	195.6	5.000	304.5	9.000	408.5
0.600	180.4	2.200	203.4	5.500	319.3	9.500	419.7
0.800	222.3	2.400	211.6	6.000	333.5		
1.000	220.0	2.600	219.8	6.500	347.1		

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Offline Controls for Storm

Weir Manhole: SW MH 3.2, DS/PN: 8.002, Loop to PN: 9.000

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 14.900

Weir Manhole: 16.15, DS/PN: 1.009, Loop to PN: 10.000

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 14.970

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Storage Structures for Storm

Cellular Storage Manhole: SWMH9.0, DS/PN: 9.000


Invert Level (m) 14.420 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	80.0	0.0	1.300	0.0	0.0
0.100	80.0	0.0	1.400	0.0	0.0
0.200	80.0	0.0	1.500	0.0	0.0
0.300	80.0	0.0	1.600	0.0	0.0
0.400	80.0	0.0	1.700	0.0	0.0
0.500	80.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Cellular Storage Manhole: SWMH10.0, DS/PN: 10.000

Invert Level (m) 14.168 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	80.0	0.0	1.300	0.0	0.0
0.100	80.0	0.0	1.400	0.0	0.0
0.200	80.0	0.0	1.500	0.0	0.0
0.300	80.0	0.0	1.600	0.0	0.0
0.400	80.0	0.0	1.700	0.0	0.0
0.500	80.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0


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

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, 600, 960,  
 1440  
 Return Period(s) (years) 1, 30, 100  
 Climate Change (%) 0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%	100/15 Summer				
2.000	15 Winter	1	0%	100/15 Summer				
1.001	15 Winter	1	0%	100/15 Summer				
1.002	15 Winter	1	0%	100/15 Summer				
3.000	15 Winter	1	0%	30/15 Summer	100/15 Winter			1
3.001	15 Winter	1	0%	30/15 Summer				
3.002	15 Winter	1	0%	30/15 Summer				
1.003	15 Winter	1	0%	100/15 Summer				
4.000	15 Winter	1	0%	100/15 Summer				
1.004	15 Winter	1	0%	30/15 Summer				
5.000	15 Winter	1	0%	30/15 Summer				
6.000	15 Winter	1	0%	100/15 Summer				
1.005	15 Winter	1	0%	30/15 Winter				
1.006	15 Winter	1	0%	30/15 Winter				
1.007	15 Winter	1	0%	30/15 Winter				
7.000	30 Winter	1	0%	100/15 Summer				
1.008	15 Winter	1	0%	30/15 Summer				
8.000	15 Winter	1	0%	100/15 Summer				
8.001	30 Winter	1	0%	30/30 Winter				
9.000	120 Winter	1	0%	100/15 Winter				
9.001	120 Winter	1	0%	100/15 Winter				
8.002	30 Winter	1	0%	30/15 Summer		100/15 Summer		8
8.003	30 Winter	1	0%	30/15 Summer				
8.004	30 Winter	1	0%	30/15 Summer				
8.005	30 Winter	1	0%	30/15 Summer				
8.006	30 Winter	1	0%	30/15 Summer				
10.000	120 Winter	1	0%					
10.001	120 Winter	1	0%					
1.009	15 Winter	1	0%	30/15 Summer		100/15 Summer		7
1.010	15 Winter	1	0%	30/15 Summer				
1.011	15 Winter	1	0%	30/15 Summer				

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

PN	US/MH Name	Water	Surch'ed Depth (m)	Flooded	Flow / Cap.	O'flow	Pipe	Status
		Level (m)		Volume (m <sup>3</sup> )		(l/s)	Flow (l/s)	
1.000	SW MH 12	19.034	-0.141	0.000	0.29	0.0	12.8	OK
2.000	SM MH 13	19.003	-0.172	0.000	0.13	0.0	7.4	OK
1.001	SW MH 1.0	18.603	-0.122	0.000	0.42	0.0	31.3	OK
1.002	SW MH 1.1	18.066	-0.134	0.000	0.34	0.0	31.4	OK
3.000	SW MH14	17.565	-0.085	0.000	0.31	0.0	3.1	OK
3.001	SW MH 15	17.545	-0.055	0.000	0.72	0.0	9.4	OK
3.002	SW MH 16	17.500	-0.125	0.000	0.40	0.0	15.3	OK
1.003	SW MH 1.2	17.107	-0.184	0.000	0.32	0.0	46.6	OK
4.000	SW MH 17	17.068	-0.157	0.000	0.20	0.0	8.2	OK
1.004	SW MH 1.3	16.792	-0.161	0.000	0.44	0.0	64.8	OK
5.000	SW MH 2.0	16.233	-0.067	0.000	0.58	0.0	10.2	OK
6.000	SWMH 18	14.859	-0.391	0.000	0.04	0.0	9.5	OK
1.005	SW M H 1.5	14.719	-0.331	0.000	0.25	0.0	83.6	OK
1.006	SW MH 1.6	14.693	-0.267	0.000	0.35	0.0	93.4	OK
1.007	SW MH 1.7	14.635	-0.275	0.000	0.33	0.0	91.7	OK
7.000	SW MH 19	14.528	-0.422	0.000	0.01	0.0	4.2	OK
1.008	SW MH 1.8	14.528	-0.222	0.000	0.31	0.0	93.3	OK
8.000	SW MH 3.0	14.652	-0.398	0.000	0.03	0.0	11.6	OK
8.001	SW MH 3.1	14.539	-0.331	0.000	0.09	0.0	26.8	OK
9.000	SWMH9.0	14.410	-0.450	0.000	0.00	0.0	0.0	OK
9.001	SWM9.1	14.335	-0.450	0.000	0.00	0.0	0.0	OK
8.002	SW MH 3.2	14.535	-0.233	0.000	0.08	0.0	23.0	OK
8.003	SW MH 3.3	14.530	-0.170	0.000	0.13	0.0	22.4	OK
8.004	SW MH 3.4	14.527	-0.153	0.000	0.07	0.0	19.5	OK
8.005	SW MH 3.5	14.516	-0.109	0.000	0.08	0.0	21.8	OK
8.006	SW MH 3.6	14.500	-0.068	0.000	0.13	0.0	25.6	OK
10.000	SWMH10.0	14.168	-0.450	0.000	0.00	0.0	0.0	OK
10.001	SWMH10.1	14.108	-0.450	0.000	0.00	0.0	0.0	OK
1.009	16.15	14.494	-0.056	0.000	0.29	0.0	79.1	OK
1.010	SW MH 1.10	14.432	-0.103	0.000	0.33	0.0	76.3	OK
1.011	SW MH 1.11	14.426	-0.059	0.000	1.38	0.0	76.1	OK

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

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, 600, 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	30	0%	100/15	Summer			
2.000	15 Winter	30	0%	100/15	Summer			
1.001	15 Winter	30	0%	100/15	Summer			
1.002	15 Winter	30	0%	100/15	Summer			
3.000	15 Winter	30	0%	30/15	Summer	100/15 Winter		1
3.001	15 Winter	30	0%	30/15	Summer			
3.002	15 Winter	30	0%	30/15	Summer			
1.003	15 Winter	30	0%	100/15	Summer			
4.000	15 Winter	30	0%	100/15	Summer			
1.004	15 Winter	30	0%	30/15	Summer			
5.000	15 Winter	30	0%	30/15	Summer			
6.000	15 Winter	30	0%	100/15	Summer			
1.005	15 Winter	30	0%	30/15	Winter			
1.006	30 Winter	30	0%	30/15	Winter			
1.007	15 Winter	30	0%	30/15	Winter			
7.000	15 Winter	30	0%	100/15	Summer			
1.008	15 Winter	30	0%	30/15	Summer			
8.000	30 Winter	30	0%	100/15	Summer			
8.001	30 Winter	30	0%	30/30	Winter			
9.000	120 Winter	30	0%	100/15	Winter			
9.001	120 Winter	30	0%	100/15	Winter			
8.002	30 Winter	30	0%	30/15	Summer	100/15 Summer		8
8.003	30 Winter	30	0%	30/15	Summer			
8.004	30 Winter	30	0%	30/15	Summer			
8.005	30 Winter	30	0%	30/15	Summer			
8.006	30 Winter	30	0%	30/15	Summer			
10.000	120 Winter	30	0%					
10.001	120 Winter	30	0%					
1.009	30 Winter	30	0%	30/15	Summer	100/15 Summer		7
1.010	30 Winter	30	0%	30/15	Summer			
1.011	30 Winter	30	0%	30/15	Summer			



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


PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	SW MH 12	19.094	-0.081	0.000	0.71	0.0	31.5	OK
2.000	SM MH 13	19.037	-0.138	0.000	0.31	0.0	18.2	OK
1.001	SW MH 1.0	18.718	-0.007	0.000	1.00	0.0	73.7	OK
1.002	SW MH 1.1	18.127	-0.073	0.000	0.80	0.0	73.8	OK
3.000	SW MH14	17.856	0.206	0.000	0.83	0.0	8.4	SURCHARGED
3.001	SW MH 15	17.831	0.231	0.000	1.85	0.0	24.1	SURCHARGED
3.002	SW MH 16	17.661	0.036	0.000	1.05	0.0	40.2	SURCHARGED
1.003	SW MH 1.2	17.240	-0.051	0.000	0.78	0.0	114.0	OK
4.000	SW MH 17	17.112	-0.113	0.000	0.48	0.0	20.1	OK
1.004	SW MH 1.3	17.040	0.087	0.000	1.05	0.0	155.9	SURCHARGED
5.000	SW MH 2.0	16.503	0.203	0.000	1.32	0.0	23.4	SURCHARGED
6.000	SWMH 18	15.090	-0.160	0.000	0.10	0.0	23.1	OK
1.005	SW M H 1.5	15.080	0.030	0.000	0.58	0.0	197.2	SURCHARGED
1.006	SW MH 1.6	14.964	0.004	0.000	0.67	0.0	180.3	SURCHARGED
1.007	SW MH 1.7	14.917	0.007	0.000	0.74	0.0	207.5	SURCHARGED
7.000	SW MH 19	14.887	-0.063	0.000	0.03	0.0	12.0	OK
1.008	SW MH 1.8	14.886	0.136	0.000	0.58	0.0	176.2	SURCHARGED
8.000	SW MH 3.0	14.893	-0.157	0.000	0.06	0.0	20.9	OK
8.001	SW MH 3.1	14.877	0.007	0.000	0.18	0.0	50.1	SURCHARGED
9.000	SWMH9.0	14.410	-0.450	0.000	0.00	0.0	0.0	OK
9.001	SWM9.1	14.335	-0.450	0.000	0.00	0.0	0.0	OK
8.002	SW MH 3.2	14.872	0.104	0.000	0.13	0.0	36.2	SURCHARGED
8.003	SW MH 3.3	14.867	0.167	0.000	0.25	0.0	44.2	SURCHARGED
8.004	SW MH 3.4	14.862	0.182	0.000	0.17	0.0	44.3	SURCHARGED
8.005	SW MH 3.5	14.854	0.229	0.000	0.19	0.0	49.6	FLOOD RISK
8.006	SW MH 3.6	14.845	0.277	0.000	0.27	0.0	52.1	SURCHARGED
10.000	SWMH10.0	14.168	-0.450	0.000	0.00	0.0	0.0	OK
10.001	SWMH10.1	14.108	-0.450	0.000	0.00	0.0	0.0	OK
1.009	16.15	14.840	0.290	0.000	0.69	0.0	191.5	SURCHARGED
1.010	SW MH 1.10	14.797	0.262	0.000	0.83	0.0	193.1	SURCHARGED
1.011	SW MH 1.11	14.782	0.297	0.000	3.51	0.0	193.5	SURCHARGED

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

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, 600, 960, 1440  
 Return Period(s) (years) 1, 30, 100  
 Climate Change (%) 0, 0, 30


PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%	100/15 Summer				
2.000	15 Winter	100	+30%	100/15 Summer				
1.001	15 Winter	100	+30%	100/15 Summer				
1.002	15 Winter	100	+30%	100/15 Summer				
3.000	15 Winter	100	+30%	30/15 Summer	100/15 Winter			1
3.001	15 Winter	100	+30%	30/15 Summer				
3.002	15 Winter	100	+30%	30/15 Summer				
1.003	15 Winter	100	+30%	100/15 Summer				
4.000	15 Winter	100	+30%	100/15 Summer				
1.004	15 Winter	100	+30%	30/15 Summer				
5.000	15 Winter	100	+30%	30/15 Summer				
6.000	15 Winter	100	+30%	100/15 Summer				
1.005	15 Winter	100	+30%	30/15 Winter				
1.006	15 Winter	100	+30%	30/15 Winter				
1.007	15 Winter	100	+30%	30/15 Winter				
7.000	15 Winter	100	+30%	100/15 Summer				
1.008	15 Winter	100	+30%	30/15 Summer				
8.000	30 Summer	100	+30%	100/15 Summer				
8.001	30 Winter	100	+30%	30/30 Winter				
9.000	30 Winter	100	+30%	100/15 Winter				
9.001	30 Winter	100	+30%	100/15 Winter				
8.002	30 Winter	100	+30%	30/15 Summer		100/15 Summer		8
8.003	30 Winter	100	+30%	30/15 Summer				
8.004	30 Winter	100	+30%	30/15 Summer				
8.005	15 Winter	100	+30%	30/15 Summer				
8.006	15 Winter	100	+30%	30/15 Summer				
10.000	30 Winter	100	+30%					
10.001	30 Winter	100	+30%					
1.009	15 Winter	100	+30%	30/15 Summer		100/15 Summer		7
1.010	30 Summer	100	+30%	30/15 Summer				
1.011	30 Summer	100	+30%	30/15 Summer				

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

PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	SW MH 12	19.963	0.788	0.000	0.91	0.0	40.5	FLOOD RISK
2.000	SM MH 13	19.707	0.532	0.000	0.47	0.0	27.6	FLOOD RISK
1.001	SW MH 1.0	19.653	0.928	0.000	1.25	0.0	92.0	SURCHARGED
1.002	SW MH 1.1	18.840	0.640	0.000	0.99	0.0	91.5	SURCHARGED
3.000	SW MH14	18.700	1.050	0.116	1.15	0.0	11.6	FLOOD
3.001	SW MH 15	18.673	1.073	0.000	2.29	0.0	29.8	FLOOD RISK
3.002	SW MH 16	18.408	0.783	0.000	1.35	0.0	51.4	FLOOD RISK
1.003	SW MH 1.2	17.985	0.694	0.000	0.99	0.0	143.7	SURCHARGED
4.000	SW MH 17	17.768	0.543	0.000	0.67	0.0	27.9	SURCHARGED
1.004	SW MH 1.3	17.678	0.725	0.000	1.33	0.0	198.1	SURCHARGED
5.000	SW MH 2.0	17.209	0.909	0.000	2.10	0.0	37.1	FLOOD RISK
6.000	SWMH 18	15.481	0.231	0.000	0.16	0.0	36.6	SURCHARGED
1.005	SW M H 1.5	15.404	0.354	0.000	0.78	0.0	265.0	SURCHARGED
1.006	SW MH 1.6	15.310	0.350	0.000	1.09	0.0	291.4	SURCHARGED
1.007	SW MH 1.7	15.263	0.353	0.000	1.04	0.0	290.4	SURCHARGED
7.000	SW MH 19	15.216	0.266	0.000	0.05	0.0	19.1	SURCHARGED
1.008	SW MH 1.8	15.213	0.463	0.000	1.00	0.0	301.7	SURCHARGED
8.000	SW MH 3.0	15.177	0.127	0.000	0.10	0.0	35.3	SURCHARGED
8.001	SW MH 3.1	15.171	0.301	0.000	0.39	0.0	111.6	SURCHARGED
9.000	SWMH9.0	15.116	0.256	0.000	0.25	0.0	68.7	SURCHARGED
9.001	SWM9.1	15.113	0.328	0.000	0.17	0.0	39.1	SURCHARGED
8.002	SW MH 3.2	15.113	0.345	0.000	0.26	161.2	70.3	SURCHARGED
8.003	SW MH 3.3	15.108	0.408	0.000	0.39	0.0	69.6	SURCHARGED
8.004	SW MH 3.4	15.102	0.422	0.000	0.26	0.0	68.2	FLOOD RISK
8.005	SW MH 3.5	15.096	0.471	0.000	0.29	0.0	77.5	FLOOD RISK
8.006	SW MH 3.6	15.111	0.543	0.000	0.39	0.0	74.9	FLOOD RISK
10.000	SWMH10.0	14.549	-0.069	0.000	0.17	0.0	41.0	OK
10.001	SWMH10.1	14.549	-0.009	0.000	0.09	0.0	23.1	OK
1.009	16.15	15.114	0.564	0.000	0.83	140.1	229.4	FLOOD RISK
1.010	SW MH 1.10	15.088	0.553	0.000	0.97	0.0	225.2	SURCHARGED
1.011	SW MH 1.11	15.074	0.589	0.000	4.04	0.0	222.3	SURCHARGED



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Existing Network Details 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	24.502	0.130	188.5	0.095	5.00	0.0	0.600	o	300
1.001	5.864	0.041	143.0	0.000	0.00	0.0	0.600	o	300
2.000	34.088	0.171	199.3	0.058	5.00	0.0	0.600	oo	300
1.002	34.122	0.074	461.1	0.000	0.00	0.0	0.600	o	1050
3.000	11.941	0.048	248.8	0.000	5.00	0.0	0.600	o	525
3.001	16.973	0.027	628.6	0.033	0.00	0.0	0.600	o	525
4.000	10.000	0.092	108.7	0.000	5.00	0.0	0.600	o	300
1.003	10.200	0.108	94.4	0.127	0.00	0.0	0.600	o	300

Network Results Table

PN	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	13.250	0.095	0.0	1.14	80.7
1.001	13.120	0.095	0.0	1.31	92.8
2.000	13.250	0.058	0.0	1.11	156.9
1.002	12.329	0.153	0.0	1.60	1383.9
3.000	12.300	0.000	0.0	1.42	306.4
3.001	12.252	0.033	0.0	0.89	191.8
4.000	13.050	0.000	0.0	1.51	106.6
1.003	12.208	0.313	0.0	1.62	114.4

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07.05.2012

Support Services

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	HEADWALL	14.400	12.100	12.100	1200	0



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Simulation Criteria for Storm


Volumetric Runoff Coeff	0.840	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)	240
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	4

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	120
Ratio R	0.400		



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Online Controls for Storm

Non Return Valve Manhole: SWAMH 3, DS/PN: 3.001, Volume (m<sup>3</sup>): 6.6

Hydro-Brake<sup>®</sup> Manhole: SWMH 4.5, DS/PN: 1.003, Volume (m<sup>3</sup>): 37.8

Design Head (m) 1.492 Hydro-Brake<sup>®</sup> Type Md5 SW Only Invert Level (m) 12.208  
Design Flow (l/s) 5.0 Diameter (mm) 82


Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	1.200	4.4	3.000	7.0	7.000	10.7
0.200	2.4	1.400	4.8	3.500	7.6	7.500	11.1
0.300	2.4	1.600	5.1	4.000	8.1	8.000	11.4
0.400	2.6	1.800	5.4	4.500	8.6	8.500	11.8
0.500	2.9	2.000	5.7	5.000	9.0	9.000	12.1
0.600	3.1	2.200	6.0	5.500	9.5	9.500	12.5
0.800	3.6	2.400	6.3	6.000	9.9		
1.000	4.0	2.600	6.5	6.500	10.3		

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Offline Controls for Storm

Weir Manhole: SWMH 4.5, DS/PN: 1.003, Loop to PN: 3.001

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 13.920

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Storage Structures for Storm

Cellular Storage Manhole: SWAMH 3, DS/PN: 3.001

Invert Level (m) 12.252 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	80.0	0.0	2.600	0.0	0.0
0.200	80.0	0.0	2.800	0.0	0.0
0.400	80.0	0.0	3.000	0.0	0.0
0.600	80.0	0.0	3.200	0.0	0.0
0.800	80.0	0.0	3.400	0.0	0.0
1.000	80.0	0.0	3.600	0.0	0.0
1.200	0.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0


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

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, 600, 720,  
 960, 1440  
 Return Period(s) (years) 30, 100  
 Climate Change (%) 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	120 Winter	30	0%	30/60 Winter				
1.001	120 Winter	30	0%	30/30 Winter				
2.000	120 Winter	30	0%	30/60 Winter				
1.002	120 Winter	30	0%	30/30 Winter				
3.000	960 Winter	30	0%	100/60 Winter				
3.001	960 Winter	30	0%	100/60 Summer				
4.000	120 Winter	30	0%	30/30 Summer	100/30 Winter			3
1.003	120 Winter	30	0%		100/30 Winter	100/15 Summer	20	3

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 4.0	13.921	0.371	0.000	0.14	0.0	10.3	SURCHARGED
1.001	SWMH 4.1	13.919	0.499	0.000	0.17	0.0	10.3	SURCHARGED
2.000	SW MH 4.6	13.919	0.369	0.000	0.04	0.0	6.3	SURCHARGED
1.002	SWMH 4.2	13.918	0.539	0.000	0.01	0.0	13.6	SURCHARGED
3.000	TANK	12.448	-0.377	0.000	0.00	0.0	0.1	OK
3.001	SWMH 3	12.448	-0.329	0.000	0.02	0.0	2.2	OK
4.000	SWMH4.6	13.918	0.568	0.000	0.01	0.0	0.6	FLOOD RISK
1.003	SWMH 4.5	13.918	1.410	0.000	0.06	0.0	5.3	FLOOD RISK

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

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, 600, 720, 960, 1440  
 Return Period(s) (years) 30, 100  
 Climate Change (%) 0, 30

PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	30 Winter	100	+30%	30/60 Winter				
1.001	30 Winter	100	+30%	30/30 Winter				
2.000	30 Winter	100	+30%	30/60 Winter				
1.002	30 Winter	100	+30%	30/30 Winter				
3.000	240 Winter	100	+30%	100/60 Winter				
3.001	240 Winter	100	+30%	100/60 Summer				
4.000	60 Winter	100	+30%	30/30 Summer	100/30 Winter			3
1.003	30 Winter	100	+30%		100/30 Winter	100/15 Summer	20	3

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'ed Depth (m)	Volume (m³)	Flow / O'flow Cap. (l/s)	Flow (l/s)		
1.000	SWMH 4.0	14.190	0.640	0.000	0.58	0.0	41.5	SURCHARGED
1.001	SWMH 4.1	14.092	0.672	0.000	0.58	0.0	35.7	SURCHARGED
2.000	SW MH 4.6	14.023	0.473	0.000	0.17	0.0	24.2	SURCHARGED
1.002	SWMH 4.2	14.004	0.625	0.000	0.04	0.0	45.2	SURCHARGED
3.000	TANK	13.171	0.346	0.000	0.00	0.0	0.1	SURCHARGED
3.001	SWAMH 3	13.171	0.394	0.000	0.02	0.0	2.6	SURCHARGED
4.000	SWMH4.6	14.000	0.650	0.223	0.04	0.0	3.2	FLOOD
1.003	SWMH 4.5	14.002	1.494	1.706	0.07	58.4	5.4	FLOOD





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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)	100	Add Flow / Climate Change (%)	0
ME-60 (mm)	20.000	Minimum Backdrop Height (m)	0.000
Ratio R	0.400	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500
PIMP (%)	100		

Designed with Level Soffits

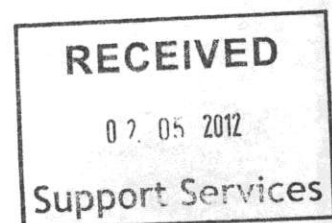
Network Design Table for Storm


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	5.000	0.050	100.0	0.000	5.00	0.0	0.600	o	150
1.001	9.263	0.093	99.6	0.000	0.00	0.0	0.600	o	150
1.002	28.503	0.225	126.7	0.075	0.00	0.0	0.600	o	300
2.000	18.722	0.062	302.0	0.069	5.00	0.0	0.600	o	600
3.000	19.583	0.065	301.3	0.068	3.00	0.0	0.600	o	600
1.003	8.874	0.059	150.4	0.000	0.00	0.0	0.600	o	300

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	5.08	14.750	0.000	0.0	0.0	0.0	1.00	17.8	0.0
1.001	50.00	5.24	14.680	0.000	0.0	0.0	0.0	1.01	17.8	0.0
1.002	50.00	5.58	14.000	0.075	0.0	0.0	0.0	1.40	98.6	10.2
2.000	50.00	5.22	14.250	0.069	0.0	0.0	0.0	1.40	394.7	9.3
3.000	50.00	3.23	14.200	0.068	0.0	0.0	0.0	1.40	395.2	9.2
1.003	50.00	5.69	13.775	0.212	0.0	0.0	0.0	1.28	90.5	28.7

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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		15.500	13.716	12.600	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 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	1
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

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Online Controls for Storm

Non Return Valve Manhole: PSW MH 1.0, DS/PN: 1.001, Volume (m³): 1.4

Hydro-Brake® Manhole: PSW MH 1.2, DS/PN: 1.003, Volume (m³): 16.4

Design Head (m) 1.716 Hydro-Brake® Type Md4 Invert Level (m) 13.775  
Design Flow (l/s) 31.7 Diameter (mm) 176


Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	1.200	26.5	3.000	41.8	7.000	63.9
0.200	15.1	1.400	28.6	3.500	45.2	7.500	66.1
0.300	24.2	1.600	30.5	4.000	48.3	8.000	68.3
0.400	25.7	1.800	32.4	4.500	51.2	8.500	70.4
0.500	23.3	2.000	34.1	5.000	54.0	9.000	72.4
0.600	21.6	2.200	35.8	5.500	56.6	9.500	74.4
0.800	22.1	2.400	37.4	6.000	59.1		
1.000	24.2	2.600	38.9	6.500	61.5		

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Offline Controls for Storm

Weir Manhole: PSW MH 1.1, DS/PN: 1.002, Loop to PN: 1.000

Discharge Coef 0.544 Width (m) 0.463 Invert Level (m) 14.000

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

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, 180, 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	30 Winter	100	+30%	100/15 Summer				
1.001	30 Winter	100	+30%	100/15 Summer				
1.002	30 Winter	100	+30%	30/15 Summer		100/15 Summer	8	
2.000	30 Winter	100	+30%	100/15 Summer				
3.000	30 Winter	100	+30%	100/15 Summer				
1.003	30 Winter	100	+30%	1/15 Winter				

PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000		1 15.119	0.219	0.000	0.36	0.0	5.1	SURCHARGED
1.001	PSW MH 1.0	15.118	0.288	0.000	0.35	0.0	5.5	SURCHARGED
1.002	PSW MH 1.1	15.122	0.822	0.000	0.30	59.3	26.9	SURCHARGED
2.000	PSW MH 2.0	15.114	0.264	0.000	0.10	0.0	28.8	SURCHARGED
3.000	PSW MH 3	15.114	0.314	0.000	0.09	0.0	27.4	FLOOD RISK
1.003	PSW MH 1.2	15.111	1.036	0.000	0.45	0.0	27.9	SURCHARGED