



**HOLDGATE
CONSULTING**

Drainage Design Calculations

Project:
Former Combs Hostel
Hall lane

Job No.:
21-105

DRAFT

Author: NM

Date: 22.09.21

Checked: RJP

Approved: RJP

FINAL

Author: NM

Date: 22.09.21

Checked: RJP

Approved: RJP



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	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)	19.000	Minimum Backdrop Height (m)	0.000
Ratio-R	0.350	Preferred Cover Depth (m)	1.200
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)
IC S38	0.034	5.00	76.960	1200	2.100
IC S39	0.048	5.00	76.960	1200	2.177
IC S40	0.000		75.100	1200	1.425
IC S41	0.040	5.00	71.600	1200	1.425
IC S42	0.018	5.00	68.850	1200	1.425
IC S43	0.145	5.00	68.800	1200	2.467
IC S44	0.074	5.00	67.894	1200	2.100
IC S45	0.189	5.00	67.843	1200	2.168
IC S46	0.000		67.804	1200	2.188
IC C1	0.000		67.804	1200	2.203

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	IC S38	IC S39	6.170	0.600	74.860	74.783	0.077	80.0	900	5.03	48.5
1.001	IC S39	IC S40	22.200	0.600	74.783	73.675	1.108	20.0	225	5.16	48.0
1.002	IC S40	IC S41	37.800	0.600	73.675	70.175	3.500	10.8	225	5.31	47.4
1.003	IC S41	IC S42	23.000	0.600	70.175	67.425	2.750	8.4	225	5.40	47.1
1.004	IC S42	IC S43	33.350	0.600	67.425	67.008	0.417	80.0	225	5.78	45.7
1.005	IC S43	IC S44	12.800	0.600	66.333	65.794	0.539	23.7	900	5.81	45.6
1.006	IC S44	IC S45	17.800	0.600	65.794	65.675	0.119	150.0	900	5.93	45.2
1.007	IC S45	IC S46	8.920	0.600	65.675	65.616	0.059	150.0	900	5.98	45.0
1.008	IC S46	IC C1	2.200	0.600	65.616	65.601	0.015	150.0	900	6.00	45.0

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	3.504	2229.4	4.5	1.200	1.277	0.034	0.0	29	0.725
1.001	2.936	116.7	10.7	1.952	1.200	0.082	0.0	45	1.835
1.002	4.004	159.2	10.5	1.200	1.200	0.082	0.0	39	2.297
1.003	4.552	181.0	15.6	1.200	1.200	0.122	0.0	44	2.815
1.004	1.463	58.2	17.4	1.200	1.567	0.140	0.0	84	1.280
1.005	6.443	4098.8	35.2	1.567	1.200	0.285	0.0	58	2.065
1.006	2.556	1625.9	44.0	1.200	1.268	0.359	0.0	100	1.146
1.007	2.556	1625.9	66.9	1.268	1.288	0.548	0.0	122	1.292
1.008	2.556	1625.9	66.8	1.288	1.303	0.548	0.0	122	1.292



Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
IC S38	76.960	2.100	1200					
				0	1.000	74.860	900	
IC S39	76.960	2.177	1200		1	1.000	74.783	900
				0	1.001	74.783	225	
IC S40	75.100	1.425	1200		1	1.001	73.675	225
				0	1.002	73.675	225	
IC S41	71.600	1.425	1200		1	1.002	70.175	225
				0	1.003	70.175	225	
IC S42	68.850	1.425	1200		1	1.003	67.425	225
				0	1.004	67.425	225	
IC S43	68.800	2.467	1200		1	1.004	67.008	225
				0	1.005	66.333	900	
IC S44	67.894	2.100	1200		1	1.005	65.794	900
				0	1.006	65.794	900	
IC S45	67.843	2.168	1200		1	1.006	65.675	900
				0	1.007	65.675	900	
IC S46	67.804	2.188	1200		1	1.007	65.616	900
				0	1.008	65.616	900	
IC C1	67.804	2.203	1200		1	1.008	65.601	900

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	19.000	Drain Down Time (mins)	240
Ratio-R	0.350	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 %)
1	0	0	0
30	0	0	0
100	30	0	0

Node IC S46 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	65.616	Product Number	CTL-SHE-0174-1450-0900-1450
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	14.5	Min Node Diameter (mm)	1200

Node IC S39 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	74.783	Product Number	CTL-SHE-0147-1000-0900-1000
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	10.0	Min Node Diameter (mm)	1200

Node IC S43 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	66.333	Product Number	CTL-SHE-0154-1100-0900-1100
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	11.0	Min Node Diameter (mm)	1200

Node IC S44 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	65.794
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

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	72.0	0.0	0.900	72.0	0.0	0.901	0.0	0.0

Node IC S45 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	65.675
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

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	50.0	0.0	1.200	50.0	0.0	1.201	0.0	0.0

Node IC S43 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	66.333
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	104

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	65.0	0.0	1.200	65.0	0.0	1.201	0.0	0.0



Results for 1 year Critical Storm Duration. Lowest mass balance: 29.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	IC S38	11	74.940	0.080	4.3	0.1166	0.0000	OK
15 minute winter	IC S39	11	74.942	0.159	8.8	0.2501	0.0000	OK
15 minute winter	IC S40	11	73.712	0.037	9.4	0.0418	0.0000	OK
15 minute winter	IC S41	11	70.217	0.042	14.1	0.0716	0.0000	OK
15 minute winter	IC S42	11	67.508	0.083	16.3	0.1148	0.0000	OK
1440 minute winter	IC S43	1020	66.548	0.215	2.3	14.4688	0.0000	OK
1440 minute summer	IC S44	1140	66.513	0.719	3.9	53.0850	0.0000	OK
1440 minute winter	IC S45	1050	66.513	0.838	4.5	44.3343	0.0000	OK
1440 minute winter	IC S46	1620	66.513	0.897	0.2	1.0146	0.0000	OK
15 minute summer	IC C1	1	65.601	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	IC S38	1.000	IC S39	3.4	0.144	0.002	0.3172	
15 minute winter	IC S39	Hydro-Brake®	IC S40	9.4				
15 minute winter	IC S40	1.002	IC S41	9.3	2.026	0.059	0.1777	
15 minute winter	IC S41	1.003	IC S42	14.1	1.566	0.078	0.2120	
15 minute winter	IC S42	1.004	IC S43	16.1	1.240	0.277	0.4335	
1440 minute winter	IC S43	Hydro-Brake®	IC S44	2.3				
1440 minute summer	IC S44	1.006	IC S45	3.6	0.069	0.002	10.3054	
1440 minute winter	IC S45	1.007	IC S46	0.2	0.036	0.000	5.5656	
1440 minute winter	IC S46	Hydro-Brake®	IC C1	0.0				0.0



Results for 30 year Critical Storm Duration. Lowest mass balance: 29.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	IC S38	14	75.504	0.644	10.6	0.9368	0.0000	OK
15 minute winter	IC S39	14	75.501	0.718	22.6	1.1293	0.0000	SURCHARGED
15 minute winter	IC S40	23	73.714	0.039	10.0	0.0442	0.0000	OK
15 minute winter	IC S41	10	70.228	0.053	22.3	0.0898	0.0000	OK
15 minute winter	IC S42	10	67.538	0.113	27.8	0.1559	0.0000	OK
60 minute winter	IC S43	52	66.989	0.656	44.0	44.1661	0.0000	OK
720 minute winter	IC S44	450	66.862	1.068	9.6	66.7967	0.0000	SURCHARGED
720 minute winter	IC S45	450	66.859	1.184	237.2	62.5993	0.0000	SURCHARGED
960 minute summer	IC S46	555	67.337	1.721	23.2	1.9467	0.0000	SURCHARGED
15 minute summer	IC C1	1	65.601	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	IC S38	1.000	IC S39	8.0	0.185	0.004	3.1713	
15 minute winter	IC S39	Hydro-Brake®	IC S40	10.0				
15 minute winter	IC S40	1.002	IC S41	10.0	2.310	0.063	0.2173	
15 minute winter	IC S41	1.003	IC S42	22.2	1.697	0.123	0.3104	
15 minute winter	IC S42	1.004	IC S43	27.4	1.422	0.471	0.6441	
60 minute winter	IC S43	Hydro-Brake®	IC S44	11.0				
720 minute winter	IC S44	1.006	IC S45	7.1	0.114	0.004	11.2812	
720 minute winter	IC S45	1.007	IC S46	-187.9	-0.296	-0.116	5.6533	
960 minute summer	IC S46	Hydro-Brake®	IC C1	0.0				0.0


Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 29.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	IC S38	13	75.817	0.957	578.2	1.3929	0.0000	SURCHARGED
30 minute summer	IC S39	21	76.067	1.284	1122.6	2.0181	0.0000	SURCHARGED
15 minute winter	IC S40	12	73.715	0.040	10.8	0.0450	0.0000	OK
15 minute winter	IC S41	10	70.237	0.062	30.7	0.1051	0.0000	OK
120 minute winter	IC S42	100	68.510	1.085	20.1	1.5023	0.0000	SURCHARGED
120 minute winter	IC S43	100	68.498	2.165	46.2	83.0245	0.0000	SURCHARGED
180 minute winter	IC S44	116	66.864	1.070	28.3	66.8001	0.0000	SURCHARGED
180 minute winter	IC S45	116	66.867	1.192	118.9	63.0492	0.0000	SURCHARGED
60 minute summer	IC S46	126	67.702	2.086	504.7	2.3595	0.0000	FLOOD RISK
15 minute summer	IC C1	1	65.601	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	IC S38	1.000	IC S39	-520.0	-0.841	-0.233	3.8733	
30 minute summer	IC S39	Hydro-Brake®	IC S40	10.9				
15 minute winter	IC S40	1.002	IC S41	10.9	2.309	0.068	0.2532	
15 minute winter	IC S41	1.003	IC S42	30.3	1.760	0.168	0.4062	
120 minute winter	IC S42	1.004	IC S43	20.1	1.315	0.346	1.3264	
120 minute winter	IC S43	Hydro-Brake®	IC S44	14.7				
180 minute winter	IC S44	1.006	IC S45	67.6	0.178	0.042	11.2812	
180 minute winter	IC S45	1.007	IC S46	171.0	0.270	0.105	5.6533	
60 minute summer	IC S46	Hydro-Brake®	IC C1	0.0				0.0