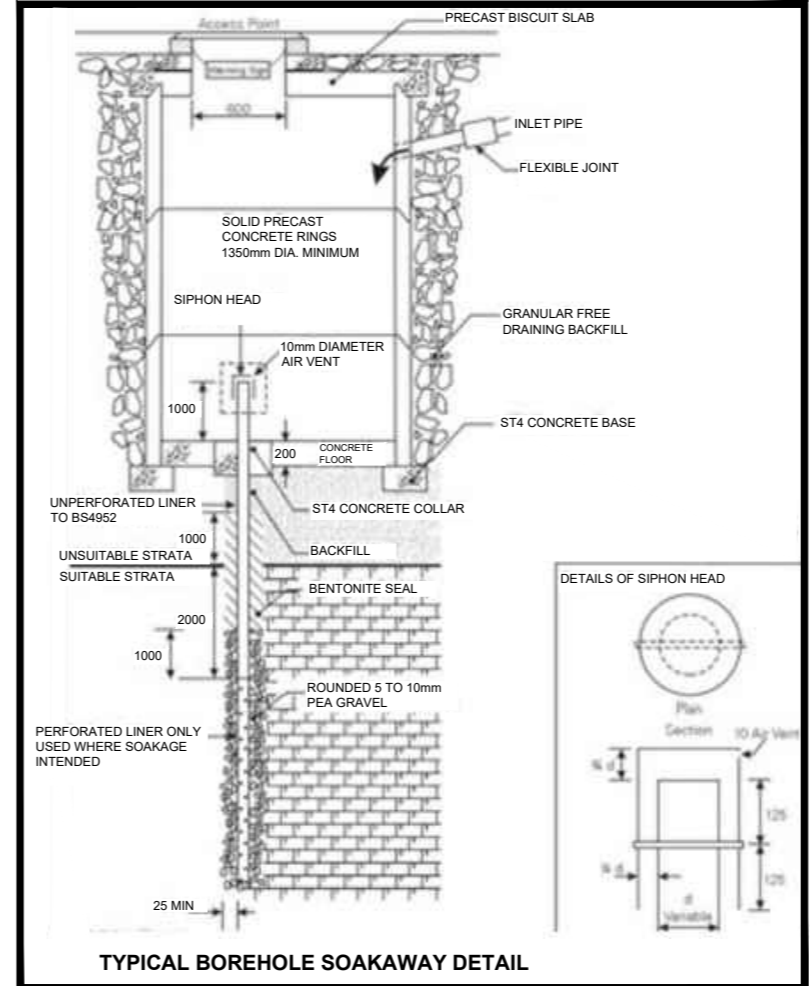
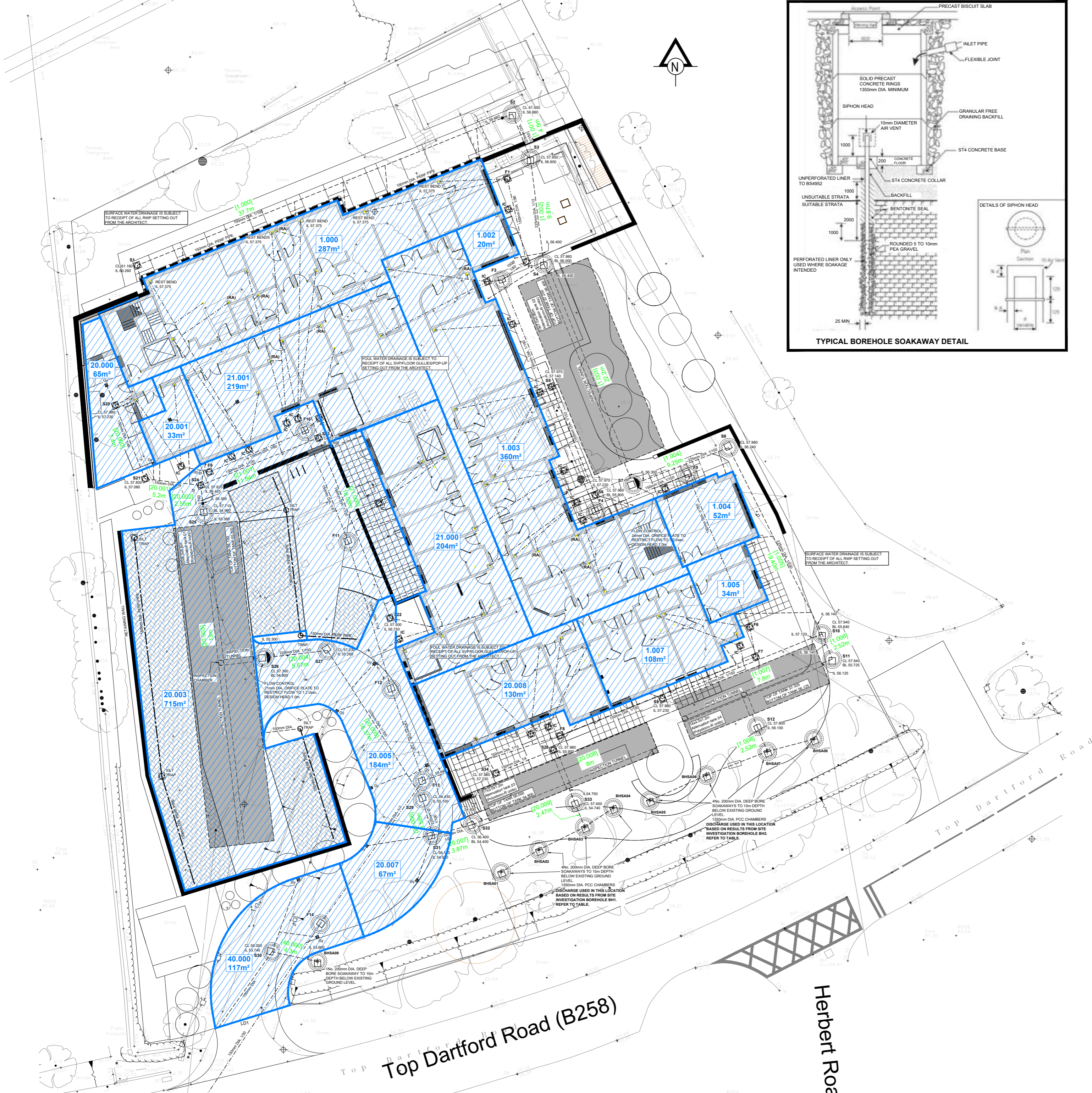


CAMERON DARROCH ASSOCIATES

APPENDIX IV

CAMERON DARROCH ASSOCIATES
KESTREL BUSINESS CENTRE, PRIVATE ROAD No. 2, COLWICK,
NOTTINGHAM, NG4 2JR



DRAINAGE STRATEGY

THE FOLLOWING TEXT DESCRIBES THE SURFACE WATER DRAINAGE DISPOSAL STRATEGY FOR THIS DEVELOPMENT.

THE SITE IS CLASSIFIED AS BROWNFIELD (BEING PREVIOUSLY USED FOR RESIDENTIAL PURPOSES). KEY POINTS FOR THE STRATEGY ARE AS FOLLOWS:

- THE FIRST CHOICE FOR SURFACE WATER IS ATTENUATION WITH DIRECT INFILTRATION, HOWEVER SITE INVESTIGATIONS IDENTIFIED THAT SHALLOW INFILTRATION WAS NOT FEASIBLE DUE TO POOR INFILTRATION RATES ACHIEVED.
- THERE ARE NO WATERCOURSES WITHIN CLOSE PROXIMITY OF THE SITE. NEITHER IS THERE A SURFACE WATER SEWER.
- FURTHER DEEP BORE INVESTIGATION FOUND GOOD INFILTRATION RATES AS INDICATED BELOW. DRILLING CONTINUED TO 30.0M AND NO GROUND WATER WAS ENCOUNTERED.

Location	Depth (m)	Flow	Permeability (k/s/m)
BH1	15	1	1.14E-07
	15	2	5.73E-07
	20	2	2.41E-07
BH2	10	1	2.48E-07
	10	2	4.17E-07
	20	2	4.03E-07
	15	1	1.75E-07
	20	2	4.68E-07

- FOR THIS DESIGN, DISCHARGE HAS BEEN USED IN TWO LOCATIONS (BH1 & BH2) WITH THE HIGHLIGHTED VALUES (ABOVE) USED FOR THE CALCULATIONS.
- THE PROPOSED DEVELOPMENT HAS AN IMPERMEABLE AREA OF APPROXIMATELY 2653m² (0.265ha) AND HAS A LEVEL DIFFERENCE, FALLING FROM NORTH TO SOUTH BY APPROXIMATELY 6.5M.
- THE SURFACE WATER FLOW HAS BEEN DESIGNED TO CAPTURE AND ATTENUATE RUNOFF IN 4m³ CRATED TANKS WITH FLOW RESTRICTED TO 1.2LS FROM THE UPPER LEVEL TANKS.
- DUE TO THE SITE TOPOGRAPHY AND PROPOSED LAYOUT THERE IS NO SPACE FOR ANY OTHER SUDS FEATURES SUCH AS SWALES AND PONDS ETC.
- FOUL WATER FLOW ASSUMED TO BE UNRESTRICTED INTO THE PUBLIC SEWER WHICH THE NEAREST POINT IS FOUND IN THE JUNCTION OF MABLE ROAD JUST OFF THE SOUTH-WESTERN CORNER OF THE PROPOSED SITE.
- THE SURFACE WATER DESIGN CATERES FOR ALL STORM EVENTS UP TO AND INCLUDING THE 1 IN 100 YEAR EVENT PLUS 40% CLIMATE CHANGE.

PRELIMINARY

CAMERON DARROCH ASSOCIATES
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CLIENT	BARCHESTER	JOB NO	CDA-2601
PROJECT	PROPOSED CARE HOME, TOP DARTFORD ROAD, HEXTABLE.	DRG NO	DD100
TITLE	DRAINAGE DESIGN DRAWING	REVISION	P2
		SCALE	1:10 @ A4
		DATE	APR 2023
		DRAWN BY	MAC
		CHECK	SEL

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.411	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
S1	0.029	5.00	0.0	61.160	450	0.900
S2	0.000	5.00	0.0	61.000	1200	4.120
S3	0.002	5.00	0.0	57.950	1200	1.100
S4	0.036	5.00	0.0	57.960	1200	1.560
S7	0.005	5.00	0.0	57.960	1200	1.660
S8	0.003	5.00	0.0	57.980	1200	1.740
S10	0.011	5.00	0.0	57.940	1200	1.800
S11	0.000	5.00	0.0	57.940	1200	1.815
S12	0.000	5.00	0.0	57.800	1200	1.700
BHSA07	0.000	5.00	0.0	57.600	1200	1.550

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	37.700	0.600	60.260	59.800	0.460	82.0	150	5.57	50.0
1.001	S2	S3	4.500	0.600	56.880	56.850	0.030	150.0	225	5.64	50.0
1.002	S3	S4	9.870	0.600	56.850	56.400	0.450	21.9	225	5.69	50.0
1.003	S4	S7	22.200	0.600	56.400	56.300	0.100	222.0	225	6.12	50.0
1.004	S7	S8	9.250	0.600	56.300	56.240	0.060	154.2	225	6.27	50.0
1.005	S8	S10	19.400	0.600	56.240	56.140	0.100	194.0	225	6.61	50.0
1.006	S10	S11	2.520	0.600	56.140	56.125	0.015	168.0	225	6.65	50.0
1.007	S11	S12	7.800	0.600	56.125	56.100	0.025	312.0	225	6.83	50.0
1.008	S12	BHSA07	2.520	0.600	56.100	56.050	0.050	50.4	225	6.85	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.111	19.6	3.9	0.750	1.050	0.029	0.0	45	0.869
1.001	1.065	42.3	3.9	3.895	0.875	0.029	0.0	46	0.670
1.002	2.806	111.6	4.2	0.875	1.335	0.031	0.0	29	1.351
1.003	0.873	34.7	9.1	1.335	1.435	0.067	0.0	79	0.739
1.004	1.050	41.8	9.8	1.435	1.515	0.072	0.0	73	0.858
1.005	0.935	37.2	10.2	1.515	1.575	0.075	0.0	80	0.800
1.006	1.006	40.0	11.7	1.575	1.590	0.086	0.0	83	0.875
1.007	0.735	29.2	11.7	1.590	1.475	0.086	0.0	99	0.695
1.008	1.846	73.4	11.7	1.475	1.325	0.086	0.0	60	1.357

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	37.700	82.0	150	Circular	61.160	60.260	0.750	61.000	59.800	1.050
1.001	4.500	150.0	225	Circular	61.000	56.880	3.895	57.950	56.850	0.875
1.002	9.870	21.9	225	Circular	57.950	56.850	0.875	57.960	56.400	1.335
1.003	22.200	222.0	225	Circular	57.960	56.400	1.335	57.960	56.300	1.435
1.004	9.250	154.2	225	Circular	57.960	56.300	1.435	57.980	56.240	1.515
1.005	19.400	194.0	225	Circular	57.980	56.240	1.515	57.940	56.140	1.575
1.006	2.520	168.0	225	Circular	57.940	56.140	1.575	57.940	56.125	1.590
1.007	7.800	312.0	225	Circular	57.940	56.125	1.590	57.800	56.100	1.475
1.008	2.520	50.4	225	Circular	57.800	56.100	1.475	57.600	56.050	1.325

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	450	Manhole	Adoptable	S2	1200	Manhole	Adoptable
1.001	S2	1200	Manhole	Adoptable	S3	1200	Manhole	Adoptable
1.002	S3	1200	Manhole	Adoptable	S4	1200	Manhole	Adoptable
1.003	S4	1200	Manhole	Adoptable	S7	1200	Manhole	Adoptable
1.004	S7	1200	Manhole	Adoptable	S8	1200	Manhole	Adoptable
1.005	S8	1200	Manhole	Adoptable	S10	1200	Manhole	Adoptable
1.006	S10	1200	Manhole	Adoptable	S11	1200	Manhole	Adoptable
1.007	S11	1200	Manhole	Adoptable	S12	1200	Manhole	Adoptable
1.008	S12	1200	Manhole	Adoptable	BHSA07	1200	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	61.160	0.900	450				
				0	1.000	60.260	150
S2	61.000	4.120	1200				
				0	1.001	56.880	225
S3	57.950	1.100	1200				
				1	1.001	56.850	225
				0	1.002	56.850	225
S4	57.960	1.560	1200				
				1	1.002	56.400	225
				0	1.003	56.400	225
S7	57.960	1.660	1200				
				1	1.003	56.300	225
				0	1.004	56.300	225
S8	57.980	1.740	1200				
				1	1.004	56.240	225
				0	1.005	56.240	225

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S10	57.940	1.800	1200	1	1.005	56.140	225
				0	1.006	56.140	225
S11	57.940	1.815	1200	1	1.006	56.125	225
				0	1.007	56.125	225
S12	57.800	1.700	1200	1	1.007	56.100	225
				0	1.008	56.100	225
BHSA07	57.600	1.550	1200	1	1.008	56.050	225
				0			

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.411	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Node S7 Online Orifice Control

Flap Valve	x	Invert Level (m)	56.300	Diameter (m)	0.024
Downstream Link	1.004	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.2		

Node S7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	56.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	133.0	0.0	0.300	133.0	0.0	0.600	133.0	0.0
0.100	133.0	0.0	0.400	133.0	0.0	0.700	133.0	0.0
0.200	133.0	0.0	0.500	133.0	0.0	0.800	133.0	0.0

Node BHSA07 Deep Bore Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.49320	Invert Level (m)	42.600	Borehole Diameter	0.200
Side Inf Coefficient (m/hr)	0.49320	Time to half empty (mins)	405	Borehole Depth (m)	15.000
Safety Factor	2.0	Diameter (m)	1.350	Inf Depth (m)	10.000
Porosity	1.00	Depth (m)		Number Required	4

Node S12 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	56.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	56.0	0.0	0.400	56.0	0.0	0.800	56.0	0.0	1.200	56.0	0.0
0.100	56.0	0.0	0.500	56.0	0.0	0.900	56.0	0.0			
0.200	56.0	0.0	0.600	56.0	0.0	1.000	56.0	0.0			
0.300	56.0	0.0	0.700	56.0	0.0	1.100	56.0	0.0			

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	S1	11	60.313	0.053	5.3	0.0425	0.0000	OK
15 minute winter	S2	11	56.935	0.055	5.1	0.0625	0.0000	OK
15 minute winter	S3	11	56.884	0.034	5.4	0.0395	0.0000	OK
15 minute summer	S4	9	56.511	0.111	11.3	0.1771	0.0000	OK
240 minute winter	S7	232	56.389	0.089	2.6	11.2980	0.0000	OK
15 minute winter	S8	11	56.260	0.020	0.7	0.0237	0.0000	OK
15 minute winter	S10	10	56.186	0.046	2.6	0.0574	0.0000	OK
15 minute summer	S11	10	56.179	0.054	2.4	0.0612	0.0000	OK
60 minute winter	S12	43	56.119	0.019	1.5	1.0418	0.0000	OK
120 minute winter	BHSA07	96	42.618	-13.432	0.9	0.8030	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
15 minute winter	S1	1.000	S2	5.1	0.932	0.261	0.2072
15 minute winter	S2	1.001	S3	5.1	0.928	0.122	0.0254
15 minute winter	S3	1.002	S4	5.5	0.554	0.049	0.1118
15 minute summer	S4	1.003	S7	11.8	1.341	0.341	0.2255
240 minute winter	S7	Orifice	S8	0.3			
15 minute winter	S8	1.005	S10	0.6	0.261	0.017	0.0726
15 minute winter	S10	1.006	S11	2.6	0.427	0.065	0.0164
15 minute summer	S11	1.007	S12	2.6	0.865	0.089	0.0294
60 minute winter	S12	1.008	BHSA07	1.0	0.625	0.013	0.0039
120 minute winter	BHSA07	Infiltration		0.6			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	S1	10	60.337	0.077	10.1	0.0614	0.0000	OK
15 minute winter	S2	11	56.956	0.076	9.8	0.0865	0.0000	OK
15 minute winter	S3	11	56.897	0.047	10.5	0.0543	0.0000	OK
15 minute winter	S4	10	56.545	0.145	22.9	0.2315	0.0000	OK
600 minute winter	S7	465	56.471	0.171	2.3	21.7691	0.0000	OK
15 minute winter	S8	11	56.268	0.028	1.2	0.0321	0.0000	OK
15 minute winter	S10	9	56.205	0.065	4.9	0.0820	0.0000	OK
15 minute winter	S11	8	56.201	0.076	5.0	0.0858	0.0000	OK
30 minute winter	S12	23	56.130	0.030	3.9	1.6093	0.0000	OK
120 minute winter	BHSA07	90	42.635	-13.415	1.7	1.5390	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
15 minute winter	S1	1.000	S2	9.8	1.102	0.497	0.3345
15 minute winter	S2	1.001	S3	9.8	1.116	0.231	0.0400
15 minute winter	S3	1.002	S4	10.5	0.685	0.094	0.1625
15 minute winter	S4	1.003	S7	23.0	1.542	0.663	0.3528
600 minute winter	S7	Orifice	S8	0.5			
15 minute winter	S8	1.005	S10	1.2	0.293	0.032	0.1176
15 minute winter	S10	1.006	S11	5.0	0.537	0.124	0.0265
15 minute winter	S11	1.007	S12	5.1	1.060	0.174	0.0464
30 minute winter	S12	1.008	BHSA07	2.3	0.792	0.031	0.0073
120 minute winter	BHSA07	Infiltration		1.2			

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.411	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
S20	0.007	5.00	0.0	57.980	450	0.750
S21	0.003	5.00	0.0	57.830	450	0.750
S22	0.020	5.00	0.0	57.500	450	0.750
S23	0.022	5.00	0.0	57.980	450	1.380
S24	0.000	5.00	0.0	57.820	450	1.395
S25	0.072	5.00	0.0	57.710	1200	2.350
S26	0.000	5.00	0.0	57.360	1200	2.060
S27	0.018	5.00	0.0	57.230	1200	1.970
S29	0.000	5.00	0.0	56.430	1200	1.330
S31	0.007	5.00	0.0	56.170	1200	1.200
S32	0.013	5.00	0.0	56.400	1200	1.600
S33	0.000	5.00	0.0	57.400	1200	2.650
BHSA03	0.000	5.00	0.0	57.400	1350	2.700

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
20.000	S20	S21	7.400	0.600	57.230	57.080	0.150	49.3	150	5.09	50.0
20.001	S21	S24	5.200	0.600	57.080	56.425	0.655	7.9	150	5.11	50.0
21.000	S22	S23	18.080	0.600	56.750	56.600	0.150	120.5	150	5.33	50.0
21.001	S23	S24	11.840	0.600	56.600	56.425	0.175	67.7	150	5.49	50.0
20.002	S24	S25	2.550	0.600	56.425	56.390	0.035	72.9	225	5.52	50.0
20.003	S25	S26	13.000	0.600	55.360	55.300	0.060	216.7	225	5.76	50.0
20.004	S26	S27	5.670	0.600	55.300	55.260	0.040	141.8	225	5.85	50.0
20.005	S27	S29	16.370	0.600	55.260	55.100	0.160	102.3	225	6.06	50.0
20.006	S29	S31	3.580	0.600	55.100	54.970	0.130	27.5	225	6.08	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
20.000	1.436	25.4	0.9	0.600	0.600	0.007	0.0	20	0.680
20.001	3.598	63.6	1.4	0.600	1.245	0.010	0.0	15	1.438
21.000	0.914	16.2	2.7	0.600	1.230	0.020	0.0	41	0.678
21.001	1.224	21.6	5.7	1.230	1.245	0.042	0.0	52	1.034
20.002	1.534	61.0	7.0	1.170	1.095	0.052	0.0	51	1.030
20.003	0.884	35.2	16.8	2.125	1.835	0.124	0.0	109	0.874
20.004	1.096	43.6	16.8	1.835	1.745	0.124	0.0	97	1.028
20.005	1.292	51.4	19.2	1.745	1.105	0.142	0.0	95	1.202
20.006	2.502	99.5	19.2	1.105	0.975	0.142	0.0	66	1.940

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
20.007	S31	S32	3.870	0.600	54.970	54.800	0.170	22.8	225	6.11	50.0
20.008	S32	S33	8.000	0.600	54.800	54.750	0.050	160.0	225	6.24	50.0
20.009	S33	BHSA03	2.470	0.600	54.750	54.700	0.050	49.4	225	6.26	50.0


Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
20.007	2.754	109.5	20.2	0.975	1.375	0.149	0.0	65	2.120
20.008	1.031	41.0	22.0	1.375	2.425	0.162	0.0	117	1.048
20.009	1.865	74.2	22.0	2.425	2.475	0.162	0.0	84	1.632

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
20.000	7.400	49.3	150	Circular	57.980	57.230	0.600	57.830	57.080	0.600
20.001	5.200	7.9	150	Circular	57.830	57.080	0.600	57.820	56.425	1.245
21.000	18.080	120.5	150	Circular	57.500	56.750	0.600	57.980	56.600	1.230
21.001	11.840	67.7	150	Circular	57.980	56.600	1.230	57.820	56.425	1.245
20.002	2.550	72.9	225	Circular	57.820	56.425	1.170	57.710	56.390	1.095
20.003	13.000	216.7	225	Circular	57.710	55.360	2.125	57.360	55.300	1.835
20.004	5.670	141.8	225	Circular	57.360	55.300	1.835	57.230	55.260	1.745
20.005	16.370	102.3	225	Circular	57.230	55.260	1.745	56.430	55.100	1.105
20.006	3.580	27.5	225	Circular	56.430	55.100	1.105	56.170	54.970	0.975
20.007	3.870	22.8	225	Circular	56.170	54.970	0.975	56.400	54.800	1.375
20.008	8.000	160.0	225	Circular	56.400	54.800	1.375	57.400	54.750	2.425
20.009	2.470	49.4	225	Circular	57.400	54.750	2.425	57.400	54.700	2.475

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
20.000	S20	450	Manhole	Adoptable	S21	450	Manhole	Adoptable
20.001	S21	450	Manhole	Adoptable	S24	450	Manhole	Adoptable
21.000	S22	450	Manhole	Adoptable	S23	450	Manhole	Adoptable
21.001	S23	450	Manhole	Adoptable	S24	450	Manhole	Adoptable
20.002	S24	450	Manhole	Adoptable	S25	1200	Manhole	Adoptable
20.003	S25	1200	Manhole	Adoptable	S26	1200	Manhole	Adoptable
20.004	S26	1200	Manhole	Adoptable	S27	1200	Manhole	Adoptable
20.005	S27	1200	Manhole	Adoptable	S29	1200	Manhole	Adoptable
20.006	S29	1200	Manhole	Adoptable	S31	1200	Manhole	Adoptable
20.007	S31	1200	Manhole	Adoptable	S32	1200	Manhole	Adoptable
20.008	S32	1200	Manhole	Adoptable	S33	1200	Manhole	Adoptable
20.009	S33	1200	Manhole	Adoptable	BHSA03	1350	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S20	57.980	0.750	450		20.000	57.230	150

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S21	57.830	0.750	450	1	20.000	57.080	150
				0	20.001	57.080	150
S22	57.500	0.750	450	0	21.000	56.750	150
S23	57.980	1.380	450	1	21.000	56.600	150
				0	21.001	56.600	150
S24	57.820	1.395	450	1	21.001	56.425	150
				2	20.001	56.425	150
				0	20.002	56.425	225
S25	57.710	2.350	1200	1	20.002	56.390	225
				0	20.003	55.360	225
S26	57.360	2.060	1200	1	20.003	55.300	225
				0	20.004	55.300	225
S27	57.230	1.970	1200	1	20.004	55.260	225
				0	20.005	55.260	225
S29	56.430	1.330	1200	1	20.005	55.100	225
				0	20.006	55.100	225
S31	56.170	1.200	1200	1	20.006	54.970	225
				0	20.007	54.970	225
S32	56.400	1.600	1200	1	20.007	54.800	225
				0	20.008	54.800	225
S33	57.400	2.650	1200	1	20.008	54.750	225
				0	20.009	54.750	225
BHSA03	57.400	2.700	1350	1	20.009	54.700	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.411	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Node S26 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.200	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.2		
Invert Level (m)	55.300	Diameter (m)	0.022		

Node S26 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	55.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	180.0	0.0	0.300	180.0	0.0	0.600	180.0	0.0
0.100	180.0	0.0	0.400	180.0	0.0	0.700	180.0	0.0
0.200	180.0	0.0	0.500	180.0	0.0	0.800	180.0	0.0

Node S33 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	54.750
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	51.0	0.0	0.400	51.0	0.0	0.800	51.0	0.0	1.200	51.0	0.0
0.100	51.0	0.0	0.500	51.0	0.0	0.900	51.0	0.0			
0.200	51.0	0.0	0.600	51.0	0.0	1.000	51.0	0.0			
0.300	51.0	0.0	0.700	51.0	0.0	1.100	51.0	0.0			

Node BHSA03 Deep Bore Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.93960	Invert Level (m)	42.400	Borehole Diameter	0.200
Side Inf Coefficient (m/hr)	0.93960	Time to half empty (mins)	213	Borehole Depth (m)	15.000
Safety Factor	2.0	Diameter (m)	1.350	Inf Depth (m)	10.000
Porosity	1.00	Depth (m)		Number Required	4

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	S20	10	57.255	0.025	1.3	0.0085	0.0000	OK
15 minute winter	S21	10	57.098	0.018	1.9	0.0042	0.0000	OK
15 minute winter	S22	10	56.798	0.048	3.7	0.0334	0.0000	OK
15 minute winter	S23	10	56.664	0.064	7.6	0.0305	0.0000	OK
15 minute winter	S24	10	56.494	0.069	9.4	0.0109	0.0000	OK
15 minute winter	S25	8	55.681	0.321	22.5	0.5601	0.0000	OK
720 minute winter	S26	675	55.434	0.134	1.8	23.1263	0.0000	OK
15 minute winter	S27	10	55.301	0.041	3.4	0.0542	0.0000	OK
15 minute winter	S29	11	55.130	0.030	3.4	0.0336	0.0000	OK
15 minute winter	S31	10	55.001	0.031	4.6	0.0391	0.0000	OK
15 minute winter	S32	10	54.869	0.069	7.0	0.0886	0.0000	OK
30 minute winter	S33	22	54.788	0.038	5.5	1.8884	0.0000	OK
60 minute winter	BHSA03	47	42.434	-12.266	3.1	1.4792	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
15 minute winter	S20	20.000	S21	1.3	0.849	0.050	0.0112
15 minute winter	S21	20.001	S24	1.9	0.442	0.029	0.0235
15 minute winter	S22	21.000	S23	3.6	0.608	0.226	0.1088
15 minute winter	S23	21.001	S24	7.5	1.005	0.348	0.0888
15 minute winter	S24	20.002	S25	9.3	1.004	0.152	0.0236
15 minute winter	S25	20.003	S26	25.5	1.612	0.726	0.2615
720 minute winter	S26	Orifice	S27	0.4			
15 minute winter	S27	20.005	S29	3.4	0.841	0.065	0.0658
15 minute winter	S29	20.006	S31	3.3	1.040	0.033	0.0115
15 minute winter	S31	20.007	S32	4.6	0.716	0.042	0.0262
15 minute winter	S32	20.008	S33	7.0	1.212	0.170	0.0515
30 minute winter	S33	20.009	BHSA03	3.7	0.906	0.050	0.0101
60 minute winter	BHSA03	Infiltration		2.2			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	S20	10	57.264	0.034	2.4	0.0116	0.0000	OK
15 minute winter	S21	10	57.104	0.024	3.4	0.0056	0.0000	OK
15 minute winter	S22	10	56.818	0.068	7.0	0.0473	0.0000	OK
15 minute winter	S23	10	56.697	0.097	14.6	0.0463	0.0000	OK
15 minute winter	S24	10	56.524	0.099	17.7	0.0158	0.0000	OK
15 minute winter	S25	7	55.739	0.379	42.7	0.6602	0.0000	SURCHARGED
720 minute winter	S26	690	55.550	0.250	3.2	43.0771	0.0000	SURCHARGED
15 minute winter	S27	10	55.317	0.057	6.5	0.0746	0.0000	OK
15 minute winter	S29	10	55.142	0.042	6.4	0.0471	0.0000	OK
15 minute winter	S31	10	55.014	0.044	8.7	0.0554	0.0000	OK
15 minute winter	S32	10	54.892	0.092	13.2	0.1189	0.0000	OK
15 minute winter	S33	13	54.810	0.060	13.1	2.9838	0.0000	OK
30 minute winter	BHSA03	31	42.685	-12.015	8.2	3.5383	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
15 minute winter	S20	20.000	S21	2.4	1.021	0.094	0.0174
15 minute winter	S21	20.001	S24	3.4	0.506	0.053	0.0367
15 minute winter	S22	21.000	S23	6.9	0.696	0.428	0.1792
15 minute winter	S23	21.001	S24	14.4	1.180	0.664	0.1442
15 minute winter	S24	20.002	S25	17.6	1.178	0.288	0.0382
15 minute winter	S25	20.003	S26	42.9	1.758	1.222	0.3032
720 minute winter	S26	Orifice	S27	0.5			
15 minute winter	S27	20.005	S29	6.4	0.998	0.124	0.1055
15 minute winter	S29	20.006	S31	6.3	1.198	0.063	0.0189
15 minute winter	S31	20.007	S32	8.7	0.865	0.079	0.0402
15 minute winter	S32	20.008	S33	13.1	1.368	0.320	0.0873
15 minute winter	S33	20.009	BHSA03	8.6	1.119	0.115	0.0189
30 minute winter	BHSA03	Infiltration		3.3			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	S20	10	57.276	0.046	4.4	0.0160	0.0000	OK
15 minute winter	S21	10	57.112	0.032	6.3	0.0076	0.0000	OK
15 minute winter	S22	11	56.954	0.204	12.7	0.1410	0.0000	SURCHARGED
15 minute winter	S23	11	56.856	0.256	24.9	0.1222	0.0000	SURCHARGED
15 minute winter	S24	11	56.564	0.139	30.9	0.0222	0.0000	OK
15 minute winter	S25	10	55.914	0.554	75.6	0.9657	0.0000	SURCHARGED
720 minute winter	S26	690	55.786	0.486	5.9	83.6717	0.0000	SURCHARGED
15 minute winter	S27	10	55.337	0.077	11.6	0.1012	0.0000	OK
15 minute winter	S29	10	55.158	0.058	11.5	0.0652	0.0000	OK
15 minute winter	S31	10	55.036	0.066	15.8	0.0818	0.0000	OK
15 minute winter	S32	10	54.926	0.126	23.9	0.1630	0.0000	OK
15 minute winter	S33	13	54.842	0.092	23.8	4.5389	0.0000	OK
60 minute winter	BHSA03	57	43.794	-10.906	11.8	9.8833	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
15 minute winter	S20	20.000	S21	4.4	1.204	0.172	0.0271
15 minute winter	S21	20.001	S24	6.2	0.614	0.098	0.0513
15 minute winter	S22	21.000	S23	11.8	0.736	0.731	0.3183
15 minute winter	S23	21.001	S24	24.9	1.414	1.150	0.2053
15 minute winter	S24	20.002	S25	30.9	1.353	0.507	0.0583
15 minute winter	S25	20.003	S26	75.8	2.351	2.157	0.4668
720 minute winter	S26	Orifice	S27	0.7			
15 minute winter	S27	20.005	S29	11.5	1.156	0.224	0.1638
15 minute winter	S29	20.006	S31	11.4	1.300	0.115	0.0315
15 minute winter	S31	20.007	S32	15.7	0.978	0.144	0.0628
15 minute winter	S32	20.008	S33	23.8	1.492	0.580	0.1451
15 minute winter	S33	20.009	BHSA03	17.8	1.336	0.240	0.0329
60 minute winter	BHSA03	Infiltration		3.3			

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.411	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
S30	0.012	5.00	55.000	1200	1.260
BHSA09	0.000	5.00	55.700	1350	2.040

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
40.000	S30	BHSA09	4.300	0.600	53.740	53.660	0.080	53.8	150	5.05	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
40.000	1.375	24.3	1.6	1.110	1.890	0.012	0.0	26	0.779

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
40.000	4.300	53.8	150	Circular	55.000	53.740	1.110	55.700	53.660	1.890

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
40.000	S30	1200	Manhole	Adoptable	BHSA09	1350	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S30	55.000	1.260	1200				
BHSA09	55.700	2.040	1350		0	40.000	53.740
				1	40.000	53.660	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.411	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Node BHSA09 Deep Bore Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.93960	Invert Level (m)	40.700	Borehole Diameter	0.200
Side Inf Coefficient (m/hr)	0.93960	Time to half empty (mins)	213	Borehole Depth (m)	15.000
Safety Factor	2.0	Diameter (m)	1.350	Inf Depth (m)	10.000
Porosity	1.00	Depth (m)		Number Required	1

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	S30	10	53.772	0.032	2.2	0.0426	0.0000	OK
30 minute winter	BHSA09	23	40.800	-12.860	1.7	0.6186	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
15 minute winter	S30	40.000	BHSA09	2.2	0.819	0.090	0.0114
30 minute winter	BHSA09	Infiltration		0.8			

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	S30	10	53.786	0.046	4.2	0.0604	0.0000	OK
30 minute winter	BHSA09	26	41.417	-12.243	3.2	1.5023	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
15 minute winter	S30	40.000	BHSA09	4.1	0.970	0.170	0.0184
30 minute winter	BHSA09	Infiltration		0.8			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	S30	10	53.804	0.064	7.6	0.0850	0.0000	OK
60 minute winter	BHSA09	50	42.794	-10.866	3.9	3.4725	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
15 minute winter	S30	40.000	BHSA09	7.5	1.126	0.310	0.0288
60 minute winter	BHSA09	Infiltration		0.8			